MATHEMATICS KITS, PRACTICAL ACTIVITIES AND EXPERIMENTS USER GUIDE

UPPER PRIMARY (P4-P6)

Kigali, 2022

FOREWORD

Dear teacher,

Rwanda Basic Education Board (REB) is honoured to present Mathematics practical activities and experiments user guide for Upper Primary (P4-P6). This book will serve as a guide to competence-based teaching and learning to ensure consistency and coherence in the learning of Mathematics.

In this book, special attention was paid to practical activities that facilitate the learning process in which students can manipulate concrete materials, develop ideas, and make new discoveries during activities carried out individually, in pairs or small groups.

In competence-based curriculum, practical activities open students' minds and provide them with the opportunities to interact with the world, use available tools, collect data, and effectively model real life problems.

For efficient use of this book, your role as a teacher is to:

- Plan your lessons and prepare appropriate teaching materials.
- Organize groups for students considering the importance of social constructivism.
- Engage students through active learning methods.
- Provide supervised opportunities for students to develop different competences by giving tasks which enhance critical thinking, problem solving, research, creativity and innovation, communication, and cooperation.
- Support and facilitate the learning process by valuing students' contributions in the practical activities.
- Guide students towards the conclusion on the results of the experiments.
- Encourage individual, peer, and group evaluation of the work done and use appropriate competence-based assessment approaches and methods.

To facilitate you in the teaching activities, the content of this guide is self-explanatory so that you can easily use it. It is divided in 3 parts:

The part 1 explains the structure of this guide and gives you the general introduction on the role of practical activities and experiments in the implementation of CBC.

The part 2 gives the list of Mathematics kits items.

The part 3 explains selected practical activities for each grade and how you can facilitate them in lessons.

Even though this guide contains practical activities, they are not enough, as expert and experienced teacher, you can guide students to carry out more practical activities using improvised teaching resources.

I wish to sincerely extend my appreciation to the people who contributed towards the development of this guide, particularly REB staff who organized the whole process from its inception. Special appreciation goes also to university, teachers and independent experts in education who supported the exercise throughout. Any comment or contribution would be welcome for the improvement of this book for next versions.

Dr. MBARUSHIMANA Nelson

Director General, REB

ACKNOWLEDGEMENT

I wish to express my appreciation to the people who played a major role in the development and the editing of the Mathematics practical activities and experiments user guide for Upper Primary. It would not have been successful without active participation of different education stakeholders.

I owe gratitude to Curriculum Officers, teachers, and independent people and university lecturers whose efforts during the development of this teaching and learning resource were very much valuable.

Finally, my word of gratitude goes to REB-SPIU for their usual support in terms of human and financial resources towards improving the quality of education under RQBE project.

Joan MURUNGI

Head of CTLR Department

LIST OF ACRONYMS

CBC: Competence-based curriculum

ICT: Information Communication Technology

Lab: Laboratory

STEM: Science Technology Engineering and Mathematics

KBC: Knowledge Based Curriculum

SET: Science and Elementary Technology

CPA: Concrete, Pictorial and Abstract.

SPIU: Single Project Implementation Unit

RQBE: Rwanda Quality Basic Education

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PART 1: GENERAL INTRODUCTION

a) Structure of the user guide

The user guide for practical activities and experiments in P4-P6 Mathematics is divided in 3 parts:

The part 1 explains the structure of this book and gives you the general introduction on the role of practical activities and experiments in the implementation of CBC.

The part 2 gives the list of mathematics kits items.

The part 3 details the practical activities and how you can facilitate them in lessons.

b) Practical activities and experiments in the Competence Based Curriculum

A competence-based curriculum (CBC) focuses on what learners can do and apply in different situations by developing skills, attitudes, and values in addition to knowledge and understanding. This learning process is learner-focused, where a learner is engaged in active and participatory learning activities, and learners finally build new knowledge from prior knowledge. Since 2015, the Rwanda Education system has changed from KBC to CBC for preparing students that meet the national and international job market requirements and job creation. Therefore, implementing the CBC education system necessitates qualitative practical works for mathematics and science as more highlighted aspects.

In addressing this necessity, practical activities and experiments play a major role. A child is motivated to learn mathematics by getting involved in handling various concrete manipulatives in various activities. In addition to activities, games in mathematics also help the child's involvement in learning by strategizing and reasoning.

For learning mathematical concepts through the above-mentioned approach, a child-centred Mathematics kits have been availed for the students of primary and Secondary schools. The kits include various kit items along with a manual for performing activities.

The kit broadly covers the activities in the areas of algebra, geometry, trigonometry, statistics and probability.

The kit has the following advantages:

- Availability of necessary and common materials at one place,
- Multipurpose use of items,

- Economy of time in doing the activities,
- Portability from one place to another,
- Provision for teacher's innovation,
- Low-cost material and use of indigenous resources.

Apart from the kit, the user guide for practical activities to be used by teachers was developed. This experiment user guide is designed to help mathematics teachers to perform high-quality experiments in mathematics. This user guide structure induces learner's interest, achievement, and motivation through the qualitative mathematics experiments offered by their teachers and will finally lead to the targeted goals of the CBC particularly in the field of mathematics and science.

In CBC, learners use the materials and reveal the theory behind the experiment done. Here, experiments are done inductively, where experiments serve as an insight towards revealing the theory. Thus, the experiment starts, and theory is produced from the results of the experiment.

Mathematics experiment is a procedure undertaken to demostrate a known fact such as formula. In this book we have practical activities that are also experiments.

c) Type of practical works

Mathematics laboratory is a place where students can learn and explore mathematical concepts and verify mathemathetical facts, formula and theorems through a variety of activities using different techniques: Measuring, observing, Comparing etc.

The goal of the practical work defines the type of practical work and how it is organized. Therefore, before doing practical work, it is important to have a clear idea of the objective.

The three types of practical work that correspond with its three main goals are:

1) **Equipment-based practical work:** the goal is for students to learn to handle scientific equipment like measuring angles, measuring the length,etc.

2) **Concept-based practical work:** learning new concepts such as exploring the volume of a cube, etc.

3) **Inquiry-based practical work:** learning process skills. Examples of process skills are defining the problem and good research question(s), installing an experimental setup, observing, measuring, processing data in tables and graphs, identifying conclusions, defining limitations of the experiment etc.

Note:

- To learn the new concept by practical work, the lesson should start with the practical work, and the theory can be explained by the teacher afterward (explore – explain). Starting by teaching the theory and then doing the practical work to prove what they have learned is demotivating and offers little added value for student learning.
- Try to avoid complex arrangements or procedures. Use simple equipment or handling skills to make it not too complicated and keep the focus on learning the new concept.
- If this is not possible and is necessary to use new equipment or handling skills, then first exercise these skills before starting the concept-based practical work experiments.
- The experiments or practical activities should be useful for all learners and not only for aspiring scientists. Try to link the practical work as much as possible with their daily life and preconceptions.

d) Organising lab experiments

i) Methods of organizing a practical work

There are 3 methods of organizing practical work:

- **Each group does the same practical activity at the same time**

All learners can follow the logical sequence of the experiments, but this implies that a lot of material is needed. The best group size is 3, as all learners will be involved. With bigger groups, you can ask to do the experiment twice, where learners change roles.

- **Practical activities are divided among groups with group rotation**

Each group does the assigned experiment and moves to the next experiment upon a signal by the teacher. At the end of the lesson, each group has done every experiment. This method saves material but is not perfect when experiments are ordered in a logical way where by next experiment depends on results of previous experiment. In some cases, the conclusion of an experiment provides the research question for the next experiment. In that case, this method is not very suitable.

Before starting the lesson, the materials for each experiment should be placed in the different places where the groups will work. Also, the required time for each experiment should be about the same. Use a timer to show learners the time left for each experiment. Provide an extra exercise for fast groups.

- **All practical activities are divided among groups without group rotation**

Each group does only one or two experiments. The other experiments are done by other groups. Afterward, the results are brought together and discussed with the whole class. This saves time and materials, but it means that each learner does only one experiment and 'listens' to the other experiments' description. The method is suitable for experiments that are optional or like each other. It is not a good method for experiments that all learners need to master.

ii) Preparation of a practical work

When preparing a practical work, do the following:

- Have a look at the available material at school and make a list of what you can use and what you need to improvise.
- Determine the required quantities by determining the method (see above).
- Collect all materials for the experiments in one place. If learners' group is small, they can come to get the materials on that spot, but with more than 15 learners, this will create disorder. In that case, prepare for each group a set of materials and place it on their desk.
- Test all experiments and measure the required time for each step before the experiment.
- Prepare a nice but educational extra task for learners who complete their task before the end of the allocated time.
- Write on the blackboard how groups of learners are formed.

iii) Preparation of a lesson for practical work

In the lesson plan of a lesson with practical work, there should be the following phases:

1) The introduction of the practical work or the 'excite' phase consists of formulation of a key question, discrepant event, or a small conversation to motivate learners and make connections with daily life and learners' prior knowledge.

2) The discussion of safety rules for the practical work:
   - Only work at the assigned place; do not walk around in the class if this is not asked.
   - Long hairs should be tied together, and safety eyeglasses should be worn for chemical experiments.

- Only the material needed for the experiment should be on the table.
- The practical work instructions: how groups are formed, where they get the materials, special treatment of materials (if relevant), what they must write down…
- When the practical work materials aren't yet at the correct location, then distribute them now. Once learners have the materials, it is more difficult to get their attention.

3. How to conduct a practical work:
   - learners do the experiments, while the teacher coaches by asking questions (Explore phase).
   - The practical work should preferably be processed immediately with an explain phase. If not, this should happen in the next lesson.
4. How to conclude the lesson of a practical work:
   - Learners refer to instructions and conduct the experiment,
   - Learners record and interpret recorded data,
   - Cleaning the workspace after the practical work (by the learners as much as possible).

e) Role and responsibilities of teacher and learners in a practical work

The roles and responsibilities of teacher during a practical activity

Before conducting an experiment, the teacher will do the following:

- Decide how to incorporate experiments into class content best,
- Prepare in advance materials needed in the experiment,
- Prepare protocol for the experiment,
- Perform in advance the experiment to ensure that everything works as expected,
- Designate an appropriate amount of time for the experiment - some experiments might be adapted to take more than one class period, while others may be adapted to take only a few minutes.
- Match the experiment to the class level, course atmosphere, and your students' personalities and learning styles.
- Verify lab equipment before practices.
- Provide the working sheet and give instructions to learners during a practical work.

During practical work, the teacher's role is to coach instead of helping with advice or questions. It is better to answer a learner's question with another question than to immediately give the answer or advice. The additional question should help learners to find the answer themselves.

- Prepare some questions for each practical work, no matter what the type is.
- Try and start the practical work: start with a discrepant event or questions that help define the problem or questions that link the practical work with students' daily life or their initial conceptions about the topic.
- Use coaching questions during the practical work: 'Why do you do this?', 'What is a control tube?', ''What is the purpose of the experiment?', 'How do you call this product?', 'What are your results?' etc.
- Use some questions to end the practical work: 'What was the meaning of the experiment?', 'What did we learn?', 'What do we know now that we didn't know at the start?', 'What surprised you?'etc.
- Announce the end of the practical work 10 minutes before giving learners enough time to finish their work and clean their space.

The Role of a lab technician during a lesson with practical activities

In schools having laboratory technicians, they assist the science and mathemathics teachers in the following tasks:

- Maintaining, calibrating, cleaning, and testing the sterility of the equipment,
- Collecting, preparing and/or testing samples,
- Demonstrating procedures.

The learners' responsibilities in the practical work

During an experiment, both learners have different activities to do; the table barrow summarizes them. General learner's activities are:

- Experiment and obtain data themselves,
- Record data using the equipment provided by the teacher,
- Analyze the data often this involves graphing it to produce the related graph,
- Interpret the obtained results and deduct the theory behind the concept under the experimentation,

- Discuss the error in the experiment and suggest improvements,
- Cleaning and arranging material after the experiment.

f) Safety rules and precautions during a practical work

Regardless of the type of practical work you are in, there are general rules enforced as safety precautions. Each lab member must learn and adhere to the rules and guidelines set, to minimize the risks of harm that may happen to them within the working environment. Please make sure you are familiar with the safety precautions, hazard warnings, and procedures of the experiment you perform on a given day before you start any work. Experiments should not be performed without an instructor in attendance and must not be left unattended while in progress.

i) Hygiene plan

Mathematics experiments can be done in the classroom, outside, in the laboratory or in the maths corner.

This place is a shared workspace, and everyone has the responsibility to ensure that it is organized, clean, well-maintained, and free of contamination that might interfere with the members' work or safety.

For waste disposal, all used materials must be discarded in designated containers. Keep the container closed when not in use. When in doubt, check with your instructor.

ii) Hazard warning symbols

To maintain a safe workplace and avoid accidents, lab safety symbols and signs need to be posted throughout the workplace.

The hazard class will determine how similar materials should be stored and handled and what special equipment and procedures are needed to use them safely.

The annex 1 shows hazard symbols found in the working place and the corresponding explanations.

iii) Safety rules

Safety is the number one priority in any working place. All students are required to know and comply with good practices and safety norms; otherwise, they will be asked to leave the working place. Make sure you understand all the safety precautions before starting your experiments, and you are requested to help your learners to understand too.

The following are some general guidelines that should always be followed:

- **Lab coat**

While doing experiments, everyone must always wear a lab coat (Figure 1) to prevent incidental and unexpected exposures to the skin and clothing. The primary purpose of a lab coat is to protect against splashes and spills.

The lab coat must be wrist-fitted and must always keep buttoned.

A lab coat should be non-flammable and should be easily removed.

- **Breathing Masks**

Respirators are designed to prevent contamination from volatile compounds that may enter in your body through the respiratory system. "Half mask" respirators (Figure3) cover just the nose and mouth; "full face" respirators cover the entire face, and "hood" or "helmet" style respirators cover the entire head.

The breathing mask safety sign lets you know that you are working in an area with potentially contaminated air.

- **Footwear**

Shoes that cover entirely the toes, heel, and top of the foot provide the best general protection (Figure 1.5). Closed shoes must always be worn while in the experiment, regardless of the experiment or curricular activity. Shoes must fully cover your feet up to the ankles, and no skin should be shown.

Socks do not constitute a cover replacement for shoes. Sandals, backless and open shoes are unacceptable.

- **Gloves**

When handling any hazards that can enter the body through the skin, it is important to wear the proper protective gloves.

- **Hair dressing**

If hair is long, it must be tied back. It is good to report all accidents including minor incidents to your instructor immediately.

- **Eat and drink**

Never drink, eat, taste, or smell anything in the working place for experiments unless you are allowed by the instructor.

- **Hot objects**

Never hold very hot objects with your bare hands.

Always hold them with a test tube holder, tongs, or a piece of cloth or paper.

g) **Guidance on the Management of math kit items: Storage Management, Repairing and Disposal of Lab equipment**

Keeping and cleaning up

Working spaces must always be kept neat and cleaned up before leaving. Equipment must be returned to its proper place. Keep backpacks or bags off the floor as they represent a tripping hazard.

Management of for math corner materials

A laboratory is a place where basic experimental skills are learned only by performing a set of prescribed experiments. Safety procedures usually involve hygiene plans and waste disposal procedures. In the laboratory, materials should be stored in their original containers, and cabinets should be suitably ventilated. It is important to notify students that some materials made in glass cannot be stored on the floor. Sharp and pointed tools should be stored properly.

Students should always behave maturely and responsibly in the laboratory or wherever chemicals are stored or handled.

– **Hot equipment and glassware handling**

All glassware must be handled carefully and stored in its appropriate place after use. When working in a lab, do never leave a hot plate unattended while it is turned on. It is recommended to handle hot equipment with safety gloves and other appropriate aids but never with bare hands. You must ensure that hands, hair, and clothing are kept away from the flame or heating area and turn heating devices off when they are not in use in the laboratories.

– **Waste disposal considerations**

Waste disposal is a normal part of any laboratory. As teachers or students perform demonstrations or experiments, some used materials become part of waste.

These wastes should be collected in appropriate containers and disposed of according to local, and natinal regulations. All schools should have a person with the responsibility of being familiar with this waste disposal. In order to minimize the amount of waste generated and handle it safely, there are several steps to consider.

Sinks with water taps for washing purposes and liquid waste disposal are usually provided on the working table. It is essential to clean the sink regularly. Notice that you should never put broken glass or ceramics in a regular waste container. Use a dustpan, a brush, and heavy gloves to carefully pick-up broken pieces, and dispose of them in a container specifically provided for this purpose.

- **Equipment Maintenance**

Maintenance consists of preventative care and corrective repair. Both approaches should be used to keep equipment in working order. Records of all maintenance, service, repairs, and histories of any damage, malfunction, or equipment modification must be maintained in the equipment logs. The record must describe hardware and software changes and/or updates and show the dates when these occurred. Each school must have on inventory of math kit items that should be updated at least once a year.

h) Student Experiment Work Sheet

There should be a sheet to guide students about how they will conduct the experiment, materials to be used, procedures to be followed and the way of recording data. The following is a structure of the student experiment worksheet. It can be prepared by teacher or be availed from the other level.

1. Date
2. Name of student/group
3. The title of experiment
4. Type of experiment (concept, equipment and inquiry based)
5. Objective(s) of the experiment
6. Key question(s)
7. Materials (equipment/instrument, resources, etc...)
8. Procedures & Steps of experiment
9. Schematic reference if required.
10. Table of Data recording and presentation

Number of tests	Variables	Results	Comments/Observations
1			
2			
3			
Etc			

11. Reflective questions and answers

Question1

Question 2

Question 3

12. Answer for the key question or conclusion.

i) Report Template for Learner

After conducting an experiment, students should write a report about their findings and the conclusion they took.

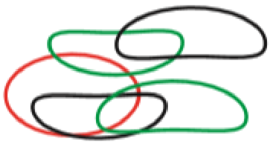
The report to be made depends on the level of students. The report done by primary school learners is not the same us the one to be made by secondary school learners.

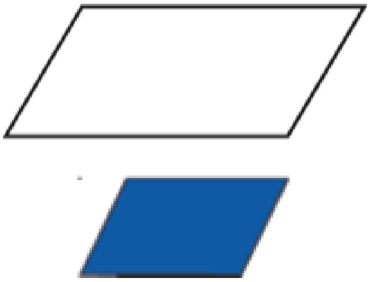
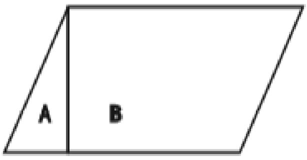
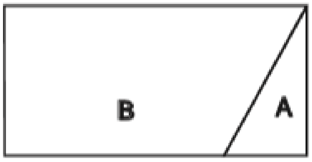
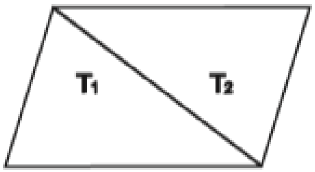
The following is a structure of the report to be made by a group of secondary school learners.

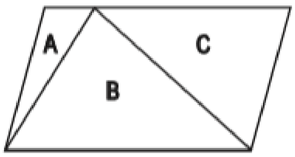
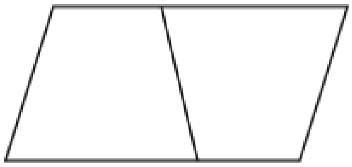
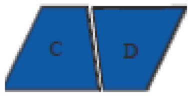
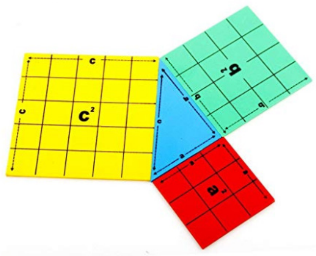
1. Introduction (details related to the experiment: Students identification, date, year, topic area, unit title and lesson).
2. The title of experiment.
3. Type of experiment (concept, equipment and inquiry based)
4. Objective(s) of the experiment.
5. Key question(s)
6. Materials (equipment/instrument, resources, etc...)
7. Procedures & Steps of experiment
8. Schematic reference if required.
9. Data recording
10. Data analysis and presentation (Plots, tables, pictures, graphs)
11. Interpretation/discussion of the results, student alternative ideas from observation.
12. Theory or Main ideas concept, formulas, and application).
13. Conclusion (answer reflective questions and the key question).

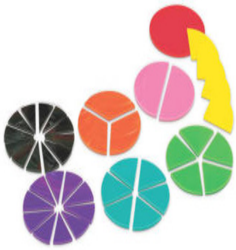
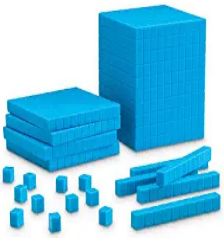
As a conclusion, there are safety rules and precautions to consider before, during and at the end of a lab experiment. We hope teachers are inspired to conduct lab experiments in a conducive Competence Based Curriculum way.

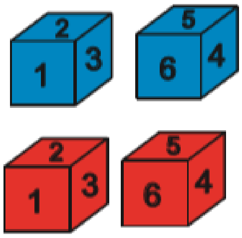
PART 2:LIST OF MATHEMATICS KIT ITEMS DISTRIBUTED IN PRIMARY SCHOOLS

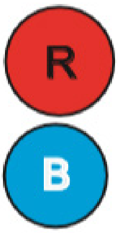
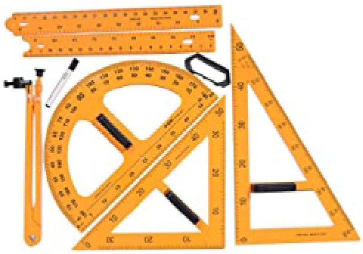
#	Kit item and use	Sample picture	Description
1	Geoboard *Geoboard is used to represent planar shapes/ figures and to find the approximate areas as well as to learn different geometric figures using a rubber band.*		*1 geographic board of 33.5 cm × 53.5 cm. It is printed with 187 grids 3 cm × 3 cm each in alternated colors.* *Copper pins are nailed on each crossing point of the grids.*
2	Rubber bands *for use with geoboard*		120 rubber bands in 6 colors come with the boards.
3	Transparent geometric 3D-shapes plus their corresponding fold-up nets Use: Used to make solid shape.		- Transparent geometric shapes plus their corresponding fold-up net inserted. They include: **cylinder, square pyramid, cube, rectangular prism, cone, hexagonal prism, triangular pyramid, and triangular prism** - 16-piece set (8 transparent and 8 folding shapes).

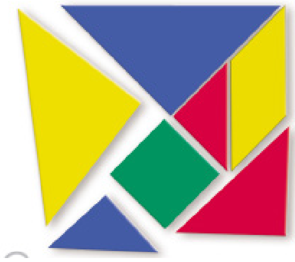
4	Laminated papers of cut-outs of 2D shapes	Parallelogram  Triangles cut from a parallelogram  Trapezium and triangle to form rectangle  Two congruent triangles  	Different shapes cut-outs of a 3mm thick blue colored corrugated sheets. The shapes are as follow: (a) A parallelogram. (b-c) A triangle and a trapezium marked as A and B respectively. (d) Two triangles marked asT1 & T2 respectively.

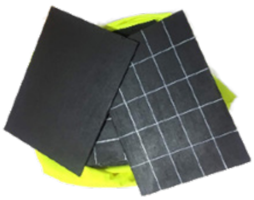
		  Two congruent trapeziums forming a parallelogram  	(e) Three triangles marked as A, B and C. (f) Two trapezia marked as C & D respectively.
5	Cut Outs for Pythagoras Theorem.		1 plastic right angled triangle. Measure: 3” x 4” x 5” & 3 different size square equal to sides of triangle.

6	Circle and set fraction Use: Used for exploring “Area of Circle “and activities related to “Fractions”		7 Blue (or any other colour) coloured circular plastic having 3mm thickness and diameter 160 mm. divided into 4, 6, 8, 12, 16 and 32 equal sectors. As per sample Each piece is magnetic
7	Basic geometric solids.		**6** *pieces* **of** *wooden solids* Includes cube, cylinder, sphere, cone, triangular prism, pyramid. *Use: To demonstrate geometry solids (3D).*
8	Clock *Use: To learn to tell the time according to the 24 hours international convention.*		1 plastic teaching clock
9	Plastic base Ten starter kit.		A set of plastic items composed of 1000 detachable cubes. The volume of each cube is 1 cubic cm. All 1000 cubes can form 1 cube.

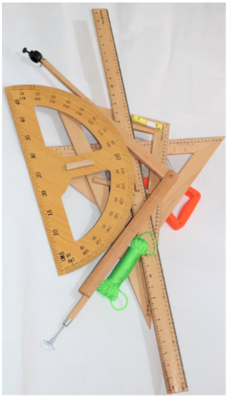
10	Wooden Vertical Abacus Use: To learn place value of numbers and operation of numbers between 1 up to 10,000. Beads can be used in sets and probability.		1 item composed of 5 columns with 10 beads of alternate color in each column.
11	Laminated number cards *Use: Used in game for composition, sorting, factorization of numbers, etc.*		A pack of laminated cards numbered from 0 to 9 (16 cards from an A4 paper)
12	Dice numbered 1–6 a) Two blue dice b) Two red dice		4 wooden dice numbered from 1 to 6 each with the same edges of 25mm each. Two dices are in blue while the other two are in red.
13	Cubic dotted dice – From 1 sided to 6 sided.		6 plastic dices with different edges and different shapes: 8mm, 12mm, 16mm, 19mm and 25mm.

14	Counters: (20) *Use: Used in activity "Addition and Subtraction of Integers".*		A set of 20 Plastic pieces or lamineted transparent counters whose one side is blue and other side is red.
15	Measuring tape		Retractable Fiberglass Tailor Measuring Tape of 150 cm
16	Mathematical set for teachers: Full circle protractor, meter ruler, compass, tape measure, T-square, rope, decameter.	 	Wooden or plastic.
17	Mathematical set for students		Geometry 10 Piece Set, Includes 2 Metal Study Compasses, 2 T-squares, Ruler, Protractor, Pencil for Compass, Pencil Sharpener, Eraser, Lead Refill.

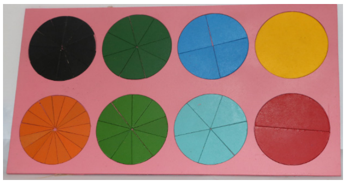
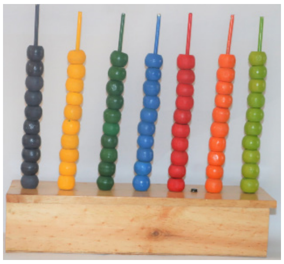
18	Magnetic Quiet shape foam tangrams.		Making a frame or 2D shape using different kinds of 2D shapes. The back side is magnetized for demonstration on any magnetic surface.
19	Fest night Stainless Steel 180 Degree Protractor		Angle Finder Both Arms Stainless Steel Protractor with 0-180 Degrees Angle 10 inch,250mm, 30cm Scale Angle Finder Ruler Smooth surface, convenient to use, easy to read. • 0-180degrees arbitrary rotation. • Adjustable screw design, easy operation for fixed reading.
20	A container: a box to keep all of the Mathematics kit items per kit.		A container in metal which can contain all of the Mathematics kit items

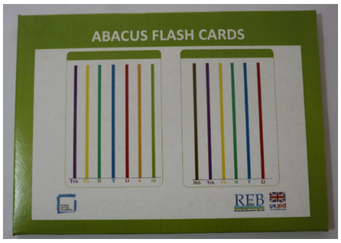
Nbr	Item	Sample Picture	Specification
21	Show me boards		A5 size, 5X5 grid on one side in white paint, plain on the other, dark color, - matt paint so chalk will mark clearly, made from thin plywood

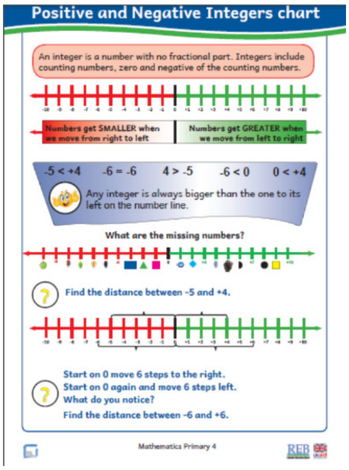
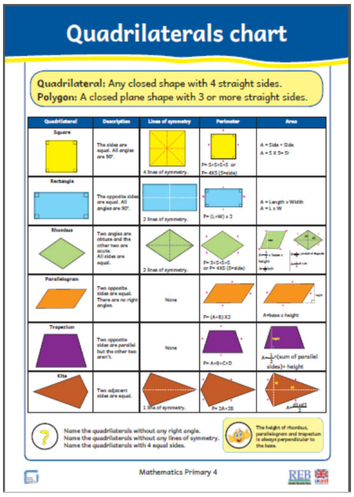
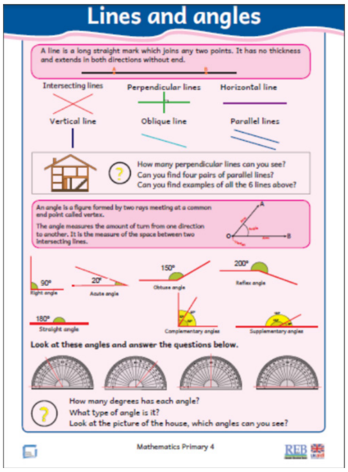
22	Digit dice		Wooden cubes of 4cm X 4cm X 4cm with numbers on them 6 sided dice with 1,2,3,4,5, 6 on each side.
23	Dotty dice		wooden 6 sided cubes of 4cm x 4cm x4cm with dots on them 4side one – 1 dot, opposite side has 6 dots side two has 3 dots and opposite side has 4 dots side three has 5 dots opposite side has 2 dots Note: The opposite faces of a dice always add up to make 7. Numbers written in different colors. eg 10 black, 10 blue, 10 red, 10 green, 10 yellow, 10 white

24	Place value counters		1 set of plastic counters of each of the 10 types (x 10 type) 10 counters with 1 (red) 10 counters with 10 (dark blue) 10 counters with 100 (green) 10 counters with 1000 (yellow) 10 counters with 10000 (purple) 10 counters with 100000 (light blue) 10 counters with 1000000 (white) 10 counters with 0 10 counters with 0.01 10 counters with 0.001
25	Mathematical set for teachers		Wooden with the following items: Semi circle protractor, meter rule, compass, tape measure, T-square, rope, decametre

26	Wooden teaching clock		Wooden clock with 3 hands of different colour. Add numbers 1 to 12 and 60 small lines to show seconds or minutes.
27	Capacity measuring containers		Measuring jags: 1000ml, 500ml, 250ml
28	Mathematical set for pupils	 	Metal box with the following items: Metal Study Compasses, T-squares, Ruler, Protractor, Pencil for Compass, Pencil Sharpener, Eraser, Lead Refill
29	Coloured cubes		1cmx1cmx1cm blank colored wooden cubes for measuring volume and using for probability games Mixed colours (5 yellow, 5 red, 5 dark blue, 5 light blue, 5 dark green, 5 light green, 5 black, 5 orange and 5 pink)

30	Fraction board		sets of circles cut into different fractions (wood) of 3mm thickness and diameter 160 mm. 1 set comprising whole circles of different colours cut into 2, 4, 6, 8, 10, 12, and 16 equal sectors. The set should also have a whole circle.
31	2D wooden shapes		set of all 2D shapes so far learned (4 types of triangles, square, rectangle, rhombus, trapezium, parallelogram, circle and kite) – Shapes have to be different colours and different sizes. Make 5 pieces of each shape.
32	Abacus		A wooden rectangular box with drawer with 7 wooden removable uprights and at least 70 wooden beads. Coloured beads (7 different colours and 10 beads for each colour)

33	Abacus flash cards		A4 portrait - laminated card with abacus drawn on it for children to use with bottle tops abacus with whole numbers Hth – O and with decimals Th - th Make 20 cards of whole numbers and 20 cards of decimal numbers Note: Make the 'spikes' as long as possible – ie use the full length of the page.
34	Number Flash cards		Laminated small cards with numbers and symbols on them numbers: 0,1,2,3,4,5,6,7,8,9. (x 7 each number = 70 cards) Signs: +, -, x, :, ., <, =, >, and a thick line for making fractions -- (x 5 each sign = 45 cards)
35	Hundred square cards		Laminated card of 21cm X 21cm - one side (10 by 10 grid) and the other side with numbers 1-100

Nbr	Item	Sample Picture	Specification
36	Negative/ positive number lines wallchart		A chart with negative numbers -10 - +10 with some examples showing addition (negative numbers in red, 0 in black and positive numbers in green)
37	Quadrilaterals-chart -		A chart of quadrilaterals covered in P4: (square, rectangle, rhombus, parallelogram, trapezium and kite) including their properties, perimeter formulas and surface area formulas.
40	Lines and angles chart		A chart with all the lines and angles covered in P4 and showing how to measure those with a protractor

41	Shaded fraction flash cards		Laminated cards with number fractions (55 pieces) and with shape fractions (55 pieces): 1 **½ , 2/2.** 1/3 , 2/3, 3/3. **¼, 2/4, ¾, 4/4.** 1/5, 2/5, 3/5, 4/5, 5/5. 1/6, 2/6, 3/6, 4/6, 5/6, 6/6. 1/7, 2/7, 3/7, 4/7, 5/7, 6/7, 7/7. 1/8, 2/8, 3/8, 4/8, 5/8, 6/8, 7/8, 8/8. 1/9, 2/9, 3/9, 4/9, 5/9, 6/9, 7/9, 8/9, 9/9. 1/10, 2/10, 3/10, 4/10, 5/10, 6/10, 7/10, 8/10, 9/10, 10/10.

PART 3: PRACTICAL ACTIVITIES PER GRADE

PRACTICAL ACTIVITY 1: Composition of numbers using number cards

a) Rationale

This practical activity is conducted when teaching the lesson about forming numbers from given digits. It is taught in unit 1. In real life, the composition of numbers helps us to compare number of objects where we can identify a big number of objects and a small number of objects. For example, we can decide that 320 schools are more than 230 schools.

b) Objective:

Compose smallest /largest/odd/even 5-digit numbers from the given digits

c) Required materials:

Number cards containing the following digits 1, 3, 5, 7, and 2.

d) Procedures

Step 1: Take the number cards of different colours containing the following digits: 1, 3, 5, 7, 2. Then place them on the table for easy manipulation.

Step 2: Read and discuss the following instructions then identify the number card to start with to obtain the correct number.

i) Form the biggest number composed by digits: 1, 3, 5, 7, and 2.

ii) Read the number obtained

iii) Write the number formed in words.

iv) Form the biggest number composed by digits 1, 3, 5, 7, 2 and for which the place value of ones is represented by 2.

Read and write the number formed in words.

v) Form the smallest number composed by digits 1, 3, 5, 7, 2.

Read and write the number formed in words.

Expected answers:

The biggest number composed by digits 1, 3, 5, 7, 2 and for which the place value of ones is represented by 2 is 75312.

e) Interpretation of results and Conclusion

How do you form a number using number cards?

Expected answers:

To form a number, we use digits. These digits are arranged depending on the number to be formed. For example, to form the number 12,357, we can start by arranging digits from left side by placing the digit 1 for ten thousand, the digit 2 for thousands, the digit 3 for hundreds, the digit 5 for tens and finally the digit 7 for ones. We can also start by the right side towards the left side: placing the digit 7 for ones, the digit 5 for tens, the digit 3 for hundreds, the digit 2 for thousands and finally the digit 1 for ten thousand.

f) Guidance on the evaluation

Students can be asked to cut and manipulate the number cards and use them as learning materials that help them to compose and read numbers.

Example:

Arrange these number cards for the given digits **1, 3, 5, 7** and **4** so that they form the smallest number.

i. Read the number correctly.

ii. Write the number formed in words correctly.

PRACTICAL ACTIVITY 2: Addition and subtraction of whole numbers using a wooden vertical abacus

a) Rationale

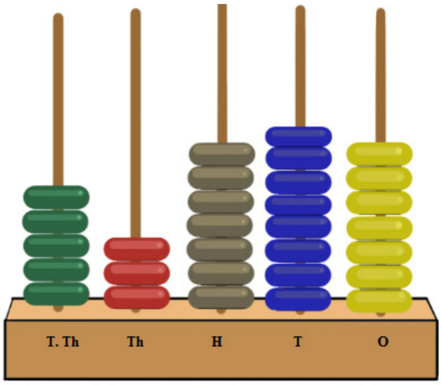
This practical activity is conducted when teaching the lesson about addition and subtraction of whole numbers. It is taught in unit 1. Addition and subtraction are useful for many activities of everyday life, like setting the table, making change at the supermarket, and playing some games. Addition and subtraction prepare children for learning about other math topics, including multiplication and division, in school.

b) Objective:

To apply the addition and subtraction of whole numbers to solve problems from real life situation.

c) Required materials:

Wooden Vertical abacus with five spikes, Beads.



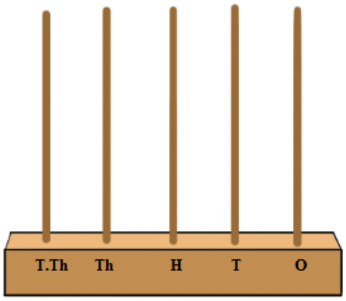
d) Procedures

Step 1*:* Read the given problem:

In the year 2020, the population of town A was 13,254 and that of town B was 40,533. What was the total population of the two towns?

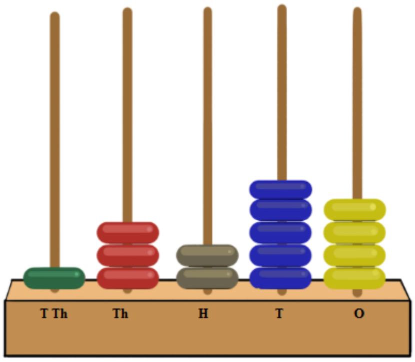
If the total number of people from both towns infected by COVID-19 was 12,343 in the year 2020, find the total number of people from both towns that were not infected by COVID-19 in 2020.

Step 2: Get an empty wooden vertical abacus with five spikes and label the spikes from right to left as **ones, tens, hundreds, thousands, and ten-thousands**.



Step 3: Since the population of town A is 13,254;

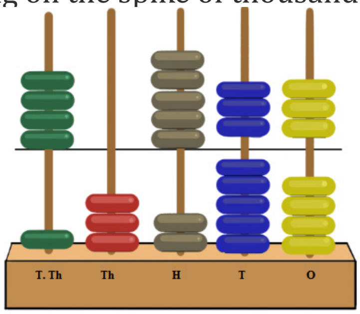
i. Put 4 beads on the spike of ones
ii. Put 5 beads on the spike of tens
iii. Put 2 beads on the spike of hundreds
iv. Put 3 beads on the spike of thousands
v. Put 1 bead on the spike of ten thousand



Step 4: To add the population of town B which is 40,533;

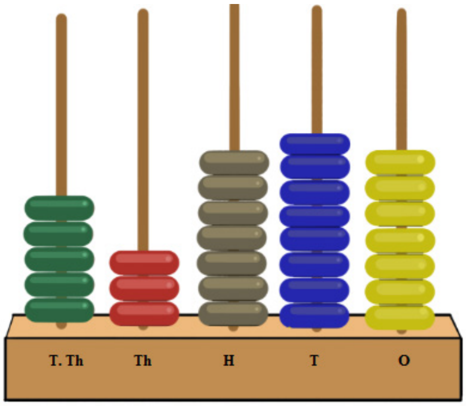
i. Add 3 beads on the spike of ones
ii. Add 3 beads on the spike of tens
iii. Add 5 beads on the spike of hundreds
iv. Add nothing on the spike of thousands
v. Add 4 beads on the spike of ten thousand

Why do did we add nothing on the spike of thousands?



Step 5: To find the total population of both towns.

i. Count and record the total number of beads on the spike of Ones.
ii. Count and record the total number of beads on the spike of tens.
iii. Count and record the total number of beads on the spike of hundreds.
iv. Count and record the total number of beads on the spike of thousands.
v. Count and record the total number of beads on the spike of ten thousands.
vi. Now Record, the number as represented on the abacus starting from left to right. So, what is the total population of town A and town B in the year 2020?



Step 6: To find the total population of both towns not infected by COVID-19 in 2020, we subtract the total number infected which was 12,343 from the obtained total population.

Using the abacus in step 4 with all the beads do the following:

i. Count 3 beads and remove them from the spike of Ones.
ii. Count 4 beads and remove them from the spike of tens.
iii. Count 3 beads and remove them from the spike of hundreds.
iv. Count 2 beads and remove them from the spike of thousands.
v. Count 1 beads and remove it from the spike of ten thousand.

Step 7: To get the remaining total population not infected by COVID-19 in 2020;

i. Count and record the remaining number of beads on the spike of Ones.
ii. Count and record the remaining number of beads on the spike of tens.
iii. Count and record the remaining l number of beads on the spike of hundreds.
iv. Count and record the remaining number of beads on the spike of thousands.
v. Count and record the remaining number of beads on the spike of ten thousand.

vi. Now Record, the number represented on the abacus starting from left to right

e) Data recording

In Step 3, the population of town A was 13,254

In Step 4, the population of town B was 40,533

In Step 5, the total population of two towns was equal to the number represented on the abacus which is 53,787

In Step 6, the total number of people from both towns infected by COVID-19 was 12,343

In Step 7, the total number of people from both towns that were not infected by COVID-19 in 2020 was the number represented on the abacus starting from left to right which is 41,444.

f) Interpretation of results and Conclusion

What do we do to add numbers using vertical abacus?

