Intervention Mathematics

Level 2

SECTION

4

GEOMETRICAL REASONING AND MEASUREMENT

GEOMETRY AND MEASUREMENT

Shape And Space/Measurement

In this section, you will learn to;

1. *Identify and applying parallel, perpendicular, complementary, supplementary angles, vertical and parallel lines cut by transversal in real-life contexts.*
2. *Measure and recording area for regular and irregular shapes in squared cm and squared m using grid sheets.*
3. *Develop and applying a formula for determining area of given shapes in centimetres and metres squared.*
4. *Determine the volume of boxes by finding how many cubes of sizes 1cm^3 each contains.*
5. *Determine different sizes of boxes that have the same volume.*
6. *Determine the time taken to conduct an event.*
7. *Determine the starting or ending time of events given a duration.*

SECTION INTRODUCTION

In this section, you will identify and apply the concepts of parallel, perpendicular, complementary and supplementary angles, as well as vertical and parallel lines cut by a transversal in real-life situations. You will measure and record the area of both regular and irregular shapes in square centimetres and metres using grid sheets, and develop and apply formulas for determining these areas. Additionally, you will determine the volume of boxes by calculating how many 1 cm^3 cubes fit inside them, and explore different sizes of boxes and containers that can hold the same volume or capacity. You will also determine the time taken to conduct an event and calculate the starting or ending time of events given a specific duration.

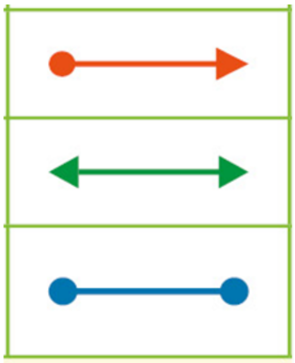
THE CONCEPT OF LINES AND ITS APPLICATIONS

FOCAL AREA: THE CONCEPT OF LINES

Lines are like the basic building blocks of shapes and space. They are everywhere, from the straight roads we walk on to the edges of the things we see. In this lesson we will explore lines, types of lines and characteristics of lines and examples of lines in real life.

Let's review our knowledge of lines, line segments and rays

In our previous lessons, we explored the basic building blocks of geometry: lines, line segments and rays. Let's quickly review these concepts to refresh our memory.



1. **Lines**:
   - A line is a straight path that extends infinitely in both directions. It has no endpoints, which means it goes on forever.
   - We can represent a line by drawing a straight line with arrows at both ends.
   - Example: Think of a line as a straight road that never ends in either direction.
2. **Line Segments**:
   - A line segment is a part of a line that has two endpoints. Unlike a line, it does not extend infinitely.
   - It is the shortest path between two points.
   - Example: Imagine a piece of string stretched between two points. The string represents a line segment.
3. **Rays**:
   - A ray is a part of a line that starts at one point and extends infinitely in one direction.
   - It has one endpoint and goes on forever in the other direction.
   - Example: Picture a ray as a sunbeam that starts at the sun and travels endlessly through space.

The fundamental elements in geometry that help us understand geometric shapes and structures are lines, line segments and rays. These elements have their distinct characteristics and properties.

Exploring the concepts of lines, line segments and rays

We can use the diagram below to explore the characteristics of the line, line segments and rays.

Diagram A is a line which has two arrows indicating that there are no endpoints. Therefore, a line is an infinite set of points that extends infinitely in both directions.

Diagram B is a ray which has only one arrow indicating its directions. Therefore, a ray is a part of the line that has one end point and extends in one direction.

Diagram C has two distinct endpoints. The distance between them is the line segment. Therefore, a line segment is a part of a line with two distinct endpoints.

Relationships between line, line segments and rays.

A line segment and a ray are subsets of a line and the differences between them are their length, endpoints and directional properties.

Exploring types of lines using real-life objects

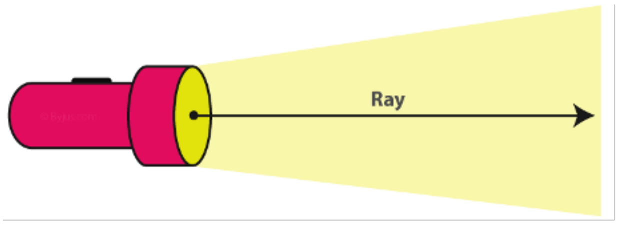
We can use objects around us to explore the types of lines. Lines can come in many shapes and orientations. Some are straight, like a ruler. Others can curve, like a snake's path. Horizontal lines run flat across, while vertical lines go straight up and down. Diagonal lines slant and intersecting lines cross each other.

For example, a straight line could be represented by a ruler, a curved line by a snake's path, a horizontal line by a table's surface, a vertical line by a doorframe, a diagonal line by a ramp, intersecting lines by a plus sign, parallel lines by railroad tracks, and perpendicular lines by the corners of a square.