Expected answer:

To add numbers using vertical abacus,

- Put your first number on the abacus by putting beads in from ones' place value to the higher place value,
- Input your second number on the abacus by putting beads in from ones' place value to the higher place value,
- Start adding from the right side (from the spike of Ones).
- Complete an exchange: Since adding the two digits can give more than 10, you›ll carry over one bead to the next spike, and add accordingly.

This way of adding gives the same results as when adding numbers in the written standard form (vertical addition).

Additional information to the teacher:

The numbers involved in our mathematical problem in the practical activity are of higher place values. Note that the user should have prior knowledge about place values and therefore be able to relate it to the arrangement of beads on the wooden vertical abacus.

g) Guidance on the evaluation

Ask students to answer to reflection questions about the practical activity. For example:

1. Why do you think we have added no beads on the spike of thousands in step 3 (iv)?

2. Why do you think there were several people in the two towns that were not infected by COVID-19?

3. Repeat the practical activity with the following:

The annual amount of rainfall received in a certain district in 2018 was 24,363mm and 13,232mm in 2019. By using the wooden vertical abacus:

i) Calculate the total amount of rainfall received by that district in the two years.

ii) Find the difference in the amount of rainfall received in 2018 and 2019.

Expected answers:

1) We have added no beads on the spike of thousands because the number 40,532 has digit 0 in a place value of thousands.

2) Open question: There were several people in the two towns that were not infected by COVID-19 because those people respected measures taken by the authorities to fight against COVID-19.

3) i) The total amount of rainfall received by the district in the two years was:

24,363 mm + 13, 232 mm = 37, 595 mm

ii) The difference in the amount of rainfall received in 2018 and 2019 is

24,363 mm - 13, 232 mm = 11,131mm

PRACTICAL ACTIVITY 3: Use circle and set fraction to form fractions with the same denominator

a) Rationale:

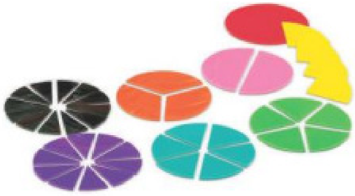
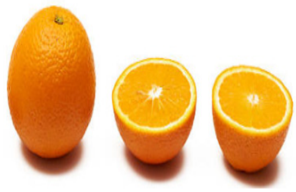
This practical activity is conducted when teaching the lesson about the introduction to fractions. It is taught in unit 4. In real life, we use fractions when sharing equally a whole object to a given number of people. For example, when you go to a restaurant with friends and the waitress brings a single bill, to divide the total amongst the friends, you use fractions.

b) Objective:

To explore and form different fractions of the same denominator as an important skill in real life situations such as sharing.

c) Required materials:

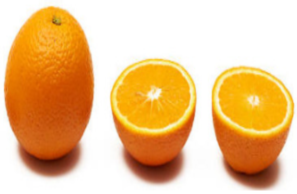
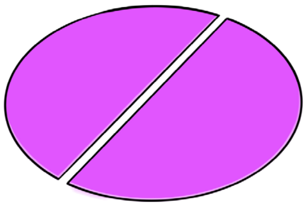
Circle, set fractions and oranges.

d) Procedures

Step 1: Put circle- set fractions on a table for easy manipulation to explore different fractions of the same denominator.

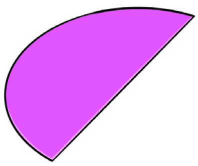
Step 2: Split a circle-set fraction into two equal parts.

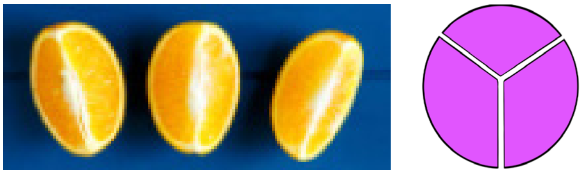
Step 3: Pick one piece from the pieces made in step 2.

i. State the fraction it represents.

ii. What fraction of the circle-set fraction does the remaining part represent?

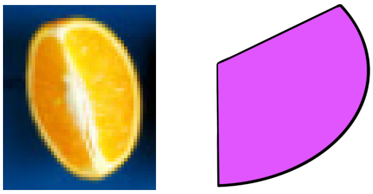



Step 4: Split a circle-set fraction into three equal parts.

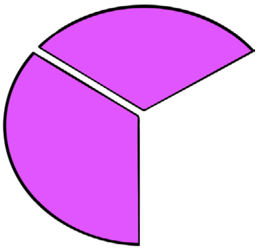


Step 5: Pick one piece from the pieces in step 4

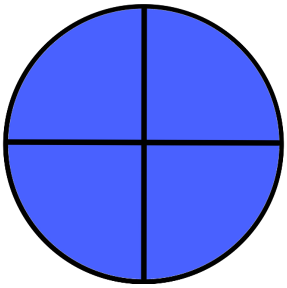
i. State the fraction that the piece of circle-set fraction you have picked represents.



ii. What fraction of the circle-set fraction does the remaining part represent?

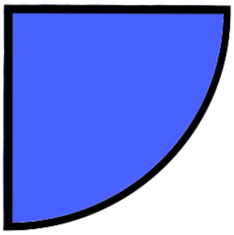


Step 6: Split a circle-set fraction into four equal parts.

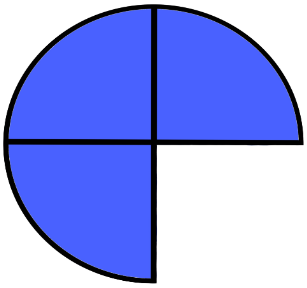


Step 7: Pick one piece from the pieces in step 6.

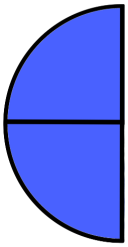
i. State the fraction that the piece of circle-set fraction you have picked represents.



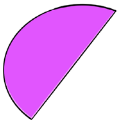
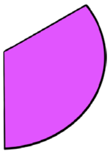
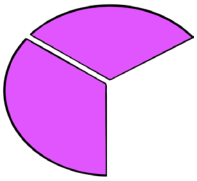
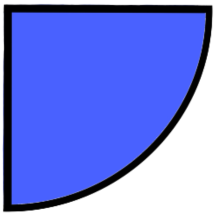
ii. What fraction of the circle-set fraction does the remaining part represent?

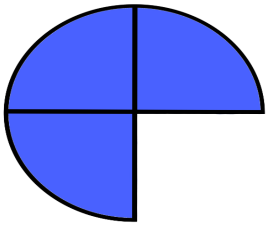
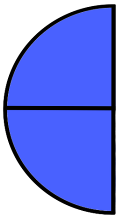


iii. Pick two pieces from the circle set fraction in step 7, what fraction do they represent?



e) Data recording

Step	**Fraction represented**	**Picture representing the fraction**
Step 3 (i) and step 3 (ii)	$\frac{1}{2}$	 
Step 5 (i)	$\frac{1}{3}$	
Step 5 (ii)	$\frac{2}{3}$	
Step 7 (i)	$\frac{1}{4}$	

Step 7 (ii)	$\frac{3}{4}$	
Step 7 (iii)	$\frac{2}{4}$	

f) Interpretation of results and Conclusion

Basing on the finding, what is the meaning of a fraction in real life? What does the numerator represent? What does the denominator represent?

Expected answer:

A fraction is a part of a whole split equally in more than one part.

The numerator of the fraction represents the number of parts taken from a whole.

The denominator of the fraction represents the total parts a whole has been split into

Considering the results in our practical activity we realize that:

When we split a whole into two equal parts, the fractions got are $\frac{1}{2}$ and $\frac{2}{2}$ and a whole can be represented as $\frac{2}{2}$.

When we split a whole into three equal parts, the fractions got are $\frac{1}{3}$, $\frac{2}{3}$ and $\frac{3}{3}$ which represents a whole.

When we split a whole into four equal parts, the fractions got are $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$ and $\frac{4}{4}$ which represents a whole.

g) Guidance on the evaluation

Ask pupils to answer to the following questions:

1) How many times do you need to split/cut/fold the circle to get 4 equal parts?

2) Repeat the experiment with a circle-set fraction split into 8 parts. Explore all the fractions that can be obtained with the same denominator 8.

Expected answers:

1. We split/cut/fold the circle 2 times to get 4 equal parts.
2. When we split a whole into 8 parts, fractions that can be obtained are:

$$\frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \frac{4}{8}, \frac{5}{8}, \frac{6}{8}, \frac{7}{8}, \frac{8}{8}.$$

PRACTICAL ACTIVITY 4: Estimating length and measuring different distances using different tools

a) Rationale:

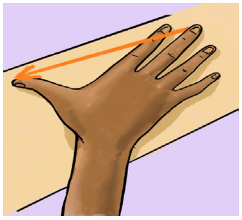
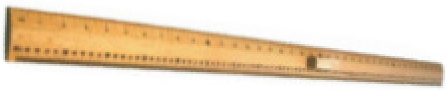
This practical activity is conducted when teaching the lesson about the introduction of length measurements. It is taught in unit 6. In real life, the measurement of length holds a special place related to the need of getting informed about the distance/length between two objects; When constructing a house, we need to know the length of the field we have, and the size of the house to construct, and when we want to visit our friend, we need to know the distance between home and their home so that we may estimate the time to be used.

b) Objective:

To use different tools to estimate and measure different distances.

c) Required materials:

Meter ruler, foot spans and hand spans, pace for different people of the class.

	
 Hand span	 Meter ruler

d) Procedures

Step 1:

i. Using a meter ruler, measure the length of your hand span in cm by placing the thumb on a zero cm mark.

ii. Measure the number of hand spans that your table have and record the number.
iii. Given that you know the length of your hand span, estimate the length of your table in cm.
iv. Now measure the actual length of your table using a meter ruler.
v. Compare the length obtained using hand span and the length obtained using a meter ruler.

Step 2:

i. Using a meter ruler, measure the length of your foot in cm.
ii. Estimate the number of foot spans that your black board has and record the number.
iii. Given that you know the length of your foot span, estimate the length of your blackboard in cm.
iv. Now measure the actual length of your blackboard using a meter ruler.
v. Compare the length obtained using foot span and the length obtained using a meter ruler.

Step 3:

i. Using a meter rule, measure the length of your pace.
ii. Measure the length of your classroom with a pace and record the number of paces.
iii. Given that you know the length of your pace, estimate the length of your classroom in meters.
iv. Now measure the actual length of your classroom using a meter ruler.
v. Compare the length obtained using a pace and the length obtained using a meter ruler.

e) Data recording

Record your results as below.

In Step 1:

Length of your hand span is about ....cm

Length of a table in hand span is about ....hand spans.

Estimated length of a table is about ....cm

Actual length of table measured with a metre ruler is ....cm

In Step 2:

Length of your foot span is about ....cm

Length of a blackboard in foot spans is about ………………..foot spans

Estimated length of a blackboard is about ……………cm

Actual length of blackboard measured with a meter rule is …………..cm

In Step 3:

Length of your pace is about ………………metres

Length of a classroom in paces is about ………………..paces

Estimated length of a classroom is about ……………metres.

Actual length of classroom measured with a meter rule is ………… metres.

f) Interpretation of results and Conclusion

Length has been measured with hand spans, foot spans, and paces.

These units vary from person to person as people have different sizes of hand spans, foot spans, and paces.

This method is used by the same person to measure shorter distances.

After knowing the length of one's hand span, foot span, and pace in cm or metres one can estimate the length of any distance by multiplying.

A metre ruler is an appropriate tool to be used to measure the actual length in either centimetres or metres. A metre is the standard unit of length.

g) Guidance on the evaluation

1) Ask pupils to measure the following lengths using the mentioned tools:

a) Length of a notebook in hand spans.

b) Length of a mattress in foot spans.

c) Length of your living room in paces.

2) Give pupils this problem to be solved:

The length of Denis's foot span is 10cm long. Denis made 5 foot spans when measuring the length of a carpet. What is the length of the carpet in centimetres?

Expected answer:

Length of the carpet in centimetres:

1 foot span =10 cm

5 foot spans = 5 x 10 cm = 50 cm

PRACTICAL ACTIVITY 5: Estimating capacities and measuring capacity using different liquid containers

a) Rationale

This practical activity is conducted when teaching the lesson about estimating the capacity of containers. It is taught in unit 7. In real life, people use capacity measurements to know the quantity of liquid that of a container holds.

b) Objective:

To estimate and measure capacities of various containers in litres and apply them in solving mathematical problems related to daily life situations.

c) Required materials:

A jug, a mug/cup, a glass, a 5 litre jerrycan, a 20 litre jerrycan, a tank of 1000litres.

Mug Jug

Glass

5 litres 20 litres

A tank of 1000 litres

d) Procedure

Step 1: Fill the jug with water.

Step 2: Carefully pour water from the jug into the glass.

Step 3: What do you observe? Record the observation.

Step 4: Use the Mug/cup full of water and ask the learners to estimate the number of mugs full of water that can fill the jug and record the estimation.

Step 5: Use the Jug and ask the learners to estimate the number of Jugs full of water that can fill the 5 litre Jerrycan and record the estimation.

Step 6: Use a 0.5 litre Mug full of water and pour in the 2 litre Jug until it is filled, while counting the number of Mugs. Record the obtained number.

Step 7: Compare the estimation got in step 4 with the actual number of mugs obtained in step 6.

Step 8: Use a 5 litre jerrycan full of water to fill a Jerrycan of 20 litres full

Step 9: Count and record number of 5 litre Jerrycans have been poured in the Jerrycan of 20 litres full.

e) Data recording

Step	Estimation	Actual number	Observation
2	-	-	-
3			Water takes the shape of the container
4			Estimated number of mugs are recorded
5			Accept all estimated jugs
6		4 mugs	
7			
8			
9		4 jerry cans of 5 litres each	

f) Interpretation of results and conclusion

- Capacity is the quantity of liquid a container can hold.
- Containers like Jugs, bottles, Jerrycans, Cups, glass, tanks etc can be used to compare capacity of liquids.
- A jug contains more water than a cup or a glass.

- The standard unit used to measure capacity of liquid is litre.
- Liquids like water, milk, cooking oil, Petrol, drinks are measured in capacity units like litres.
- Liquids can't be measured like length or solids.
- When finding the number of small containers that can fill a large container of liquid, take the large capacity (for a big container) and divide it by smaller capacity (for a small container) in **the same unit of capacity**.

g) Guidance on the evaluation

Ask pupils to work out activities below related to the practical activity:

1. Manipulate liquid from a container to another to find the number of small containers which can fill a large container.
2. Find the number of 0.5 litre bottles of cooking oil that can fill a 5-litre bottle.
3. How does a milk man measure milk and what units does he use?
4. What other liquids do you know which are measured using the units of capacity?
5. What is half a litre equal to?
6. Peter has a tank whose capacity is 1000litres when full of water. How many 20-litre Jerry cans of water will he need to have it half-way filled?

PRACTICAL ACTIVITY 6: Compare capacities of various containers in litres

a) Rationale:

This practical activity is conducted when teaching the lesson about comparison of capacity measurements. It is taught in unit 7.

In real life, people use capacity measurements to compare the container which can carry a big quantity of a liquid than another container. It is necessary to use capacity measurements to decide if a jug is greater than a small jerrycan.

b) Objective:

To compare capacities of various containers in litres and deduce that all liquid containers are made using litre as the standard unit of capacity measurement.

c) Required materials:

Glass, Jug, Cup, Can, Small Jerrycan, Big Jerrycan.

d) Procedures

Collect empty containers including Glass, Jug, Cup, Can, Small Jerrycan and Big Jerrycan with the following capacities:

i. The capacity of glass is 0.5 litres. The capacity of jug is 2 litres

ii. The capacity of cup 0.3litre. The capacity of can is 10 litres.

iii. The capacity of small jerrycan is 5 litres. The capacity of a big jerrycan is 20 litres.

Step 1: Put empty glass of 0.5 litres and jug of 2 litres on the table for easy comparison.

Step 2: Fill the water into those two containers

i. State which container has more capacity than the other

ii. Record the capacity of each container and **use the comparison sign**.

Step 3: Put empty cup of 0.3 litres and a can of 2 litres on the table for easy comparison.

Step 4: Fill the water into those two containers.

i. State which container has more capacity than the other.
ii. Record the capacity of each container and use **the comparison sign**.

Step 5: Put empty small jerrycan of 5 litres and big jerrycan of 20 litres on the table for easy comparison.

Step 6: Fill the two containers with water.

i. State which container has more capacity than the other.
ii. Record the capacity of each container and use **the comparison sign**.

e) Data recording

Data is recorded in the following way:

In step1

The capacity of glass is 0.5 litres

The Capacity of jug is 2 litres. A jug is bigger than a glass. Therefore, 2l > 0.5l

In step 2

The capacity of cup is 0.3 litres

The capacity of can is 2 litres. The cup is smaller than a can. Therefore, 0.3l < 2l

In step 3

The capacity of small jerrycan is 5 litres

The capacity of big jerrycan is 20 litres. The bigger jerrycan is bigger than the small jerrycan. Therefore, 20l > 5l

This shows that we can compare capacity measurements of liquids by comparing the size of their containers.

f) Interpretation of results and Conclusion

The capacity of any container is the amount of liquid a container can hold. On our practical activity, water was filled in different containers to show which object has more capacity.

We can compare capacity measurements of liquids by comparing the size of their containers. The bigger jerrycan of 20l is bigger than the small jerrycan of 5l. Therefore, 20l > 5l.

g) Guidance on the evaluation

Ask pupils to answer to different questions related to the practical activity done above. For example:

a) What is the total capacity of the jug and the glass?

b) How many small jerry-cans are needed to have the same capacity as a big jerry-can?

c) Compare the capacity of a cup and the capacity of a small jerrycan.

d) What is the standard unit of capacity measurements for all liquids?

Expected Answers

a) The total capacity formed by jug and glass is equal to 0.5l+2l=2.5l

b) The number of small jerrycans needed to have the same capacity as a big jerrycan is 4.

c) Capacity of a glass is less than the capacity of a small jerrycan: 0.5l < 5l.

d) The standard unit of capacity measurements for all liquids is Litre.

PRACTICAL ACTIVITY 7: Estimating and measuring the mass of different objects using a beam balance

a) Rationale:

This practical activity is conducted when teaching the lesson about estimating the mass of objects. It is taught in unit 8. In real life, we cannot be sure about the quantity of an object by lifting it in our hand, we use the measurement of mass to know the exact quantity of objects. For example when buying the quantity of sugar, salt, beans, or cement, we measure their mass.

b) Objective:

To understand the mass and measure the mass of different objects using a balance.

c) Required materials:

A beam balance, Weighing scale balance, a weighing stone of 1kg, 2 common stones of different weight (500g, 1kg), different types of balances and onions.

Balances

d) Procedure

Step 1: Lift the smaller stone, estimate, tell and record the estimated mass.

Step 2: Lift the bigger stone, estimate, tell and record the estimated mass.

Step 3: Tell and record the estimated masses from your observation.

Step 4: Put a smaller stone on the weighing scale balance.

Step 5: Read and record the mass of the smaller stone.

Step 6: Put a bigger stone on the weighing scale balance.

Step 7: Read and record the mass of the bigger stone.

Step 8: Using your records from step 5 and step 7 explain what you observed.

Step 9: Take different objects, take each one in your hands and estimate its mass. Record it and then put the object on the balance and read the actual mass. Is your estimated mass the same as the actual mass for each object?

e) Data recording

Item	Estimated mass	Measured mass	observation
Smaller stone		500g or 0.5kg	Lighter
Bigger stone		1kg	Heavier
Other items			

f) Interpretation of results and conclusion

i. Mass is the quantity of matter for solids like stones, sugar, salt, cement, Irish potatoes etc.

ii. The standard unit used to measure the mass is Kilograms.

iii. Bags of cement, sugar, rice, packet of salt, packets of flour etc are measured using units of mass like Kilogram and Grams.

iv. When measuring mass, we use tools like: beam balance, Weighing scale balance, Spring balance, Electronic balance, Pan balance, Triple beam balance, a weighing stone of 1kg, 2kg, 500g, 5kg, etc.

v. For objects of the same matter, the big object has a big mass than the smaller object. For example, the mass of a big stone is greater than the mass of a small stone.

vi. The estimated mass of an object can be less or bigger than the actual mass obtained by using a balance. *It is necessary to use a balance to get the exact mass.*

g) Guidance on the evaluation

Ask pupils to answer to questions related to the practical activity:

1. Practice estimating the mass of small packets like a packet of salt, packets of flour and the mass for large objects like a bag of rice, sugar, cement, maize flour, a bunch of banana etc. Then use the balance to measure their actual mass. Verify if your estimated mass is the same as the actual mass.
2. How does a shop attendant measure sugar and what are the units normally used?
3. What other items do you know which are measured using the unit of mass?
4. What is half a kilogram equal to?
5. Peter has a bag full of feathers of 10 kg while Immaculate has a bag full of stones of 10kg. If you are asked to help one of them, whom would you help? Why? Who carries the heavier mass than the other?

Expected answers

1. A shop attendant measures sugar by using weighing balances like; beam balance, Weighing scale balance, a weighing stone of 1kg, other common stones of different weights 500g, 1kg, 2kg, 5kg, 10kg. Units normally used are: Kilogram (Kg), Gram (g)
2. Other items measured using units of mass are, bags of Irish potatoes, Rice, Maize flour, Meat etc…
3. Half a kilogram equals to 500g.
4. I may or may not help any of the two. Because they both have the same mass of items.

PRACTICAL ACTIVITY 8: Use a geoboard to find the areas of squares and rectangles

a) Rationale:

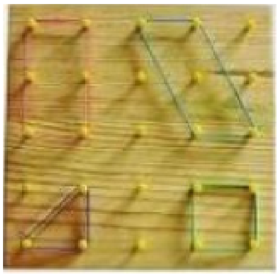
This practical activity is conducted when teaching the lesson about area of a square and the area of a rectangle. It is taught in unit 9. In real life, Surface area of an object is a measurement of the space covered by all sides of that object. People need to know the quantity of the surface for their land before constructing a house, selling or using it as a farm. The surface area of a sheet of paper means the value of the space that the paper can cover when it is put on the plane surface.

b) Objective:

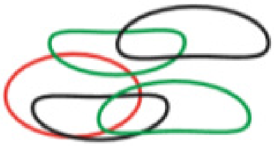
To form different a square and a rectangle on a geoboard and explore their areas.

c) Required materials:

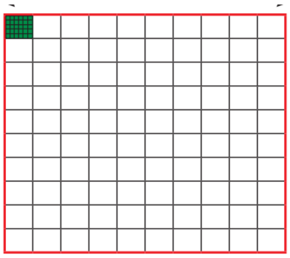
Geoboard and rubber bands, charts, Manila paper, or grided (squared) paper and copper pins.



A Geoboard



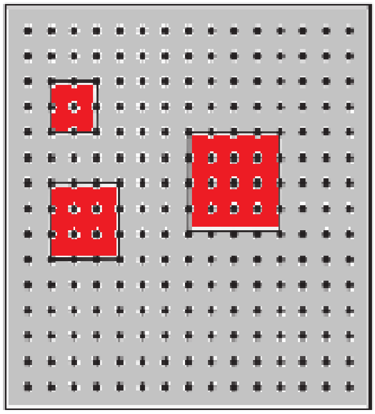
Rubber bands



A squared paper

d) Procedure

Step 1: Form different squares using rubber bands and copper pins on geoboard as shown in the figure below:

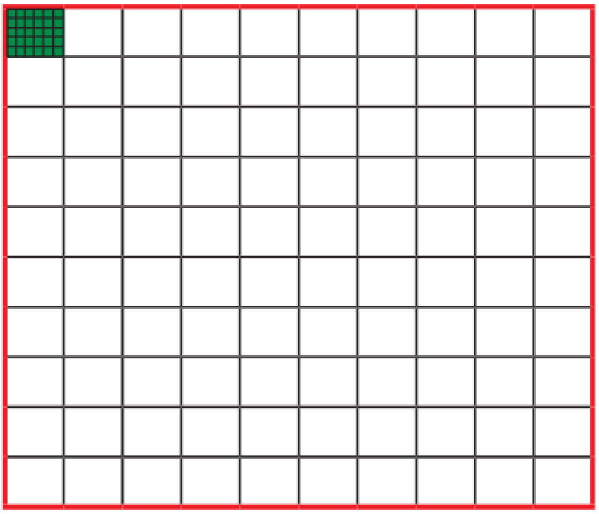


Step 2: Consider different squares, count the squares and fill in the Table

No	Total number of unit squares in the square	Side of the square	Side x Side
1			
2			
3			
4			

Step 3: Compare the result of second cell and fourth cell in each row. Write your observation.

Step 4: Use a squared paper below to form your own 4 different areas covered by the squares

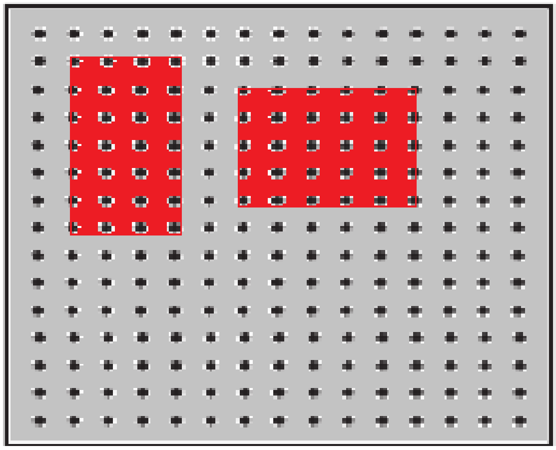


Step 5: Consider different squares, count the squares and fill in the Table below

No	Total number of unit squares in the square	Side of the square	Side x Side
1			
2			
3			
4			

Step 6: From the records in the table above what is your observation? How do we find the area of a square?

Step 7: Form different rectangles using rubber bands and copper pins on geoboard as shown in the figure below:



Step 8: Consider different rectangles count the squares and fill in the Table

No	Total number of unit squares in the rectangle	Length of the rectangle	Width of the rectangle	Length x Width
1				
2				

Step 9: Compare the result of second cell and fifth cell in each row. Then, write your observation. What is the area of a rectangle? How do we find it?

Step 10: Refer to the table and consider the case where one small square is 1cm by 1cm, what is the area of your shapes (square and rectangle) in cm?

Step 11: Given that one grid of squares above is $1cm^2$, show by shading the area of 9 cm^2 . How can we show the area of 12 cm^2 ?

e) Data recording

From Step 2

Square number	Total number of unit squares in the square	Number of unit squares on the Side of the square	Side x Side
1	4 squares	2	2 x 2 = 4 squares
2	9 squares	3	3 x 3 = 9 squares
3	16 squares	4	4 x 4 = 16 squares
4	196 squares	14	14 x 14 = 196 squares

From Step 3: The area covered by the big square is equal to the total number of unit squares of the area enclosed by the figure of the square. This area **is equal to side times side.** Therefore, area of a square is $A = s \times s$

For Step 7, we have:

No	Total number of unit squares in the rectangle	Length of the rectangle	Width of the rectangle	Length times Width
1	18	6	3	18
2	20	5	4	20

We see that the total number of unit squares is equal to the product of unit squares for the length L multiplied by the number of unit squares of the width W.

Area of a rectangle = $L \times W$

f) Interpretation of results and conclusion

- The area of a square is defined as the total number of unit squares in the shape of a square.
- A geoboard is used as a mathematical tool to explore basic concepts in plane geometry such as Area and Perimeter of geometric shapes.
- To find the total number of unit squares in square, count the unit squares on one side and multiply by the unit squares on the other side S. **Area of a square = side x side.**
- To find the total number of unit squares of a rectangle, count the number of unit squares of the length L, multiply it by the number of unit squares for the width W.

Area of a rectangle A = L x W.

g) Guidance on the evaluation

Ask pupils to answer to questions related to the practical activity:

1) Practice to measure and find area of different squares and rectangles using the concept of square units on a geoboard, or a squared paper.

2) What do you think is the area of a squared sitting room which measures 4meters each side?

3) Find the area of a rectangular field whose length is 4m and width is 2m.

4) Do we need to find the area in our daily life?

5) Do you think Geoboard, rubber bands and copper pins can be used to find areas of other polygons? If yes, how? If no, why?

Expected answers

1) The area of squared sitting room that measures 4m each side is A= 4m x 4m = 16 m^2

2) The area A of a rectangular field whose length is 4m and width is 2m.

$$A = L \times W = 4m \times 2m = 8m^2$$

3) Yes, we need to find the area in our daily life.

4) Yes geoboard, rubber bands and copper pins can be used to find the areas of other polygons, since a geoboard acts as a graph/squared paper.

PRACTICAL ACTIVITY 9: Telling time read on a clock face

a) Rationale:

This practical activity is conducted when teaching the lesson about reading and telling the time on a clock. It is taught in unit 10.

In real life, we use watches to know the time so that we may manage well the time we have. Effective time management allows students to complete more in less time, because their attention is focused and they're not wasting time on distractions such as social media, for example. Efficient use of time also reduces stress, as students tick off items from their to-do list. By using time efficiently, students can complete their work on time, stay engaged with their learning, and have more time free for pursuing activities that are important to them, such as sports, hobbies, youth group and spending time with friends and family.

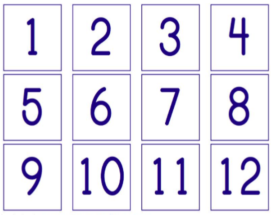
b) Objective:

To be able to appropriately tell and write the time read on a clock face.

c) Required materials:

plastic teaching clock face, Number cards, bottle tops with numbers, Manila papers.


Clock face



Number cards

Manila papers

d) Procedures

Step 1: Observe a clock face and identify the shorthand or hour hand, the long hand or minutes hand, and the thinnest hand that shows seconds.

Step 2: Consider the hour and minutes hands, then read and write the time shown by the clock face:

		
Clock A	*Clock B*	*Clock C*

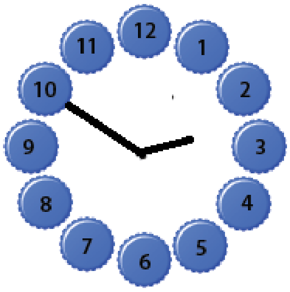
i) Starting by hour.

ii) Starting by minutes.

Step 3: Take Manila paper

Step 4: Place number cards from 1 to 12 on the Manila paper with the same interval to draw a clock.

Step 5: Use two sticks; one as a shorthand and the other as a long hand and bottle tops to show 2:50 pm



Read and write the time formed.

Step 6: Use shorthand, long hand to show the time you start class.

At which time do you start class?

Step 7: Use shorthand, long hand on the clock face to show the following time:

i. 03:20

ii. 10:35

iii. 04:55

Step 8: Read and tell the time formed above.

e) Data recording

Data are recorded in the following way:

The shorthand represents the hour

The long hand represents the minutes

The time formed is 2:50: It is ten to three or It is fifty minutes past 2.

Recording data when using Manila paper and number cards

Step 8:

i. It is twenty past three
ii. It is twenty-five to eleven
iii. It is five to five.

f) Interpretation of results and Conclusion

The Clock face used for this practical activity has numbers from one to twelve and those numbers are explained accordingly

If it is facing short hand, the number represent hour, one rotation makes 12 hours.

If it is facing long hand, the number represent minutes, it makes full rotation on clock face of 60 minutes. Each interval counts 5 minutes

If it is facing thinnest hand, the number represent seconds, It makes full rotation on clock face of 60 seconds.

Additional information for the teacher

There are two common ways of telling the time:

1) Say the hour first and then the minutes. (Hour + Minutes)
   - 6:25 - It's six twenty-five
   - 8:05 - It's eight O-five (the O is said like the letter O)
   - 9:11 - It's nine eleven
   - 2:34 - It's two thirty-four

2) Say the minutes first and then the hour. (Minutes + PAST / TO + Hour)

   For minutes 1-30 we use PAST after the minutes.

   For minutes 31-59 we use TO after the minutes.
   - 2:35 - It's twenty-five to three
   - 11:20 - It's twenty past eleven
   - 4:18 - It's eighteen past four

- 8:51 - It's nine to nine
- 2:59 - It's one to three

When it is 15 minutes past the hour we normally say: (a) quarter past

7:15 - It's (a) quarter past seven

When it is 15 minutes before the hour we normally say: a quarter to

12:45 - It's (a) quarter to one

When it is 30 minutes past the hour we normally say: half past

3:30 - It's half past three (but we can also say three-thirty)

O'clock

We use o'clock when there are NO minutes.

10:00 - It's ten o'clock

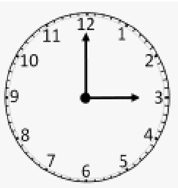
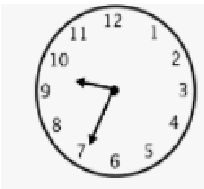
5:00 - It's five o'clock

1:00 - It's one o'clock.

g) Guidance on the evaluation

Ask pupils to answer to different questions related to the practical activity above. For example,

i. Read and tell the time of the clock faces shown below:

a)  b)  c)  d) 

ii. How many minutes formed by minute hand after one full rotation on clock face?

iii. How many hours formed by hour hand after one full rotation on clock face?

Expected Answers

i. a. It is three O'clock.

   b. It is twenty-five to ten.

   c. It is seventeen past four.

   d. It is five to eight.

ii. The minute hand after one full rotation makes total of 60 minutes.

iii. The hour hand after one full rotation makes a total of 12 hours.

PRACTICAL ACTIVITY 10: Roleplay the buying and selling using money

a) Rationale:

This practical activity is conducted when teaching the lesson about buying and selling. It is taught in unit 12. In real life, people use money to buy goods and sell goods to earn money. The goods normally sold on cash basis are edibles sold by small retailers such as: Vegetables, yam, beans, salt, pepper, etc.

b) Objective:

To be able to understand what money is and know its applications in our daily life.

c) Required materials:

Money cards in form of coins and notes, real notes, and coins for demonstration.

Real image			
Money cards	**500 Frw**	**1000Frw**	**2000Frw**

d) Procedures

Step 1: Suppose that you are Kamikazi and you go to the Market, read to understand the instruction in the following problem:

Kamikazi was given 6000 Frw by her mother for buying different school materials. She bought a t-shirt at 1000 Frw, a book at 1000 Frw, a geometrical set at 1500 Frw and notebooks at 2000 Frw.

Step 2: Put different money cards on the table, including 2 cards of 500 Frw, 4 cards 1000 Frw, and 3 cards of 2000Frw.

Step 2: Take a card of 1000 Frw and buy a T-Shirt.

Step 3: Take a card of 1000 Frw and buy a book.

Step 4: Take a card of 1500 Frw and buy geometrical set.

i. How many cards and their value are used to buy geometrical set?
ii. How many cards of 1000 Frw are remaining?

Step 5: Take a card of 2000 Frw and buy a notebook.

i. How many cards of 2000Frw are remaining?
ii. If Kamikazi was given 6000 Frw to buy school materials, how much did she remain with?

iii. What is the meaning of money? Wht is its role?

e) Data recording

At step 1: All money cards are made up of 2 cards of 500 Frw, 4 cards 1000 Frw, and 3 cards of 2000Frw.

At step 2: A t-shirt is cost 1000 Frw

At step 3: A book is cost 1000 Frw

At step 4: A geometrical set is cost 1500 Frw

i. One card of 1000 Frw and one card of 500Frw
ii. One card of 1000Frw is remaining

At step 5: Notebooks are cost 2000Frw

i. Two cards of 2000Frw are remaining
ii. The money that Kamikazi remained with is 500Frw.
iii. Money is a current medium of exchange in the form of coins and banknotes; or coins and banknotes collectively. It is used to facilitate transactional trade for goods and services.

f) Interpretation of results and Conclusion

This practical activity has used different money cards with different values, the small cards have value of 500 Frw, the second has the value of 1000 Frw, the third has the value of 2000Frw and the big money card has the value of 5000Frw.

We use money to buy and sell goods and pay services.

g) Guidance on the evaluation

Ask pupils to answer to questions related to this practical activity:

1) What do we call the national currency used in Rwanda?
2) Which Rwandan note has the highest value and which one with the smallest value?
3) A Father gives to his son Kaneza three notes of 2000 Frw and 2 notes of 1000 Frw to buy school uniform of 6000 Frw.

i. What was the total amount of money given by the father?
ii. After buying school uniform, how much did he remain with?

Expected Answers

1) The national currency used in Rwanda is called Rwandan Francs.
2) The Rwandan note with highest value is 5000Frw while with the smallest value is 500Frw.
3) i. The father gives to his son Kaneza the total amount of 8000 Frw.

ii. After buying school uniform Kaneza remained with 2000 Frw.

PRACTICAL ACTIVITY 11: Finding the missing or next number in an arithmetic progression

a) Rationale:

This practical activity is conducted when teaching the lesson about completing the missing number in a number pattern involving addition. This lesson is taught in unit 13.

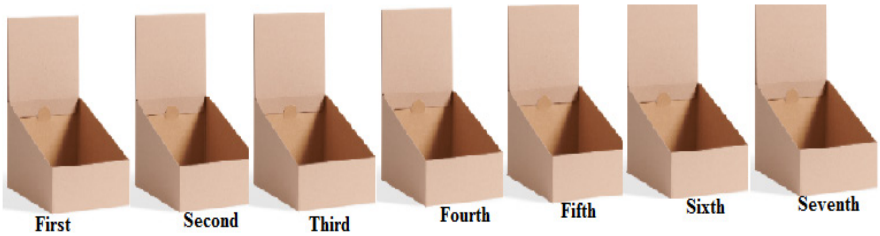
In real life, the arithmetic progression is important in real life because this enables us to understand things with the use of patterns. An arithmetic progression is a great foundation in describing several things like time which has a common difference of 1 hour. An arithmetic progression is also important in simulating systematic events. Through the arithmetic sequence, we can be able to create ideas and live with applying systematic knowledge.

b) Objective:

To find practically the missing or next number in an arithmetic progression.

c) Required materials:

6 Empty chalk boxes labelled: First, second, Third, Fourth, Fifth, Sixth; counters; marker; counters and Manila paper.



d) Procedures.

Step 1: Place one counter in the first box. Record the number of counters in the first box on a manila paper.

Step 2: Remove the counter from the first box and transfer it to the second box. Add three counters in the second box. Count the number of counters in the second box and record the number on the manila paper.

Step 3: Remove all counters from the second box and place them in the third box. Add three more counters in the third box. Count the number of counters in the third box and record the number on a manila paper.

Step 4: Remove all counters from the third box and place them in the fourth box. Add three more counters in the fourth box. Count the number of counters in the fourth box and record the number on a manila paper.

Step 5: Remove all counters from the fourth box and place them in the fifth box. Add three more counters in the fifth box. Count the number of counters in the fifth box and record the number on a manila paper.

Step 6: write all the obtained numbers of counters in the boxes in a row. Record what you think will be the next number or number of counters in the sixth box if you followed the same procedure. How do you get it?

e) Data recording

The number of counters in the first, second, Third, Fourth, Fifth, Sixth, boxes recorded are as follows

In Step 1: Number of counters in the first is **1**

In Step 2: Number of counters in the second box is **4**

In Step 3: Number of counters in third box is **7**

In Step 4: Number of counters in the fourth box is **10**

In Step 5: Number of counters in fifth box is **13**

In Step 6: The numbers are **1, 4, 7, 10, 13, ...** They form an arithmetic progression. The next number in the sixth box is 16. To get it, 3 counters are added to the number of counters in the fifth box.

f) Interpretation of results and Conclusion:

i) How do you call the list of numbers formed by the number of counters in the boxes?

ii) Basing on your observation, how do you get the number of counters to be put in the next box?

Expected answer:

i) The number of counters in the boxes in the practical activity **1, 4, 7, 10, 13** formed an arithmetic progression with first term 1 and a common difference 3.

ii) Determining the missing and next number in the progression requires one to determine the common difference and add the common difference to the previous term.

g) Guidance on the evaluation

Ask pupils to do the following activity and answer to raised questions:

Consider the following arithmetic progression: 1,3, 5,7, 9, **A**, 13, 15, **B**.

State the common difference.

Conduct a practical activity to determine the missing term A and the next term B.

Expected answers:

Common difference is equal to 3-1= 5-3 =2

Missing term A is 9 + 2=**11** and next term B is 15 + 2 = **17**.

PRACTICAL ACTIVITY 12: Angles and their measurement

a) Rationale:

This practical activity is conducted when teaching the lesson about making and measuring angles. It is taught in unit 14.

In real life, engineers use angle measurements to construct buildings, bridges, houses, monuments, etc.

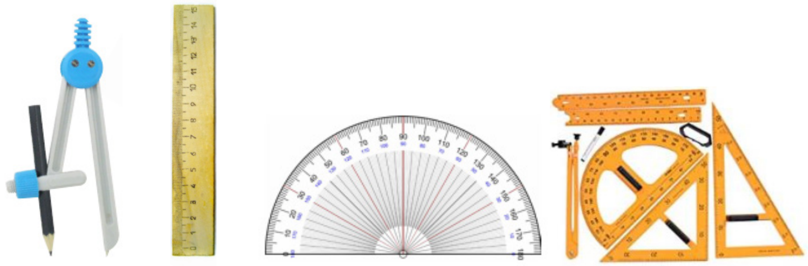
Carpenters use angle measuring devices such as protractors, to make furniture like chairs, tables, beds, etc.

b) Objective:

To form angles and use a protractor to measure different angles.

c) Required materials:

A ruler, a sharp pencil, a paper or a book, a rubber, a compass, a set square, and a protractor.

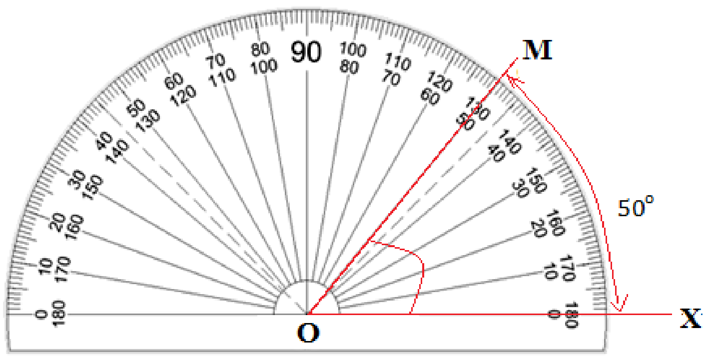


d) Procedure:

Drawing and measuring angles

Draw an angle of 50° in the steps given below:

Step 1: Draw a the first line, say OX.



Step 2: Now place the protractor in such a way that its straight horizontal edge is placed on OX and its centre is on O as shown in the figure above.

Step 3: Starting from zero from the right, read the scale on the protractor and mark a point at 50° mark on the paper as shown on the figure.

Step 4: Name the point marked say, M and join the points O and M with the help of a scale.

Angle XOM = 50°.

Step 5: Use the steps above, draw the following angles:

i) 45^0 ii) 135^0 iii) 90^0

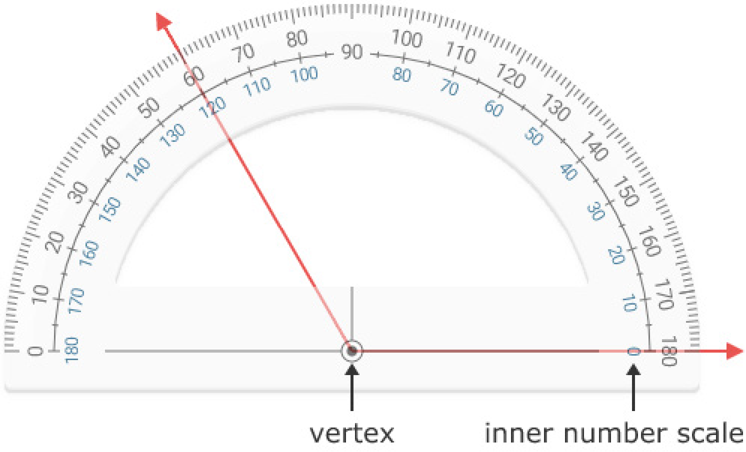
To measure an angle using a protractor

Step 1: Line up the vertex of the angle with the dot at the center of the protractor.

Step 2: Line up one line of the angle with 0 degrees on the protractor.

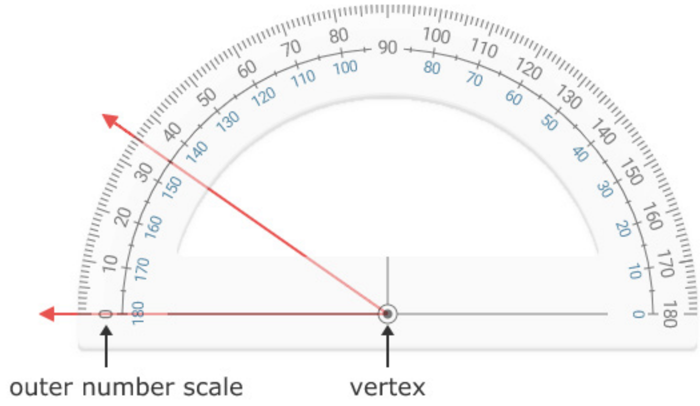
Step 3: Read the protractor to see where the second line of the angle crosses the number scale in an anticlockwise direction.

For example: one line of this **angle** is lined up with 0 degrees on the **inner number scale** of the protractor. Read the **inner number scale** where the other line segment crosses.



This angle measures 120 degrees.

Step 4: Using the clockwise direction, try another example. One side of this **angle** is lined up with 0 degrees on the **outer number scale** of the protractor. Read the **outer number scale** where the other side crosses.



This angle measures 35 degrees.

Now, try to summarize how to measure an angle.

e) Interpretation of results and conclusion

When drawing and measuring angles, the following should be observed:

i) The pencil must be sharp to help in drawing thin line for accurate readings.

ii) An angle can either be read from clockwise or anticlockwise

iii) The protractor has to be placed properly such that the lines of the angle point to the correct readings of the protractor. The centre of a protractor must coincide with the vertex of the angle.

f) Guidance on the evaluation

Ask pupils to answer to questions about the practical activity:

i. How can 180^0 be measured and drawn accurately?
ii. What is the unit of angles?
iii. How can you define an angle?

Expected answers:

i. 180^0 can be measured and drawn accurately by using a sharp pencil, a ruler and a protractor.
ii. Units of angles are degrees.
iii. An angle can be defined as the space (usually measured in degrees) between two intersecting lines. Or an angle is a figure that is formed when two lines meet at a common point.

PRACTICAL ACTIVITY 13: Triangles and quadrilaterals

a) Rationale:

This practical activity is conducted when teaching the lesson about the difference between triangles and quadrilaterals. It is taught in unit 15.

In real life, everything from blueprints (of homes) , doors, window, swimming pool, boxes, football ground, paper etc. is generally made up of triangles and quadrilaterals. In electronic devices like mobiles, laptops, computers, TVs, etc. In stationery items like books, copies, chart-papers, etc.

b) Objective:

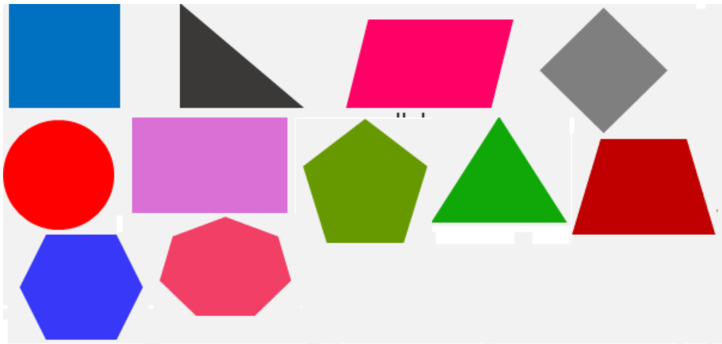
To use geometric properties to classify geometric shapes in triangles and quadrilaterals.

c) Required materials:

A pair of scissors, plain papers, cuttings of different geometric shapes: triangles, squares, rectangles, Pentagons, hexagons.

d) Procedure:

Step 1: Carefully observe the set of geometric shapes given.



Step 2: Separate the shapes according to the number of sides, number of angles.

Step 3: From the set of triangles, count and record the number of sides, vertices and angles each shape has.

Shape	Sides	Vertices	Angles
Triangle			

Step 4: From the set of **quadrilaterals**, count and record the number of sides, vertices and angles each shape has.

Shape	Sides	Vertices	Angles
Quadrilaterals			

Step 5: From each set of shapes, record any observation apart from those in (3) and (4) above.

e) Data recording

From step 3,

Shape	Sides	Vertices	Angles
Triangle	3	3	3

From **step 4)**

Shape	Sides	Vertices	Angles
Quadrilaterals	4	4	4

From step 5,

i. Some quadrilaterals have opposite sides equal.
ii. Some quadrilaterals have the right angles.
iii. Some triangular shapes have all sides equal others have all three sides not equal.

f) Interpretation of results and conclusion.

All quadrilaterals have 4 sides, 4 angles and 4 vertices.

All triangles have 3 sides, 3 angles and 3 vertices.

g) Guidance on the evaluation

Ask pupils to answer to questions related to the activity done.

i. What object do we see in our environment which has the shapes of quadrilateral?
ii. From the above activities, define a vertex
iii. What object do we see in our environment which has the shapes of triangles?
iv. How is this lesson useful in our day today life?

Expected answers

i. In our environment objects that have quadrilateral shapes are tables, desks, computer desktop, the wall of a room, the floor of the sitting room, classroom, a playground.
ii. A vertex is defined as the common point of the two lines that form an angle.
iii. In our environment objects that have shape of triangle are a geometric set square, house roof, etc.
iv. The lesson about triangles and quadrilaterals is useful in our daily life for study purposes, architectural designers, engineers, builders deal with objects with triangular or quadrilateral faces.

PRACTICAL ACTIVITY 14: Investigate the symmetrical property of 2D shapes

a) Rationale

This practical activity is conducted when teaching the lesson about symmetrical property of a 2D shape. It is taught in unit 15.

In real life, we can see identic parts in a whole vis a vis a certain line: Reflection of trees in clear water and reflection of mountains in a lake, Wings of most butterflies are identical on the left and right sides, Some human faces are the same on the left and right side. Such parts are said to be symmetric.

b) Objective:

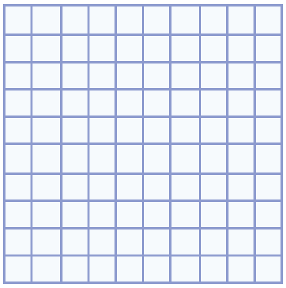
To identify the number of lines of symmetry in different geometrical shapes.

c) Required materials:

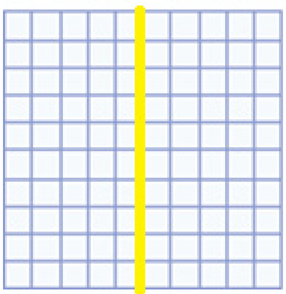
A pencil, plain papers, cuttings of different geometric shapes.

d) Procedure:

Step 1: Get a plain paper in form of a square and fold it vertically such that the two sides cover each other properly.

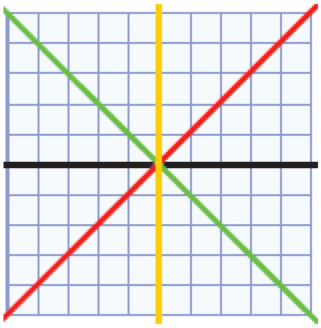


Step 2: Unfold that paper properly then use a pencil and a ruler to draw a dotted line along the folding line.



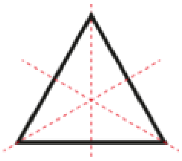
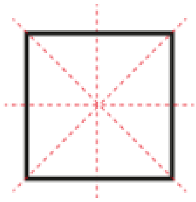
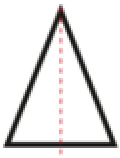
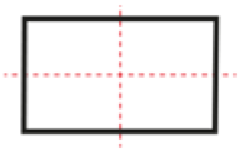
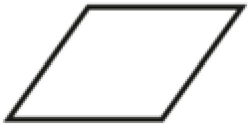
Step 3: Get that very plain paper and fold it horizontally and diagonally such that the two sides cover each other properly.

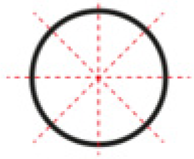
Step 4: Unfold that paper properly then use a pencil (different colours) and a ruler to draw lines along the folding lines.



How do you call the line? How many are they?

Step 4: Using the same procedures as above, find the number of symmetrical lines of the following geometric shapes in the table and complete it.

No	Name	Image	Number of symmetrical lines
1	Equilateral triangle		
2	Square		
3	Isosceles triangle		
4	Rectangle		
5	Parallelogram		

6	Circle		

e) Data recording

i. From the above figures (inserted pictures) we observe that if these figures are folded along specific lines (dotted lines), each figure on the left side of the dotted line fits exactly on the figure on the right side of the dotted line.

ii. Therefore, if a figure is divided into two equal parts by a line, then that figure is called **symmetrical** along that line and the line is called **Line of symmetry.**

iii. There are **Lines of symmetry** in a squared paper.

f) Interpretation of results and conclusion

- From the activity above, the plain paper in form of a square has 4 lines of symmetry.
- A rectangular plain paper has 2 symmetrical lines.
- Some shapes such as the parallelogram don't have symmetrical lines.
- In any symmetrical figure, symmetrical lines intersect at a common point called point of intersection.
- For regular polygons, the number of lines of symmetry is the same as the number of sides of the shape**, the circle has an infinite number of lines of symmetry.**

g) Guidance on the evaluation

Ask pupils to answer to the following questions:

i. How many lines of symmetry does a squared shape have?

ii. Get a circular paper and find how many symmetrical lines it has.

iii. Name all quadrilaterals that have symmetrical lines.

iv. Do you think a right-angled triangle has any symmetrical lines?

Expected answers:

i. There are 4 lines of symmetry in a square shape.

ii. A circular paper has got infinity symmetrical lines (very many).

iii. Quadrilaterals that have symmetrical lines are: a square, rectangle, Rhombus, equilateral trapezium.

iv. A right-angled triangle will have one symmetrical line when it is isosceles triangle.

PRACTICAL ACTIVITY 15: Area of a parallelogram

a) Rationale:

This experiment is conducted when teaching how you find the area of a parallelogram using real material. The area of a parallelogram is a topic taught in primary four-unit 16.

A parallelogram is a quadrilateral that consists of two pairs of sides that are mutually parallel to each other and are equal in length. In real life, some objects have the form of a Parallelogram: Tiles. Buildings, Roofs, Paper, Desks, Erasers, Solar Panels, Striped Pole, Steps of a Stair-Case, etc.

b) Objective:

To derive the formula of the area of a parallelogram.

c) Required Materials:

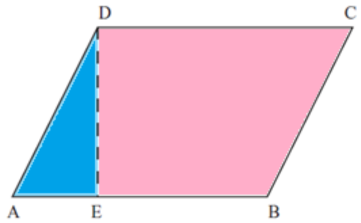
Manila paper, pencil, a pair of scissors, glue.

d) Procedures & Steps of experiment

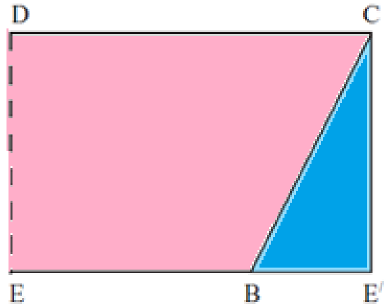
Step 1: Make the parallelogram ABCD by paper folding.

Step 2: Cut out the parallelogram with the help of a pair of scissors.

Step 3: Obtain a perpendicular from $\overline{AB}$ to meeting $\overline{AB}$ at E.



Step 4: Cut and remove the triangle ΔAED and align $\overline{AD}$ with $\overline{BC}$. Call the displaced segment $\overline{AE}$ as $\overline{AE}'$ as shown in $\overline{AE}$



– Verify that $\overline{CE'}$ is perpendicular to $\overline{EE'}$ and $\overline{EE'} = \overline{CD}$

– Observe that the figure obtained is a rectangle.

- What is a parallelogram?
- When two-line segments are parallel?
- What is a rectangle?
- What is the formula for the area of a rectangle DEE'C?
- How do we find the area of the parallelogram ABCD? What are the sides of this parallelogram?
- Compare the area of rectangle DEE'C and the area of the parallelogram ABCD.

e) Interpretation of results:

The area of the parallelogram ABCD =area of rectangle EE'CD=length x width .

Area of parallelogram= base x height

f) Conclusion

Area of parallelogram= base x height .

PRACTICAL ACTIVITY 16: Area of a triangle

a) Rationale:

This experiment is conducted when teaching how to find the area of a triangle using real material. The area of a triangle is a topic taught in primary four-unit 16.

In real life, one might have often come across different foods or things which are triangular. From the sandwiches you eat in breakfast, some timbers used by house designers, Traffic Signs, Pyramids, Sailing Boat, Roof, Staircase, and ladder, to the dangerous Bermuda triangle, almost everything is triangular.

b) Objective:

To explore how to find the area of a triangle.

c) Required Materials:

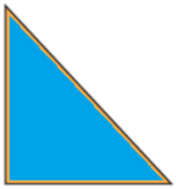
Manila paper, pencil, compass, scale, a pair of scissors, cello tape.

d) Procedures & Steps of experiment:

cut outs of congruent triangles, sheets of paper.

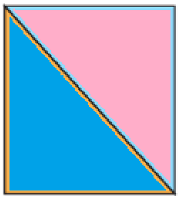
For right angle triangle

Step1: Cut a right-angle triangle on a manila paper



Step 2: Cut a triangle congruent to the right-angle triangle.

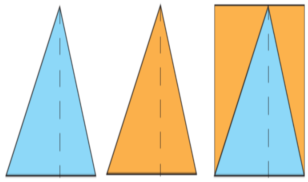
Step 3: Align the hypotenuse of the two triangles to obtain a rectangle



Step 4: Find the area of the rectangle and that of the triangle and compare them.

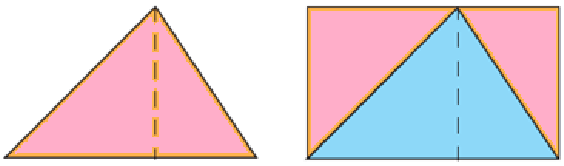
For acute angle triangle

Step1: Cut an acute angled triangle and draw the perpendicular from the vertex to the opposite side.



Step 2: Cut a triangle congruent to it and cut this triangle along the perpendicular

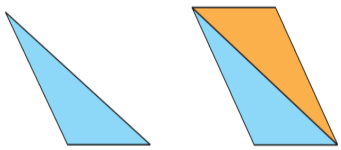
Step3: Align the hypotenuse of these cut outs to the given triangle to obtain a rectangle



Step 4: Find the area of the rectangle and that of the area of the triangle and compare them.

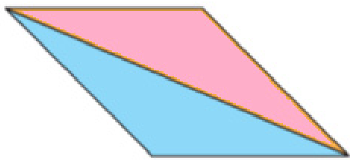
For obtuse angle triangle

Step 1: Cut an obtuse angled triangle.



Step 2: Cute a triangle congruent to this obtuse angled triangle.

Step 3: Align the greatest side of the two triangles to obtain parallelogram.



Step 4: Find the area of the parallelogram and that of the triangle and compare them.

e) Interpretation of results:

- What is a rectangle?

- When two triangles are congruent?
- What is the formula for the area of a triangle vis-avis the area of the related rectangle?
- What is a parallelogram?
- What is the formula for the area of a parallelogram?

Expected answers:

For right angle triangle,

The area of the rectangle = area of the two congruent triangles

= base x height

The area of triangle is therefore equal to $\frac{1}{2}$ area of the rectangle$=\frac{1}{2}$ base $\times$ height

For acute angle triangle

The area of the rectangle = area of the two congruent triangles = base x height

The area of triangle is therefore equal to $\frac{1}{2}$ area of the rectangle$=\frac{1}{2}$ base $\times$ height

For obtuse angle triangle

The area of a parallelogram = area of two congruent triangle = base x height

The area of a triangle= $\frac{1}{2}$ area of the parallelogram $=\frac{1}{2}$ base $\times$ height

f) Conclusion

The area of a triangle $=\frac{1}{2}$ base x height

PRACTICAL ACTIVITY 17: Area of a rhombus

a) Rationale:

This experiment is conducted when teaching how to find the area of a rhombus using real material. The area of a rhombus is topic taught in primary four, unit 16.

Rhombus is a special type of a parallelogram whose all sides are equal. In real life, Rhombus can be found in a variety of things around us, such as a kite, windows of a car, rhombus-shaped earring, the structure of a building, mirrors, and even a section of the baseball field.

b) Objective(s) of the experiment:

To derive the formula for the area of a rhombus.

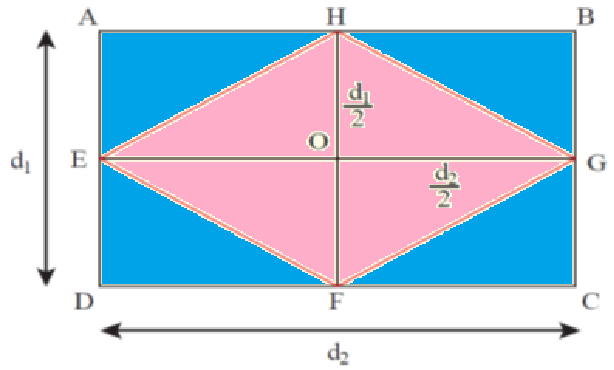
c) Required Materials:

Coloured papers, sketch pens, geometry box, a pair of scissors, glue, and eraser

d) Procedures & Steps of experiment

Step 1: Draw a rectangle ABCD with length d_2 and breadth d_1 units on a coloured paper.

Step 2: Mark points *E, F, G* and *H* as mid points of the sides $\overline{AD}$, $\overline{DC}$, $\overline{CD}$ and $\overline{BA}$ respectively of sides of the rectangle ABCD dawn in step above.



Step 3: Join $\overline{HF}$ and $\overline{ED}$. Mark their intersection as point O. Fold the rectangle along $\overline{EG}$ and $\overline{HF}$ dividing the rectangle ABCD into four congruent rectangles,namely OEAH, OEDF, OFCG and OGBH.

Step 4: Divide each of the four rectangles into two congruent triangles by drawing their respective diagonal.

What is a rectangle?

What is the formula for the area of a rectangle?

What is a rhombus? Compare the sides of the rectangle ABCD and the diagonals for the rhombus HEFG. Compare the area of the rectangle ABCD and the area of the rhombus HEFG.

e) Interpretation of results

As the small rectangles are congruent, their sides EH, HG, GF, FE are equal. Thus, is a rhombus.

In the rectangle *AHOE* , triangles *AHE* and *EHO* are congruent and hence equal in area. Thus, area of the right triangle *EOH* is half the area of the rectangle *AEOH*. Similarly, the area of right triangles *HOG,GOF,FOE* is half the area of the rectangles *HBGO,OGCF* , and *FOED* respectively.

Thus, the area of a rhombus $= \frac{1}{2}$ * area of a rectangle

$\frac{1}{2}$ * d1*d2= $\frac{1}{2}$ products of diagonals

f) Additional information for the teacher:

Emphasize the difference between a parallelogram and a rhombus. While the parallelogram has two equal opposite sides and its diagonal are not equal and bisect each other, a rhombus has all sides equal, and the diagonal bisect each other at 90^0. Moreover, a rhombus has a pair of acute angles and a pair of obtuse angles.

g) Conclusion

The area of a rhombus= $\frac{1}{2}$ * d1*d2= $\frac{1}{2}$ products of diagonals

PRACTICAL ACTIVITY 18: Tossing one coin

a) Rationale:

This practical activity is conducted when teaching the lesson about introduction to probability. It is taught in unit 18.

In real life, the game of tossing a coin reflects the decision we can take for doing or not doing something if we do not consider the inconvenient the decision can affect on us. For example, if one does not care, he/she can choose to quit a job or not, seek more education or not, end a relationship or not, quit smoking or not etc. This result shows us that the process is free from all bias, and that both the possible outcomes (yes or no) are 'equally likely' to occur if we do not care.

b) Objective:

To play a game of tossing a coin or coin-based probability.

c) Required materials:

Coins, Marker, Plain Paper.

	
Head (H)	Tail (T)

d) Procedures:

Step 1: Get a coin. Decide which side of the coin is the head and which one is the tail. Denote the Head as (H) and the as tail (T).

Step 2: Draw a table to record results for every toss with two rows and 11 columns.

The rows are labelled Number of throws and the other the result recorded as the face of the coin that shows on top.

Number of throws	1^{st} throw	2^{nd} throw	3^{rd} throw	4^{th} throw	5^{th} throw	6^{th} throw	7^{th} throw	8^{th} throw	9^{th} throw	10^{th} throw
Result (side facing up)										

Step 3: Toss the coin, allow it to fall on the floor and note the side facing up. If the head is facing up in the 1^{st} toss, then write H in the table. Write T for

a tail facing up. Repeat tossing the coin 9 more times and record your results as honestly as possible in the table.

Number of throws	1st throw	2nd throw	3rd throw	4th throw	5th throw	6th throw	7th throw	8th throw	9th throw	10th throw
Result (side facing up)	H or T	H or T	H or T	H or T	H or T	H or T	H or T	H or T	H or T	H or T

Step 4: Determine the number of heads (H) and number of tails obtained during the experiment. Which of the two faces appeared most times? Was the game fair?

e) Data recording:

Assuming that the following results were obtained after tossing the coin ten times, the recorded expected answers would be as follows:

Number of throws	1st throw	2nd throw	3rd throw	4th throw	5th throw	6th throw	7th throw	8th throw	9th throw	10th throw
Result (side facing up)	H	T	H	H	H	T	H	T	T	H

f) Interpretation of the results and conclusion

Complete:

The number of heads (H) obtained during the experiment is equal to....

The number of tails obtained during the experiment is equal to .....

Which of the two faces appeared most?

Can you exactly predict the face that is going to face up?

Expected answers:

Tossing a coin is one of the games of chance.

When a coin is tossed once there are only two possibilities; it is either a Head or a Tail. We can not say exactly the face that is going to face up. Having more Heads is gotten by chance.

The possibility of something happening is also called the chance or likelihood of something happening. The number of favourable outcomes out of all possible outcomes is called probability. So, the probability of a Head showing during a single toss is one of the two chances. It can be expressed probability of the head is $\frac{1}{2}$.

PRACTICAL ACTIVITY 19: Tossing 3 coins

a) Rationale:

This practical activity is conducted when teaching the lesson about the introduction to probability. It is taught in unit 18.

In real life, we observe situations or events for which we can predict the possibility of a result. This prediction is known as Probability. The result of tossing 3 coins is also probably possible. Probability is widely used in all sectors in daily life like sports, weather reports, blood samples, predicting the sex of the baby in the womb, congenital disabilities, etc.

b) Objective:

To play a game of tossing 3 coins and decide if the game is fair.

HHH

HTT

c) Required materials:

Three coins, Marker, Plain Paper.

d) Procedures.

Step 1: Pair up with a friend. Carefully observe the coin faces. Decide which side of the coin is the head (H) and which one is the tail (T).

Step 2: Decide on a winning combination before starting the game for example HHH. If you get anything else, for example HHT, then you have lost.

Step 3: Toss all the three coins at the same time and note the sides of the coin facing up. What are the possible combinations to show when three coins are tossed at once?

Step 4: Give the three coins to your friend and let him/her toss. Note the sides facing up and record the result as a loss or win in relation to the winning combination.

Step 5: Repeat the experiment several times and see who gets 10 wins first.

Step 6: Comment on whether you think the game was fair, state scenarios that would make the game unfair.

e) Data recording

Possible combinations when three coins are tossed once at the same time are:

all heads (H,H,H), two Heads 1 Tail (H,H,T), One Head two tails (H,T,T), all tails (T,T,T).

f) Interpretation of results and Conclusion:

The game is fair since the two people are tossing with similar coins. Unfairness would come if the winning combination was not decided before tossing.

Another source of unfairness would be if the sides of the coins are unbalanced.

g) Guidance on the evaluation

Ask pupils to repeat the game by throwing two coins at once. Decide the winning combination and play the game until one gets the winning combination.

What are some of the possible combinations when two coins are tossed once?

Possible answers:

Possible combinations when two coins are tossed at the same time are all heads (H, H), One Head one Tail (H,T), all tails (T,T).

PRACTICAL ACTIVITIES FOR P5

PRACTICAL ACTIVITY 1: Composition of numbers

a) Rationale:

This practical activity is conducted when teaching a lesson about forming numbers up to 1,000,000. It is taught in Unit 1.

In our daily life, we may come across large numbers in newspapers, on television shows, on bank slips, to express the number of objects, people of the amount of money. Whenever one gets stuck with a large number, he/she would think about how to write the number in a place value table to help him/her make sense of it.

b) Objective:

To compose smallest /largest/odd/prime/even 6-digit number from the given digits.

c) Required materials:

Number cards of the following numbers 3; 5; 7; 9; 0 and 6.

d) Procedures

Step 1: Take the number cards of different colors of the following digits: **3; 5; 7; 9; 0; 6**. Then place them on the table for easy manipulation.

Step 2: Read and discuss the following instructions to identify the number card which to start by, to get the correct number.

i) Form a smallest possible 6-digits number from the given digits.

ii) Form a largest possible 6-digits number from the given digits

iii) Form a largest even number of 6 digits from the given digits

iv) Form a smallest even number of 6 digits from the given digits

v) Form a largest odd number of 6 digits from the given digits.

vi) Form a smallest odd number of 6 digits from the given digits.

Step 3: For each case above, read the obtained number.

Step 4: For each case above, write the number obtained in words correctly.

e) Data recording

Every number formed by pupils is recorded as follows:

i. Smallest possible number from the given digits is 305,679
ii. Largest possible number from the given digits is 976,530
iii. Largest even number from the given digits is 976,530
iv. Smallest even number from the given digits is 305,796
v. Largest odd number from the given digits is 976,503
vi. Smallest odd number from the given digits is 305,679

f) Interpretation of results and Conclusion

How did you form each number?

Expected answer

To form a number, we use digits. These digits are arranged depending on the number to be formed. For example, to form the smallest number 305,679, we can start by arranging digits from left side by placing the digit 3 for hundred thousand, the digit 0 for ten thousand, the digit 5 for thousands, the digit 6 for hundreds, the digit 7 for tens and finally the digit 9 for ones. We can also start by the right side towards the left side: placing the digit 7 for ones, the digit 5 for tens, the digit 3 for hundreds, the digit 2 for thousands and finally the digit 1 for ten thousand.

Note: Guide learners to read correctly each number.

g) Guidance on the evaluation

Ask students to cut and manipulate the number cards and use them as learning materials that help them to compose, write and read numbers.

Example:

1. Arrange these number cards for the given digits 2, 3, 6, 7, 8 and 9 so that you form the smallest even number. Read the obtained number.
2. Arrange these number cards for the given numbers so that you answer the questions below:

   2, 3, 6, 7, 8, 9

i) Form a largest 6-digits number divisible by 10 from the given digits.

ii) Form a smallest 6-digits number divisible by 5 from the given digits.

Expected answer

i. Largest number divisible by 10 from the given digits is 976,530

ii. Smallest number divisible by 5 from the given digits is 306,795

PRACTICAL ACTIVITY 2: Addition and subtraction of whole numbers

a) Rationale:

This practical activity is conducted when teaching a lesson about addition and subtraction of whole numbers up to 1,000,000. It is taught in Unit 1. Addition and subtraction are useful for many activities of everyday life, like setting the table, making change at the supermarket, and playing some games. Addition and subtraction prepare children for learning about other math topics, including multiplication and division, in school.

b) Objective:

Use the local abacus to add and subtract whole numbers when solving problems in real life situations.

c) Required materials:

Wooden vertical local Abacus and beads.

d) Procedures

Addition

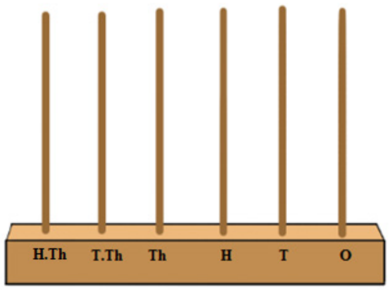
Step 1: Read the following real-life problem.

Mugabo invested 422,233 Frw in the first year of the business.

In the second year he invested 122 111Frw.The third year he invested 233,222 Frw.

i. How much money did he invest in all three years?
ii. How much more did he invest in the first year than the second year?

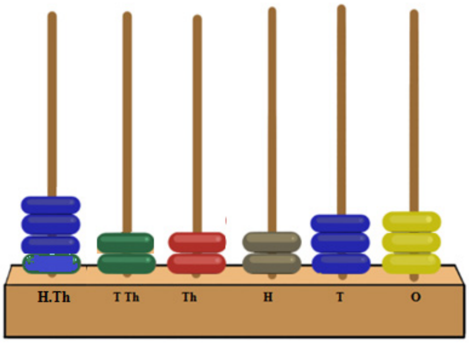
Step 2: Get an empty wooden vertical abacus with six spikes and label the spikes from right to left as ones, tens, hundreds, thousands and ten thousands, hundred thousands.



Step 3: Since the investment for the first year is 422,233 Frw, then

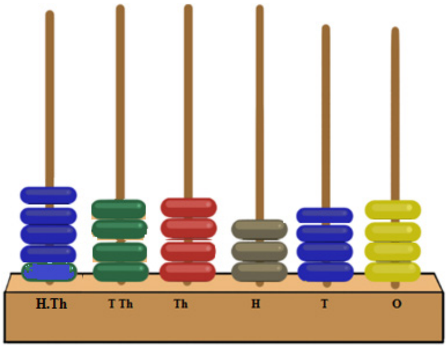
i. Put 3 beads on the spike of ones.

ii. Put 3 beads on the spike of tens.
iii. Put 2 beads on the spike of hundreds.
iv. Put 2 beads on the spike of thousands and
v. Put 2 beads on the spike of ten thousands.
vi. Put 4 beads on the spike of hundred thousands



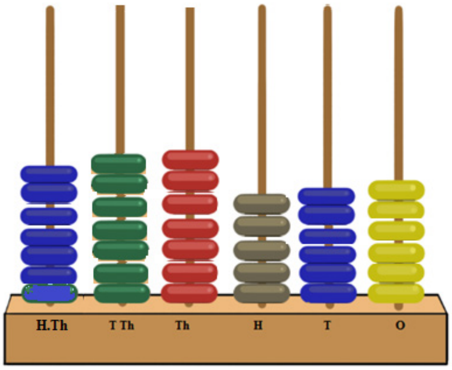
Step 4: To add the investment of the second year 122 111Frw

i. Add 1 bead on the spike of ones.
ii. Add 1 bead on the spike of tens.
iii. Add 1 bead on the spike of hundreds.
iv. Add 2 beads on the spike of thousands
v. Add 2 beads on the spike of ten thousand.
vi. Add 1 bead on the spike of hundred thousand



Step 5: To add the investment of the third year 233,222 Frw.

i. Add 2 beads on the spike of ones.
ii. Add 2 beads on the spike of tens.
iii. Add 2 beads on the spike of hundreds.
iv. Add 3 beads on the spike of thousands
v. Add 3 beads on the spike of ten thousands.
vi. Add 2 beads on the spike of hundred thousands.

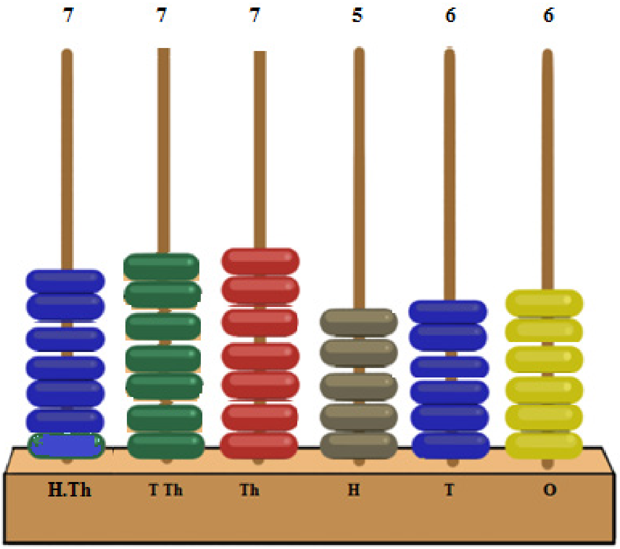


Step 6: To find the total investments done by Mugabo;

i. Count and record the total number of beads on the spike of ones.
ii. Count and record the total number of beads on the spike of tens.
iii. Count and record the total number of beads on the spike of hundreds.
iv. Count and record the total number of beads on the spike of thousands.
v. Count and record the total number of beads on the spike of ten thousands.
vi. Count and record the total number of beads on the spike of hundred thousands.

Expected answers

Now Record, the number represented on the abacus starting from left to right.



Step 7: To find how much more he invest in the first year than the second year

Using the abacus in **step 3** with all the beads do the following; 122 111Frw

i. Count and remove 1 bead from the spike of ones

ii. Count and remove 1 bead from the spike of tens
iii. Count and remove 1 bead from the spike of hundreds
iv. Count and remove 2 beads from the spike of thousands
v. Count and remove 2 beads from the spike of ten thousands
vi. Count and remove 1bead from the spike of hundred thousands

e) Data recording

In step 3, the investment of the first year is 422,233 Frw

In Step 4, the investment of the second year is 122, 111Frw

In step 5, the investment of the third year 233,222 Frw

In step 6, the total investment for Mugabo is 777,566 Frw

In step 7, the more money that he invested in the first year more than the second year is 300,111 Frw

f) Interpretation of results and Conclusion

Can you find the answer without using the abacus? What is the easiest way in finding the answer?

Expected answer

The money involved in our mathematical problem in the practical activity is of higher place values. We also note that the user has prior knowledge about place values and therefore the wooden vertical abacus is the most appropriate tool to use in addition and subtraction of numbers of higher place values.

g) Guidance on the evaluation

Give pupils a reflection questions related to the practical activity. For example,

A school uses 230, 224 litres of water in the first term. In the second term, the school planned to use 424,662 litres but the school was closed two weeks earlier. They had used 411,221 litres of water.

i. How many litres of water were used for two terms?
ii. How many litres of water were not used**?**

Expected Answers of second Activity

i. The number of litres used for two terms were 641,445 Litres of water.
ii. The Litres of water not used were 13,441litres.

PRACTICAL ACTIVITY 3: Addition of integers using counters

a) Rationale:

This practical activity is conducted when teaching the lesson about the addition of integers from unit 2.

some situations in everyday life use positive and negative numbers, such as temperatures, banking, and sports. For example, a debt of 500Rwandan francs could be represented as -500 Rwandan francs. It is necessary to learn how to add such numbers as every one will necessarily use them.

b) Objective:

To explore practically the addition of integers using counters (or buttons) of different coloured faces

c) Required materials:

Plastic pieces or laminated transparent counters whose one side is blue and other side is red,

Note: Use red and blue counters or small pieces of paper coloured in red and blue.

d) Procedures

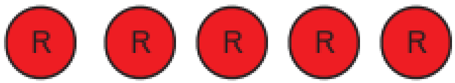
Step 1: Consider the red side of the counter as positive (+) and the blue side of the counter as negative (–).

Positive

Negative

Step 2: Add two positive integers for example of (+5) + (+3)

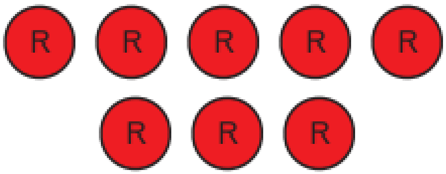
i) For the first +5, take five counters and place them in a row with red faces facing up as below.



ii) To add +3, pick other three counters and arrange them in a row with red faces up.

and

iii) As it is the addition, count all the counters with red faces up.



iv) How many counters placed with red faces up are they in total? Deduce (+5) + (+3).

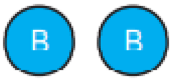
Expected answer:

There are eight (8) counters placed with red faces up.

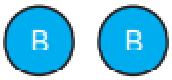
Therefore (+5) + (+3) = +8 = 8

Step 3: **Add two negative integers** for example of (-2) + (-3)

i) For the first -2, take two counters and place them in a row with blue faces facing up as below

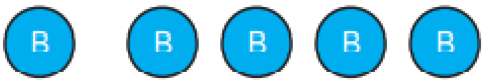


ii) To add -3, pick other three counters and place them in a row with blue faces up



and

iii) Count the total counters placed with blue faces up.



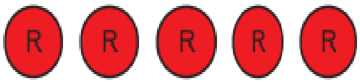
Question: How many counters placed with blue faces up are they in total? Deduce -2 + -3

Expected answer:

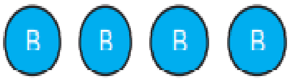
They are five counters placed with blue faces up. Therefore (-2) + (-3) = -5

Step 4: **Adding a positive and a negative intege**r for example of (+5) + (-4)

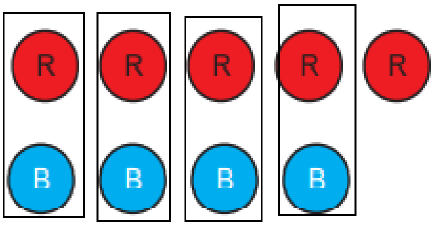
i) For the first +5, take five counters and place them in a row with red faces facing up as below.



ii) To add -4, pick other four counters and place them in a row with blue faces facing up.



iii) Now match (pair) the counters with red faces on top with those with blue faces on top.



Question: How many counters have remained after matching and what colour are they? Deduce (+5) + (- 4).

Expected answer:

There is one counter with a red face on top that remained after matching. This represents +1.

Therefore (+5) + (-4) = +1 = 1

e) **Data recording:**

On Step 2: Adding two positive integers

i. Number of counters placed on the row with red faces on top equals five. They represent the number +5

ii. Number of counters added on the row with red faces on top equals five. They represent the number +3

iii. Total number of counters on the row with red faces on top equals eight.

They represent the number +8 and we write (+5)+ (+3)=+8=8

On Step 3: Adding two negative integers

i. Number of counters placed on the row with blue faces on top equals two. They represent the number -2

ii. Number of counters added on the row with blue faces on top equals three. They represent the number -3

iii. Total number of counters on the row with blue faces on top equals five. They represent the number -5

On Step 4

i. Number of counters placed on the row with red faces on top equals five. They represent the number +5

ii. Number of counters added on the row with blue faces on top equals four. They represent the number -4

iii. Total number of counters remaining after matching one counter of blue face on top to one counter with a red face on top is a one red face counter. They represent the number +1 and we write (+5) + (-4) = +1 =1

f) Interpretation of results and Conclusion

i) How do we add positive and negative integers using counters?

ii) When you add integers using counters, is the answer the same as when you add normally using a number line?

iii) What is the general observation on answers you got?