TYPE OF LINES

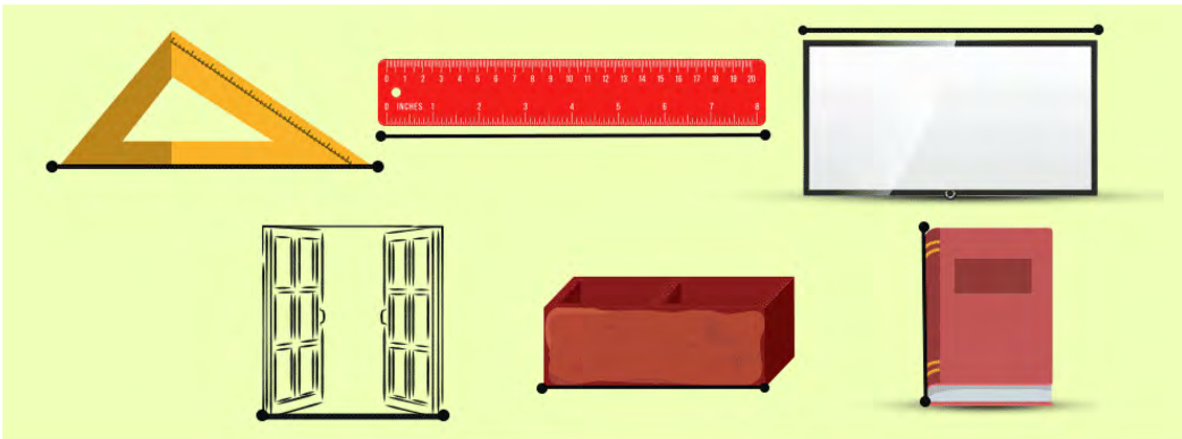
Straight Line: A line that does not change direction.

Ray: A line that starts at a specific point (the endpoint) and extends infinitely in one direction.

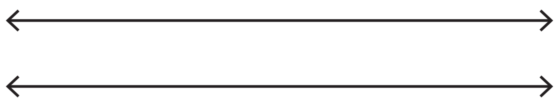


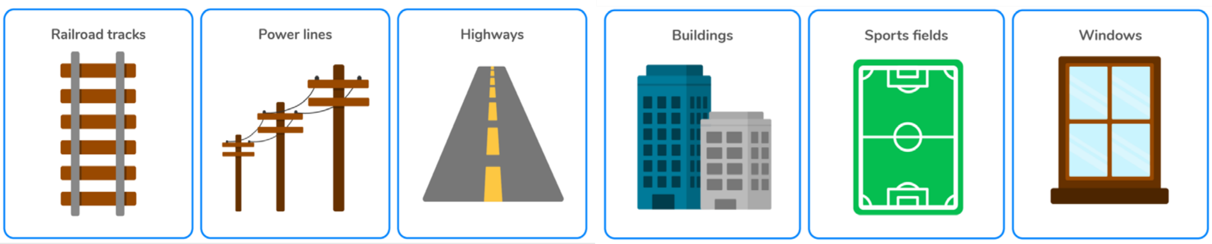
Line Segment: the shortest distance between two points.

Lines can be classified based on their intersection with other lines or the angles they form. The following are some examples of such lines:

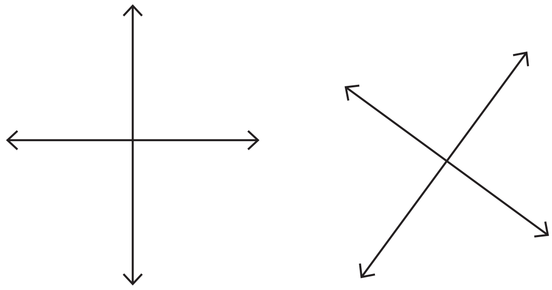


Parallel Lines: Lines that are in the same plane and never intersect, even when extended infinitely. Real-life examples of parallel lines are railroad tracks.

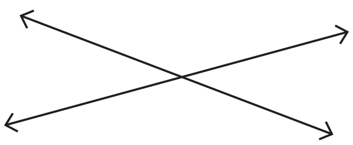


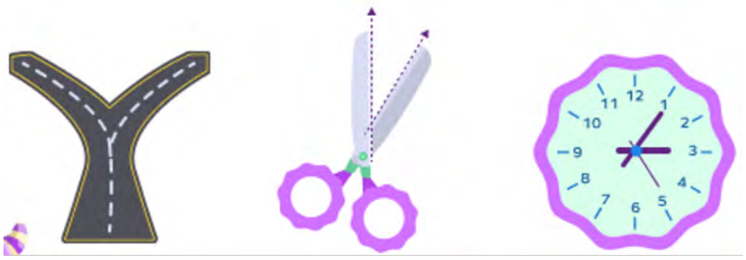


Perpendicular Lines: Lines that intersect at a right angle (90°). A real-life example of a perpendicular line is the corners of a square.

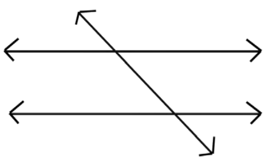


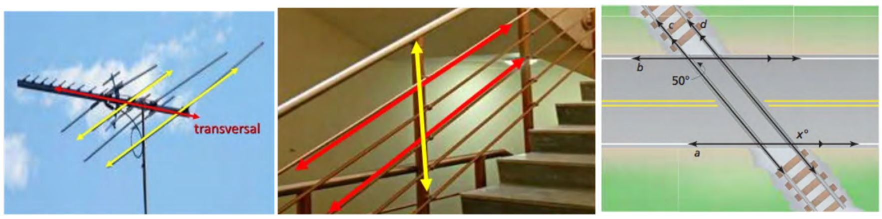
Intersecting Lines: Lines that share a common point and cross each other at that point. For example, a plus sign, corners of a desk or the crossing paths on a grid



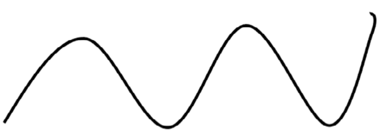


Transversal: A line that intersects two or more parallel lines, creating corresponding angles, alternate interior angles, alternate exterior angles and consecutive interior angles.