Expected answer

i) To add using counters, match the counters with red faces on top with those with blue faces on top.

Then, count the remained number of counters by noting their color and their corresponding number.

ii) When adding integers using counters you get the same answer as when adding using number line

iii) As observed from the results we note the following;

The Sum of two positive integers is a positive integer.

The Sum of two negative integers is a negative integer.

The Sum of one negative integer and one positive integer is a negative integer if the numerical value of the negative integer is greater.

The Sum of one negative integer and one positive integer is a positive integer if the numerical value of the positive integer is greater.

The Sum of two opposite integers is always zero

Also note the following:

Matching the counters will be done only if they are of different colours.
You can also take red side of the counter as negative and the blue side as positive.

g) Guidance on the evaluation

Ask students to repeat the practical activity with the following:

i. +3 + (+ 7)

ii. -6 + -2

iii. +7 + -5

iv. -8 + +2

Expected answers:

i. (+3) + (+ 7) = +10

ii. (-6) + (-2) = -8

iii. (+7) + (-5) = +2

iv. (-8) + (+2) = -6

PRACTICAL ACTIVITY 4: Subtraction of integers using counters

a) Rationale:

This practical activity is conducted when teaching the lesson about subtraction of integers. It is taught in unit 2.

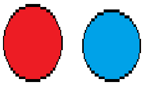
Some situations in everyday life use positive and negative numbers, such as temperatures, banking, and sports. For example, a debt of 500Rwandan francs could be represented as -500 Rwandan francs. It is necessary to learn how to subtract such numbers as every one will necessarily use them.

b) Objective:

To explore the subtraction of integers using counters (or buttons) of different coloured faces.

c) Required materials.

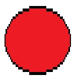
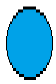
Plastic pieces or laminated transparent counters whose one side is blue and other side is red



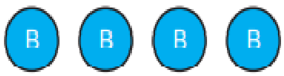
d) Procedures

Consider the subtraction of integers (−6) from (-4). That is to say (−4) – (– 6) =?

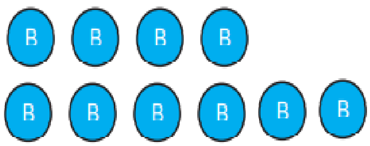
Step 1: Consider the red side of the counter as positive (+) and the blue side of the counter as negative (–).

Positive	Negative
	

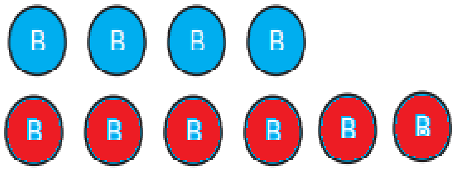
Step 2: For the first -4, take four counters and place them in a row with blue faces facing up as illustrated below:



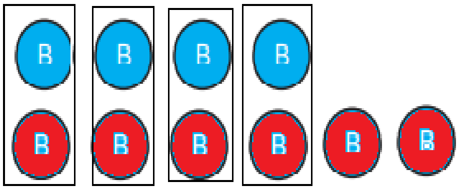
Step 3: Now take other six counters and place them in a second row with blue faces facing up.



Step 4: Now, keep the counters of the first row as they are and place the counters of the second row after inverting sides in which the blue faces on top become the red faces on top. (**Note**: If the two faces of the blue counter are blue, in this case, replace the second row by the red counters).



Step 5: Match red-faced counters with blue-faced counters. Count remaining unmatched counters along with their colours.



Question: How many counters are unmatched? What color are they?

Hence Deduce (–4) – (– 6) = ?

Expected answer:

.There are two unmatched counters placed with red faces up.

Therefore (–4) – (– 6) = +2

e) Data recording:

On Step 2: Number of counters placed on the row with blue faces on top equals four. This is -4

On Step 3: Number of counters added on the row with blue faces on top equals six. This is -6

On Step 4: Total number of counters after keeping the first row and inverting the second row equal to 4 counters with blue faces on top and six counters with red faces on top.

This is -4 – (-6) = -4+6

On Step 5: After matching red-faced counters with blue-faced counters, the remaining unmatched counters along with their colours are two counters with red faces on top which equals +2.

f) Interpretation of results and Conclusion

During subtraction of integers, the sign of the integer being subtracted is inverted (changes the sign)

Also note the following:

Matching the counters will be done only if they are of different colors. If the counters are of the same color, there is no need of matching, we just count all the counters and consider their color.

You can also take red side of the counter as negative and the blue side as positive.

The answer obtained when subtracting integers using counters is the same as the answer found when adding normally but the use of counters is practical.

g) Guidance on the evaluation

Ask students to use counters to find the answer of the following:

i. -3 – (-7)

ii. +6 – (+2)

iii. -7 – (-5)

Expected answers:

i. -3 – (-7) = +5

ii. +6 – (+2) = +4

iii. -7 – (-5) = -2

PRACTICAL ACTIVITY 5: Exploring and comparing fractions

a) Rationale:

This practical activity is conducted when teaching a lesson about comparing fractions. It is taught in unit 4.

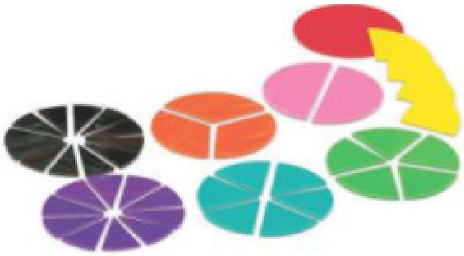
In real life, we use fractions when sharing equally a whole object to a given number of people. For example, when you go to a restaurant with friends and the waitress brings a single bill, to divide the total amongst the friends, you use fractions. The comparison of fractions appears in this situation when we want to compare different parts of a whole taken by two different people.

b) Objective:

To explore, understand and compare various fractions practically.

c) Required materials:

A set of 8 circular sheets of equal sizes which are divided into 1, 2, 3, 4, 6, 8, 12 and 16 equal parts respectively:



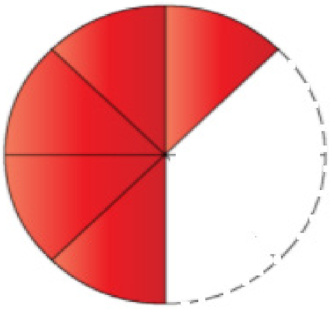
d) Procedures

Step 1: Concept of fraction

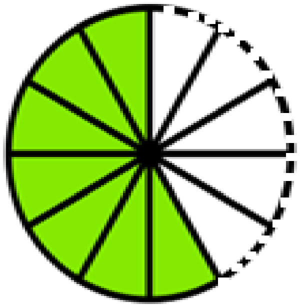
Take a circular sheet which is divided into 8 equal parts.

Now take out five equal parts from it as parts of a whole. What fraction do they represent?

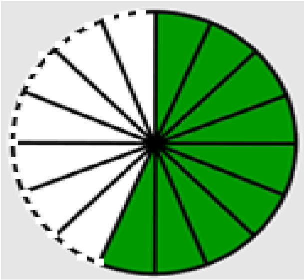
Which fraction of the circular sheet remained?



Step 2: Take another circular set divided into 12 equal parts. Take out 7 parts from it. This represents fraction 7/12. Which fraction has remained?



Step 3: Take a circular sheet divided into 16 parts. Take nine parts from the circular sheet having 16 equal parts. This represents 9/16. What is the fraction of the remaining circular part?



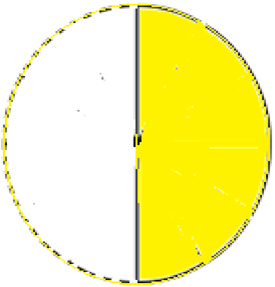
Comparison of fractions

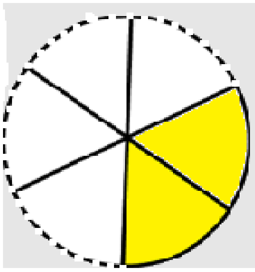
Step 4: Take out two circular sheets of the same size, one divided into two parts and another six parts.

Take out fractions $\frac{1}{2}$ and $\frac{2}{6}$ from the circular sheets respectively and compare them by placing one on another.

Which one is bigger?

Which one is smaller? Try to use the comparison signs to compare fractions they represent.



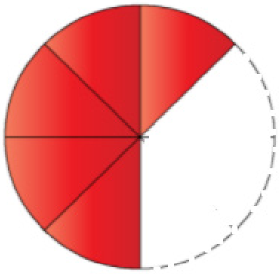


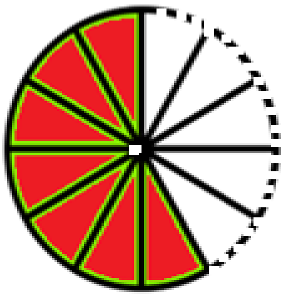
Step 5: Take out other two circular sheets, one divided into eight parts and another twelve parts.

Take out fractions 5/8 and 7/12 from the circular sheets respectively and compare them by placing on one another.

Which one is bigger?

Which one is smaller?





e) Data recording

Step	Number of parts a circular sheet has been split.	Fraction of the taken piece	Fraction of the remaining piece.
Step1	8	$\frac{5}{8}$	$\frac{3}{8}$
Step2	12	$\frac{7}{12}$	$\frac{5}{12}$
Step3	16	$\frac{9}{16}$	$\frac{7}{16}$

On step 4: The part of 1/2 piece is bigger than 2/6, therefore $\frac{1}{2} > \frac{2}{6}$.

The part of 2/6 is smaller than 1/2

On step 5: The part of 5/8 is bigger than 7/12. therefore $\frac{5}{8} > \frac{7}{12}$.

The part of 7/12 is smaller than 5/8.

f) Interpretation of results and Conclusion

Basing on your findings, what is a fraction? What does a numerator represent? How do you compare fractions with the same denominator?

Expected answer

A fraction is a part of a whole split equally. The denominator of the fraction represents the total parts a whole has been split into.

The size of a fraction not only depends on the numerator (the number of parts in consideration) but also the number of parts the whole has been split into matters.

Fractions that have the same size but from wholes split into different number of parts are called equivalent fractions.

g) Guidance on the evaluation

Now take the following pairs of fractions compare them and fill up the blanks using the sign '<' or '>' Or '='.

i. $\frac{1}{8}$ ------------- $\frac{5}{16}$

ii. $\frac{7}{8}$ ------------- $\frac{8}{12}$

iii. $\frac{1}{2}$ ------------- $\frac{6}{16}$

iv. $\frac{2}{12}$ ------------- $\frac{1}{16}$

Expected answers

i. $\frac{1}{8} < \frac{5}{16}$

ii. $\frac{7}{8} > \frac{8}{12}$

iii. $\frac{1}{2} > \frac{6}{16}$

iv. $\frac{2}{12} = \frac{1}{16}$

PRACTICAL ACTIVITY 6: Addition of fractions with different denominators

a) Rationale:

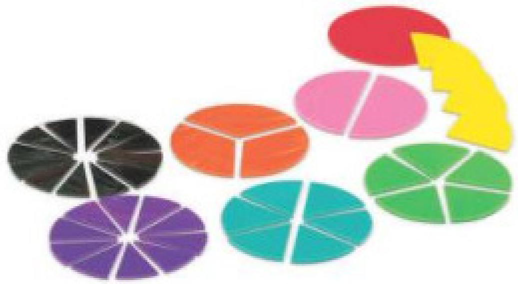
This practical activity is conducted when teaching a lesson about addition of fractions of different denominators. It is taught in Unit 4. In real life fractions are used when sharing things to a given number of people. A pizza is a great example of fractions; Each piece represents a part of a whole, we can need to add a half of a pizza to the quarter of the same pizza.

b) Objective:

To be able to add fractions of different denominators.

c) Required materials:

Plain papers, pencil, pair of scissors, plastic circle and set fractions.

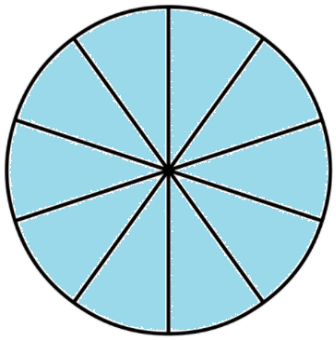


Plastic circle and set fractions.

d) Procedures

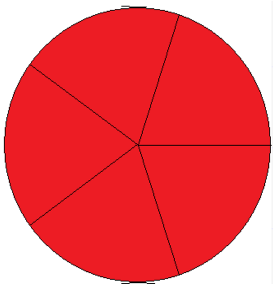
Using Plastic circle and set fractions let us add: $\frac{1}{10}+\frac{3}{5}$

Step 1: Circle 1: Take a circular plastic and split it into 10 equal parts.



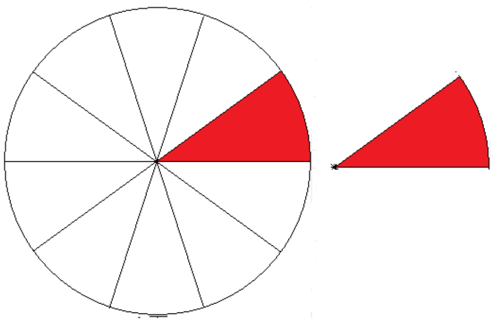
Circle 1

Step 2: Circle 2: Take a similar circular plastic and split it into 5 equal parts.

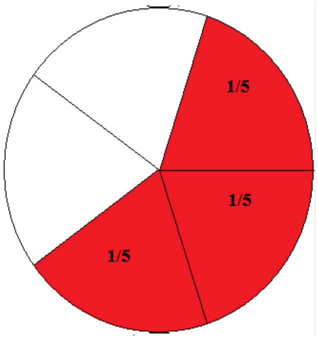


circle 2

Step 3: Split 1 piece from **Circle 1.** What fraction is it?



Step 4: Split 3 pieces from **Circle 2.** What fraction is it?



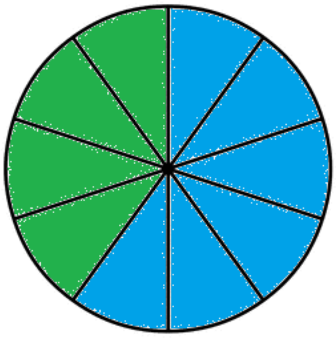
Question: Is it possible to add the split pieces from **Circle 1** and **Circle 2** together?

Answer: Yes but it is difficult.

Question: How?

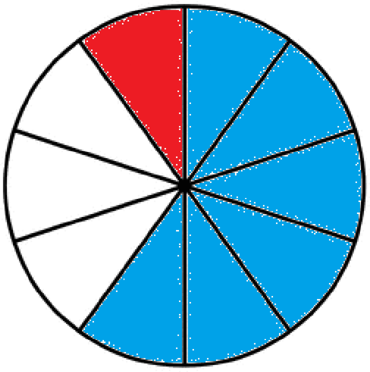
Answer: Because the sizes of the pieces are not the same.

Step 5: In order to have sectors of our circles, let them have the same sizes by splitting pieces of **Circle 2** into 10 equal pieces.



What does the part "3 pieces out of 5" become? What fraction does it represent?

Step 6: Add one part split from circle 1 to the part represented by the part of circle 2 obtained on step 5.



What fraction do you get?

e) Data recording

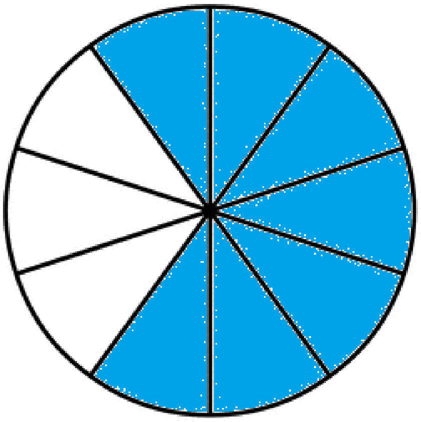
From **Step 1:** Circle 1 split into 10 equal pieces. One part represents the fraction $\frac{1}{10}$.

From **Step 2:** Circle 2 split into 5 equal pieces.

On **step 4**, 3 parts out of 5 parts represent the fraction $\frac{3}{5}$

From **Step 5:** The part of $\frac{3}{5}$ becomes $\frac{6}{10}$

From step 6, we get $\frac{1}{10}+\frac{6}{10}=\frac{7}{10}$



f) Interpretation of results and Conclusion

When adding fractions of different denominators, let the whole (circle) be split into equal number of pieces that can be easily added by considering the denominator.

$$\frac{1}{10}+\frac{3}{5}=\frac{1}{10}+\frac{6}{10}=\frac{7}{10}$$

This way of using a whole divided into the same number of equal parts is the same as reducing the fractions to be added to the same denominator.

$$\frac{1}{10}+\frac{3}{5}=\frac{1}{10}+\frac{2\times3}{2\times5}=\frac{1}{10}+\frac{6}{10}=\frac{7}{10}.$$

g) Guidance on the evaluation

Students can be asked to use **circle and set fractions a**nd manipulate fractions in addition and use them as learning materials that help them to add fractions of different denominators.

Example: Follow the steps above and practically add $\frac{1}{4}$ to $\frac{3}{8}$.

PRACTICAL ACTIVITY 7: Subtraction of fractions with different denominators

a) Rationale:

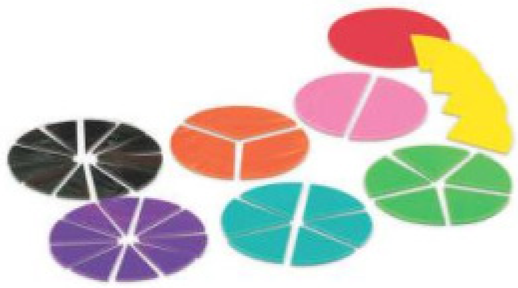
This practical activity is conducted when teaching a lesson about subtraction of fractions. It is taught in Unit 4. Subtraction of fractions are used in real life when a person who has a part of the whole needs to cut the small part of what he/she must begiven to another person. A pizza is a great example of fractions; each piece represents a part of a whole, we can need to take away a quarter of the pizza from a half that pizza.

b) Objective:

To be able to subtract fractions of different denominators such as $\frac{7}{8}-\frac{1}{2}$.

c) Required materials:

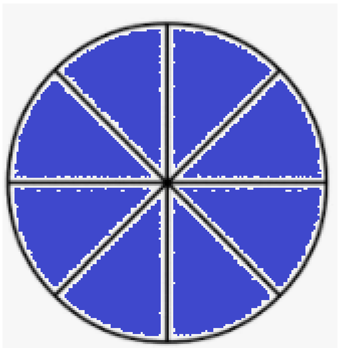
Plain papers, pencil, pair of scissors, Plastic circle and set fractions.



Plastic circle and set fractions

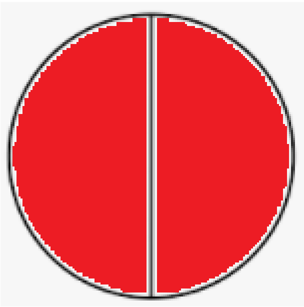
d) Procedures

Step 1: Circle A: Take a set fractions split into 8 equal parts.



Circle A.

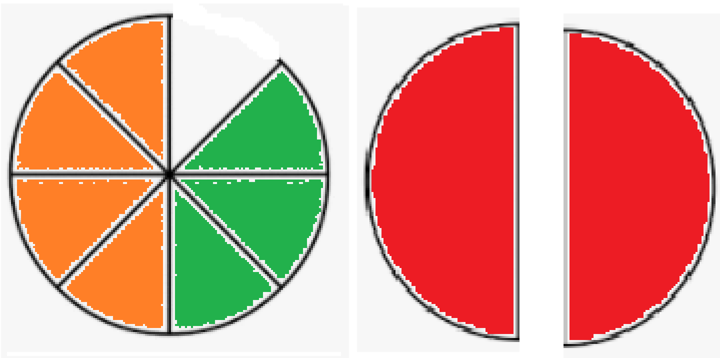
Step 2: Circle B: Take a similar set fractions split into 2 equal parts.



Circle B.

Step 3: Split 7 pieces of plastic circle- set fractions from **Circle A.**

Step 4: Split 1 piece from **Circle B and put it apart.**

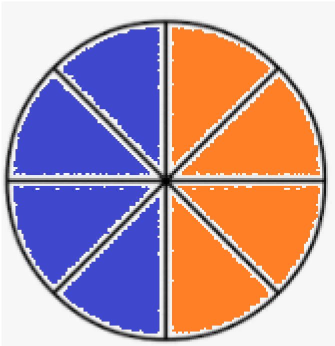


Question: Is it possible to cut one similarpiece of **Circle B** from **Circle A?**

How can you do it? What is the remaining part?

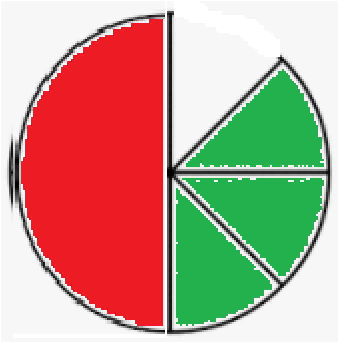
Answer: Yes.

Step 5: In order to cut that part, let sectors of the 2 circles have the same sizes; We need to split the pieces of **Circle B** into 8 equal pieces.



What is the fraction represented by 1 out 2 after splitting the circle B into 8 equal parts?

Step 6: Consider the part of B obtained on step 5 and cut the similar part from the remained part of Circle A. What is the remaining part?



e) Data recording

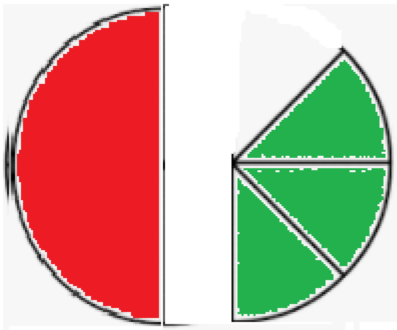
- Circle A has 8 pieces; we split off 1 piece to remain with $\frac{7}{8}$

- Circle B has 2 pieces where we have $\frac{1}{2}$

On step 5; 1 piece out of 2 of the circle B was split into 4 pieces each to become $\frac{4}{8}$.

This means that Circle A and B are split into 8 equal splits/pieces.

Therefore, we can use the picture in step 3 to do the subtraction.



So $\frac{7}{8}-\frac{1}{2}=\frac{7}{8}-\frac{4}{8}=\frac{3}{8}$

Hence, $\frac{7}{8}-\frac{1}{2}=\frac{3}{8}$ practically.

f) Interpretation of results and Conclusion

When subtracting fractions of different denominators take the whole and divide it into equal number of pieces considering the denominator.

The action of cutting or putting away the part of a whole is the subtraction.

The way of dividing the whole into the same number of equal parts is the same as reducing the fractions to be subtracted to the same denominator.

$\frac{7}{8}-\frac{1}{2}=\frac{7}{8}+\frac{4\times 1}{4\times 2}=\frac{7}{8}-\frac{4}{8}=\frac{3}{8}.$

g) Guidance on the evaluation

Students can be asked to use **circle and set fractions a**nd manipulate fractions in subtraction and use them as learning materials that help them to subtract fractions of different denominators.

Example: Follow the steps above and practically subtract $\frac{2}{3}-\frac{2}{9}$

PRACTICAL ACTIVITY 8: Comparing decimal numbers

a) Rationale:

This practical activity is conducted when teaching a lesson about comparing decimal numbers. It is taught in Unit 5.

We use decimals every day while dealing with money, weight, length etc. Decimal numbers are used in situations where more precision is required than the whole numbers can provide. For example, when we calculate our weight on the weighing machine, we do not always find the weight equal to a whole number on the scale. To know our exact weight, we must understand what the decimal value on the scale means. While measuring the length of an item, it is not necessary that the length of an object is a multiple of the given graduation. For example, while measuring the length of a table with a metre rule, the length may not be a whole number, it may lie between two graduations on the metre rule. In such situations, the decimal numbers are used.

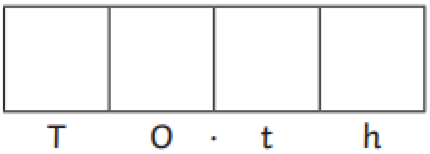
Therefore, when two measurements were done, it is possible to compare them.

b) Objective:

To use number cards to compare decimal numbers.

c) Required materials:

Number cards, the point card, comparison sign cards, place value counters, and place value table for decimal numbers.

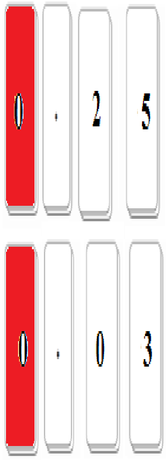


d) Procedures

Consider the case of **comparing 0.25 and 0.03.**

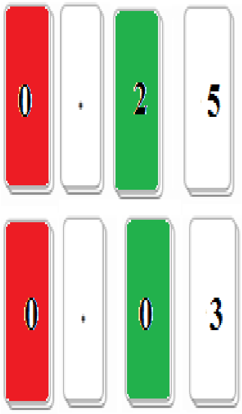
In this case we are going to use 3 cards labelled 0 on each, 2 cards labelled a decimal point on each, a card labelled 2 on it, a card labelled 3 on it and a card labelled 5 on it.

Step 1: Arrange cards labelled digits in place value of ones first vertically according to the numbers in question.



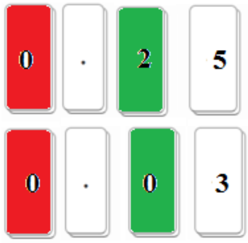
Step 2: Compare the digits; in this case we have 0 in place value of ones in both places.

Step 3: After ones in each number, place cards labeled decimal point in each case.

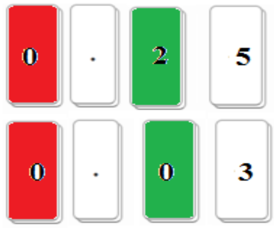


Step 4: Place a card labelled digit **2** in the tenths place value.

Step 5: Place a card labelled digit **0** after a card labelled decimal point



Step 6: Compare the digits, in this case we have digit **2** and digit **0** in place values of **tenths** in both numbers.



i) Which digit is **larger** than the other?

ii) Which digit is **smaller** than the other?

iii) Rearrange them using the comparison sign card > or <.

e) Data recording

i) From Step 6: Digit 2 in place value of tenths is larger than digit 0 in the place value of ten

Therefore,

i) 0.25 is larger than 0.03.

ii) 0.03 is smaller than 0.25.

iii) Cards will be arranged as

0 . 2 5 > 0 . 0 3	0.25 > 0.03
0 . 0 3 < 0 . 2 5	0.03 < 0.25.

f) Interpretation of results and Conclusion

How do you compare decimal numbers?

Expected answer:

When comparing decimal numbers using number cards, number cards are arranged respecting the place values of each digit in a given number, and then compare the digits in respect to each place value.

Symbols like, <,>and=can be used accordingly.

g) Guidance on the evaluation

Students can be asked to make number cards to use them when comparing whole numbers and decimal numbers and use them as learning materials that help them to compare numbers.

Example: Use number cards to compare the following decimal numbers

Follow the steps above and practically compare 0.005 and 0.05.

Use symbols to show your answers.

PRACTICAL ACTIVITY 9: Application of direct proportion

a) Rationale:

This practical activity is conducted when teaching a lesson about direct proportions. It is taught in Unit 6.

In real life, the variation of one variable can affect in the same way the variation of another variable. For example, the weight of a person can be related to the clothing size that they might use, The number of construction workers that are working can be related to the how much time it takes to finish a project, he number of bananas can be related to the number of boxes needed to store them, The distance between two towns can be related to the time it takes in traveling between them. With such examples we find it necessary to learn direct proportions.

b) Objective:

To model two quantities in direct proportion using the constant of proportionality

c) Required materials:

Empty bottles of water and counters or small stones.



d) Procedures

Step 1: Read the following situation that happened in a certain school.

When a pupil brings one empty battle of water the teacher gives him/her four counters. Find how many counters will be given to a child who brings four empty battles of water.

Step 2: Take bottles of water and stones, counters, or bottle tops to illustrate this situation.

Step 3: Put 6 empty bottles of water and 25 small stones on the table

Step 4: Take one empty bottle of water with number of stones/counters that represent counters to be given to a child.

Draw a table (showing column of empty bottles of water and stones) and insert the data obtained.

Step 5: Take two empty bottles of water with number of stones/counters to be given to a child who brings 2 bottles.

Insert the data obtained in the table from **Step 4**

Step 6: Take three empty bottles of water with number of stones/counters to be given to a child who brings the 3 bottles.

Insert the data obtained in the table from **Step 5**

Step 7: Take four empty bottles of water with number of stones/counters to be given to a child who brings 4 bottles.

Insert the data obtained in the table from **Step 6**

How many stones/counters will be related to four bottles of water?

e) Data recording

Step	Number of bottles	Counters (Stones)
Step 4		 **4**
Step 5		 **8**
Step 6		 **12**
Step 7		 16

A child who brings 4 bottles of water will be given 16 counters.

f) Interpretation of results and Conclusion

What happens when the number of bottles increases?

Is there a factor to be multiplied the number of bottles to obtain the number of counters/stones?

If the bottles increase from 1 to 2, stones/counters increase from 4 to 8, we write $\frac{2}{1}=\frac{8}{4}$. Write the expression representing:

If bottles increase from 1 to 4, the stones increase from 4 to 16.

Expected answer:

As the number of bottles increases, also the number of stones/counters increases, Similarly, when the number of bottles decreases, the number of stones/counters decreases.

We find that the number of bottles is multiplied by 4 to obtain the number of counters.

The bottles increase from 1 to 4. Similarly, the stones increase from 4 to 16.

This is noted as $\frac{4}{1}=\frac{16}{4}$.

This variation of the number of objects to be distributed in a same variation is called the **direct proportion.**

g) Guidance on the evaluation

Ask pupils questions related to the practical activity for example; What have you observed? Explain your answer.

Expected Answer

The bottles increase from 1 to 4. Similarly, the stones increase from 4 to 16.

This is noted as $\frac{4}{1}=\frac{16}{4}$.

We can say 2 bottles represents 8 stones. When we decrease the bottles from 2 to 1, the stones reduce from 8 to 4.

PRACTICAL ACTIVITY 10: Finding the number of intervals on an open line

a) Rationale:

This practical activity is conducted when teaching a lesson about finding number of intervals on an open line. It is learnt in Unit 7. In real life, this experiment helps to determine the number of poles necessary to build a part of the fence for a house.

b) Objective:

To find the number of intervals on an open line.

c) Required materials:

Meter ruler, Stick, 10 empty water bottles or poles.

d) Procedures

Step 1: Using a metre ruler, measure a stick of 1.5 metres long.

Step 2: In an open field outside class, using the 1.5metre stick, mark fixed distances from one end to another.

Put an empty bottle at every end of the stick until all the 10 empty bottles are on a straight line as shown below. Find the number of intervals.

Record the following.

Interval length.................metres

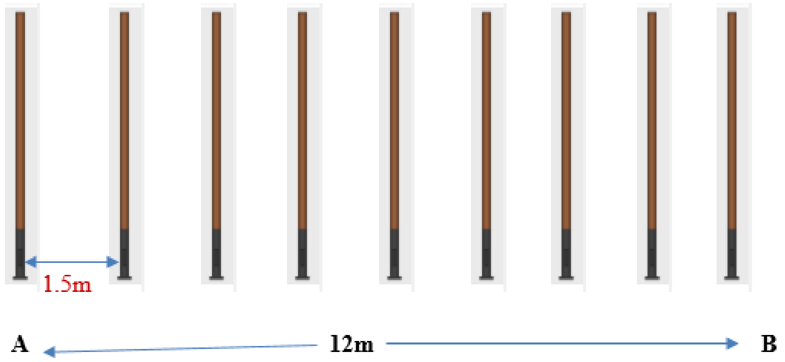
Number of bottles............

Number of intervals...........

What is the relationship between the number of bottles and the number of intervals?

Step 3: Using a metre ruler, measure 12 metres between two points A and B on a straight line.

Place poles from point A to point B with the distance between them equalling to the length of the stick you measured in step 1 (the length of the stick is 1.5m).



e) Recording data

Length AB: ………….

The size of the interval: ……..

Number of intervals: ……

Number of Poles: ……….

What is the relationship between the number of poles and the number of intervals on an open line?

How many poles would you have if the length AB =18m given that interval between 2 poles is 1.5m?

Find the relationship between the number of poles, the total distance is **D** and the interval length is **I** on an open line.

On step 2:

Interval length = 1.5metres

Number of bottles= 10 bottles

Number of intervals= 9 intervals.

On step 3:

Length AB = 12m

The size of the interval = 1.5m

Number of intervals = 8 intervals.

Number of Poles = 9 poles.

f) Interpretation of results and Conclusion

As observed in the step 2 the number of intervals is less than the number of bottles by one.

Also, the number of intervals in step 3 is less than the number of poles on the line.

Therefore, on an open line the *number of intervals on an open line = Number of poles minus one.*

On this part of the fence, we have 6 intervals and 7 poles.

g) Guidance on evaluation

Give pupils real life problems to be solved. For example,

A road is 2 km long. Trees were planted 2 m apart along one side of the road. An interval of 2 m was left at one end without a tree due to an existing shop. How many trees were planted along the road?

PRACTICAL ACTIVITY 11: Finding the number of intervals on a closed line

a) Rationale:

This practical activity is conducted when teaching a lesson about finding number of intervals on closed line. It is learnt in Unit 7. In real life, this experiment helps to determine the number of poles necessary to build the fence of house.

b) Objective:

To find the number of intervals on a closed line.

c) Required materials:

Meter ruler, Stick, 10 empty water bottles or poles.

d) Procedures

Step 1: Using a meter ruler now measure another stick of length of one meter (1m).

Measure a rectangle of length **3m** by width **2m on the ground.**

Step 2: Starting from one vertex of the rectangle, place empty bottles along the rectangle with a distance of 1m in between them measured with the stick you measured in step 4.

Record the following:

Perimeter of the rectangle	Number of bottles	Size of interval	Number of intervals
	...	...	...

What is the relationship between the number of bottles, the number of intervals and perimeter (the total distance)?

Step 3: Using a meter ruler now measure another stick of length of one meter (1m).

Measure on the ground a square of **3m** each side.

Step 4: Starting from one vertex of the square, place empty bottles along the it with a distance of 1m in between them measured with the stick you measured in step 3.

Record the following:

Perimeter of the square	Number of bottles	Size of interval	Number of intervals
	...	...	...

What is the relationship between the number of bottles, the number of intervals and perimeter (the total distance)?

e) Data recording

On step 2: Perimeter of the rectangle = 10m

Number of bottles = 10 bottles

Size of interval = 1metre.

Number of intervals = 10 intervals.

On step 4:

Perimeter of the square = 9m

Number of bottles = 12 bottles

Size of interval = 1metre.

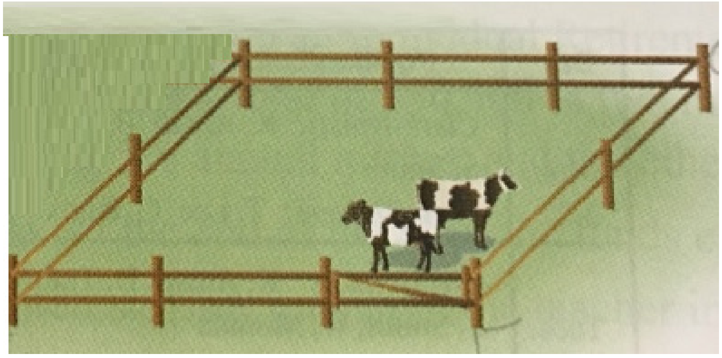
Number of intervals = 12 intervals.

f) Interpretation of results and Conclusion

On a closed line,

Number of intervals = Number of poles.

Also note that **Number of intervals =** $\frac{Total\ length}{Interval\ length}$



On this fence we have 10 intervals and 10 poles.

g) Guidance on the evaluation

Ask pupils to solve the following problem:

A farmer wishes to fence his rectangular garden of perimeter 100m with poles placed 5 metres apart. Find:

a) The number of intervals between the poles.

b) The total number of poles needed to fence the garden.

c) If one side of the garden is 30m. Calculate the number of poles that will be put on that side.

Expected answer:

a) The number of intervals between the poles.

Number of intervals = $\frac{\text{Total length}}{\text{interval size}}$ = 100 /5= 20 intervals.

b) The total number of poles needed to fence the garden.

For a closed line number of poles = number of intervals = 20poles.

If one side of the garden is a straight of 30m, what is the number of poles that will be put on that side?

On an open line Number of poles = Number of intervals plus one.

Number of intervals =30/5m=6

Number of poles = 6 + 1 = 7 poles.

PRACTICAL ACTIVITY 12: Using clock faces, watches, and calendars to find time intervals or the time taken by an event

a) Rationale:

This practical activity is conducted when teaching a lesson about finding time intervals of an event. It is learnt in unit 8. In real life when a person knows the starting and the ending times for doing an activity, he/she can need to determine the time used.

b) Objective:

To solve problems involving time intervals.

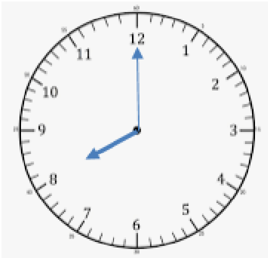
c) Required materials:

Clock faces, Number cards, Manilas.

d) Procedures

A student was taken to the football playground and made laps according to the following steps and then found time intervals for each lap(complete turn).

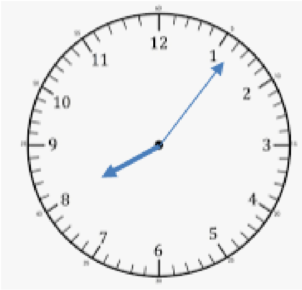
Step 1: Record the starting time for the first lap.



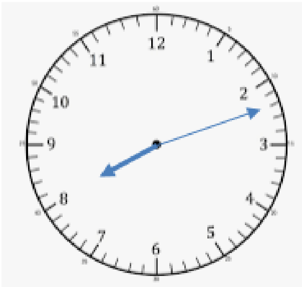
Step 2: Record the ending time for first lap

What is the time interval for the first lap?

Step 3: Record the starting time for the second lap.

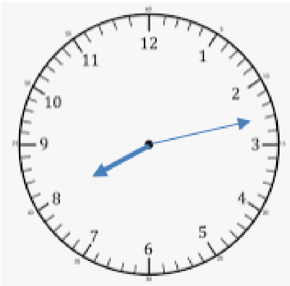


Step 4: Record the ending time for the second lap.

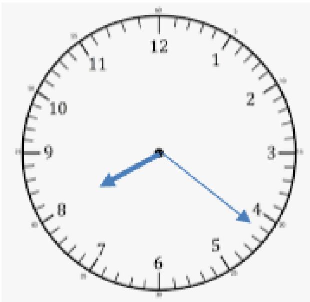


What is the time interval for the second lap?

Step 5: Record the starting time for third lap.



Step 6: Record the ending time for third lap.



What is the time interval for the third lap?

e) Data recording

Data recorded in the following way:

Step 1: The starting time for the first lap is 8:00 a.m

Step 2: The ending time for first lap is 8:05 a.m

The time interval = Ending time – Starting time = 8:05 a.m -8:00 a.m = 5min

Step 3: The starting time for the second lap is 8:06 a.m

Step 4: The ending time for second lap is 8:12 a.m

The time interval = Ending time –Starting time = 8:12 a.m - 8:06 a.m = 6min

Step 5: The starting time for third lap is 8:13 a.m

Step 6: The ending time for third lap is 8:21 a.m

The time interval = Ending time –Starting time = 8:21 a.m -8:13 a.m = 8 min

f) Interpretation of results and Conclusion

How do we find the time taken by an event from the starting time to the ending time?

Expected answer

The time interval is calculated by subtracting starting time from ending time. For this practical activity, time interval changed as we increase the number of laps. This is because, as the student makes more laps, the student gets tired and reduces speed.

g) Guidance on the evaluation

Invite pupils to answer to questions related to the practical activity above.

i. What is the time interval between the first lap and the last lap?
ii. Comparing the time intervals observed for second lap and third lap
iii. What do you think is the cause of the increase of time intervals from first lap to the third lap?

Expected Answers for the practical activity

i. The time interval between first lap and last lap = 8:21a.m - 8:00 a.m = 21min
ii. The minutes taken for the third lap is more than the minutes used for the first lap
iii. On the third lap, student started to get tired and used more minutes to finish the lap

PRACTICAL ACTIVITY 13: Establishing a budget of what comes in and what goes out and setting priorities of a family

a) Rationale:

This practical activity is conducted when teaching a lesson about establishing a budget and setting priorities in a family. It is taught in Unit 9. In real life, each family is used to make a budget when planning how the gotten money will be used depending on priorities.

b) Objective:

To establish a budget of what comes in and what goes out and setting priorities in a family.

c) Required materials:

Real money or money cards or place value counters representing money in form of coins and notes, Flash cards showing items such as family food, clothes, school fees, painting house, transport for visiting friends, transport for going to the hospital, buying car, buying television and shoes.

d) Procedures

Step 1: Read to understand the real-life problem about the use of money:

Keza earns a monthly salary of 50,000 Frw per month, 30,000Frw from farming and 40,000Frw per month from business. Keza plans to do the following expenses at home: Transport for visiting friend of 30,000Frw, Transport of going to the hospital of 15,000Frw, buying family food of 30,000Frw, Buying clothes of 10,000 Frw, Paying school fees 30,000Frw, Painting house for the family 25,000Frw.

Step 2: Put different flash cards representing money on the table.

Step 3: Find the total amount of money that Keza earns per month.

Step 4: Find the total amount of expenses that Keza wants to make per month.

Does Keza have enough money? What can Keza do without borrowing money?

Step 5: If you are Keza, arrange items you can buy starting by the most important: Prioritization.

Step 6: Which items will you buy at the first round? How much more money will you need to pay for the remaining items?

e) Data recording

In step 3, the total amount that Keza earns per month is 120,000Frw

In step 4, the total amount of expenses per month is equal to 140,000 Frw

In step 5 the items are arranged by priority:

1) Family food: 30,000Frw
2) Clothes: 10,000Frw
3) Transport to hospital: 15,000Frw
4) Paying school fees: 30,000Frw
5) Painting house: 25,000Frw
6) Transport for visiting friends: 30,000Frw

The amount money that will be needed for those items is 140,000Frw.

Given that this money is not sufficient, I get 120,000Frw, I will need 20,000Frw more.

I can pay the following:

1) Family food: 30,000Frw
2) Clothes: 10,000Frw
3) Transport to hospital: 15,000Frw
4) Paying school fees: 30,000Frw
5) Painting house: 25,000Frw

That make 110,000Frw and I can save 10,000Frw.

f) Interpretation of results and Conclusion

What is the lesson do you learn from this situation?

Expected answer:

This practical activity demonstrates the total amount of income that Keza earns and amount of expenses that Keza makes. From the experiment, it is clear that according to the planned expenses, Keza wants to spend much more than she earns. But after setting the priorities Keza understands what items she needs to be done first.

It is necessary to set priorities of the family before using the money received.

g) Guidance on the evaluation

Ask pupils to answer to questions reflecting the practical activity done:

Identify the item that can be done later by Keza and explain why?

Expected Answers for the practical activity

Painting house and Transport to visit friend. Because the cost of those items makes the budget of expenses to be higher compared to the budget of income and it should be done later once, they have more money.

PRACTICAL ACTIVITY 14: Use charts/flash cards, number cards or fraction cards to form different number patterns

a) Rationale:

This practical activity is conducted when teaching a lesson about forming sequences. It is learnt in unit 10. In real life sequence are used to arrange objects or colours in a good way.

b) Objective:

To use number cards to form different number patterns.

c) Required materials:

Number cards, 1, $2\frac{1}{2}$, $3\frac{1}{2}$, $3\frac{1}{2}$, 2,4 ,$4\frac{1}{2}$, $1\frac{1}{2}$

d) Procedures

Consider the following fraction cards labelled on 1, $2\frac{1}{2}$, $3\frac{1}{2}$, $3\frac{1}{2}$, 2,4 ,$4\frac{1}{2}$, $1\frac{1}{2}$

Step 1: Display the fraction cards on the table

Display a picture of fraction cards displayed on a table not in order.

Step 2: Start with $\frac{1}{2}$ bread

Display a fraction card labelled $\frac{1}{2}$ to represent bread on a table.

Step 3: A friend gives you bread of the same size and you have 1whole bread now.

Then display a card labelled 1 on the table to represent bread on the same line with the first card.

Step 4: When you get a bread of the same size you have $1\frac{1}{2}$. Then display a card labelled $1\frac{1}{2}$ to represent bread on the same line with other cards.

i. Pick a fraction card number to represent bread in Step 2 and 3 above.

ii. If you are given the same size of bread, pick a card to represent the bread you will be having when the **fourth** person gives you the same size and display it on the table following the order as above.

iii. Observe these cards arranged in line on the table then describe the pattern you have.

iv. Try to follow the same order and display, on the table, the card numbers presented to you.

e) Data recording

From the activity,

i) Fraction cards labeled on $\frac{1}{2}$ and 1

ii) A card labelled $2\frac{1}{2}$ will be picked.

iii) The pattern obtained is "adding $\frac{1}{2}$".

iv) Card numbers will be displayed in the order: $\frac{1}{2}$; 1; $1\frac{1}{2}$; 2; $2\frac{1}{2}$; 3; $3\frac{1}{2}$; 4; $4\frac{1}{2}$; ...

f) Interpretation of results and Conclusion

What does the list of numbers represent? What is the common difference of consecutive numbers? How do you get the next number.

Expected answer:

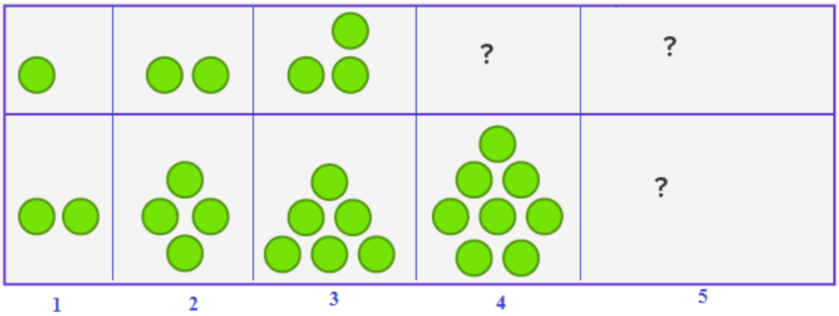
The list of number made is a number pattern. the common difference is $\frac{1}{2}$. To get the next number, we add $\frac{1}{2}$ to the number we have. The unlimited list of such numbers is a number sequence.

When making a number sequence, choose a common difference to use, then set the 1st number, and determine the next number.

g) Guidance on the evaluation

1) Ask pupils to use fraction cards to formulate different number pattern that they can describe.

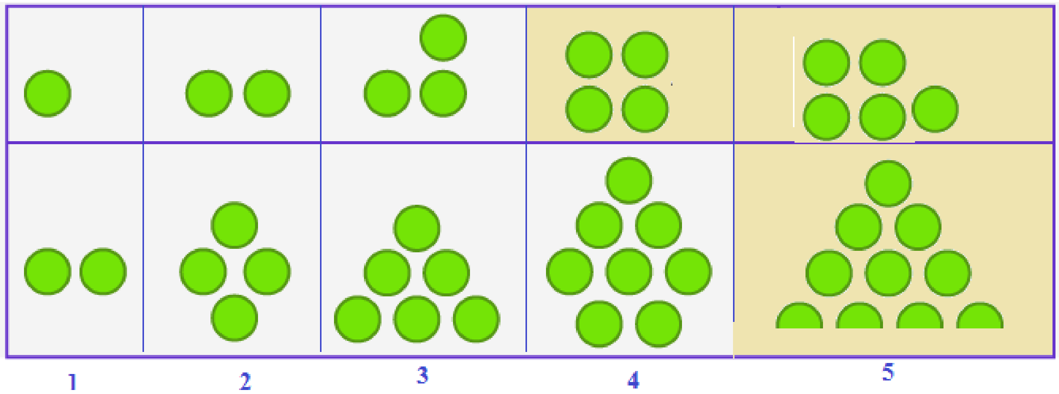
2) Form object pattern and invite pupils to complete them. For example, observe the following patterns made by piles of counters. Complete the number of counters in the next pile for each row.



Expected answer:

On the first row, the pattern is to add 1.

On the second row, the pattern is to add 2. Therefore, next piles will be completed as follow:



PRACTICAL ACTIVITY 15: Identify different lines and angles formed by lines

a) Rationale:

This practical activity is conducted when teaching a lesson about identifying different lines and angles formed by them. It is learnt in unit 11. Carpenters and engineers usually use angles when designing house materials: wall, roof, chairs, tables, etc.

b) Objective:

To identify different lines and show angles formed by those lines on different materials.

c) Required materials:

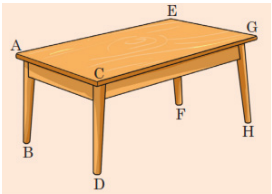
(Table, chair, desk, letter cards that are named A, B, C, D, E, F, G, H and stick).

Insert the pictures of cards named A, B, C, D, E, F, G, H

d) Procedures:

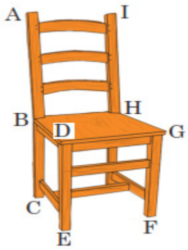
Step 1: Present the materials such as table, desk, chair, stick and letter cards in a room

Step 2: Use flash cards to show parallel lines on the table



State the flash cards that form parallel lines

Step 3: Use flash cards to show perpendicular line on the chair



State the flash cards that form perpendicular lines

Step 4: Put a stick PQ in a slanting position on the surface of the table to cut across AE and CG at point X and Y respectively

State which line is formed?

e) Data recording

In step 2, the letter cards that form parallel lines are as follow;

AE//CG AB//EF

AC//EG AB//GH

AB//CD EF//CD

EF//GH

In step 3, the letter cards that form perpendicular lines are as follow;

GD is perpendicular to DE

DB is perpendicular to AC

GH is perpendicular to IH

In step 4, the line that cut across AE and CG at point X and Y respectively is called **Transversal line**

f) Interpretation of results and Conclusion

When do we have a line? When lines are parallel? When are they intersecting?

Expected answer:

A line joins two points on a flat surface. When the lines do not meet, they are called Parallel lines. When two lines meet, it said they have intersected. When straight lines intersect, they form an angle.

g) Guidance on the evaluation

Ask pupils to answer to questions reflecting the practical activity done. For example,

i. Which angles are formed with parallel lines?

ii. Which angle is formed with perpendicular lines?

iii. Write the angles formed when the line PQ cuts across line AE and CG at the points X and Y?

Expected Answers for the practical activity

i. Parallel lines do not meet and can't form any angles

ii. Perpendicular lines always form a right angle.

iii. The angles formed when the line PQ cuts across line AE and CG at point X and Y are;

<PXE; <PXA; <EXY; <XYG; <XYC; <GYP; <PYC

PRACTICAL ACTIVITY 16: Angles formed by two Parallel Lines and a Transversal line

a) Rationale:

This practical activity is conducted when teaching a lesson about parallel lines and angles formed by a transversal line. It is taught in Unit 11. Home designers and engineers usually use angles made by parallel lines and their transversals when designing house materials: roofs, doors, tables, etc.

b) Objective:

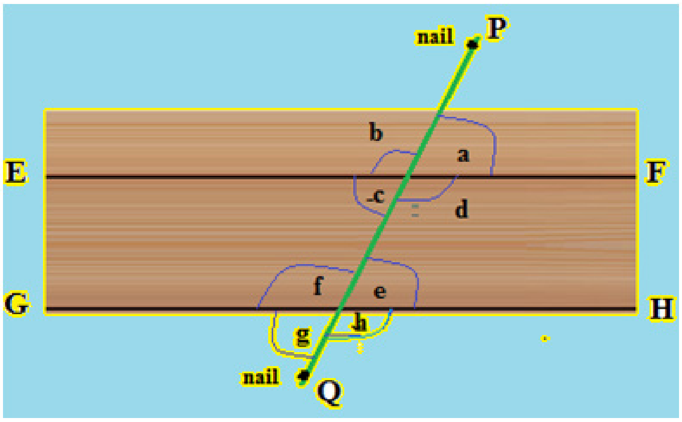
To measure the angles formed by two parallel lines and a transversal line using a protractor.

c) Required materials:

Two flat pieces of wood, nails, thread, ruler, and protractor.

d) Procedure:

Step 1: Take two flat pieces of wood and arrange them as bellow. With the help of nails fix the thread in such a way that it is transversal to them.



Measure all the angles numbered from **a** to **h**

e) Data recording:

Summarize your data in a table

No	Name of the angle	Measure of the angle	Name of the angle	Measure of the angle	Observation: equal angles are:
1	<a		<e		
2	<b		<f		
3	<c		<g		
4	<d		<h		

For example, we can find:

The measurement of angle a=52^0

The measurement of angle b = 128^0

The measurement of angle c =52^0

The measurement of angle d =128^0

The measurement of angle e =52^0

The measurement of angle f =128^0

The measurement of angle g =52^0

The measurement of angle h =128^0

No	Name of the angle	Measure of the angle	Name of the angle	Measure of the angle	Observation: Equal angles are
1	<a	52^o	<e	52^o	Ange a and angle e
2	<b	128^o	<f	128^o	...
3	<c	52^o	<g	52^o	...
4	<d	128^o	<h	128^o	...

f) Interpretation of results and Conclusion

Try to summarize the case of angles that are equal

Expected answer:

When a transversal line intersects two parallel lines, two pairs of equal angles are formed as shown in the practical activity.

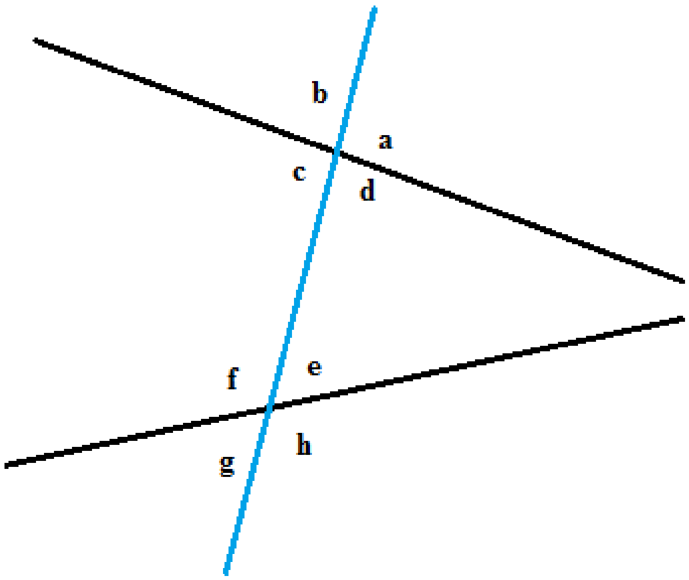
i. Angle 1 and angle 5 are called **corresponding angles** and they are equal.

ii. Angle 4 and angle 5 are called **co- interior angles** and they add up to180^{o}

iii. Angle 3 and angle 5 are called **alternate angles** and they are equal

g) Guidance on the evaluation

Now, place these two metallic wires or bicycle spikes as shown in the diagram below in such a way that the two metallic wires or bicycle spikes are not parallel to each other, and the thread or straight metallic wire is transversal to them. Use a protractor to:



i. Measure all the angles numbered from 1 to 8

ii. Write your data in the following table

No	Name of the angle	Size of the angle	Name of the angle	Size of the angle	Observation
1	<a		<e		
2	<b		<f		
3	<c		<g		
4	<d		<h		

iii. Draw your conclusion

Expected answer:

No	**Name of the angle**	**Size of the angle**	**Name of the angle**	**Size of the angle**	**Observation**
1	<a		<e		Angle a and angle e are not equal.
2	<b		<f		Angle b and angle f are not equal.
3	<c		<g		
4	<d		<h		

h) Conclusion:

When the transversal line cuts two lines which are not parallel, the angles formed by the transversal are not equal.

PRACTICAL ACTIVITY 17: Establishing the scale of a real object to be drawn on a sheet of paper

a) Rationale:

This practical activity is conducted when teaching a lesson about establishing scale drawings to draw a real object on a paper. It is taught in unit 12. The scale drawing is used by designers when drawing maps of countries, provinces, districts, sectors, etc.

b) Objective:

To establish the scale of a real object to be drawn on a paper.

c) Required materials:

Metre ruler, A4 sheets of papers, pencil, set ruler, rope, objects (table, or black board).

d) Procedure

Let us consider the length of a table. Do you think that the entire table can be drawn on a small sheet of paper?

Step1: Draw a diagram of a table on an A4 sheet of paper.

Step 2: Measure the actual length of your table. Record the actual length.

Step 3: Measure the length of the table you have drawn in step 1. Record the length.

Step 4: Compare the two lengths. What is the factor to be multiplied to the length of the drawing to get the length of the real table? Determine the

$$\text{Scale} = \frac{\text{Size of the drawing}}{\text{Size of real ofject}}$$

Step 5: Now, draw a classroom block on an A4 sheet of paper and measure off its length. Record it.

Step 6: Stretch a rope from one end of the classroom block to the other.

i. Measure the length of the piece of a rope from one end of the block to the other.
ii. Record as the actual length of the block
iii. Compare the two lengths in step 5 and step 6. Determine the scale of the drawing and give the meaning of the scale drawing.

e) Data recording

Considering the length of a table,

Actual length of your table.................... cm

Length of the table drawn .... cm

Assuming the actual length of the table = 120cm and that of the drawn table to be 10cm

To compare the two lengths; 10cm drawn on the paper represent 120cm length of the table.

1cm drawn on the paper will then represent (120/10) cm = 12cm of the table.

Hence the scale of the drawing is 1cm represents 12cm on the paper.

Therefore, $\text{Scale} = \dfrac{\text{Size of the drawing}}{\text{actual size of real object}}$

f) Interpretation of the results

Consider the length of the classroom block.

Actual length of the classroom block = actual length of the rope = ... cm

Length of the classroom block drawn = ... cm

Assuming the actual length of the classroom block = 700cm and that of the drawn classroom to be 20cm

To compare the two lengths; 20cm drawn on the paper represents 700cm actual length of the classroom block.

1cm drawn on the paper will then represent (700/20) cm = 35cm of the classroom block

Hence the scale of the drawing is that 1cm on a paper represents 35cm of the classroom block on ground. The scale = 1/35.

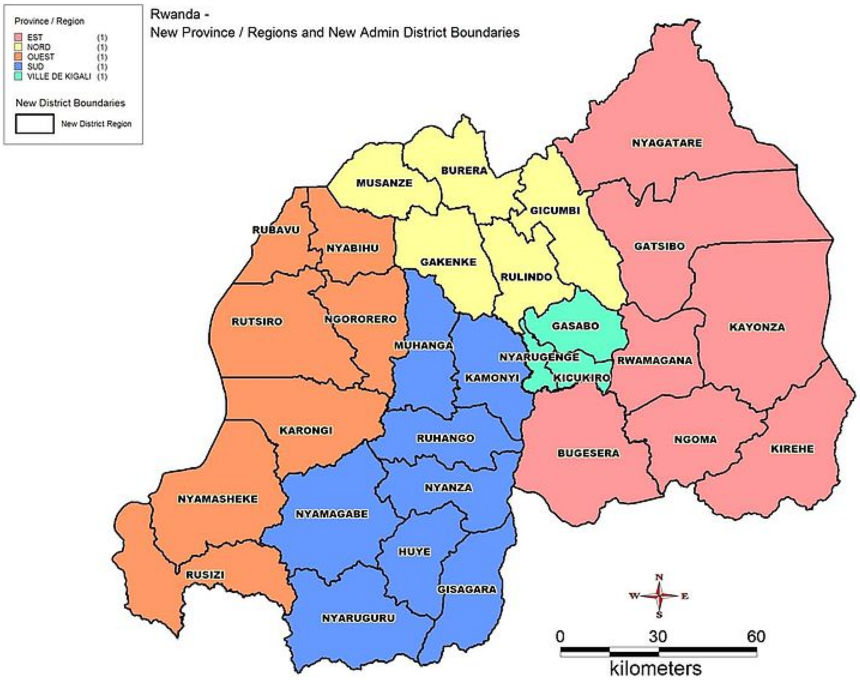
g) Conclusion:

A scale drawing is a drawing that shows a real object with **accurate sizes reduced or enlarged** by a certain amount called the scale.

Actual distances may not be possible to fit in a drawing on a paper. We draw them to the size of the paper using a shorter-distance.

The scale is the number that shows how a real object with **accurate size reduced or enlarged. For example**. Just like a 700cm length of a classroom block could not fit on the paper so it can be represented by a line segment of 7cm. The scale is 1/100 to mean that 1cm stands for 100cm. Another example is that a distance of 12 km of road can be drawn as 12 cm on paper. This way, we have drawn the object to a scale. This means 1km=1,000,000cm on ground is represented by 1cm on the paper. Therefore, 12cm on a paper will represent 12km of road on the ground.

On the following map, 1cm stands for 30km = 30,000,000cm. The scale is 1/30,000,000.



h) Guidance on the evaluation

Ask pupils to answer to questions related to the practical activity done. For example,

i. Repeat the practical activity with the length of a blackboard.

ii. The actual distance for a section of road is 25000cm. It is drawn on a map using a line of 50cm. Find the scale used to draw it.

Expected answer

50cm represents 25000cm, 1cm represents (25000/50) cm

1cm on a map represents 500cm on the ground. The scale is 1/500.

PRACTICAL ACTIVITY 18: Discovering and explaining the concept of diameter and the number Pi

a) Rationale:

This practical activity is conducted when teaching a lesson about the relationship between Circumference, diameter and Pi. It is taught in unit 13 of P5.

The number pi is a special number met in several areas of Geometry. It is denoted by the Greek letter "π" and used in mathematics to represent a constant, approximately equal to 3.1415... We need to understand its value as we will use it to determine perimeter and the area of circular objects found in real life.

b) Objective:

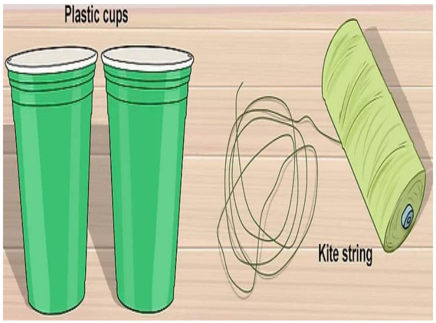
To discover the concept of Diameter and Pi

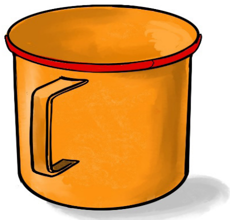
c) Required materials:

A String, ruler or tape measure, a pencil, a Manila paper, any circular object like a wheel, a cup, a coin, a saucepan.

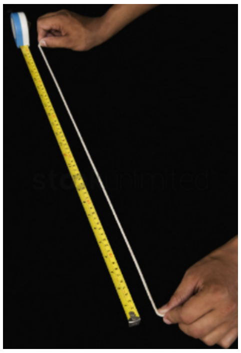
d) Procedures

Step 1: Wrap a string around the top of the plastic cup one time.





Step 2: Untie the string and use a tape measure to measure the length of the string from the plastic cup and record its length.

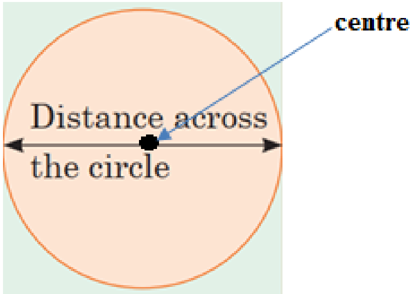


Note: The length of the string from the cup is the distance around the cup called **Circumference (C)**

Step 3: Use a tape measure to measure the distance from one side of the cup through the center to the other end and record it.

Note: This distance that passes through the center of the cup is called **Diameter (D)**

See the figure below;



Step 4: Draw a table on a manila chart as shown below to record in other measurements of circular objects.

Object	Circumference (C)	Diameter (D)	C÷ D

Step 5: In each case, calculate **Circumference (C) ÷Diameter (D)** and record the results in the table above.

From your records in the table, what is the number of diameters contained in the length of the circumference C?

e) Data recording

Use the table shown below to record in the measurements of **Circumference (C)** and **(D)** for different circular objects, then in each case,

calculate **Circumference (C) ÷Diameter (D)** and record the results.

Object	Circumference (C)	Diameter (D)	C ÷ D
1.			3.14
2.			3.14
3.			3.14

When **Circumference (C)÷Diameter (D)** of each object the result got is a constant number called **Pi** symbolically written as π**.**

For every circular object;

Pi (π) = $\frac{\text{Circumference (C)}}{\text{Diameter (D)}}$ = approximately **3.14** as a constant value.

f) Interpretation of results and Conclusion

Basing on your findings, explain what the number pi represent.

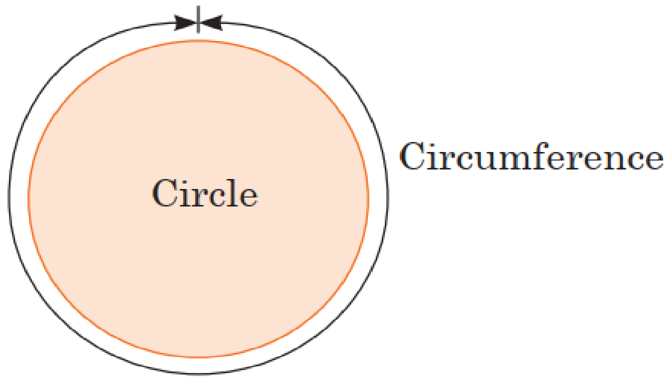
Expected answer:

When discovering the concept of Diameter (D) and Pi π **of any circular object,** we need to find the circumference of the circular object and its diameter by measuring respectively.

Then divide $\frac{\text{Circumference (C)}}{\text{Diameter (D)}}$ to get **Pi** (π) which is approximately equal to

3.14 for every circular object.

The distance around a circular object is called **Circumference (C).**



g) Guidance on the evaluation

Ask students to collect different circular objects and use the steps shown above to determine the concept of diameter and Pi.

PRACTICAL ACTIVITY 19: Measuring the circumference of a circle

a) Rationale:

This practical activity is conducted when teaching a lesson about the circumference of a circle. It is taught in unit 13. In real life, the circumference is the total length of a circular path such as a roundabout, the top of a cup, etc.

b) Objective:

To measure the distance around a circular object (circumference).

c) Required materials:

A rope, a measuring tape, nails, a roundabout such as the following of Kigali.

d) Procedures

Step 1: Consider a near-by round about in the school compound, and then trace the circular path of the roundabout.

Step 2: Wrap a rope along the circular path of the roundabout (following the red decorations).

Step 3: Now straighten the rope and measure it using a measuring tape.

Step 4: Record the length of the rope that traced the circular path as the circumference of the roundabout.

Step 4: Measure the radius of the circle round about and complete the following table.

Radius	**Diameter**	**Measured length of the roundabout**	**Circumference** **=(Length of diameter x 3.14)**

Step 5: Compare the Measured length of the roundabout and the product "Length of diameter x 3.14". What is your observation? How do we find the circumference of a circular object if we have its diameter?

e) Data recording

Length of the rope.........m

Circumference........m

Assuming the length of the rope that traced the path of the roundabout was 157m, the circumference of the roundabout is also 157m.

f) Interpretation of results and Conclusion

Basing on your findings, what is the meaning of a circumference of a circular object?

Expected answer:

The circumference of a circular path is the total distance around that path. We obtain it by tracing their paths, wrapping a rope or string around the path and then measure the string or rope with a ruler or by finding the product of the diameter by 3.14.

Circumference = diameter x 3.14 = diameter* x *Pi.

g) Guidance on the evaluation

Ask pupils to follow the same procedure and measure the circumference of the following objects:

i) Basin ii) Cup iii) A circular field whose radius is 20m.

PRACTICAL ACTIVITY 20: Calculating a volume of a cuboid

a) Rationale:

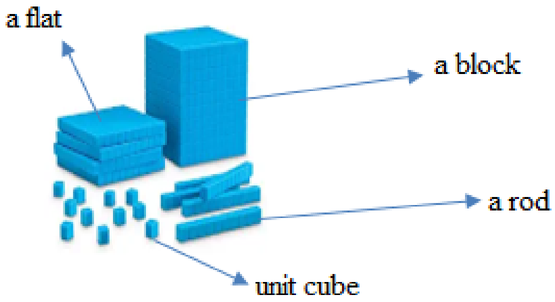
This experiment is conducted when teaching how to find a volume of a cuboid using real material. This concept is taught in geometry, P5, unit 13. In real life, different objects have the form of cuboids such as boxes of soap, block of tiles, etc.

b) Objective(s) of the experiment:

- Establish the relationships between cubes and cuboids.
- Explain how to find the volume of cubes or cuboids.

c) Required Materials:

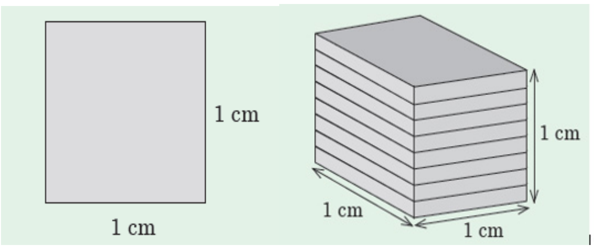
Meter ruler, base Ten starter kit, unit cube, rods, flat and a block, rope, sticks, paper squares, manila cards, charts, and markers.



d) Procedures & Steps of experiment

Step one

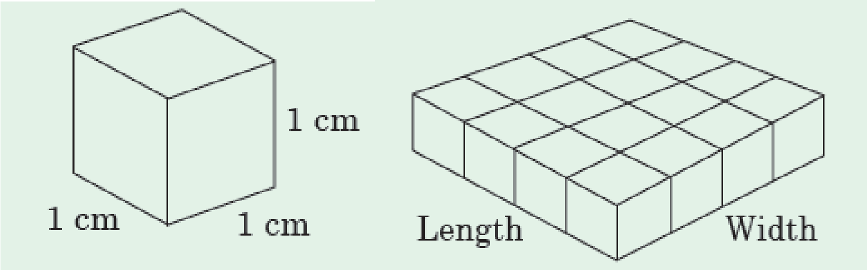
- Cut out squared pieces of manila paper with sides of each
- Observe the space occupied by one squared card and evaluate it?
- Stack the square card up to a height of
- Take the cubes and cuboids that you made from the previous activities.



- Determine which ones occupy bigger space? Which ones occupy less space?

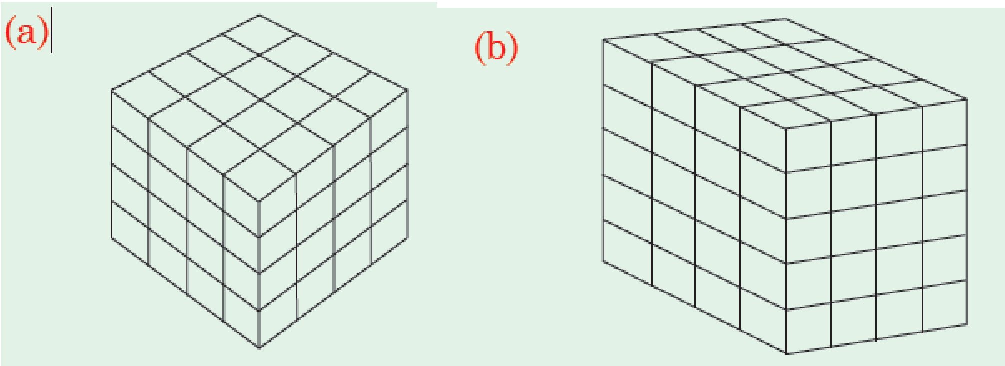
Step two

- Make several unit cubes in rods and then make a flat like one shown below:



- Using flats make a block as shown in step two (b) bellow
  i. How many cubes are there along the length?
  ii. How many cubes are there along the width?
  iii. How many cubes are there along the height?
  iv. Count the number of cubes in the layer.
  v. Calculate the number of cubes in the layer.

Step3: By adding similar layers on top, make the following block (b),



i. How many cubes are along the length?
ii. How many cubes are along the width?
iii. How many cubes are along the height?
iv. How many flats are in the block? Explain.
v. How many cubes form each block? Is this the volume of the block? Comare it with the (Length x Width) x height. Discuss your results.

How to calculate the volume of a cub and Cuboid using real materials?

e) Interpretation of results

- From the activity we see that in (a):

Its length = **a** cm, its width = **a** cm , Its height = **a** cm. This is a cube.

Its volume = length × width × height or V= a cm × a cm × a cm = a^3 cm^3

- <u>Note that</u>: If we want to convert units of volume into different units, we can convert the units of dimensions to same of volume first
- Now, calculate the **volume of cuboid** (b) using the formula.

Volume = length × width × height or $V = l \times w \times h$

The Volume of a cuboid is found by multiplying the width by the length by the height (our 3 dimensions!) Volume is usually measured in units of volume such as m^3, dm^3, cm^3, etc.

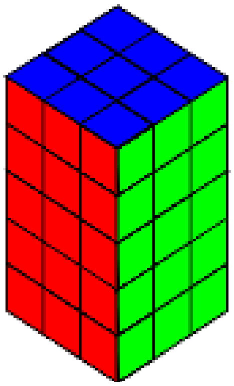
f) Conclusion

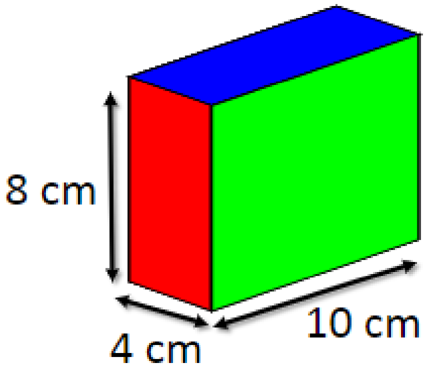
Cuboid is a solid box whose every surface is a rectangle of same area or different areas.

A cuboid will have a length, breadth and height. Thus, Volume of a cuboid = (length × width × height) cubic units.

g) guidance on the evaluation

In the first cuboid, each small square has a side of 1cm. Find the volume for each solid.





PRACTICAL ACTIVITY 21: Collecting, representing, and interpreting data

a) Rationale:

This practical activity is conducted when teaching a lesson about interpreting and representing data on a bar graph. The lesson on bar graph is taught in unit 14. In real life, when data are presented on a bar graph, it helps people to easily see the observation with higher frequency (more repeated) and the observation with lower frequency (less repeated).

b) Objective:

To collect, represent data on a bar graph and interpret them.

c) Required materials:

A pencil, squared papers, Manila paper or sticks, glue, Markers, coloured papers, ruler, and a pair of scissors.

d) Procedures:

Collecting data to present on bar graph and interpreting the result.

Step 1: Consider the popularity of different colours among a group of children. Collect the number of children favourable for each colour among 5.

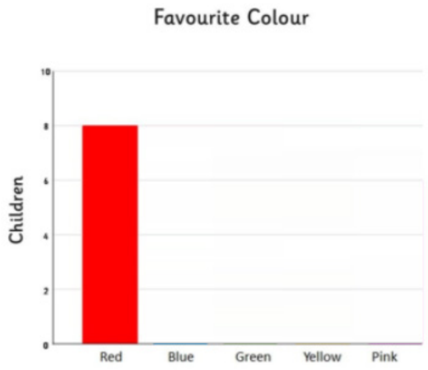
Step 2: Observe the table below showing the results of the observation from you colleague:

Colour	**Red**	**blue**	**green**	**yellow**	**pink**
Number of children who like it	8	7	5	9	6

Step 3: Cut 5colored or manila papers into rectangular pieces (width of 1cm) or take sticks with length equal to the number of children for each colour as shown in the table above.

Step 3: Draw a graph of horizontal (X) and vertical (Y) on a manila paper such that the X shows the names of colour and vertical line (Y) axis graduated on the number of children from 1 to 10.

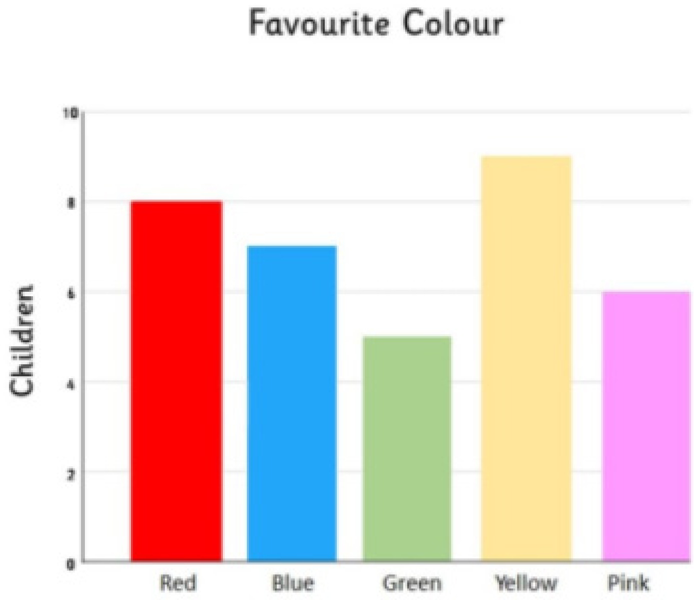
Step 4: Use glue to stick each measured paper and place it along the name of the colour with the corresponding number of children favourable to the colour on the vertical axis. Follow the example done on the graph:



Step 5: Interpret the data from the bar graph: what is the color preferred by many children? What color which is less liked?

e) Data recording

From **Step 4:** The length of these bars is proportional to the size of the information they represent.



As you can see, the names of the colours are written along the bottom and a sequence of numbers labelled ‘children’ are written along the lefthand side. The colors written along the bottom are categories. The numbers along the side represent the value of the category, in this case, it is the number of children have said they like each color.

The height of yellow is higher than others. This means that yellow colour is liked by more children.

The height of green is smaller. This means that the green colour is less liked by children.

f) Interpretation of results

When presenting data in statistics, get the data from identified source, collect it, organize it, present it in any required form and then give the interpretation.

Any data presented in a graphical form is easier to interpret.

g) Conclusion

To read a bar chart, consider the length of the bar connected to each category to find its value. If you wanted to know how many children chose 'pink' as their favourite colour, you would look at the number that lines up with the bar for 'pink' along the vertical axis (in this case 6). If the bar does not line up with a number, but falls in a gap, the value would be the number that falls in between the two numbers given. For example, there are five children who chose green, because the bar aligns with the gap between four and six.

h) Guidance on the evaluation

Ask students to collect data of any quantity such as: their age, height, shoe sizes, marks of a certain subject etc. Ask them to organize data in a table form, present it on either a bar graph or a line graph then interpret it correctly.

For example, in a recent test, many students got these grades as follow:

Grade:	**A**	**B**	**C**	**D**
Students:	4	12	10	2

Represent them on a bar graph and give your interpretation.

PRACTICAL ACTIVITY 22: Representing the outcomes of a die tossed many times

a) Rationale:

This practical activity is conducted when teaching a lesson about the game of tossing a die many times to determine the probability of winning. It is taught in unit 15. In real life, the game of tossing a die opens our mind and we become able to differentiate fair game from unfair game of chance.

b) Objective:

To represent the outcomes of tossing a die many times in a table and bar graph.

c) Required materials:

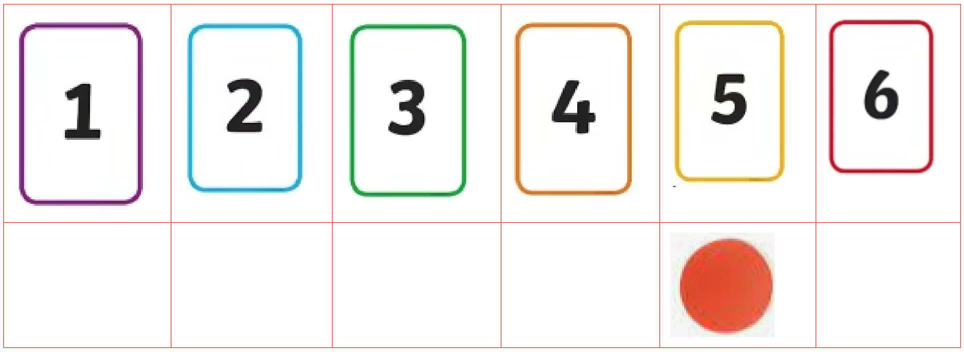
dice, pens, sheets of paper, 30 Counters, a graph paper/ squared paper,

Number cards 1 to 6.

d) Procedure.

Step 1: On the surface of your table, put number cards on a row marked 1 up to 6 corresponding to the sides of a die.

Step 2: Toss a die and observe the side that is facing up. For every toss observe the side that faces up, observe the number and put a counter along the number card representing the side. For example, if a side of 5 shows up after a toss, put a counter on number card 5.



If role a die once,

i) What is the probability of getting a 5?

ii) what is the probability of getting an even number?

Step 3: Toss the die other twenty-nine times to make it thirty times and for each toss place a counter on the number card that corresponds to the side that shows up.

Step 4: Count the number of counters on each number card which represents the number of times that sides 1, 2, 3, 4, 5, and 6 of a die have shown up during the thirty tosses. Record the results in a table shown below.

Face of a die (number card)	1	2	3	4	5	6
Outcomes = Number of times a face showed up (number of counters)						

Which Face had the highest frequency? How many chances of getting a face of 5 in the 30 times experienced?

Step 5: Represent the results from step 4, as a bar chart.

e) Data recording

For example, when a die was tossed thirty times the following results were got.