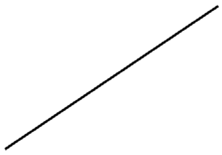


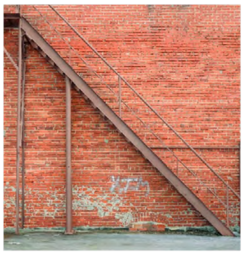


Curves: Curved lines bend or arc in different directions. For example, the contour of a circle or the edges of a leaf, snake's path etc.



Diagonals: These lines slant or lean in any direction between horizontal and vertical. For example, the edge of a staircase.



ACTIVITY 4.1: Individual/Pair/Group Work

Exploring Lines, Line Segments, and Rays

Purpose: To reinforce your understanding of lines, line segments and rays through a hands-on and interactive activity.

Activity: Geometry Scavenger Hunt

Materials Needed:

- String or yarn
- Scissors
- Ruler
- Coloured tape or chalk (if outside)
- Paper and pencil
- A large open space (classroom, playground, or open area)

Instructions:

1. **Form Small Groups**:
   - Break into small groups of 3-4 students. Each group will be given materials and a list of tasks to complete.
2. **Create and Identify**:
   - **Task 1: Lines**: Using the string or yarn, create a "line" by laying it out on the ground. Make sure the string is straight and extends as far as possible. Mark the ends with tape or chalk, but remember that a line extends infinitely, so imagine it going on forever!
   - **Task 2: Line Segments**: Now, cut a piece of string to a specific length using your ruler (e.g., 30 cm). This is your line segment.

Lay it out on the ground and mark the endpoints with tape or chalk. Measure it to ensure accuracy.

- **Task 3: Rays**: Attach one end of your string to a fixed point (like a wall or a desk). Let the other end extend out freely, representing the part of the ray that goes on infinitely. Mark the fixed point as the "endpoint" of the ray.

3. **Identify in Your Environment**:
   - Walk around your classroom or outdoor area and identify real-life examples of lines, line segments, and rays. Use your paper and pencil to jot down what you find. For example:
     - A line could be the edge of a table that you imagine continuing beyond the table's ends.
     - A line segment might be the side of a book.
     - A ray could be a flashlight beam starting at the flashlight and extending outward.
4. **Presentation**:
   - After completing the tasks, each group will present their findings to the class. Explain how you created each geometric element and what real-life examples you found. Be sure to point out the differences between lines, line segments, and rays.
5. **Discussion**:
   - As a class, discuss the different examples found. Talk about how understanding lines, line segments, and rays helps us in real life, such as in design, construction, and navigation.

Reflection: Think about how these basic geometric elements are all around us. How might we use our understanding of lines, line segments, and rays in other subjects or activities? Write a short paragraph reflecting on what you learned from the activity.

MEASUREMENT OF AREA

FOCAL AREA 1: MEASUREMENT OF AREA OF REGULAR AND IRREGULAR 2D SHAPES

Imagine you are helping to decorate a room. You want to place a large rug on the floor, but you need to make sure the rug fits perfectly. You also want to hang some pictures on the wall and you need to figure out how much space the pictures will take up. To do these tasks you need to know how to measure the area of different shapes, whether they are simple rectangles or more irregular shapes.

Area is a measure of how much surface a shape covers. It's an important concept because it helps us understand the size of spaces and objects in real life. For example, knowing how to measure area allows us to:

- Choose the right size rug for a room.
- Determine how much paint we need to cover a wall.
- Figure out how much material is needed to sew a piece of clothing.

Under this focal area, we will learn how to measure the area of both regular shapes, like squares and rectangles, and irregular shapes, which might not have straight sides or consistent measurements. Understanding how to measure area will help you make better decisions in everyday situations, like arranging furniture, planning a garden, or even designing a house.

Reinforcement Activities

Exploring the Concept of Area

Purpose: To prepare you for learning how to measure the area of regular and irregular 2D shapes by introducing the concept of area through a hands-on exploration.

Activity: Tiling with Unit Squares

Materials Needed:

- Graph paper or grid paper
- Scissors
- Coloured pencils or markers
- A ruler
- A few small objects (like erasers, coins, or small books)

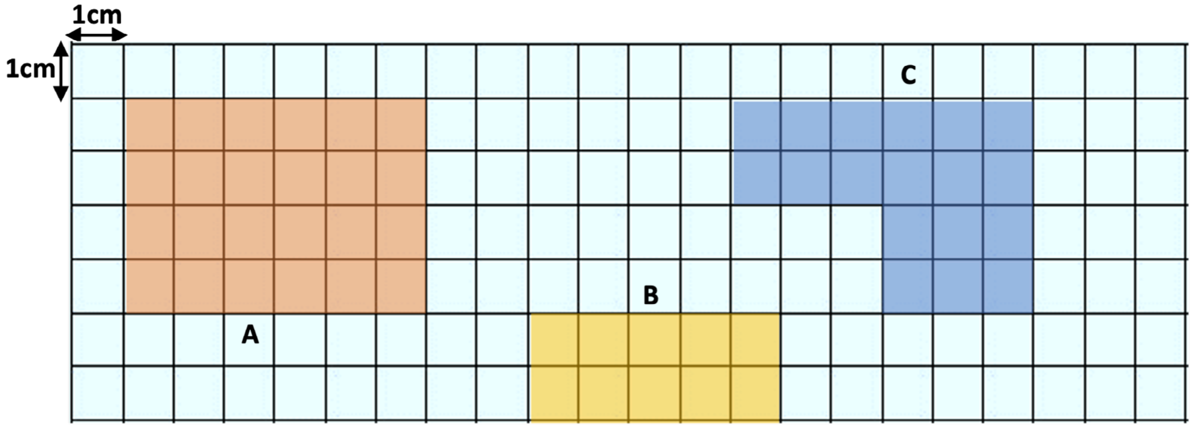
Instructions:

1. **Understanding Area**:
   - Imagine you have a floor that you want to cover with tiles. The amount of space that the tiles cover is called the "area." Area is the measure of how much surface is covered by a shape or object.
2. **Covering Shapes with Unit Squares**:
   - Take your graph paper and look at the small squares on it. Each small square is called a "unit square." These unit squares will help you understand how area is measured.
   - Choose one of your small objects (like an eraser) and place it on the graph paper. Trace around it with a pencil.
   - Now, count how many unit squares fit inside the traced shape. This is the area of the shape in "square units."
3. **Explore Different Shapes**:
   - Use your ruler to draw different shapes on the graph paper, such as rectangles, squares, and triangles. You can also trace around other objects.
   - Count the number of unit squares inside each shape to find their area. Remember, some shapes might not perfectly fit the squares, so you'll have to estimate how much of the square is covered.
4. **Colour and Compare**:
   - After finding the area of each shape, use your coloured pencils to shade in the unit squares that make up the area. This will help you visualise how much space each shape covers.
   - Compare the areas of different shapes. Which shapes cover more space? Which shapes cover less?
5. **Discussion**:
   - Think about why understanding area is important. How might you use this concept in real life? For example, if you wanted to buy a rug for your room, how would you know what size to get? Share your thoughts with your classmates.

WHAT IS AREA?

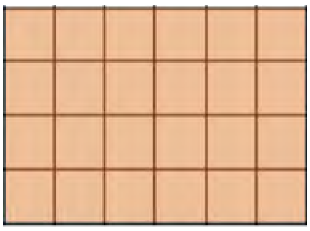
- The area is the amount of space inside a two-dimensional shape.
- Area is measured in square units, such as square centimetres (cm^2), square metres (m^2), or square inches (in^2).

As in the definition of area, we can measure square units. For example, take a look at the grid below;



To find the area of any of the three shapes on the grid, we can count the number of squares covered by the shape. So, let's find the area of each shape.

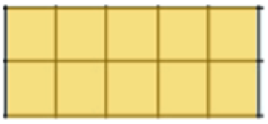
Solution



Area of shape A = number of squares in the shape

= 24 squares.

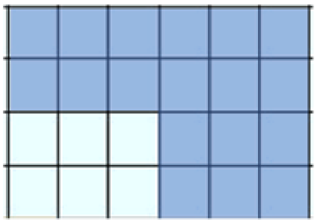
Now, since a square on the grid are 1cm by 1cm, the area of the shape is **24 cm^2**.



Area of shape B = number of squares in the shape

= 10 squares.

Therefore, area of Shape B = **10 cm^2**.



Area of shape C = number of squares in the shape

= 18 squares.

Therefore, area of Shape C = **18 cm^2**.

Measure and record areas for real-life regular shapes in cm^2 and m^2

In our various schools and homes, we can measure the area of places such as floors, walls, table tops, compound and many others. We can measure the area of such places and objects using the idea of a square grid.

Assume you are measuring the area of the floor of a room with tiles. One way to do this is to measure the side lengths of one of the tiles, then count how many of the tiles covers the floor. Take a look at this activity.

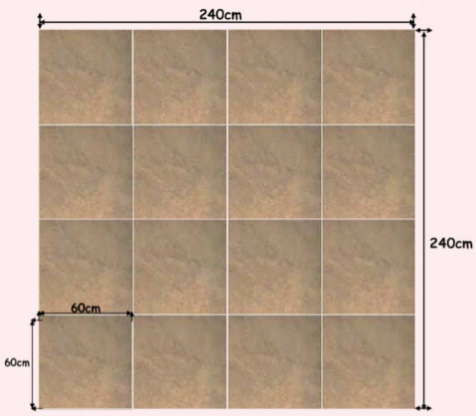
Practical ACTIVITY 4.2: Individual/Pair/Group Work

Floor tiles

Measuring the sides of 1 tile

Tile measures 60cm × 60cm

Determine the area of this floor



Area of floor $= 240 \text{ cm} \times 240 \text{ cm}$

$= 57\ 600 \text{ cm}^2$

OR

Area of floor $=$ area of 1 tile $\times$ number of tiles

$= (60 \text{ cm} \times 60 \text{ cm}) \times 16$

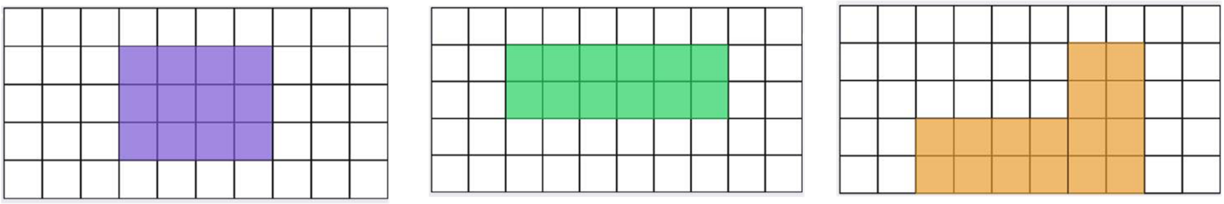
$= 3\ 600 \text{ cm}^2 \times 16$

$= 57\ 600 \text{ cm}^2$

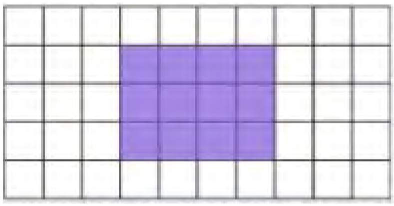
Are you able to to measure any tiled floors around you and calculate their area?