The Face of **1** showed up seven times (7 counters on number card 1)

The Face of **2** showed up five times. (5counters on number card 2)

The Face of **3** showed up once. (1counter on number card 3)

The face of **4** showed up three times. (3 counters on number card 4)

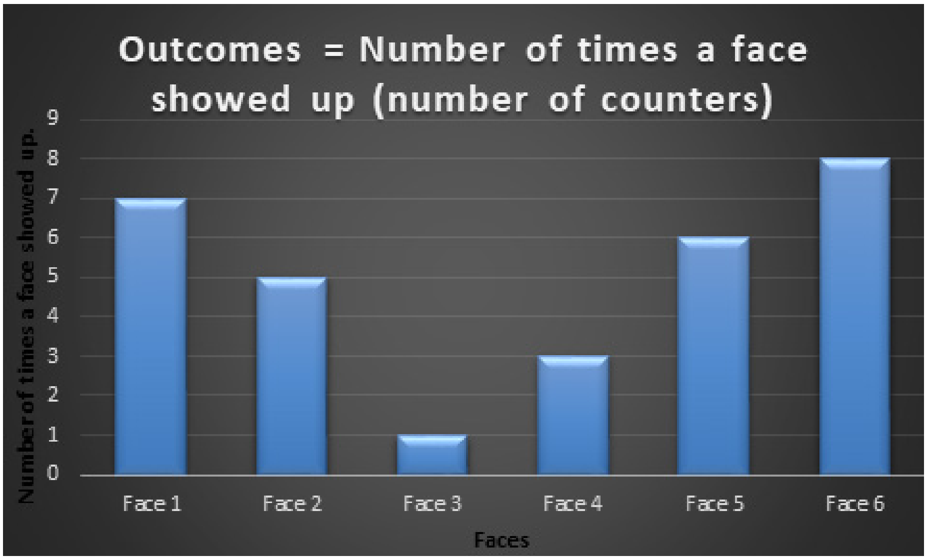
The face of **5** showed up six times (6 counters on number card 5)

The face of **6** showed up eight times. (8 counters on number card 6)

The recorded table of outcomes looks as below:

Face of a die (number card)	**Face 1**	**Face 2**	**Face 3**	**Face 4**	**Face 5**	**Face 6**
Outcomes = Number of times a face showed up (number of counters)	7	5	1	3	6	8

Representing the data on a bar graph



The Face with the highest frequency is face 6. It has 8 chances.

The probability of scoring the face 5 is

$$= \frac{\text{Result of the score}}{\text{Total outcomes recorded}} = \frac{\text{Number of counters for 5}}{\text{Total number of counters}} = \frac{6}{30}$$

Interpretation of results and Conclusion:

According to our practical activity, if we toss a die once, does any face have more chance of facing up?

Expected answer:

- During a single toss every score has equal chances.
- The probability of each face to face up is one out of 6. Probability of one number = **1/6**
- The chance of a face when a die is tossed many times is

$$= \frac{\text{Result of the score}}{\text{Total outcomes recorded}} = \frac{\text{Number of counters}}{\text{Total number of counters}}$$

f) Guidance on the evaluation.

Consider the practical activity above of tossing a die thirty times.

Determine: i) the frequency of side 3. ii) The frequency of side 1.

PRACTICAL ACTIVITY 1: Addition and subtraction of whole numbers using wooden vertical abacus

a) Rationale:

This practical activity is conducted when teaching the lesson about addition and subtraction of whole numbers up to 1,000,000. It is taught in unit 1. Addition and subtraction are useful for many activities of everyday life, like setting the table, adding money, and making change at the supermarket, and playing some games. Addition and subtraction prepare children for learning about other mathematics topics, including multiplication.

b) Objective:

To apply addition and subtraction of a whole numbers in real life situations.

c) Required materials:

Wooden Vertical Abacus with seven spikes.

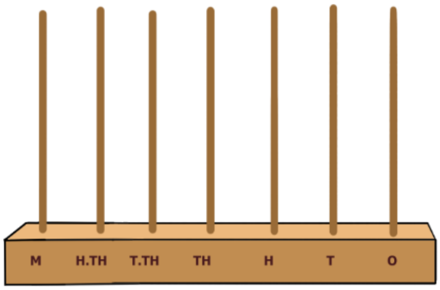
d) Procedures :

Step 1: Read and understand the following problem

A dairy cooperative sold 1,213,231 litres of milk in January. On February, they sold 2,242,321 litres of milk. In March the amount of milk sold was 1, 121,111 litres of milk less than that of February.

i. How much milk did they sell in March?
ii. How much milk did they sell in three months?

Step 2: Get an empty wooden vertical abacus with seven spikes and label the spikes from right to left as ones, tens, hundreds, thousands, ten thousand, hundred thousand, and Millions.



Step 3: Since the amount of milk sold in February is 2,242,321 litres of milk, then

Put 1 bead on the spike of ones

Put 2 beads on the spike of tens

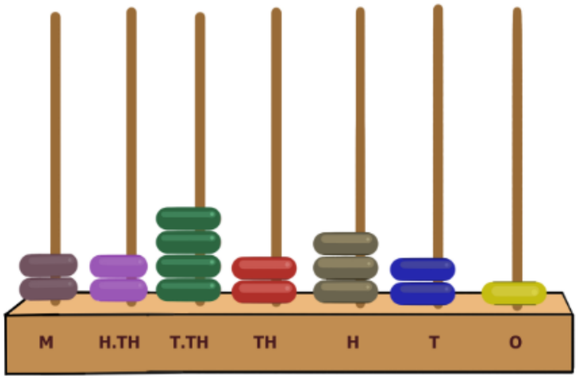
Put 3 beads on the spike of hundreds

Put 2 beads on the spike of thousands

Put 4 beads on the spike of ten thousand

Put 2 beads on the spike of hundred thousand

Put 2 beads on the spike of millions



Step 4: To find the amount of milk sold in March, which was 1, 121,111 litres of milk less than that of February, and using the abacus in step 2 do the following:

Remove 1 bead from the spike of ones

Remove 1 bead from the spike of tens

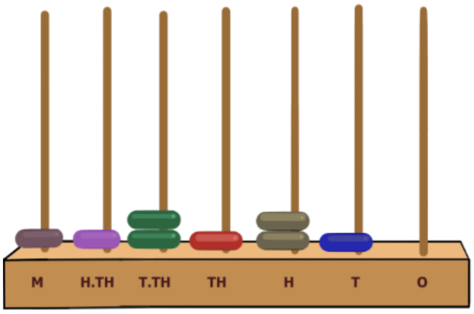
Remove 1 bead from the spike of hundreds

Remove 1 bead from the spike of thousands

Remove 2 beads from the spike of ten thousand

Remove 1bead from the spike of hundred thousand

Remove 1 bead from the spike of million



Record the number remaining on the abacus which becomes the sold milk of March.

Step 5: Now use the abacus in step 4 and add amount of milk sold in January (1,213,231 litres). Follow the following steps;

Put 1 bead on the spike of ones.

Put 3 beads on the spike of tens.

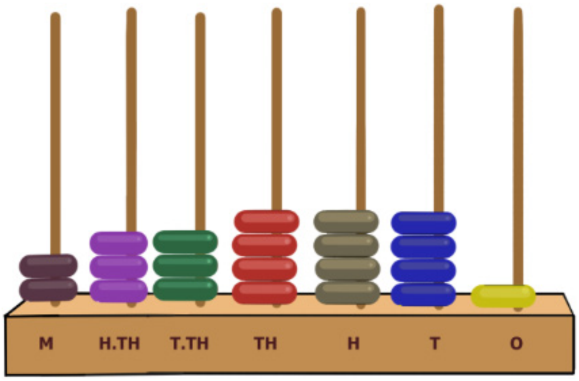
Put 2 beads on the spike of hundreds.

Put 3 beads on the spike of thousand.

Put 1 bead on the spike of ten thousand.

Put 2 beads on the spike of hundred thousand.

Put 1 bead on the spike of millions



Record the total amount of milk sold in both January and March as represented by the abacus.

Step 6: To now add the amount of milk sold in February (2,242,321 litres) to that of March and January, follow the following steps;

Starting with the abacus in step 5 above,

Add 1 bead on the spike of ones.

Add 2 beads on the spike of tens.

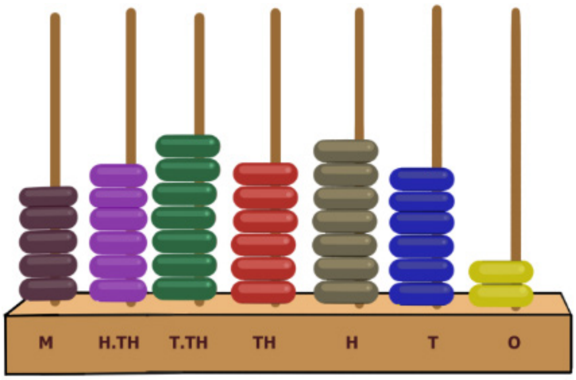
Add 3 beads on the spike of hundreds.

Add 2 beads on the spike of thousands

Add 4 beads on the spike of ten thousand.

Add 2 beads on the spike of hundred thousand.

Add 2 beads on the spike of millions.



Now Record, the number represented on the abacus starting from left to right which is the total amount of milk sold in all the three months.

e) Data recording

In step 3, the amount of milk sold in February is 2,242,321 litres

In step 4, the amount of milk sold in March is 1,121,210 litres.

In step 5, the amount of milk sold in both January and March is 2,334,441 litres.

In step 6, the amount of milk sold in all the three months is 4,576,762 litres.

f) Interpretation of results and Conclusion

The number of litres presented in our practical activity are with higher place values in millions. To add up or subtract, we need first to arrange digits according to their place values from left to right and then do other mathematical operations. We add by putting the given number of beads on the spikes then count the total beads per spike and subtract by removing beads from the spikes and count the remainder of the beads on the spike.

g) Guidance on the evaluation

Ask pupils to use the abacus while solving problems such as the following:

Mugisha invested 2,522,324 Frw in the first year of the business. The second year invested 1,212,111 Frw less than what he invested in the first year. By following all the step listed above;

i. How much did he invest in second year?
ii. How much is the total investment for two years?

Expected answers

i. The amount of money that was invested in the second year is 1,310,213 Frw
ii. The total investment of two years is 3,832,537 Frw

PRACTICAL ACTIVITY 2: Composition of numbers using number cards

a) Rationale:

This practical activity is conducted when teaching the lesson about forming numbers from given digits in unit 1.

In real life, we use 10 digits of a decimal system to represent numbers:

0 zero | 1 one | 2 two | 3 three | 4 four | 5 five | 6 six | 7 seven | 8 eight | 9 nine

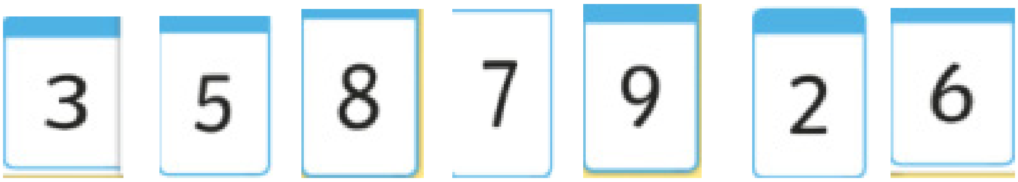
Numbers that cannot be represented by a single digit, they are arranged in columns called place values. Numbers are a useful language for counting, measuring, and identifying. We use numbers in an unlimited range of ways: in mathematical calculations, to make phone calls and to identify our bank accounts.

b) Objective:

To compose smallest/largest/odd/prime/even 7-digit numbers from the given digits numbers beyond 1,000,000 using number cards.

c) Required materials:

Number cards with the following numbers 3, 5, 8, 7, 9, 2 and 6.



d) Procedures

Step 1: Take the number cards of different colors of the following digits: **3, 5, 8, 7, 9, 2, 6**. Then place them on the table for easy manipulation.

Step 2: Read and discuss the following instructions to identify how to arrange the number cards to get the correct number. Explain how you got your answer.

i. Smallest possible 7-digits number from the given digits

ii. Largest possible 7-digits number from the given digits

iii. Largest even number of 7 digits from the given digits

iv. Smallest even number of 7 digits from the given digits

v. Largest odd number of 7 digits from the given digits

vi. Smallest odd number (7-digits number) from the given digits

vii. Largest 7-digits number divisible by 5 from the given digits

viii. Smallest 7-digits number divisible by 5 from the given digits

Step 3: For each case above, read the obtained number

Step 4: For each case above, write the number obtained in words correctly.

e) Data recording

Every number formed by pupils is recorded as follows:

- Smallest possible number from the given digits is 2,356,789.
- Explanation: Smallest number is got by putting smaller digits in higher place values done by arranging the number cards from smallest digit to the largest digit.
- Largest possible number from the given digits is 9,876,532.
- Explanation: Largest number is got by putting larger digits in higher place values done by arranging the number cards from largest digits to the smallest digit.
- Largest even number from the given digits is 9,876,532
- Explanation: Largest even number is got by arranging the number cards from largest digits to the smallest digit but making sure that the last digit is divisible by 2. Last digit 2 is divisible by 2 hence 9876532 is the largest even number.
- Smallest even number from the given digits is 2,356,798
- Explanation: Smallest even number is got by arranging the number cards from smallest digit to the largest digit making sure that the last digit is divisible by 2.
- Largest odd number from the given digits is 9,876,523
- Explanation: Largest odd number is got by arranging the number cards from largest digits to the smallest digit but making sure that the last digit is an odd number (not divisible by 2).
- Smallest odd number from the given digits is 2,356,789
- Explanation: Smallest odd number is got by arranging the number cards from smallest digit to the largest digit making sure that the last digit is odd. (not divisible by 2).
- Largest number divisible by 5 from the given digits is 9,876,325.
- Explanation: Largest number divisible by 5 is got by arranging the number cards from largest digits to the smallest digit but making sure that the last digit is either 5 or 0.
- Smallest number divisible by 5 from the given digits is 2,367,895

Explanation: Smallest number divisible by 5 is got by arranging the number cards from smallest digits to the largest digit but making sure that the last digit is either 5 or 0.

f) Interpretation of results and Conclusion

To form a number, we use digits. These digits are arranged depending on the number to be formed. For example, to form the number 8,325,679, we can start by arranging digits from left side by placing the digit 8 for million 3 for hundred thousand, the digit 2 for ten thousand, the digit 5 for thousands, the digit 6 for hundreds, the digit 7 for tens and finally the digit 9 for ones. We can also start by the right side towards the left side: placing the digit 9 for ones, the digit 7 for tens, the digit 6 for hundreds, the digit 5 for thousands, 2 digits for ten thousand, 3 for hundred thousand and finally 8 for millions.

g) Guidance on the evaluation

Ask learners to cut and manipulate the number cards and use them as learning materials that help them to compose, write and read numbers and solve the problems below:

1. Arrange these number cards for the given numbers 2, 3, 6, 7, 8, 5 and 9 so that they form the smallest even number. Read the obtained number.
2. Arrange these number cards so that they form a largest number divisible by 4.

PRACTICAL ACTIVITY 3: Multiplication of integers using counters

a) Rationale:

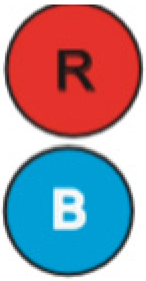
This practical activity is conducted when teaching the lesson about multiplication of integers. It is taught **in unit 2.**

Some situations in everyday life use positive and negative numbers, such as temperatures, banking, and sports. For example, a debt of 500Rwandan francs could be represented as -500 Rwandan francs. It is necessary to learn how to multiply such numbers as we will necessarily need to use them.

b) Objective:

To explore multiplying integers practically using counters (or buttons) of different coloured faces

c) Required materials:



Plastic pieces or laminated transparent counters whose one side is blue and other side is red. We can use counters of 2 different colors.

d) Procedures

Step 1: Consider the red side of the counter as positive (+) and the blue side of the counter as negative (–).

Positive

Negative

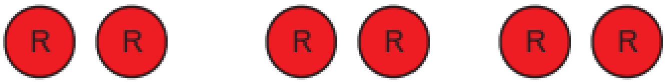
Step 2: Multiplying two positive integers

Take an example of (+3) x (+2).

Consider that the multiplication sign stands for grouping.

So read (+3) x (+2) as 3 groups of +2 counters.

According to our coloured counters, (+3) x (+2) means make three groups each group having 2 counters placed with red faces facing up as below.



How many counters are there in total? Which coloured faces are up? Deduce (+3) x (+2)

Expected answer:

There are six counters placed with red faces up.

Therefore +3 x +2 = +6

Step 3: Multiplying two negative integers.

Take an example of (– 2) x (– 4)

Note that a negative on the multiplicand is considered and read as opposite.

(– 2) x (– 4) is read as the opposite of two groups of negative four. But we know that negative four is represented by four blue counters.

i. First, make two groups of four counters with blue face showing up and place them on a row.

ii. Since it's a negative two (-2) which means the opposite two groups, we invert the blue faces of the counters or we replace these counters to have the red faces showing on top.

Note: We invert because of the negative sign on the multiplicand.

How many counters are they altogether and what color are they? Deduce (-2) x (-4)

Expected answer:

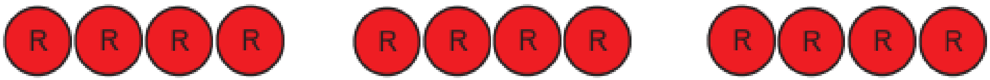
They are six counters placed with red faces up.

Therefore (-2) x (-4) = +8

Step 4: Multiply a positive by a negative integer, take the example of -3 x +4

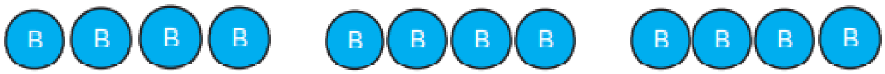
Since a negative means the opposite, (-3) x (+4) means opposite of 3 groups of positive fours.

Starting with 3 x (+4) means make three groups with each group having 4 counters placed in a row with red faces facing up as below.



But (-3) x (+4) means opposite of 3 groups of positive fours.

Since there is a negative which means opposite, we invert or replace the counters in each case putting the counters with blue faces facing up.



How many counters and what colour are they? Deduce -3 x +4

Expected answer

There are twelve counters placed with a blue face on top. This represents -12.

Therefore (-3) x (+4) = -12

e) Data recording:

Multiplying two positive integers (+3 x +2)

Number of groups of counters made = 3

Number of counters in each group = 2 counters placed with red faces on top.

Total counters = 6 counters with red faces on top = +6

Multiplying two negative integers

Take an example of (– 2 x – 4)

Number of groups of counters made = 2

Number of counters in each group before flipping or inverting = 4 counters placed with blue faces on top.

Number of counters in each group after flipping or inverting = 4 counters placed with red faces on top.

Total counters = 8 counters with red faces on top = +8

Multiplication of a positive and a negative integer

Take an example of -3 x 4

Number of groups of counters made = 3

Number of counters in each group before flipping or inverting = 4 counters placed with red faces on top.

Number of counters in each group after flipping or inverting = 4 counters placed with blue faces on top.

Total counters after inverting/flipping the counters = 12 counters with blue faces on top = -12

f) Interpretation of results and Conclusion

As observed from the results we note the following:

i. Multiplying two positive integers you get a positive Integer since according to our practical activity means picking red faced counters repeated number of times and placing them without inverting.

ii. Multiplying two negative integers gives a positive integer since it involves inverting the counters after repeatedly adding the blue counters. They are inverted to get the red faces up because of the negative sign of the multiplicand.

iii. Multiplying a negative integer and positive integer gives a negative integer. If it is the multiplicand which is negative, we invert the total counters and If tis the multiplier which is negative we don't invert the counters.

Note also the following:

You can also take red side of the counter as negative and the blue side as positive.

For integers A x B means A groups of Bs. A = number of groups, B = number of counters in each group (positive or negative). We invert or flip if A is negative since negative is considered as the opposite.

g) Guidance on the evaluation

Ask pupils to repeat the practical activity with the following:

i. +5 x + 3

ii. -3 x -5

iii. +2 x -6

iv. -8 x +2

Expected answers:

i. +5 x + 3 = +15

ii. -2 x -5 = +10

iii. +2 x -6 = -12

iv. -8 x +2 = -16

PRACTICAL ACTIVITY 4: Application of multiplication of fractions by whole a number

a) Rationale:

This practical activity is conducted when teaching the lesson about multiplying fractions. It is taught in unit 4. Multiplication of fraction is used in real life when a person who has a part of the whole needs to get more similar parts of a whole to begiven other people. A pizza is a great example of fractions; each piece represents a part of a whole. If one person has more similar parts, we can talk about the multiplication of fractions.

b) Objective:

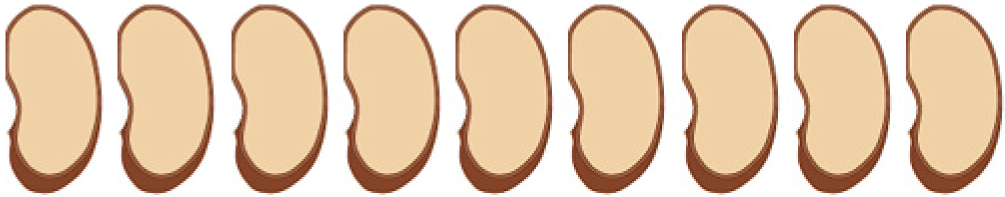
To explore multiplication of fractions using fractional objects

c) Required materials:

Beans

d) Procedures

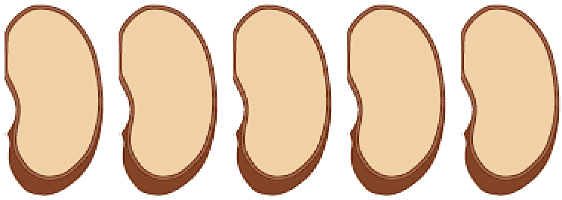
Step 1: Collect 9 halves of beans



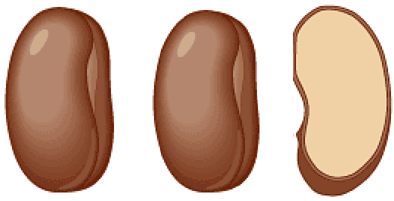
NOTE: Multiplication is a repeated addition.

Suppose we want to multiply **5 x** $\frac{1}{2}$

Step 2: Take 5 halves of beans from the 9 halves. This is $\left(\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}\right) = 5 \times \frac{1}{2}$

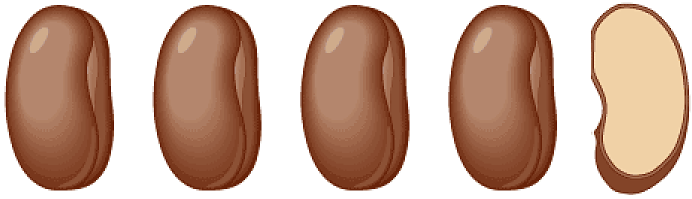


Step 3: Get each half add it to each other to form bean seeds. Record your observation



Step 4: Consider $9 \times \frac{1}{2} = \frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$

Get the 9 halves of a bean seed and Join them to form bean seeds. Record your observation.



e) Data recording

From step 3 it is observed that when 5 halves of beans are joined (added) together, we get 2 complete beans and remain with 1 half bean. It is represented

as $5\times\frac{1}{2}=\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}=2\frac{1}{2}$. Therefore, $5\times\frac{1}{2}=2\frac{1}{2}$

From step 4 it is observed that when 9 halves of beans are joined (added) together, we get 4 complete beans and remains with 1 half bean. It is represented

as $9\times\frac{1}{2}=\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}=4\frac{1}{2}$. Therefore, $9\times\frac{1}{2}=4\frac{1}{2}$

f) Interpretation of results and conclusion

When exploring the multiplication of fractions using fractional objects, it should be noted that **multiplication is a repeated addition** as it was demonstrated above **(**step2 and step 3**).**

$9\times\frac{1}{2}$ means 9 times (groups) of a half ($\frac{1}{2}$).

g) Guidance on the evaluation

Ask pupils to collect objects such as 8 quarters of oranges, 13 quarters of tomatoes, 11 two thirds of bread and practically follow the steps above to show the products of whole numbers and fractions of problems:

i. $8\times\frac{1}{4}$ ii. $13\times\frac{1}{4}$ and iii. $11\times\frac{2}{3}$ respectively.

Expected answers

i. Eight quarters of orange: $8\times\frac{1}{4}=\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}=2$; after adding up four quarters to make a whole orange.

ii. Thirteen quarters:

$13\times\frac{1}{4}=,\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}=3\frac{1}{4}$;

after adding up four quarters to make a whole tomato.

iii. Eleven two quarters: $11\times\frac{2}{3}=\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}=6\frac{2}{3}$

; after adding up three two thirds to make 2 whole breads.

PRACTICAL ACTIVITY 5: Factors of a whole number

a) Rationale:

This practical activity is conducted when teaching the lesson about factors of whole numbers. It is taught in unit 3. In real life, a factor of the whole number indicate the number of groups that can be formed in the given number of objects.

b) Objective:

To practically explore factors of a whole number.

c) Required materials:

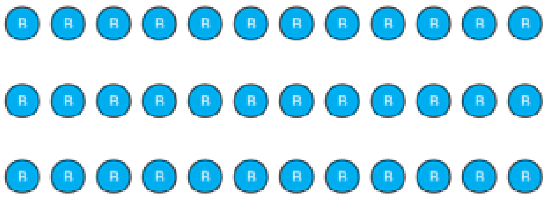
Counters or stones or beans or sticks of exact number to the whole number whose factors are to be found, empty Chalk boxes.

d) Procedures

Consider a whole number, 36. Finding the factors of 36 we follow the following steps:

Step 1: Count 36 counters and put them in one empty box.

Since we have 1 empty box and 36 counters.



Step 2: Test with 2 empty boxes to check if they can equally divide the 36 counters.

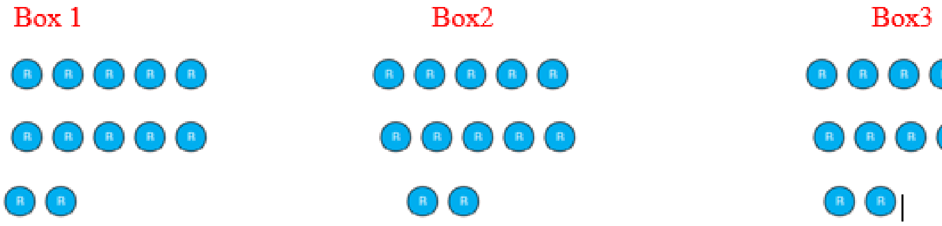
One at a time distribute equally the 36 counters in two empty boxes and count the number in each box.

Are the counters equally divided? How many boxes have you used? How many counters are in each?

Expected answer:

Yes, the counters are evenly divided. 2 boxes equally divided 36 counters to get 18 counters in each box. Therefore, **2** and **18** are **factors** of **36.**

Step 3: Now test whether 3 is a factor of 36. Get 3 empty boxes and distribute equally the 36 counters by putting one counter at a time in each box.

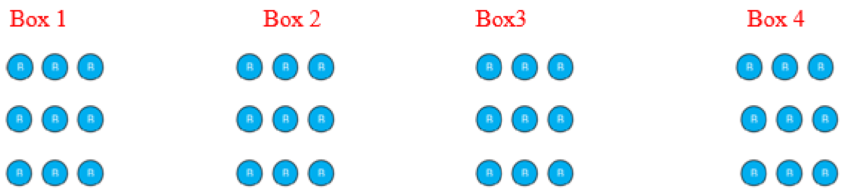


Are the counters equally divided? How many boxes have you used? How many counters are in each box?

Expected answer:

Yes, the counters are evenly divided. **3** boxes evenly divided 36 counters to get 12 counters in each box. Therefore, **3** and **12** are **factors** of **36.**

Step 4: Now let us test whether 4 is a factor of 36. Get 4 empty boxes and distribute equally the 36 counters by putting one counter at a time in each box.

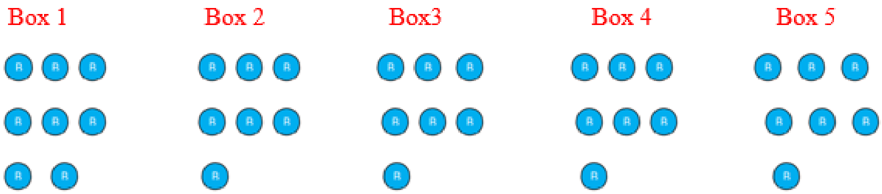


Are the counters equally divided? How many boxes have you used? How many counters are in each?

Expected answer:

Yes, the counters are evenly divided. **4** boxes evenly divided 36 counters to get 9 counters in each box. Therefore, **4** and **9** are **factors** of **36.**

Step 5: Now let us test whether 5 is a factor of 36. Get 5 empty boxes and distribute equally the 36 counters by putting one counter at a time in each box.

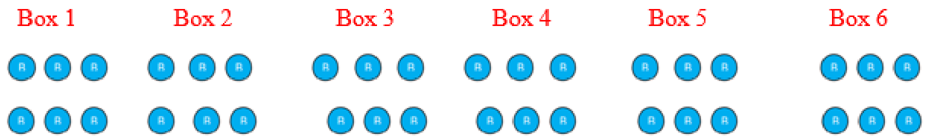


Are the counters equally divided? If yes, how many boxes have you used? How many counters are in each?

Expected answer:

No, the counters are not evenly divided. Box 1 has 8 counters, boxes 2, 3, 4, and 5 have 7 counters each. Therefore, **5 is not a factor of 36.**

Step 6: Now test whether 6 is a factor of 36. Get 6 empty boxes and distribute equally the 36 counters by putting one counter at a time in each box.



Are the counters equally divided? If yes, how many boxes have you used? How many counters are in each?

Expected answer:

Yes, the counters are equally divided. There are 6 boxes and each box has 6 counters.

Therefore, **6** is a **factor** of **36.**

Note:

Stop the testing if the number of counters in each box is **equal** or **less** than the number of boxes.

In st**ep 5**, number of boxes 6 is equal to the number of counters which is 6.

Therefore, the factors of 36 are 1,2,3,4,6,9,12,18, and 36.

e) Data recording:

Step	**Number of boxes**	**Number of counters in each box**	**Factors**
Step 1	1	36	1 and 36 are factors of 36
Step 2	2	18	2 and 18 are factors of 36
Step 3	3	12	3 and 12 are factors of 36
Step 4	4	9	4 and 9 are factors of 36

Step 5	5	Number of counters in each box is not equal. Box 1 has 8 counters, while other boxes have 7 counters each	5 is not a factor of 36
Sep 6	6	6	6 is a factor of 36.
Conclusion		The factors of 36 are 1, 2, 3, 4, 6, 9, 12, 18, and 36	

f) Interpretation of results and Conclusion.

Factors of a number are numbers that divide it equally without any remainder. In real life, the fist number is a factor of the second number means that their can be the number of groups of the fist number in the second number of objects. 4 is a factor of 36 means that we can find 4 groups of equal objects in 36 objects. Each group has 9 objects.

We can practically found factors of a number by using counters and empty boxes; Factors are both the number of boxes used to divide equally the counters (of the number whose factors are to be found) and the number of counters in each box.

Test for factors starting with 1, 2, 3, 4.... boxes and stop the testing if the number of counters in each box is equal or less than the number of boxes.

For example, in step 5, number of boxes is equal to the number of counters which is 6. So, we stopped the testing.

g) Guidance on the evaluation

Following the procedure in above practical activity, ask learners to find the factors of 9, 12 and 4

Expected answers:

Factors of 9 are 1, 3 and 9

Factors of 12 are 1, 2, 3, 4, 6 and 12

Factors of 4 are 1, 2, and 4

PRACTICAL ACTIVITY 6: Use simple arm balance to illustrate the ideas of equality and inequality of masses

a) Rationale:

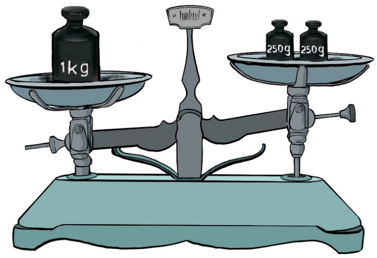
This practical activity is conducted when teaching the lesson about using weighing balances and weighing stones to **compare** masses. It is taught in unit 7. Arm balance is recommended by RBS to be used when measuring the mass of goods we purchase at the market or from any shop: beans, sugar, salt, etc.

b) Objective:

Use the double beam balance to find equal masses, deduce equilibrium and disequilibrium of weights.

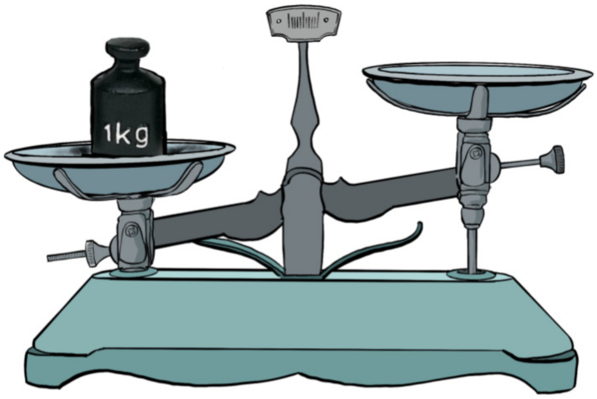
c) Required materials:

Simple weighing balance, various weighing stones (1kg, 3 stones of 250g, 500g).

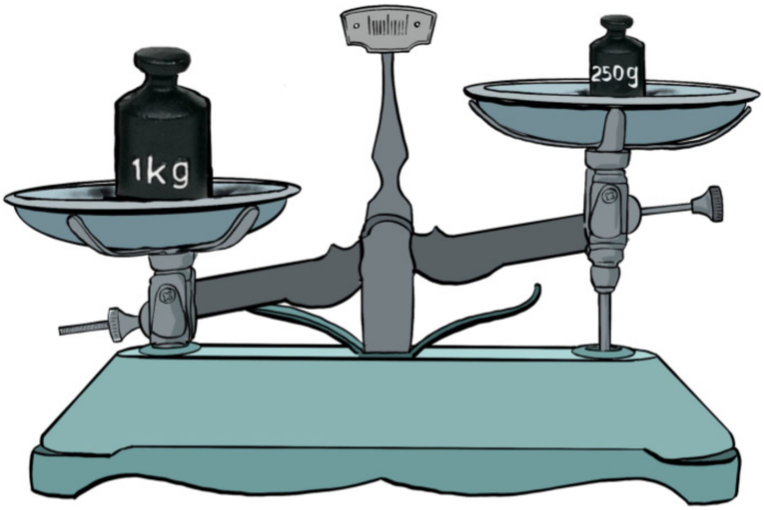


d) Procedures

Step 1: Have a simple weighing balance assembled with a 1kg weighing stone. Put a 1 kg weighing stone on the left-hand side of the balance. What do you observe? Record your observation.

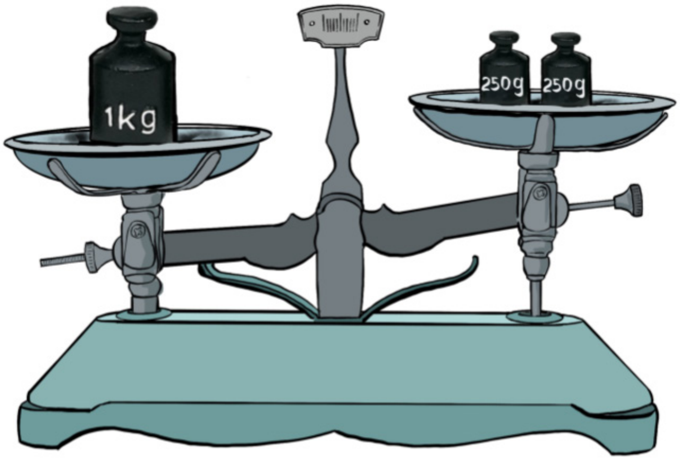


Step 2: Put a 250grams weighing stone on the right-hand side of the balance. What do you observe? Record your observation and complete with the comparison sign: 250g.... 1kg.



Step 3: Without removing the first stone, add another 250grams stone to make them two weighing stones on the right-hand side of the balance.

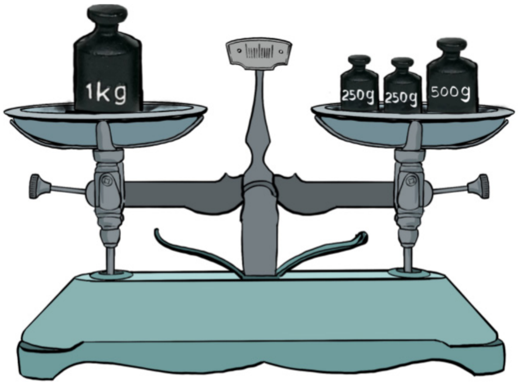
Record your observation and complete with the appropriate comparison sign: 1kg....(250g+250g)



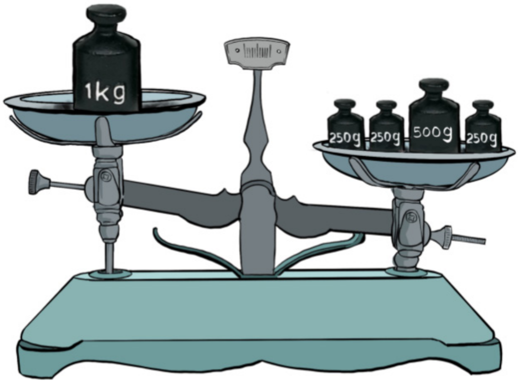
Step 4: Without removing the first two stones of 250grams add another stone of 500grams of a weighing stone on the right-hand side.

Record your observation and complete with the appropriate comparison sign.

1kg ..... (250g+250g+500g)



Step 5: Without removing the two stones of 250grams and the stone of 500grams, add another stone of 250grams on the right side.



Record your observation and complete with the appropriate comparison sign.

1kg ….. (250g+250g+500g+250g).

From the steps above, write your conclusion from your observation.

At which case do we have an equilibrium? What does this mean considering the masses on the left and the right sides of the balance?

When do we have disequilibrium on the balance?

e) Data recording

In step 1, the left hand side of the balance is down and the right side is up. 1kg is heavier than 0.

In step 2, the left-hand side remains down and the right side is up. 1kg is heavier than the 250 grams. **250g < 1kg**. There is disequilibrium.

In step 3, the left-hand side still remains down and the right side is up. 1kg is heavier than the two 250 grams stone with 500 grams. **1kg > (250g+250g)**. There is disequilibrium.

In step 4, the left-hand side and the right side of the simple weighing balance are on the same level and balancing. Therefore, there is equilibrium. The left-hand side with 1kg has the same weight as the right-hand side with two 250grams and 500 grams stones.

1kg equals 1000 grams. **1kg = (250g+250g+500g)**.

In step 5, the left-hand side is up and the right side is down. 1,250 grams are heavier than 1kg. **1kg < (250g+250g+500g+250g)**. There is disequilibrium.

f) Interpretation of results and Conclusion

- When weighing objects using a simple double weighing balance, the weight on the left hand and that on the right-hand sides of the balance must be equal in order to balance. Here we say that the weighing balance is at equilibrium point.
- We keep adding or removing weights until equilibrium is got.
- If they are not balanced or the weight on the left-hand is higher or lower than that on the right hand, the weighing balance is at disequilibrium point.

g) Guidance on the evaluation

Ask pupils to practice weighing different weights to understand the equilibrium point when weighing objects to acquire the skills in weighing mass.

With two weighing stones of 1 kilogram each on the left-hand side of the simple weighing balance, use weighing stones of 250grams and 500grams to establish equilibrium of the weighing balance. Which possible combinations of stones of 250 grams and 500grams?

Expected answer

Possible combinations are:

2kg on the left hand with 2 stones of 250g and 2 stones of 500g on the right hand

2kg on the left hand with 4 stones of 250g on the right hand.

2kg on the left hand with 2 stones of 500g on the right hand.

PRACTICAL ACTIVITY 7: Speed and the time taken by a moving body to cover a certain distance

a) Rationale:

This practical activity is conducted when teaching the lesson about speed. It is taught in unit 8. In real life, we observe the speed of a moving vehicle. The constant speed of a moving body indicates the constant distance covered at each unit of time.

b) Objective:

To determine the time taken by individuals to cover certain distance and then deduce the concept of units of speed (m/s or km/hr.)

c) Required materials:

Stop clock faces, tape measure



d) Procedures

Step 1: Measure the distance from one football goal post of the pitch to another. If pupils are to run to and from, we multiply it by 2 to determine the total distance to be run to and from. Record the distance to be covered.

Step 2: Pupils reset their stop clocks to zero, start it and then run the measured distance. For example, they run to and from one end of the goal posts to another. Record the number of seconds used.

Step 3: Divide the measured distance in step 1 with the time used in step 2.

Step 4: Summarize the data in a table below.

Pupil Nº	Distance(m)	Time(sec)	Speed(m/s) = Distance /time
1			
2			
3			
4			

e) Data recording

Assuming the measured distance from one goal post to another of a football pitch is 100m, four pupils participated in the activity and took the time to cover the distance to and from one goal post to another as 110 seconds, 95seconds, 100 sec and 120secs for **pupil 1**, **pupil 2**, **pupil 3** and **pupil 4** respectively.

Since the

We have the following summarized table;

Pupil Nº	**Step**	**Total Distance(m)**	**Time(sec)**	**Speed (m/s) = Distance/time**
1	Step 1	100m×2=200m	110sec	1.81m/s
2	Step 2	100m×2=200m	95sec	2.1m/s
3	Step 3	100m×2=200m	100sec	2m/s
4	Step 4	100m×2=200m	120sec	1.66m/s

f) Interpretation of results and Conclusion

By using stop clock faces or watches people can be able to count time used to cover a certain distance. For this practical activity, the distance covered is the same. The only changing factor is time. Speed is the rate of change of distance covered with time. The lesser the time used to cover a certain distance the higher the speed registered. For example, pupil 2 used the shortest amount of time to cover 200 meters therefore he has the highest speed recorded.

g) Guidance on the evaluation

Ask pupils to do the following questions related to the practical activity above

i. Why is there a difference in the records of speed for the four pupils?

ii. What is the formula of calculating speed?

iii. What is the standard unit of speed?