Worked Examples

Determine the area of the following shapes if a square in each of the shapes is 1cm by 1cm.

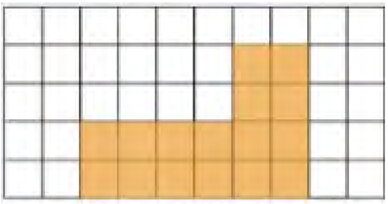


Solution



Area of shape = 12 squares
= 12 cm^2

Area of shape = 12 squares
= 12 cm2



Area of shape = 16 squares
= 16 cm^2

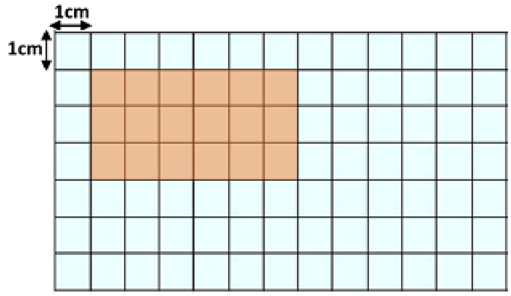
FOCAL AREA 2: DEVELOP AND APPLY A FORMULA FOR DETERMINING THE AREA OF SQUARES AND RECTANGLES IN CENTIMETRE AND METRE SQUARED

We can use formulas to determine the area of squares and rectangles. The formulae help to make our calculations faster.

Formula for Area of a Rectangle

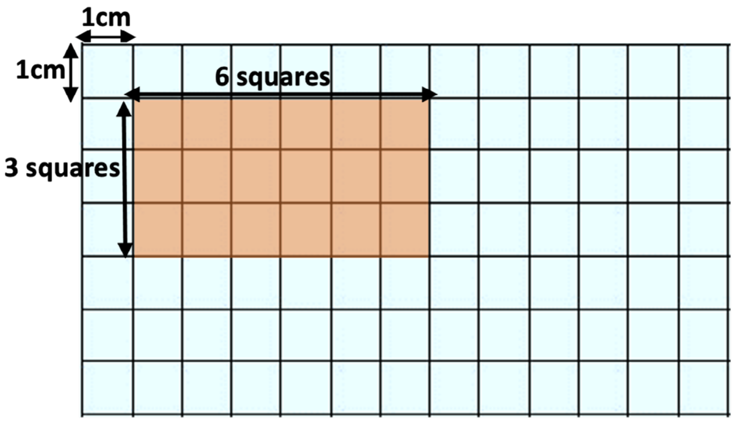
Assuming I want to calculate the area of the rectangle on the grid below, we just have to count the number of squares covered by the shape.

When we count, we get 18 squares.



We can also multiply the number of square on the vertical side of the shape by the number of squares on the horizontal side.

Therefore, we have $3 \times 6 = 18$ squares.



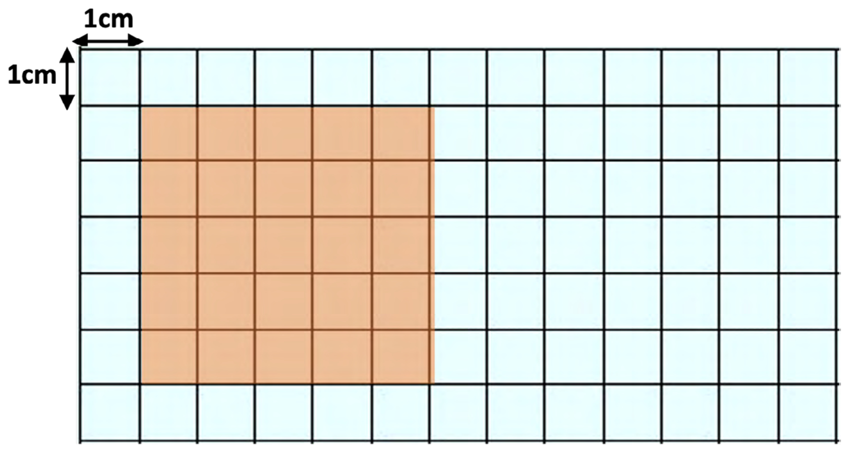
Therefore, for any given rectangle, the area is found by the product of the length by the width.

Area of rectangle $= L \times W$

Formula for Area of a Square

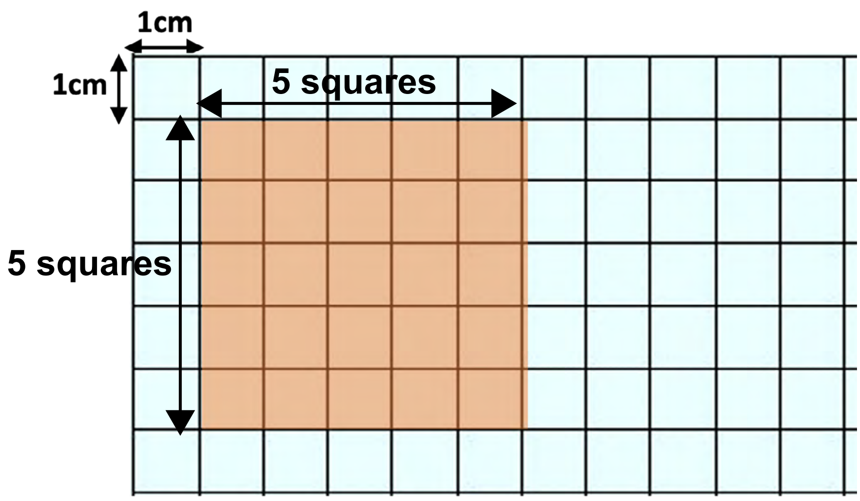
To calculate the area of the square on the grid below, we just have to count the number of squares covered by the shape.