Expected Answers for the practical activity

i. The records of speed are different because the pupils used different time (seconds) to cover the same distance

ii. The speed is calculated by taking distance over time

iii. The standard unit of speed is km/hr or m/s

PRACTICAL ACTIVITY 8: Different ways of saving and how saving can be done

a) Rationale:

This practical activity is conducted when teaching the lesson about problems involving saving and how saving can be done. It is taught in unit 9.

b) Objective:

To identify different ways of saving and how saving can be done.

c) Required materials:

Flash cards showing different items like t-shirt, vegetables and money cards with different values: 5,000Frw; 2,000Frw; 1,000Frw; and 500Frw such that their sum is greater than 20,000Frw.

d) Procedures

Step 1: Read the following situation to understand it:

Gasana earns 20,000 Frw as a monthly income. He spends 2000 Frw on buying t-shirt and 3,000 Frw on buying vegetables. He is planning to save the half of the remaining amount of money and use the other half in investment.

How much money does he save?

Step 2: Put different money cards and flash cards of expenses on the table.

Step 3: Collect the money cards whose value is equal to 20,000Frw.

Step 4: Spend 2,000Frw to buy t-shirt.

Record how much you remain with.

Step 5: Spend 3,000Frw to buy vegetables. Record how much you remain with.

Step 6: Use money cards to show the remaining money.

How much money did he save? If you were Gasana, how can you save that money?

e) Data recording

In step 3, the total amount that Gasana has is 20,000Frw

In step 4, the cost of t-shirt is 2,000Frw

The amount of money remaining after buying t-shirt is 18,000Frw

In step 5, the cost of vegetables is 3000 Frw.

The amount of money remaining after buying vegetables is 15,000Frw.

In Step 6, the money saved is 7500Frw and 7500Frw to be used in investment.

To save this money, I can save it in the bank, on mobile money, etc.

f) Interpretation of results and Conclusion

This practical activity shows the total amount of income that Gasana earns, the expenses that he made and different ways of savings.

From the practical activity, savings was defined as the amount of money kept after spending some of it on basic needs. In our practical above, the 15,000Frw is the savings.

Therefore, saving maybe done through bank or investment in order to generate interest after certain period of time.

g) Guidance on the evaluation

Instructors can design as many practical problems as they can, and let learners role play buying, selling and saving. These can be done by changing the items to buy, the money to spend on them and the total income earned.

Some reflection questions can be used:

What are the advantages of saving money in bank?

What are the advantages of saving money in investments?

When should we save?

Expected answers for the practical activity

The advantages of saving money in bank are as follow:

Banks give additional money as interest to the client who saved.

In the bank, your money is safe.

Saving money helps the client to have access to the credit in an easy way.

The advantages of saving money in investment are as follow:

Investment gives additional money or interest to the saver

It increases feelings of security and peace of mind

It improves the standard of living by earning more money in the future

Saving can be done any time. But, it is advisable to save before spending since we save for a purpose.

PRACTICAL ACTIVITY 9: Investigating the sum of interior and exterior angles of a regular polygon

a) Rationale:

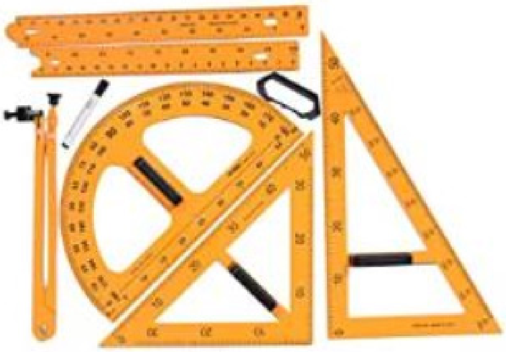
This practical activity is conducted when teaching the lesson about investigating the sum of interior and exterior angles of a regular polygon. It is taught in unit 12. We daily see the traffic signals which can be rectangular, square, or triangular. Such polygonal objects show that polygons are an important part in the education of students as they teach them how to make patterns, tessellations, how to use polygons to make other shapes.

b) Objective:

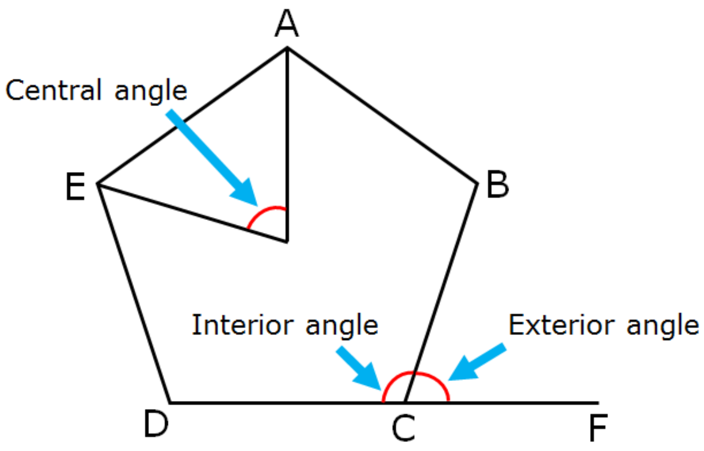
To Investigate the sum of interior and exterior angles of a regular polygon.

c) Required materials:

Ruler, Manila paper, Protractor; pair of compass.

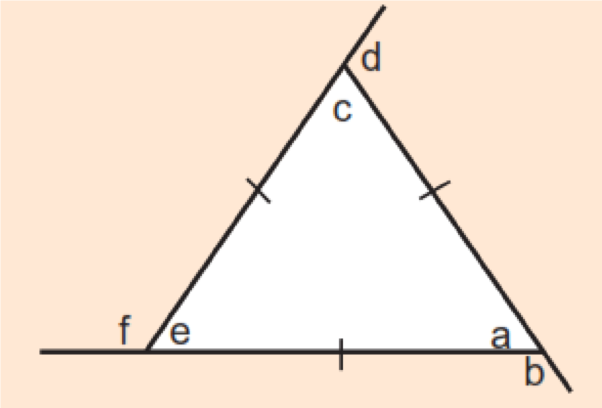


d) Diagram or illustration



e) Procedures:

Step 1: Draw a triangle of equal sides on Manila paper. Then, extend the edges from the vertices with straight lines using a ruler.



Step 2, Using a Protractor, measure the interior angles a, c, and e and record them.

Add the interior angles a, c, and e measured. What do you observe?

Step 3: Using a Protractor, measure the exterior angles d, f, and b and record them.

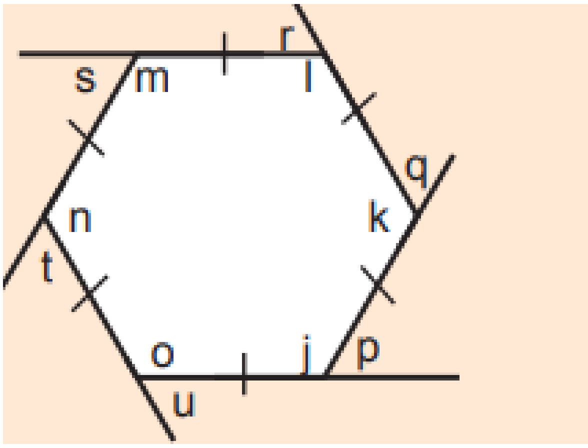
Add the measured exterior angles d, f, and b. What do you observe?

Step 4: Add every interior angle with its respective exterior angles:

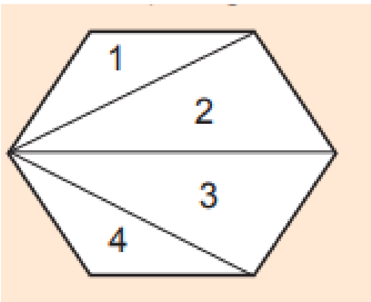
For example, angles <a + <b, <c + <d, <e + <f. What do you observe?

Step 5: Draw a regular hexagon, extend the edges from the vertices with straight lines using a ruler.

Measure and add all its interior angles. Also measure and all its exterior angles. Record all the results.



Step 6: Divide a regular hexagon into possible triangles.



How many triangles have you got? Multiply their number with 180^0.

Compare the obtained value with that you got in step 6 for the sum of interior angles; can you explain how to find the sum of interior angles of a polygon?

f) Data recording

on step 2, the interior (inside angle) <a is 60^o;

The interior (inside angle) <c is 60^o,

The interior (inside angle) <e is 60^o

The sum of interior angles <a + <c + <e = $60^o + 60^o + 60^o = 180^0$

On step 3: The exterior (outside) <b is 120^o.

The exterior (outside) <d is 120^o.

The exterior (outside) <f is 120^o

The sum of exterior angles <b + <d + <f = $120^o + 120^o + 120^o = 360^o$

On step 4: angles <a + <b = 180, <c + <d= 180, <e + <f = 180

On step 5: The interior angles of a regular hexagon <m = <n = < o = <j = <k = <l is equal to 120^0

The sum of interior angles = $120^0 + 120^0 + 120^0 + 120^0 + 120^0 + 120^0 = 720^0$

The exterior angles <u = <p= < q = <r = <s = <t is equal to 60^0

The sum of interior angles = $60^0 + 60^0 + 60^0 + 60^0 + 60^0 + 60^0 = 360^0$

On step 6: The number of triangles = 4 triangles.

4 x $180^0 = 720^0$ = Interior angle sum of the hexagon.

Hence interior angle sum = number of triangles that can be formed from the polygon x 180.

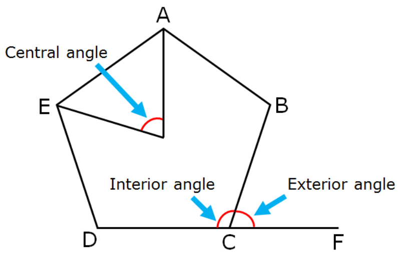
Number of tringles = number of sides - 2

g) Interpretation of results and Conclusion

- The inside angles of a polygon are called interior angles.
- The sum of the interior angles of a regular polygon is found by adding all the interior angles.
- The interior angle sum of a triangle is 180^0.
- The sum of interior angle of the polygons = number of triangles that can be formed from the polygon x 180 degrees.
- Number of triangles that can be formed from a polygon = number of sides – 2, (we subtract 2 because two sides cannot form a triangle)
- ***Sum of Interior angle = (n-2)*** **x** ***180^0*** where ***n*** **is the number of sides.**
- - ***The interior angle = ((n-2)*** **x** ***180^0)/ n*** where **n is the number of sides.**
- The outside angles of a polygon are called exterior angles.
- The sum of exterior angles of a regular polygon is **360^o.** This is equal to the sum of central angles of that regular polygon.
- The interior angle and its respective exterior angle are supplementary angles.

Interior angle + exterior angle = 180^o.

- ***A central angle*** of a regular polygon is **an angle whose vertex is the centre and whose rays, or sides, contain the endpoints of a side of the regular polygon.** Thus, an n-sided regular polygon has n apothems and n central angles, each ***central angle = (360/n) degrees***.



h) Guidance on the evaluation

Ask pupils to follow the same steps as seen above and draw a regular Octagon.

Invite them to:

- Measure the interior and exterior angles using a protractor. Then, find the interior angle sum and the exterior angle sum.
- Find the interior angle sum of a regular octagon and compare the value with the measured one.

PRACTICAL ACTIVITY 10: Constructing regular polygons given their properties

a) Rationale:

This practical activity is conducted when teaching the lesson about constructing regular polygons. It is taught in unit 13. We use office tables which can be in any shape like square, rectangle, pentagon, hexagon, heptagon, octagon, nonagon, or decagon. There are various applications of polygon in the real life, for example, the traffic signals which can be rectangular, square, or triangular. Special case of the polygon is the regular polygon: equilateral triangle, square, pentagon, etc.

b) Objective:

To be able to Construct a pentagon (polygon with 5 sides of the same length) using a protractor, ruler and a pair of compasses

c) Required materials:

Ruler, Compass, Manila paper, Protractor

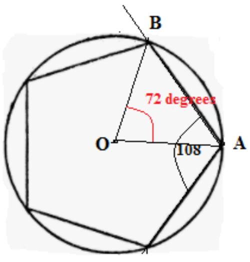
d) Procedures

Step 1: Draw a circle of radius 15cm and centre O on the manila paper

Step 2: Label point A where the radius meets the circumference of the circle.

Step 3: Find the **central angle** = 360 degrees/5 where 5 is the number of sides.

Step 4: Using a ruler, draw the radius OA, then use a protractor to measure the central angle AOB of 72^{o} such that B is the intersecting point of the circle and the line segment of from the centre O.



What is the value of interior angle of the polygon?

Sep 5: Place the compass needle at point A and the pencil point at point B and using the same length AB, make arcs of equal length along the circle from the point B.

Step 6: Using a ruler and a pencil, connect the arcs with straight lines and label the vertices after A and B as C, D and E.

Step 7: Measure the length of each side and record the measurements.

How many sides does the polygon have? Name the polygon.

e) Data recording

Step 1, the diameter of the circle is 30cm

Step 2, the radius of the circle is 15cm

On step 7, the polygon has 5 sides and it is called Pentagon. The angle formed at the centre is (180-108) degrees =72 degrees. This central angle can be found by $\frac{360}{5}$ degrees.

f) Interpretation of results and Conclusion

To construct regular polygon different materials are needed such as ruler, compass and a protractor.

A regular pentagon means five-sided figure with equal sides while an irregular pentagon means a five-sided figure with different measurements of sides and center angles.

To draw it we use:

- The value of central angle. *Central* ***angle = 360⁰/ n*** where n is the number of sides.
- The first side is the side of the triangle whose central angle is ***360⁰/ n.***

g) Guidance on the evaluation

Ask pupils to answer to reflection questions for the practical activity done. For example;

i. How many sides does a pentagon have?
ii. How can you differentiate between a regular polygon and an irregular polygon?
iii. Carry out the same steps to construct a regular hexagon, Start with a circle of radius 13cm.

Expected Answers for the practical activity

i. The pentagon has five sides.
ii. The regular polygon has all sides equal while irregular polygon has sides with different length

PRACTICAL ACTIVITY 11: Finding perimeter of regular polygons

a) Rationale:

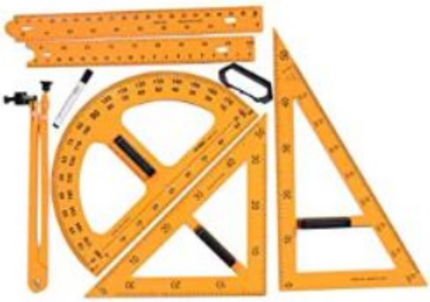
This practical activity is conducted when teaching the lesson about finding perimeter of regular polygons. It is taught in unit 12. We use office tables which can be in any shape like square, rectangle, pentagon, hexagon, heptagon, octagon, nonagon, or decagon. There are various applications of polygon in the real life, for example, the traffic signals which can be rectangular, square, or triangular. The perimeter of such materials can be needed to calculate the budget of their cost when planning to repair the damaged ones.

b) Objective:

To find the perimeter of a hexagon (regular polygons with 6 sides).

c) Required materials:

Ruler, Manila paper, Protractor.



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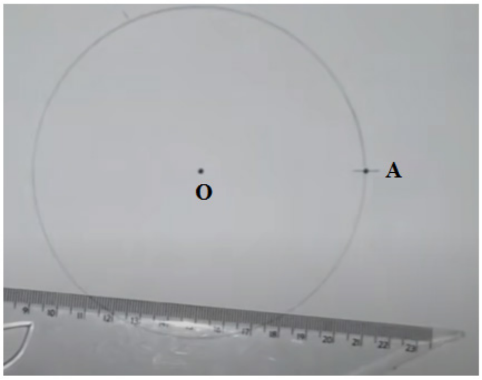
d) Procedures

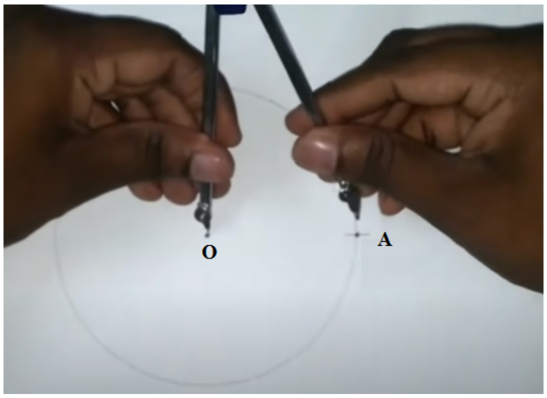
Step 1: Draw a circle of radius 15cm on the manila paper.

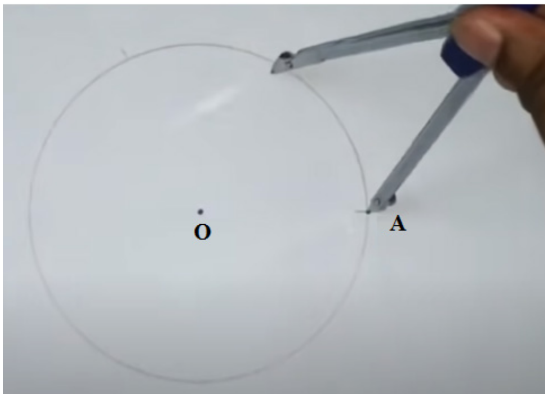
Step 2: Mark its Centre then name point A where the radius touches the circle.

Step 3: By using Protractor, measure the radius OA from the Centre O.



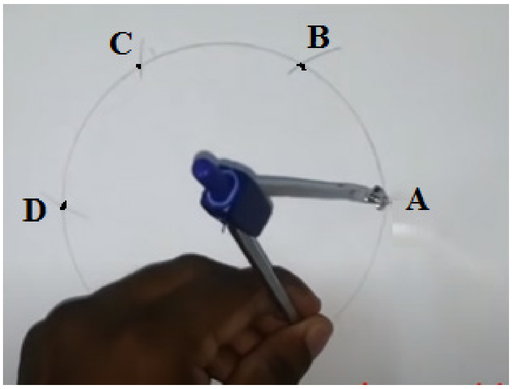
Sep 4: Without changing the compass, place the compass needle at point A and mark an arc at the point B of the circle.



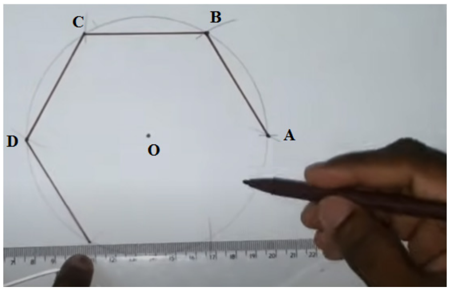


Step 5: Using the same length from step 5, place the compass at B to make an arc at C.

From C, make an arc at D, then from D, make an arc to make point E, then from E, make an arc to make point F, then from F, make an arc to the point A.



Step 6: Using a ruler, connect the points A to B, B to C, C to D, D to E, E to F and F to A.



How many sides has the polygon? Name the polygon formed. Are all sides of the same length? Use a protractor to measure the interior angle ABC of the hexagon?

Step 7: Construct a hexagon using the value of the central angle as we did it on the previous activity.

Step 8: Measure the length of the sides of the polygon formed.

Step 9: Add the length of all sides of the polygon and complete the following table:

The central angle: $360^0/6$	**The value of interior angle:** **$((6-2) x180^0)/6$**	**Length of one side**	**Number of sides**	**Sum of lengths for all sides**	**Number of sides x length of one side**

What is the perimeter for a regular hexagon if we have the length of one side? How do we find the perimeter of a regular hexagon? How can we find the perimeter of a regular polygon whose number of sides is 8?

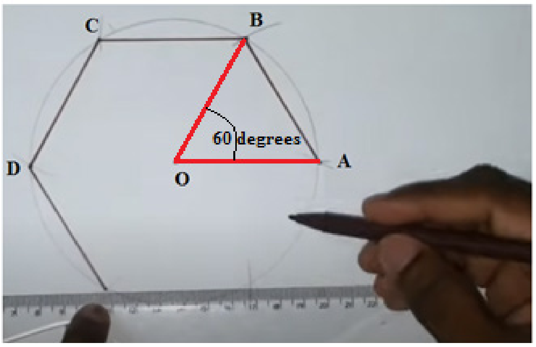
e) Data recording

Step 1, the diameter of the circle is 30cm

Step 2, the radius of the circle is 15cm

Step 6, the polygon has **6 sides,** and it is called **hexagon.**

On step 7: we can get a hexagon in this way:



On step 9:

The central angle: $360^0/6$	The interior angle: $((6\text{-}2) \times 180^0)/6$	Length of one side	Number of sides	Sum of lengths for all sides	Number of sides x length of one side
60 degrees	120 degrees	15cm	6	15cm + 15cm + 15cm + 15cm + 15cm + 15cm = **90cm**	15cm x 6 = **90 cm**

The perimeter of a hexagon is the sum of the lengths for all six sides. As all sides have the same length, the **perimeter = side x 6**.

Can you draw a hexagon if you know the value of its interior angle? How can you do it?

f) Interpretation of results and Conclusion

- The perimeter of polygons is obtained by adding the length of all sides. Perimeter is the distance around a polygon.
- To find the length of the sides for any polygon, we need first to draw and measure the first side.

The central angle = 360^0/ n. The interior angle = ((n-2) x 180^0)/ n where n is the number of sides. The central angle helps us to get the first side of the regular polygon. Then the distance of the first arc helps us to use a compass and form the distance of next arc and so on.

The perimeter of a regular polygon is the sum of lengths for all sides. It is equal to the product of the number of sides by the length of one side.

We can construct a hexagon using the value of the central angle as we did it on the previous activity.

g) Guidance on the evaluation

Ask some questions reflecting this practical activity. For example, Carry out the same steps and find the perimeter of regular octagon.

PRACTICAL ACTIVITY 12: Construct squares and rectangles accurately using a ruler and pair of compasses

a) Rationale:

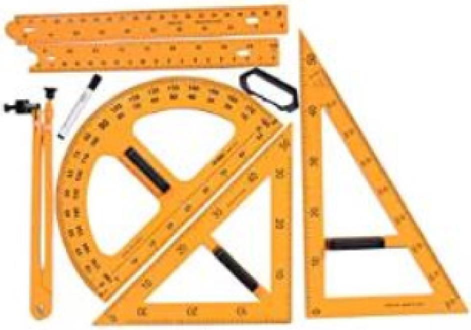
This practical activity is conducted when teaching the lesson about constructing squares and rectangles using a ruler and a pair of compasses. It is taught in unit 13. In real life, carpenters and house design need to draw rectangular and squared parts of the house: walls, windows, doors, tables, etc.

b) Objective:

To Construct squares and rectangles accurately.

c) Required materials:

Ruler, compass, Manila paper, Protractor.

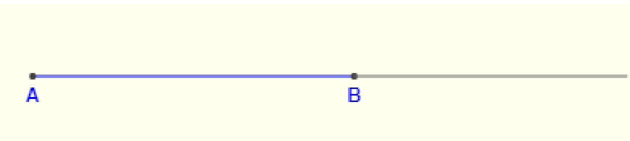


d) Procedures

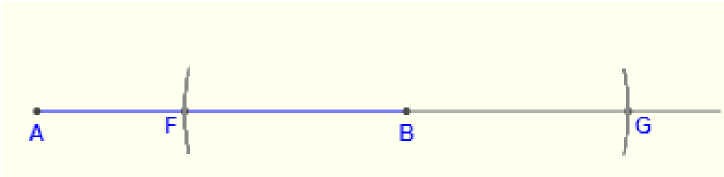
Part 1: Construct a square of 20cm.

Step 1: Use a ruler and draw a line of 20cm.

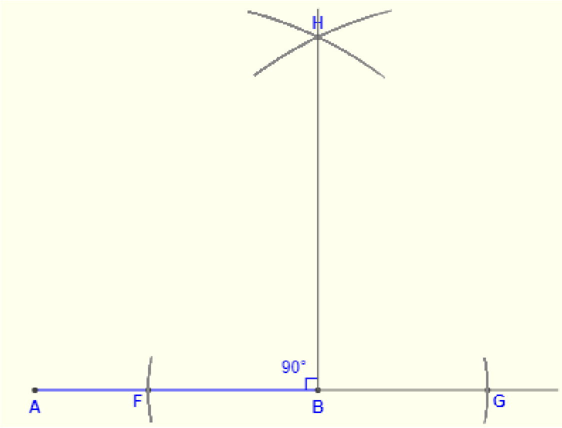
Step 2: Name the points A and B at the end of line. Extend the line AB to the right side



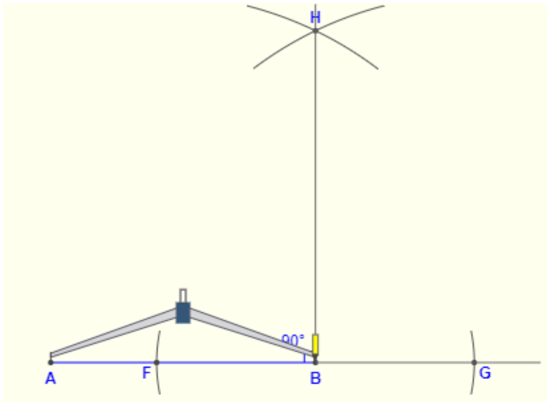
Step 3: Construct perpendicular lines at A, then at B: Draw an arc on each side of B using any compass width. Label these by F and G.



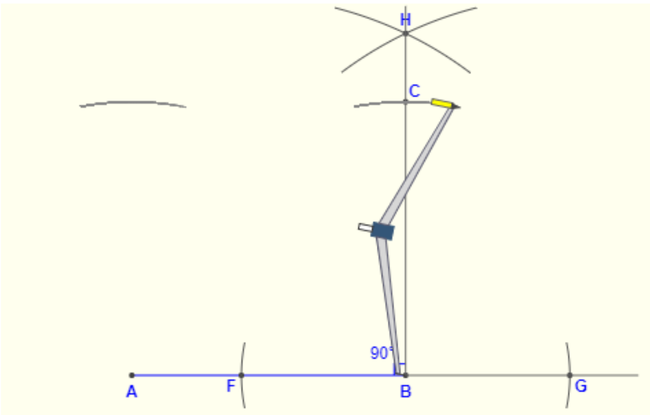
Step 4: With the compass on G and any width, draw an arc above B. Without changing the width, repeat from F creating the point H. Draw the perpendicular from B through H.



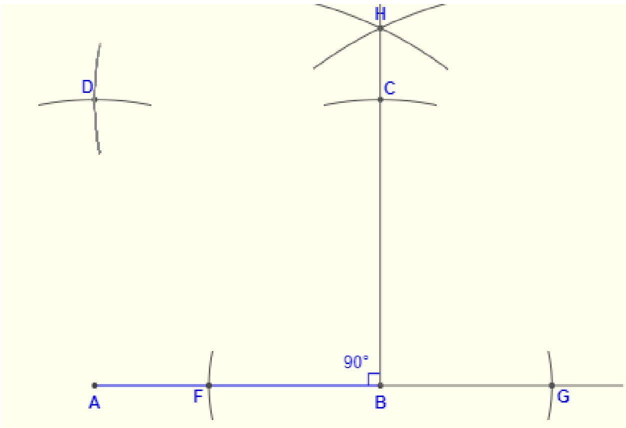
Step 5: Set the compass on A and set its width to the distance AB. Make an arc above A.



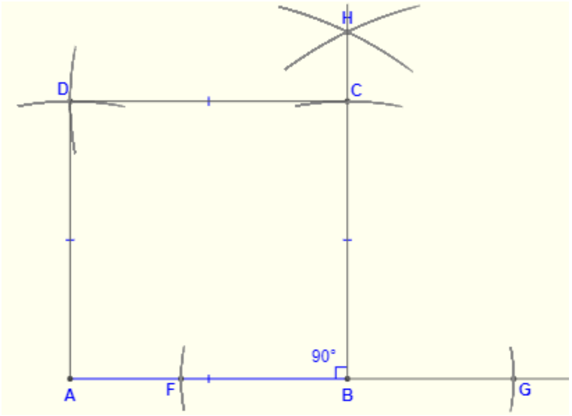
Step 6: Move the compass to B and make an arc above B creating the point C.



Step 7: Move the compass to C and make an arc left of C creating the point D



Step 8: Draw the line segment CD and DA.



Write the name of figure formed ABCD.

Part 2: Constructing a rectangle ABCD of AB=30cm and BC=15cm

Step 1: With a ruler, draw a line segment AB with the same measurement as **30cm** the length of the rectangle.

Step 2: Open the compass so that it corresponds to the width **15cm** of the rectangle. Maintain this compass opening throughout the process.

Step 3: Place the compass anchor (sharp point) at one end of the initial line segment and draw an arc.

Step 4: Place the compass anchor on the other end of the initial segment and draw an arc of a circle.

Step 5: Using the set square, draw two perpendicular lines joining both ends of the initial line segment to each of the arcs above them respectively on point C and D.

Step 6: Using the ruler, draw a line to connect the two meeting points and complete the figure ABCD

Step 5: By using protractor, measure the angles formed with points; ABC, BAD, ADC, DCB.

Name the figure formed by the points ABCD.

e) Data recording

For constructing a square

The first figure formed by point ABCD whose sides are have the same length is a Square.

The angles formed by the points are all equal to 90^o

Constructing a rectangle

The second figure formed by point ABCD is a rectangle

The angles formed by the points; ABC, BAD, ADC and DCB are all equal to 90^o

f) Interpretation of results and Conclusion

To construct square and rectangle, we can use a ruler, compass and protractor to measure the angles formed with the points.

For the square, all sides are equal, and angles formed are also equal to 90 degrees.

For the rectangle, two sides (Length) are equal and other two sides (width) also are equal.

The angles formed in a rectangle are all equal to 90^o.

g) Guidance on the evaluation

Ask questions reflecting the practical activity done. For example,

i. How many sides does a square have?
ii. What is the size of the angles of a rectangle?
iii. What is the difference between a square and rectangle?

Expected Answers for the practical activity

i. The square has 4 equal sides
ii. Each angle in rectangle is equal to 90^o
iii. The square has 4 sides that are equal but rectangle two sides are equal and other two sides are also equal

PRACTICAL ACTIVITY 13: Exploring the concept of tiling/ construction

a) Rationale:

This practical activity is conducted when teaching the lesson about exploring the concept of tiling/constructing. It is taught in unit 12. In real life, before buying tiles necessary to cover the floor of a house, we need to determine their number.

b) Objective:

To explore the concept of tiling or construction.

c) Required materials:

Glue, tiles, or square cards, Manila paper.

d) Procedures

Step 1: Get a rectangular manila paper and the different squared cards.

Step 2: Use a ruler, measure the width and length of manila paper, and record it.

Step 3: Measure and record the length of the sides of the square card.

Step 4: By using glue, fix the square cards on manila paper such that no gaps are left in between.

How many squared cards have you glued to fill the whole Manilla paper?

Step 5: Now using the measurements in step 2, Find and record the area of a manila paper $\mathbf{A_1}$ as Length x width.

Area of the manilla paper $\mathbf{A_1}$ = Length x width.

Step 6: Using measured length of the side of the squared card in step 3, find the area of the squared card $\mathbf{A_2}$ as Side x side = S^2

Area of the squared card $\mathbf{A_2}$ = Side x side = S^2

Step 7: Divide the **Area of the manilla paper A_1** in step 5 by **Area of the squared card A_2 to** get the Number of squared cards expected to fit on the manilla paper.

Step 8: Compare the results (number of squared cards) got in step 4 with that got in step 7.

How can you find the number of tiles necessary to fit the floor if you know the area of this floor?

e) Data recording

Suppose that the measurements of width and length of manila paper is 30cm and 50cm respectively while the sides of square 10 cm.

On step 2: Width = 30cm and length = 50cm

On step **3:** Side of the square card = 10cms

On step 4: Number of squared Cards glued on Manilla = 15 square cards.

On step **5:** Area of the manilla paper $A_1 = 1500cm^2$

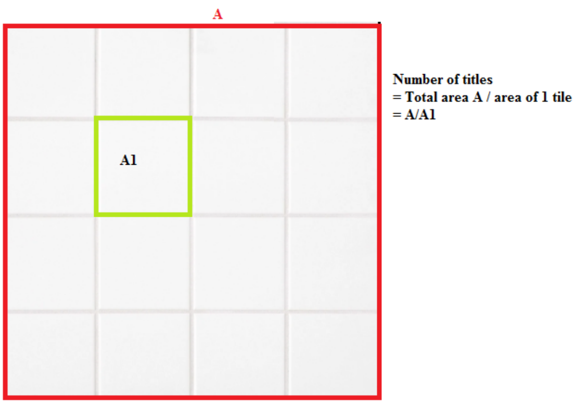
On step **6:** Area of the squared card $A_2 = 100\ cm^2$

On step 7:

$$\text{Number of squared cards} = \frac{(\textbf{Area of the manilla paper } A_1)}{(\textbf{Area of squared card } A_2)}$$

$= 1500/100 = 15$ squared cards.

To find the number of tiles necessary to fit the floor, we take the area of the floor divided by the Area of one tile.



f) Interpretation of results and Conclusion

Tiling is done to cover plane like floors, walls, compounds to form beautiful designs. Square, equilateral triangular, regular pentagonal, hexagonal, and other shapes of tiles are used for tiling.

Tiling a plane or other surface requires the dimensions of tiles to perfectly fit the area of the plane.

Designers measure the sides and calculate area of a plane surface, they to calculate the number of tiles to be used by dividing the total area of a plane surface by the area of one tile in the same unit of area.

g) Guidance on the evaluation

Ask pupils a question reflecting the practical activity done. For example, a square floor measures 9 m by 9m. A builder tiles the floor with square tiles of sides 30cm each.

i. Explain how he would carry out tilling.

ii. How many tiles does he use?

iii. How is tilling important in daily life?

PRACTICAL ACTIVITY 14: Designing nets of cuboids, cubes, and prisms

a) Rationale:

This practical activity is conducted when teaching the lesson about designing accurate nets for prisms. It is taught in unit 13. Cuboid shapes are often used for boxes, cupboards, rooms, buildings, containers, cabinets, books, a sturdy computer chassis, printing devices, electronic calling touchscreen devices, washing and drying machines, etc. To find the area of such containers, it is easy to sum the area of all 6 faces of a cuboids.

b) Objective:

To design accurate nets for cuboids, cubes and Prisms

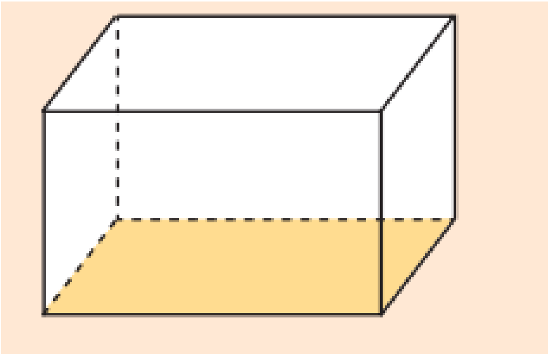
c) Required materials:

Empty boxes with two opposite sides equal for example a box of bars of soap, a box of chalk with all sides equal, sheet of paper and a pair of scissors.

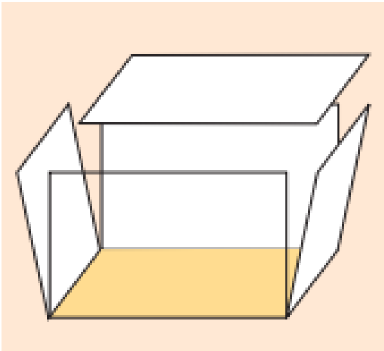
d) Procedures

Step 1: Cuboid:

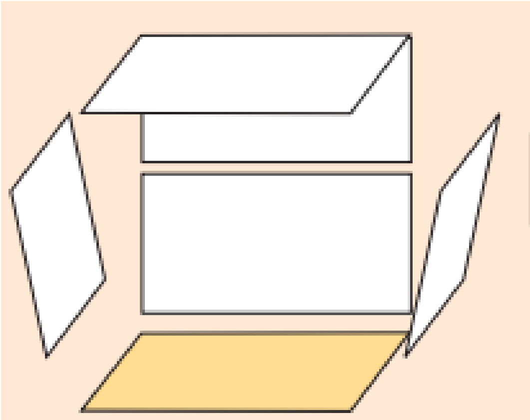
i. Get an empty box of soap with two opposite sides equal.



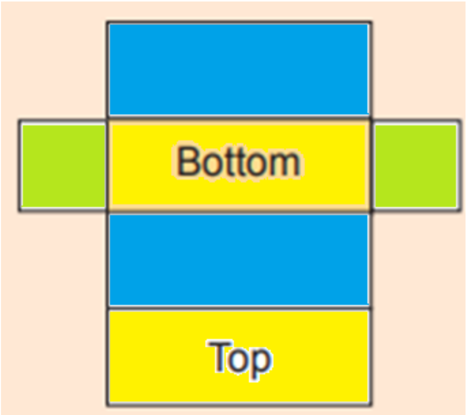
ii. Unfold the empty box carefully to display the sides that were used.



iii. Now carefully use a scissor to cut all the faces and separate them. How many faces have you got? What shapes are they?



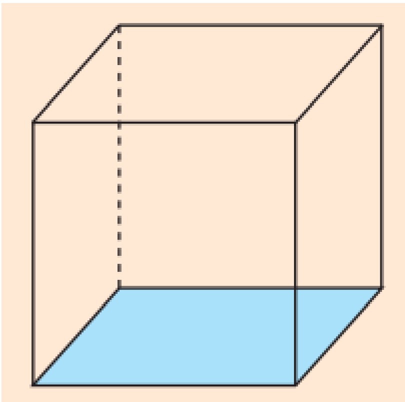
iv. Finally draw the net considering the obtained faces.



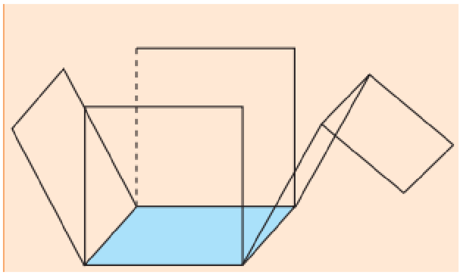
How are sides of the nets? What figures are they? How many have the same size?

Step 2: Cube:

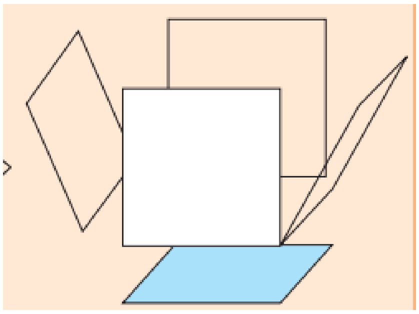
i. Get an empty box of chalk with all sides equal.



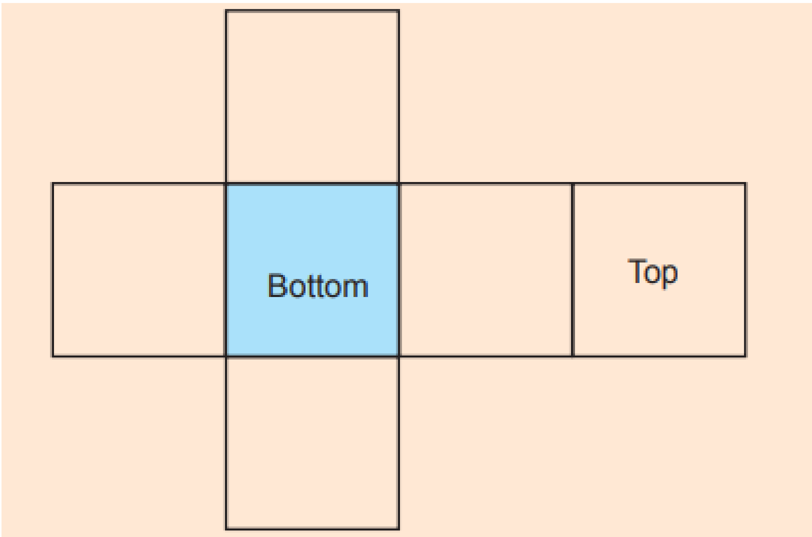
ii. Unfold and open the empty box carefully to display the sides that were used.



iii. Now carefully, use scissors to cut all the faces and separate them. How many faces have you got? What are their shapes? How many faces are equal?



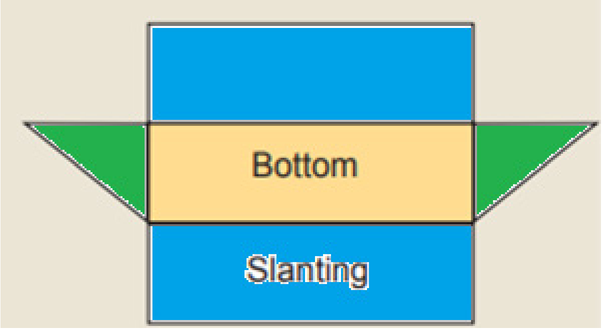
iv. Finally draw the net considering the faces.



How are sides of the nets? What figures are they?

Step 3:

i. Get a piece of paper and draw the following net:



ii. Trace out the net along the outside lines and make a cut out of only the net.

iii. Then fold the net to get a geometric figure by keeping the bottom and slanting sides as shown in the figure. Which figure have you formed?