When we count, we get 25 squares.

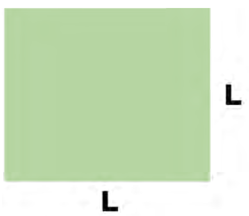


We can also multiply the number of squares on the vertical side of the shape by the horizontal side. But, since it is a square, all the sides are equal. Therefore, we can count the number of squares on any of the sides, then multiply this by itself.

Therefore, we have $5 \times 5 = 25$ squares.



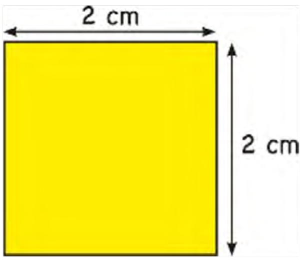
Therefore, for a given square, the area is found by the product of the length by the length

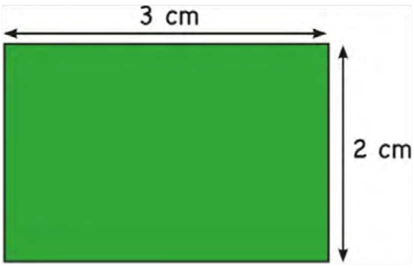


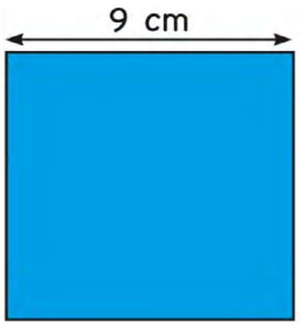
Area of square $= L \times L = L^2$

Worked Examples

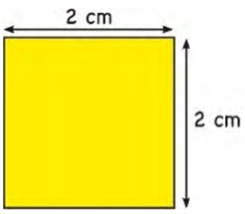
Calculate the area of the following shapes.





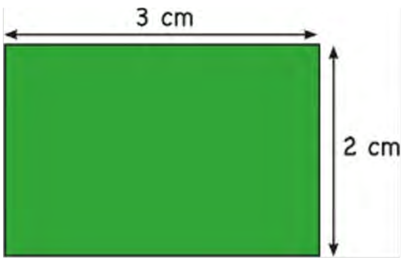


Solution



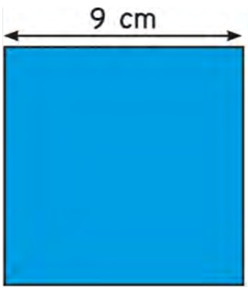
Area of square $= L \times L$

Area of square $= 2 \text{ cm} \times 2 \text{ cm} = 4 \text{ cm}^2$



Area of rectangle $= L \times W$

Area of square $= 2 \text{ cm} \times 3 \text{ cm} = 6 \text{ cm}^2$



Area of square $= L \times L$

Area of square $= 9 \text{ cm} \times 9 \text{ cm} = 81 \text{ cm}^2$

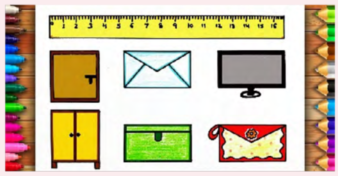
ACTIVITY 4.3: Individual/Pair/Group Work

Hands-On Practical Activity: Measuring the Area of Real-Life Rectangular and Square Objects

Purpose:

- Measure the area of real-life rectangular and square-shaped objects.
- Calculate the area using the formula.
- Explore and verify the area using grid paper.

Materials Needed:

- Measuring tape or ruler
- Grid paper
- Pencils and erasers
- Real-life rectangular and square objects (e.g., a book, a table, a tile, a window)
- Calculator (optional)

Activity Instructions:

Part 1: Measuring and Calculating the Area

1. **Identify the Objects:**

   Look around the classroom or at home to find real-life rectangular and square objects. Some examples could be a book, a table, a tile or a window.

2. **Measure the Length and Width:**
   - Use a measuring tape or ruler to measure the length and width of the object. Record these measurements in your notebook.
   - Make sure to measure accurately and write down the measurements in centimetres (cm) or inches (in).

3. **Calculate the Area:**
   - Use the formula for the area of a rectangle or square: Area = Length × Width
   - Multiply the length by the width to find the area of each object.
   - Write down your answers next to your measurements.

   Example:

   - If the length of a book is 20 cm and the width is 15 cm: Area = $20\,\text{cm} \times 15\,\text{cm} = 300\,\text{cm}^2$

Part 2: Exploring the Area with Grid Paper

4. **Draw the Shape on Grid Paper:**
   - Use the grid paper to draw the outline of the objects you measured. Each square on the grid paper represents 1 square unit (e.g., 1 cm^2 or 1 $inch^2$).
   - Make sure to match the dimensions of your drawing to the real-life measurements you took.

5. **Count the Squares:**
   - After drawing the shapes, count the number of squares inside the shape to determine the area.
   - Compare this count with the area you calculated using the formula in Part 1.

   Example:
   - If your book was 20 cm by 15 cm, you should have drawn a rectangle that covers 20 squares by 15 squares on the grid paper. Count the total number of squares inside the rectangle (you should get 300 squares).

6. **Verify and Reflect:**
   - Compare the area calculated by counting squares with the area calculated using the formula. They should match.
   - Discuss with your classmates or reflect on how accurate your measurements and calculations were.

Extension Activity

- **Irregular Shapes:**

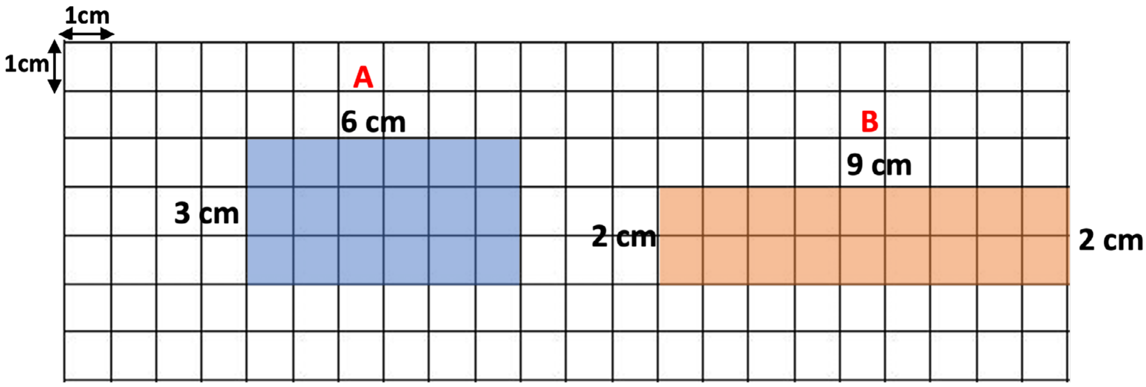
  If time permits, try measuring and calculating the area of an irregular shape (like a desk with an attached shelf) using the same grid paper method. Notice how counting squares becomes more challenging and how important accurate measurement is.

FOCAL AREA 3: DRAWING DIFFERENT SHAPES FOR THE SAME AREA

We can draw different shapes for the same area using the grid paper. Let's take a look at some examples.

Example 1

Given the area 18 cm^2, draw two different shapes with different length sides for the same area.

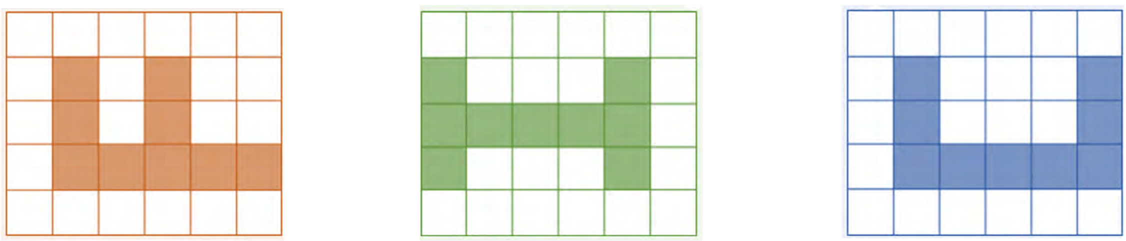


Now, comparing the two shapes (Shape A and B), we can see that they both have different side lengths and are obviously different shapes but they both have the same area of 18 cm^2.

Example 2

Given the area 9 cm^2, draw three different shapes with different length sides for the same area.

Solution



ACTIVITY 4.4: Individual/Pair/Group Work

Hands-On Practical Activity: Drawing Different Shapes for the Same Area

Purpose:

- Use grid paper to draw different shapes that have the same area.

Materials Needed:

- Grid paper
- Pencils and erasers
- Ruler

Activity Instructions:

1. **Understand the Concept of Area:**
   - Recall that the area of a shape is the amount of space it covers on a flat surface. On grid paper, each square represents 1 square unit (e.g., 1 cm^2 or 1 $inch^2$).
2. **Choose an Area:**
   - Decide on a specific area you want to work with. For this activity, let's choose an area of 12 square units. This means that each shape you draw should cover exactly 12 squares on the grid paper.
3. **Draw Your First Shape:**
   - Use your pencil and ruler to draw a rectangle on the grid paper that has an area of 12 square units.
   - For example, you could draw a rectangle that is 3 squares wide and 4 squares long: Area $= 3 \times 4 = 12$ square units
4. **Experiment with Different Shapes:**
   - Now, try to draw different shapes that also cover exactly 12 square units, but are not all rectangles. You can try:
     - A long, thin rectangle (e.g., 2 squares wide and 6 squares long).
     - An "L" shaped figure made up of two smaller rectangles.
     - A shape that looks like a "T" or an "H" by connecting smaller rectangles together.

5. **Count and Check:**
   - After drawing each shape, count the total number of squares inside it to ensure that it covers 12 square units.
   - Double-check your work to make sure each shape has the same area.
6. **Compare Your Shapes:**
   - Compare the different shapes you've drawn. Notice how they all have the same area, even though they look very different.
   - Discuss with your classmates how different shapes can have the same area but different appearances.
7. **Reflect:**
   - Think about how the same area can be represented in many different ways. This is similar to how in real life, different objects might take up the same amount of space but have different shapes.

Challenge Activity:

- **Create a Design:**
  - Use your grid paper to create a design or pattern where all the different shapes have the same area (e.g., 12 square units). You can create a picture or a geometric pattern and share it with the class.