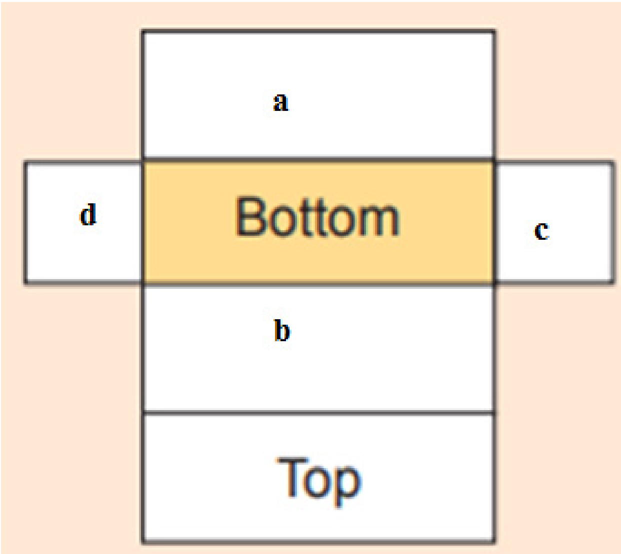
e) Data recording

On step 1:

Cuboid:

The cut outs are 6 faces. All the faces are rectangular. Two parallel faces have the same size.

Net of a Cuboid.

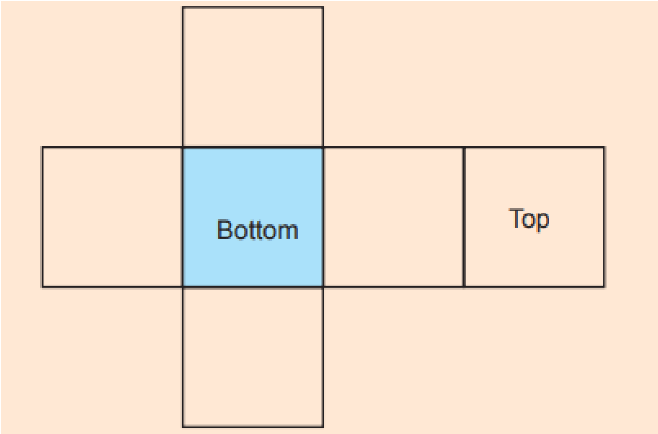


The face **a** and face **b** have the same size. The face **c** and face **d** have the same size. The **bottom** and the **top** faces have the same size.

On step 2:

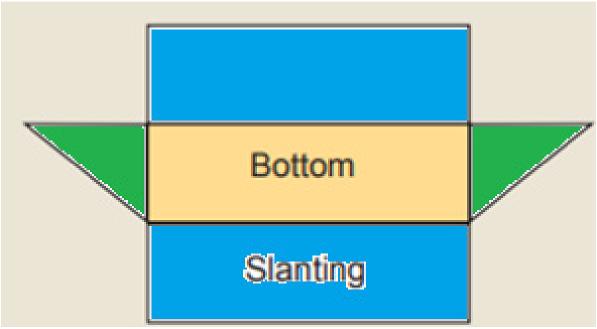
The cut outs are six faces. All the faces are squares of the same size.

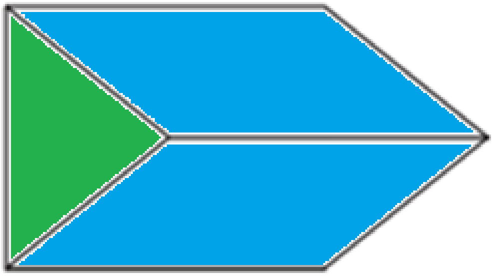
Net of a cube:



On step 3:

Folding the net gives a triangular prism.





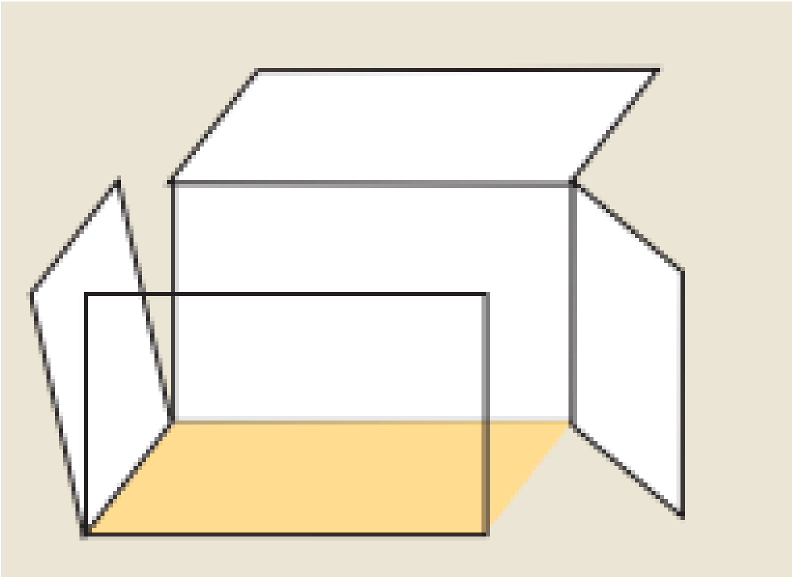
f) Interpretation of results and Conclusion

Pupils are to be encouraged to trace the nets on the thick paper and fold them into hollow solids in different ways.

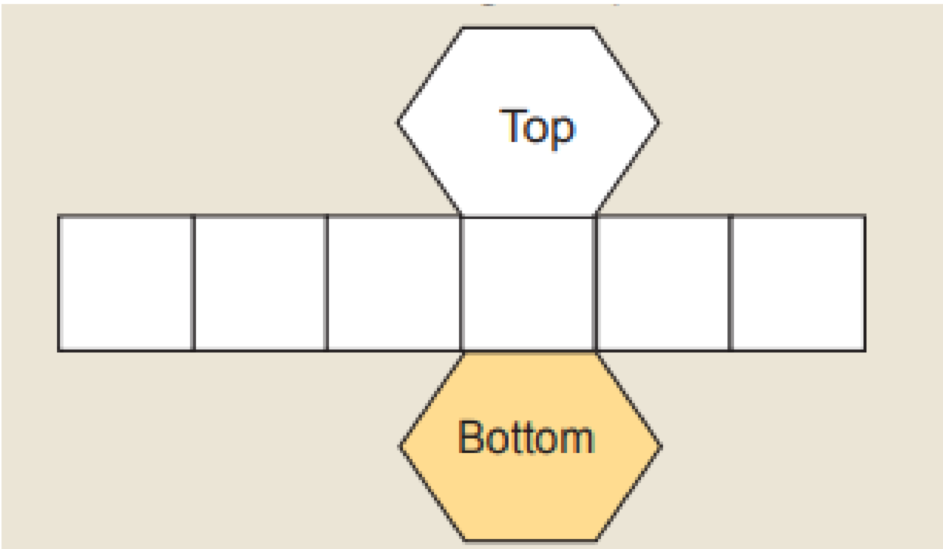
Encourage pupils to open cube or cuboid, cardboard boxes and create different nets similar to the ones observed in the classroom.

g) Guidance on the evaluation

Ask pupils to draw nets for the following object:



Ask pupils to make and name prism whose net is the following:



PRACTICAL ACTIVITY 15: Estimating the area bounded by a circle using a squared paper

a) Rationale:

This practical activity is conducted when teaching the lesson about estimating the area bounded by a circle using a squared paper. It is taught in unit 14. In real life, many shapes around us have the circular form. An object with a circular face such as a dinning plate, a pop can, a traffic cone, or a circular flower bed in a garden are all built or prepared keeping the concept of area of a circle in mind. The area of a circle is any space that the circle occupies on a flat surface. When finding the circle area, there are three other measures that we take into consideration, including the circumference, diameter, and radius. Architects use the symmetrical properties of a circle to design Ferris-wheels, buildings, athletic tracks, roundabouts, etc. There are many practical applications in everyday life where you need to calculate a circle area.

b) Objective:

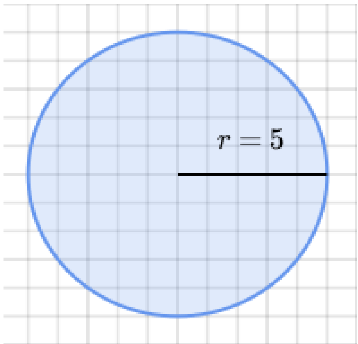
To estimate the area bounded by a circle using a squared paper.

c) Required materials:

A squared paper, a pair of compasses, a pencil, ruler.

d) Procedures

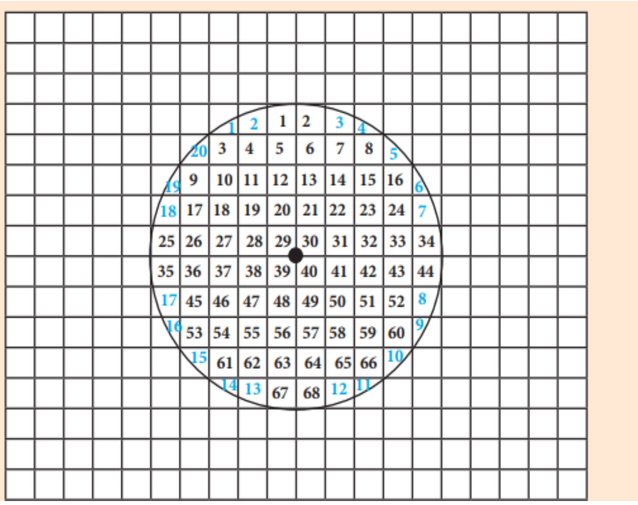
Step 1: Using a pair of compasses and a pencil, draw a circle on a squared paper, let us say a circle of radius 5 squares as below.



Step 2: Count the number of complete squares and record it.

Step 3: Add two parts of squares which do not form complete squares to form 1 square.

Or count the number of incomplete squares and divide it by 2 to get the number of complete squares.



Step 4: Find the total area bounded by the circle by adding the results in step 2 and step 3.

Step 5: Repeat the practical activity with radius 2cm and 3cm and complete the following table

	Number of unit squares on radius	r x r = The square of the number of unit squares on radius	Total number of all squares	3.14 x (r x r)
Square 1 (r = 5)				
Square 2 (r =2)				
Square 3 (r = 3)				

Step 6: For each circle, compare the total number of all squares and the results got in the last column. What do you observe? What do you think can be the area of a circle of radius r?

e) Data recording

On step 1:

Radius = 5 square units.

On step 2: Number of complete squares = 68 whole squares

On step 3: Number of incomplete squares = 20

Complete squares out of the 20 incomplete ones = 20/2 = 10 squares

On step 4: Area = 68 squares + 10 squares. Area = 78 square units

	Number of unit squares on radius	**r x r = The square of the number of unit squares on radius**	**Total number of all squares**	**3.14 x (r x r)**
Square 1 (r = 5)	5	25	78	78.5
Square 2 (r =2)	2	4	13	12.56
Square 3 (r = 3)	3	9	28	28.26

We find that the total number of unit squares is approximatively equal to the product of radius squared by the number 3.14.

f) Interpretation of results and Conclusion

The area bounded by a circle found by a squared paper by counting full and incomplete unit squares gives an estimated value of area.

It is found through adding complete squares plus half the number of incomplete squares.

We find that the total number of unit squares is approximatively equal to the product of radius squared by the number 3.14.

The area of a square of radius r can be found by multiplying the radius squared by the number 3.14.

g) Guidance on the evaluation

Ask pupils to use a squared paper, a pair of compasses, a ruler and a pencil, to find the area bounded by a circle of radius 4 square units.

Invite them to compare the result with the area got by Area = 3.14 x r^2 where r = 4.

PRACTICAL ACTIVITY 16: Exploring the area bounded by a circle using the concept of circumference and radius

a) Rationale:

This practical activity is conducted when teaching the lesson about exploring area bounded by a circle using the concept of circumference and radius. It is taught in unit 14. The area of a circle is any space that the circle occupies on a flat surface. When we talk about the surface area of the circle, we are focusing on two-dimensional objects. When finding the circle area, there are three other measures that we take into consideration, including the circumference, diameter, and radius. Architects use the symmetrical properties of a circle to design Ferris-wheels, buildings, athletic tracks, roundabouts, etc. These circular measurements are also significant for engineers in designing airplanes, bicycles, rockets. There are many practical applications in everyday life where you need to calculate a circle area.

b) Objective:

To explore the area bounded by a circle using the concept of concept of circumference and radius.

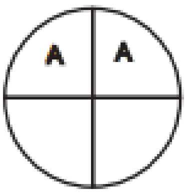
c) Required materials:

Circular sheets divided into 4, 6, 8, 12 and 16 equal parts (sectors).

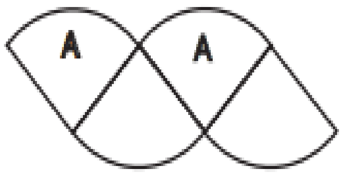
d) Procedures

Step 1:

i. Consider four sectors of a circular sheet, half of them labeled A. Arrange them to form a circle using connectors.



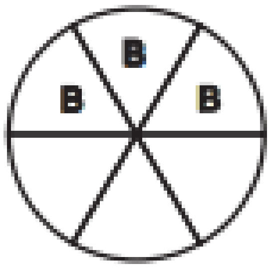
ii. Now, rearrange these sectors to form a figure as shown below.



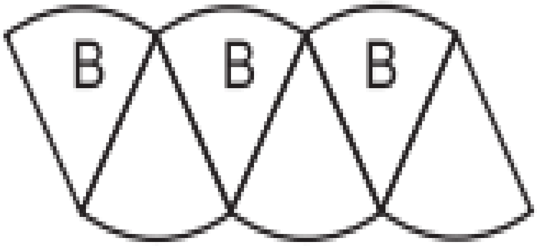
How is the obtained figure?

Step 2:

i. Now consider and arrange six sectors, label half of them B, to form a circle.



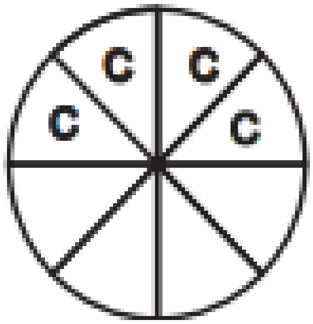
ii. Re-arrange these sectors to form shape as shown below.



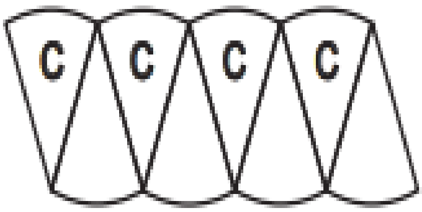
How is the obtained figure? Does it make sense of a rectangle?

Step 3:

i. Consider and arrange eight sectors, half of them labelled C to form a circle.



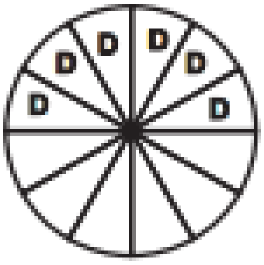
ii. Rearrange these sectors to form a shape as shown below:



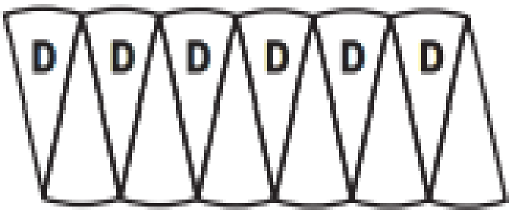
How is the obtained figure? Does it make sense of a rectangle? What is the length and width?

Step 4:

i. Consider and arrange 12 sectors of a circular sheet half of them labelled D to form a circle.



ii. Rearrange these sectors to form a shape as shown below

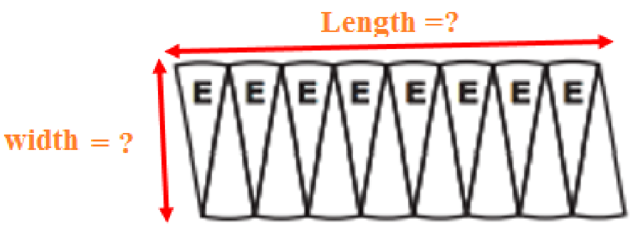


How is the obtained figure? Does it make sense of a rectangle? What is the length and width?

Step 5:

i. Consider and arrange 16 sectors of a circular sheet half of them labelled D to form a circle.

ii. Rearrange these sectors to form a shape as shown below



How is the obtained figure? Does it make sense of a good rectangle? What is the length and width?

How does the figure become as the number of equal sectors of the circle is increasing?

How can you find the area of the obtained figure?

e) Data recording

Remember Area of rectangle = Length x width

We see that as the number of equal sectors of the circle is increasing the figure becomes a good rectangle with Length = the half of the circumference of the circle, and Width = radius.

As the area of rectangle = Length x width,

Area of circle = (the half of the circumference of the circle) x r $= \frac{1}{2} \times 2\pi r \times r = \pi r^2$

f) Interpretation of results and Conclusion

As number of equal sectors of the circle is increasing, the shape of the figure becomes a rectangle with Length = the half of the circumference of the circle, and Width = radius.

Area of circle = (the half of the circumference of the circle) x r $= \frac{1}{2} \times 2\pi r \times r = \pi r^2$

g) Guidance on the evaluation

Ask pupils to work out the following activities:

a) Let learners explore the activity using 32 sectors from a circular sheet.

b) Calculate the area of a circle whose radius 7cm and π = 3.14.

Expected answers

Area = $\frac{1}{2} \times 2\pi r \times r = \pi r^2 = 3.14 \times 7^2 cm^2 = 154 cm^2$

PRACTICAL ACTIVITY 17: Using the net of a cuboid to determine its surface area

a) Rationale:

This practical activity is conducted when teaching the lesson about using the net of a cuboid to determine its surface area. It is taught in unit 14. Cuboid shapes are often used for boxes, cupboards, rooms, buildings, containers, cabinets, books, a sturdy computer chassis, printing devices, electronic calling touchscreen devices, washing and drying machines, etc. To find the area of such containers, it is easy to sum the area of all 6 faces of a cuboids.

b) Objective:

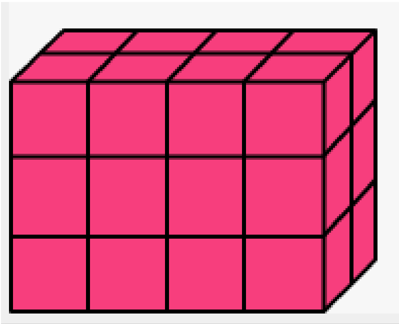
To be able to calculate the surface area of a cuboid.

c) Required materials:

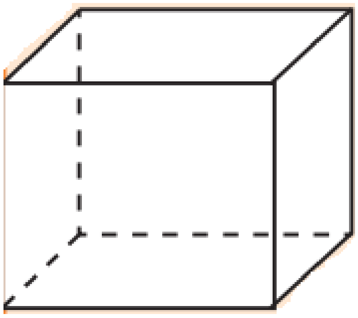
A pencil, ruler, cuboid and its net, an empty box of soap and a rubber.

d) Procedures:

Step1: Observe the full cuboid and discuss if it is possible to find the surface area of its faces.



Step 2: Get an empty box of bars of soap. Use a ruler to measure the length of edges and compare the size of its faces.



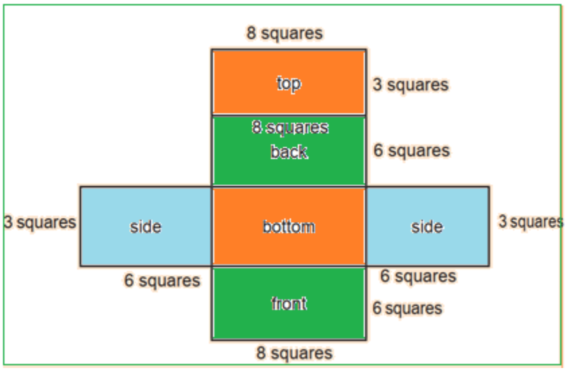
What do you observe? How many faces does it have.

Step 2: Use a scissor to unfold the box properly and display it on a table.

Step 3: Count the number of rectangles in the unfolded box on the table.

How many rectangles are there in the net? Use a ruler to measure their faces and identify the faces with the same size.

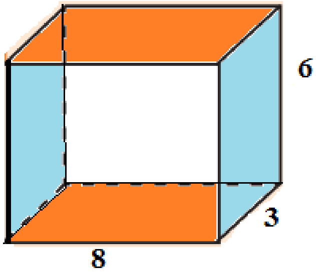
Step 4: Get a grided sheet of paper and draw a net with the same form as the one from the box such that their size are as follow:



How many equal faces are there in the net?

How do you find the area of all the faces in the net?

Step 5: Use scissors and try to cut the net, and then, use a scotch to form a cuboid similar to the box of soap.



Do you know the surface area of your cuboid? Explain how you can find the area a cuboid basing on faces of its net.

e) Data recording

On step 1:

It is possible to find the area of faces but all sides are not equal and all faces are not equal.

On step 2: The box has 6 faces, 12 edges and 8 vertices.

Opposite faces are equal and parallel.

On step 3:

There are 6 rectangles in the net: Top = Bottom, Front = Back, and Side = Side

There are 3 pairs of rectangular faces opposite to each other equal in the net.

On step 4: Since every two opposite faces are equal, l = 8squares, w = 3squares and h = 6squares

- Area of each face = (length x width), (length x height), (width x height)
- Area of 2 faces = 2(length x width), 2(length x height), 2(width x height)
- Total surface area = 2(length x width) +2(length x height) + 2(width x height) square units.

For the above case: The total surface area = 2(8 x3) + 2(8 x 6) + 2(3 x 6)

= 2(24) + 2(48) + 2(18) = 180 square units.

On step 5: The surface area of your cuboid is the one we found as 180 square units.

To get it, we add the surface areas of all faces.

f) Interpretation of results and Conclusion

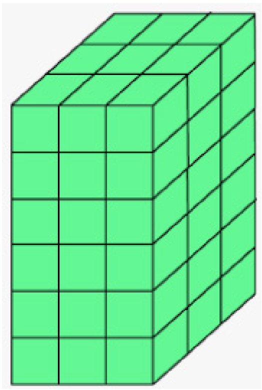
When calculating the surface area of a cuboid,:

– Find the areas of each of the surfaces of the net of a cuboid and then add them together.

– Since there are six surfaces but the Top surface equals the Bottom surface, the Front surface equals the Back surface, and 2 side surfaces are also equal; we deduce the total surface area of the cuboid as 2(l x w) +2(l x h) + 2(w x h) square units.

g) Guidance on the evaluation

Ask pupils to collect empty boxes which are in cuboid form, unfold the boxes and display them on a table.



Let them use ruler to measure the edges of the cuboid. Invite them to calculate the total surface area of the cuboid.

PRACTICAL ACTIVITY 18: The volume of a cylinder

a) Rationale:

This experiment is conducted when teaching how to derive the volume of a cylinder using real material. The volume of a cylinder is topic taught in primary six unit 14.

Since a cylinder is a 3-D shape, it can hold something like a liquid. Therefore, you can measure the volume of a cylinder. If you look at some examples of objects that are cylindrical in shape, you will notice that some of them hold liquid or a substance. For example, a soft drink can hold the soft drink. A jar may hold soup. Therefore, something can be poured into a container that is cylindrical in shape. The volume of a cylinder is the measure of the amount of space occupied by a cylinder or the measure of the capacity of a cylinder. It is necessary to know how to find the volume of a cylindrical container.

b) Objective(s) of the experiment:

To derive the formula for the volume of a cylinder

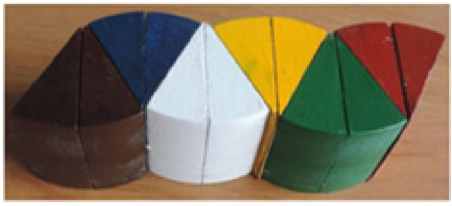
c) Required Materials:

Wooden Cylinder or cylindrical piece of potato or sugar cane cut into 12 pieces.

d) Procedures & Steps of experiment

Step1: Take the wooden cylinder/ cylindrical piece of potato or sugar cane

Step 2: Take the same-colored pieces and place the 6 (2 same colored together form 1) different colored alternatively.



Step 3: Find the volume of this cuboid to obtain the approximate formula for the Volume of Right Circular Cylinder.

- What is the shape of the base of the cylinder?
- What is the shape of the base of the solid obtained

Step 4: Repeat step placing 12 pieces alternatively .

$r\pi$

Step 5: Find the volume of the cylinder.

- What is the formula for the area of a rectangle or parallelogram?

e) Interpretation of results

- The segments approximately form a solid cuboid of height '*h*', breadth '*r*' and length 'π*r*'
- The approximation of cuboid improves by increasing the number of segments/pieces.
- The volume of the cylinder is the area of the base $r \times r\pi$ time the height *h*. e. g. $V = \pi r^2 h$

f) Additional information for the teacher:

The teacher must highlight the difference between bisector and median.

The volume of a solid is a measure of the amount of space occupied by that solid. The formula for the volume of a cylinder is given by $V = \pi r^2 h$ where *r* is the radius of the base and *h* is the height.

g) Conclusion:

The formula for the volume of the cylinder is $V = \pi r^2 h$.

PRACTICAL ACTIVITY 19: Collect the data, summarize it in a table and represent in a bar chart

a) Rationale:

This practical activity is conducted when teaching the lesson about collecting data, summarising in a table and representing it on a bar chart from unit 15. In real life, when data are well organized and presented on a bar chart, it helps people to easily see the observation with higher frequency (more repeated) and the observation with lower frequency (less repeated).

b) Objective:

To be able to collect, represent, and interpret data from real life problems.

c) Required materials:

A pencil, squared papers, ruler and a rubber

d) Procedures:

Step 1: Collecting data from a given source. For example you can measure the weight in kg:

Consider the following weight in Kg of goats of Ishimwe's farm sold on Saturday:

28, 30, 28,33,35,40,40,28,30,30,42,40,35,40,40,40, 33,30, 28, 30, 30, 30, 33, 40, 33, 33, 35, 40, 35, 40, 35, 35.

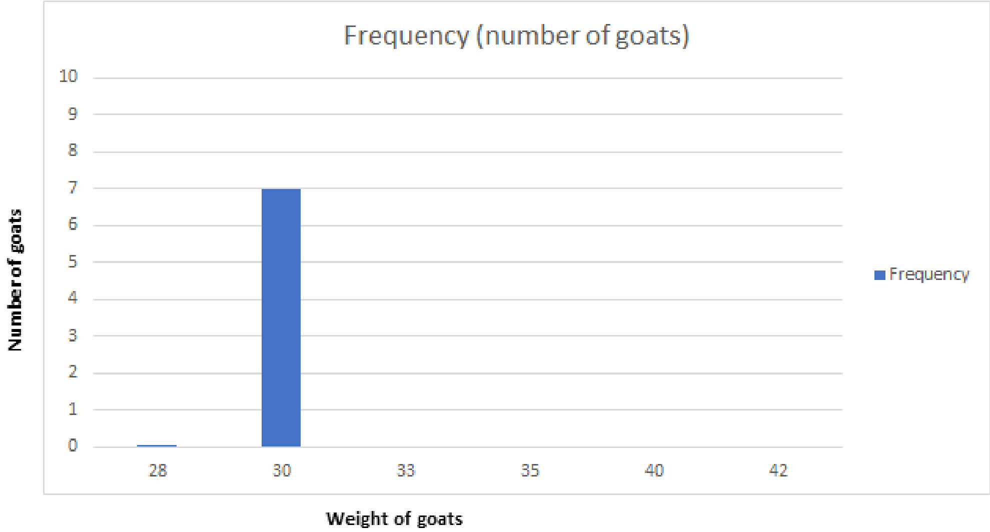
Step 2: Find the lowest and the highest weight in Kg and Represent/ summarize the data using tallies on a frequency table.

Step 3: Take sheets of paper and a ruler, measure the sheet with the same width but with the length equal to different frequencies identified in the table of frequencies.

Step 4: Draw graduated axes: the vertical and horizontal axes, write mass under the horizontal axis and write frequencies on the vertical axis.

Step 5: Identify the first mass of 28 kg, the second mass 30kg, the third etc on the horizontal axis.

Step 6: For each mass, take the paper of height equal to its frequency and fix it on this mass and verify if its height corresponds to the related number on the vertical axis. In the following graph, the paper for the goat with 30kg was pasted, paste papers for others.



Step 7: Interpret the data using the bar graph: which mass is gotten by many goats, which mass is gotten by a small number of goats? How many goats have got 40kg? What is the role of this graph? What is the name of such a graph?

Step 8: Draw the same graph on a manila paper by using lines instead of sheets of papers.

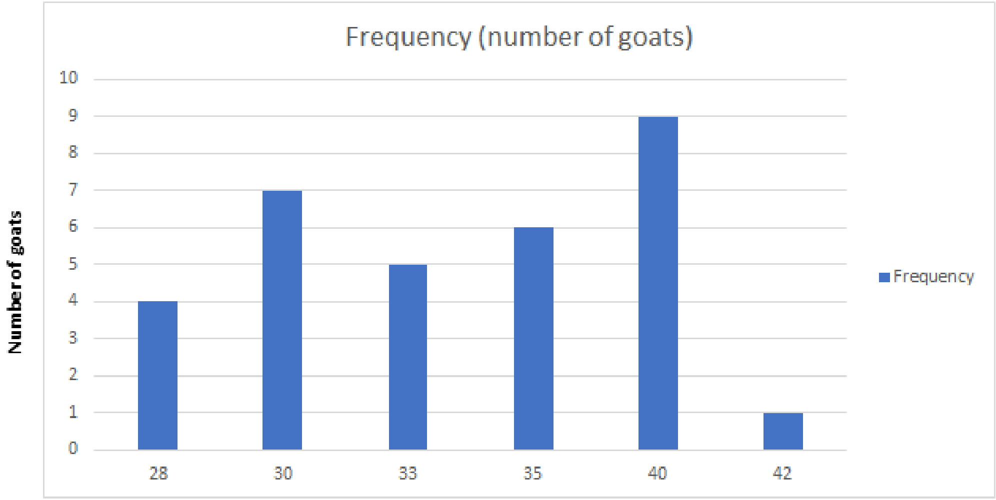
e) Data recording

On step 2: The lowest weight is 28 kg. The highest weight is 42kg.

The following frequency table:

Mass in kg	Tally	Frequency (Number of learners)
28	||||	4
30	~~||||~~ ||	7
33	~~||||~~	5
35	~~||||~~ |	6
40	~~||||~~ ||||	9
42	|	1
Total		32

From **Step 6:** Below is the bar graph to represent Ishimwe's goats' weight in Kg on Saturday.



Weight of goats

On step 7: The graph shows that the mass of 40kg has gotten by many goats: 9 is the greatest frequency.

The graph shows that the mass of 42kg has gotten by only one goat: 1 is the smallest frequency.

The graph is called a bar graph. It helps to interpret data easily.

f) Interpretation of results and Conclusion

When presenting data in statistics, get the data from identified source, collect it, organize it, present it in any required form and then give the interpretation.

Any data presented in a graphical form is easier to interpret.

For example, from the above graph,

i. Ishimwe has fatty and heavy goats on his farm.

ii. The least weight is 28kg and the highest weighs 42kg

iii. Frequency is number of times an item has appeared

g) Guidance on the evaluation

Ask pupils to collect data of any quantity such as; their age, height, shoe sizes, marks of a certain subject etc. Ask them to organize it in a table form, present it on a frequency table, draw a bar chart then interpret it correctly.

PRACTICAL ACTIVITY 20: Representing data in a pie chart

a) Rationale:

This practical activity is conducted when teaching the lesson about representing data in a pie chart. It is taught in unit 15. In real life, when data are well organized, and presented in a pie chart, it helps people to easily see the observation with higher frequency (more repeated) and the observation with lower frequency (less repeated).

b) Objective:

To be able to collect data from real life, represent this data using a Pie chart and interpreting it.

c) Required materials:

A pencil, squared papers, ruler, a rubber and a protractor.

d) Procedures:

Step 1: Collecting data from a given source. For example, get data from pupils stating their favorite subjects. Consider the following case in in Primary Six of School A where each learner like one subject: 15 learners like Mathematics, 12 learners like Social Studies, 24 learners like Science and 9 learners like English.

Step 2: Summarize the data in a table illustrating for each subject the number of learners, the corresponding fraction, the related percentage, and the number of degrees out of 360 degrees for a full angle.

Step 3: Draw a Pie-chart and represent this data on it.

Step 4: Interpret the data: from the Pie chart, what is the subject liked by many pupils?

What is the least liked subject? Why do you think this situation may happen?

e) Data recording

On step 2:

Summary of the data:

Subject	Number of learners	Fractions	Percentages	Degrees
Mathematics	15	$\frac{15}{60} = \frac{1}{4}$	$\frac{1}{4} \times 100 = 25\%$	$\frac{1}{4} \times 360^\circ = 90^\circ$
Social Studies	12	$\frac{12}{60} = \frac{1}{5}$	$\frac{1}{5} \times 100 = 20\%$	$\frac{1}{5} \times 360^\circ = 72^\circ$
Science	24	$\frac{24}{60} = \frac{2}{5}$	$\frac{2}{5} \times 100 = 40\%$	$\frac{2}{5} \times 360^\circ = 144^\circ$
English	9	$\frac{9}{60} = \frac{3}{20}$	$\frac{3}{20} \times 100 = 15\%$	$\frac{3}{20} \times 360^\circ = 54^\circ$
Total	**60**	**1**	**100%**	**360°**

Step 3: Using a pair of compasses, pencil, and a protractor, the information is represented in a pie-chart as shown below:

f) Interpretation of results and Conclusion

When presenting data in statistics, get the data from identified source, collect it, organize it, present it in any required form and then give the interpretation. Any data presented in a graphical form is easier to interpret.

A Pie-chart is one way of presenting data in a circular graph that is divided into sectors. Each sector is represented in degrees or percentage.

The quantity represented in each sector is corresponding to its fraction out of 360^0 in case of degrees and out of 100 in case of percentages.

First find the total of items if it is not given. Write each item as a fraction of the total then multiply by 360^0 to get the angle of the sector.

For example, from the above Pie chart, interpreting the data

- Science is the best subject liked by many pupils in P6.
- The least liked subject is English

g) Guidance on the evaluation

Ask pupils to collect data of any quantity such as their height, number of people in 4 districts or marks obtained in different subjects, games etc.

Ask them to organize it in a table form and calculate the sector angle representation, then draw a Pie- chart then interpret it correctly.

PRACTICAL ACTIVITY 21: Determining the likelihood of events

a) Rationale:

This practical activity is conducted when teaching the lesson about determining the like hood of events. It is taught in unit 16.

The term probability refers to the likelihood of an event occurring. Probability is used in all types of areas in real life including weather forecasting, sports betting, investing, and more. Once you know the probability, you can determine the likelihood of an event, which falls along this range:

Certain (probability of 1, the highest possible likelihood), Likely (probability between ½ and 1), even chance (probability of ½), unlikely (probability between 0 and ½), impossible (probability of 0, the lowest possible likelihood).

Objective:

To play games of tossing a coin or a die and determine the likelihood of an event.

b) Required materials:

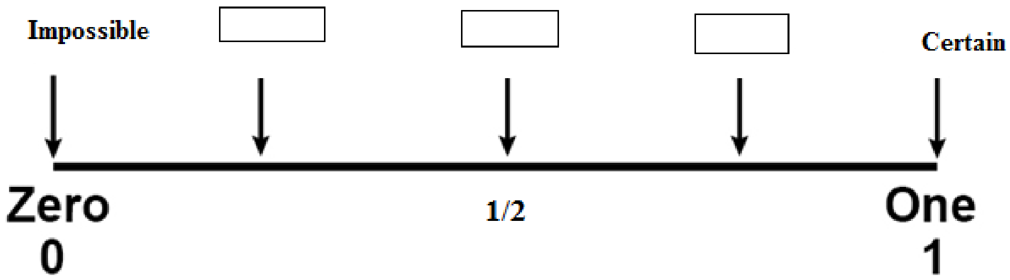
A coin, a die, Four Flash cards written on them **certain, likely, equally likely, unlikely, impossible.**

c) Procedures.

Step 1: Discuss the following words that describe an event to happen: **certain, likely, equally likely, unlikely, impossible.** Try to use them on the following events:

i. It will rain tonight - …….
ii. A lion eats grass - …..
iii. A cow will deliver a male calf - …..
iv. Mukamana who will visit us is a girl.

Step 2: Basing on your answer. Place these words expressing the likelihood of event on the probability line:



Step 3: Get a coin. Toss it once and record the possible outcomes. What is the likelihood of getting a head?

Step 4: Observe a die, r**ole it** and record all possible numbers (outcomes) that can face up.

Step 5: Discuss the following events and place flash card with the appropriate likelihood when you roll a die:

i. Getting a number greater than 6: ……………………

ii. Getting the number 2:…..

iii. getting an even number: …………..

iv. getting a number less than 6: ………

Step 5: Draw a probability line and show where you can place the probability of each event given on step 5.

d) Data recording

Tossing a Coin

The possible outcomes when a coin is tossed are either a Head (H) or a Tail (T)

Getting a head is an equally likely event.

Rolling a die.

When a die is rolled, the possible outcomes at every roll are the following:

Face side 1	Face side 4
Face side 2	Face Side 5
Face side 3	Face Side 6

Therefore, each face has one number 1, 2, 3, 4, 5 and 6. There are 6 possible outcomes.

Getting 2, is one of 6 outcomes, it is an unlikely event.

Getting an even number has 3 outcomes out of 6. These are 2, 4 and 6. The probability of getting an even number is 1/2 which is equal to the probability of getting an odd number. Therefore, getting an even number is an equally likely event.

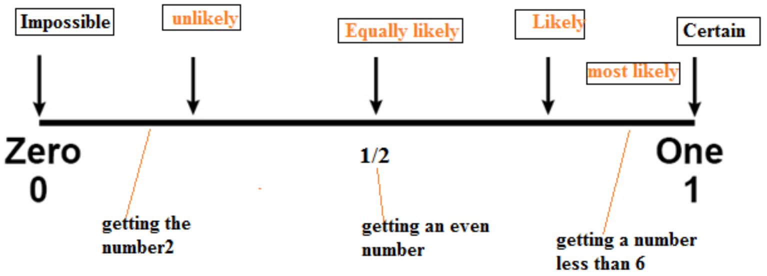
Getting a number less than 6 has 5 outcomes: there are 1, 2, 3, 4 and 5. The probability of getting a number less than 6 is 5/6. This is a likely event.

e) Interpretation of results and Conclusion

From the given example explain: Certain event, most likely event, less likely event, and impossible event.

As seen from the activity, the probability that the coin Lands on a head or tail a an equally likely event.

When rolling a die, the event of getting a number less than 6 is an event that has the big chance to happen, it is a likely event. The event of getting a number greater than 6 is an impossible event.



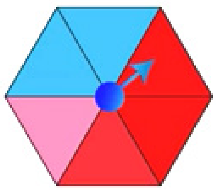
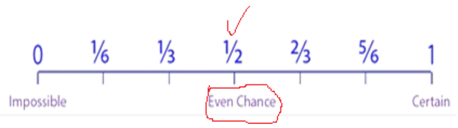
f) Information for Teachers:

Teacher may give different examples of events to help students understand likelihood of events.

g) Guidance on evaluation

Provide an activity of students to arrange the probabilities of the spinner landing on

a) blue b) red c) pink d) not blue

Landig on a red		
Landig on a blue		
Landig on a Pink		
Landig Not on a blue		

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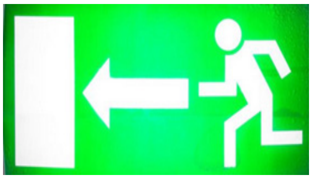
Annex 1:

Name of commonly hazard symbols useful in the laboratory

S/N	Name	Hazard Symbol	Explanation
1	Flammable and combustible		The flammable and combustible symbol signifies substances that will ignite and continue to burn in air. Substances in this category may be gases, aerosols, liquids, or solids, and include many solvents and cleaning materials that are commonly used in the laboratory.
2	Oxidizing agents		The symbol for oxidizing materials indicates the presence of chemicals that readily give off oxygen or other oxidizing substances. Oxidizing materials may intensify fires and cause explosions, and also may be toxic or corrosive. Some common oxidizing liquids and solids found in laboratories are bromine, chlorates, nitrates, perchloric acid, and peroxides.

3	Toxic		A substance known to pose that is classified as posing skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity, and other toxicity is classified as hazardous or toxic substance. These substances can cause death or damage to health by inhalation, ingestion, or skin absorption. Example: acid
4	Irritants		Irritants are substances that cause reversible inflammatory effects on living tissue at the site of contact.

5	Magnetic Field		Certain pieces of laboratory equipment generate strong magnetic fields. The strong magnetic field sign alerts lab members to the dangers that this type of equipment can pose. The risks are especially imminent for people wearing pacemakers and implants, which will tend to align themselves with the magnetic field lines, as will watches, clipboards, and certain tools. Magnetic fields result from the flow of current through wires or electrical devices. Examples of sources: machines, electrical wiring (such as power lines)
6	Exit		It is good to know where all of the exits are located, especially when working in a laboratory environment where you may need to get out quickly. Labs are required to mark exits routes from the area with clearly identifiable signs.

7	Fire extinguisher		Fires can happen anywhere, but lab fires can be even more dangerous due to Bunsen burners, flammable liquids, research documents, laptops, and lab equipment that might be present at any given time. It is essential that the occupants of a laboratory are fully aware of the risks and the appropriate extinguishing media. A fire extinguisher safety sign indicates the exact location of a lab's fire extinguisher.
8	Electrical hazard		The electrical hazard safety symbol, which typically includes a frayed wire and a hand with a lightning bolt across it, indicates any electrical hazards in the lab. If an electrical hazard is suspected, the device in question should be disconnected immediately and the cause determined by a qualified technician. Equipment should always be turned off and unplugged when any work is being done on it.