FOCAL AREA 4: SOLVING WORD PROBLEMS ON AREA MEASUREMENT

Example 1

A rectangular carpet is 6 m long and 4 m wide. Find its area.

Solution

Area of rectangle = L × W

Area of rectangle = 6 m × 4 m = 24 m^2

Example 2

Find the area of the floor of a square room in square metres with each side measuring 8 m.

Solution

Area of square = L × L

Area of square = 8 m × 8 m = 64 m^2

Example 3

A laptop's rectangular screen measures 22 cm by 18 cm. What is the area of the laptop screen?

Solution

Area of rectangle = L × W

Area = 22 cm × 18 cm = 396 cm^2

ACTIVITY 4.5: Individual/Pair/Group Work

Hands-On Practical Activity: Solving Word Problems on Area Measurement

Purpose:

- Apply your understanding of area measurement to solve real-life word problems.

Materials Needed:

- Ruler
- Grid paper
- Pencil and eraser
- Calculator (optional)

Activity Instructions:

1. **Introduction to Word Problems:**
   - You've learned how to measure and calculate the area of different shapes. Now, let's apply that knowledge to solve word problems that you might encounter in real life.

2. **Scenario 1: Designing a Garden**
   - Imagine you are helping to design a rectangular garden for your school. The garden needs to be 8 metres long and 5 metres wide.
   - **Task:** Calculate the area of the garden to determine how much space you will have for planting flowers.
   - **Steps:**
     - Draw the rectangle on your grid paper, with each square representing 1 square metre.
     - Use the formula for the area of a rectangle: Area = Length × Width
     - Write down your calculation and find the area.
3. **Scenario 2: Flooring a Room**
   - Your family is planning to install new tiles in a square-shaped room. Each side of the room measures 6 metres.
   - **Task:** Calculate the area of the room to determine how many tiles you will need.
   - **Steps:**
     - Draw the square on your grid paper.
     - Use the formula for the area of a square: Area = Length × Length.
     - Write down your calculation and find the area.
4. **Scenario 3: Carpet for the Living Room**
   - You need to buy a carpet for your living room, which is shaped like an "L." The long part of the "L" is 7 metres by 3 metres, and the short part is 4 metres by 3 metres.
   - **Task:** Calculate the total area of the living room that needs to be covered by the carpet.
   - **Steps:**
     - Draw the "L" shape on your grid paper, breaking it into two rectangles.
     - Calculate the area of each rectangle separately and then add them together to find the total area.
     - Write down your calculations.

5. **Scenario 4: Painting a Wall**
   - You want to paint a rectangular wall in your classroom. The wall is 10 metres long and 4 metres high, but there is a window that takes up 2 metres by 1.5 metres.
   - **Task:** Calculate the area of the wall that needs to be painted, excluding the window.
   - **Steps:**
     - Draw the wall and the window on your grid paper.
     - Calculate the area of the entire wall, then subtract the area of the window.
     - Write down your calculations.
6. **Check Your Work:**
   - After solving each word problem, compare your answers with your classmates. Discuss any differences and ensure that your calculations are correct.
7. **Reflection:**
   - Think about how understanding area measurement helps you in everyday situations, such as designing spaces, buying materials, or decorating a room. Discuss with your classmates how you can use this knowledge in real-life situations.

Challenge Activity

- **Create Your Own Word Problem:**
  - Come up with your own real-life scenario that involves measuring the area of a shape. Write the word problem and solve it using the steps you've learned. Share your problem with the class and see if others can solve it too!

MEASUREMENT OF VOLUME

FOCAL AREA 1: DETERMINING THE VOLUME OF SOLID SHAPES

Imagine you're helping to fill a swimming pool with water. You need to know how much water is required to fill the pool to the top. To figure this out, you would need to calculate the volume of the pool. The volume tells us how much space is inside a 3D object, like a pool, a box or a bottle. Knowing how to determine the volume of solid shapes is crucial in real-life situations like this, where you need to measure how much a container can hold or how much material you need to fill a space.

For example, if you're baking a cake and want to know how much batter will fit in a cake pan, you need to calculate the volume of the pan. Or, if you're packing a box with items, understanding the volume helps you know how much you can fit inside. In construction, architects and engineers calculate the volume of concrete needed to build structures like columns, beams or foundations.

REINFORCEMENT ACTIVITIES

Exploring the Concept of Space Inside Objects

Activity: Exploring the Space Inside Objects

Materials Needed:

- Empty boxes of different sizes (e.g., cereal box, shoe box, tissue box)
- Small items like cubes, marbles, or balls
- Measuring tape or ruler

Instructions:

1. **Explore Different Boxes:**
   - Look at the empty boxes provided to you. Imagine filling each box with small items like cubes or balls.
   - Before you start, think about which box you believe will hold the most items and which will hold the least.

     Write down your guesses.

2. **Filling the Boxes:**
   - Now, start placing the small items (cubes, marbles, or balls) inside the boxes one by one.

     Count how many items you can fit inside each box.
   - After you've filled each box, write down the number of items it could hold.
3. **Compare Your Guesses:**
   - Look back at your guesses and compare them to the actual number of items each box could hold.

     Were your guesses correct? Did any of the boxes surprise you?
4. **Discussion:**
   - Think about why some boxes could hold more items than others, even if they looked similar in size.

     What did you notice about the shape or size of the boxes that made a difference?
5. **Measurement Activity:**
   - Use a measuring tape or ruler to measure the length, width, and height of each box.

     Write down these measurements.
   - Discuss how these measurements might help you figure out how much space is inside the box.

WHAT IS VOLUME?

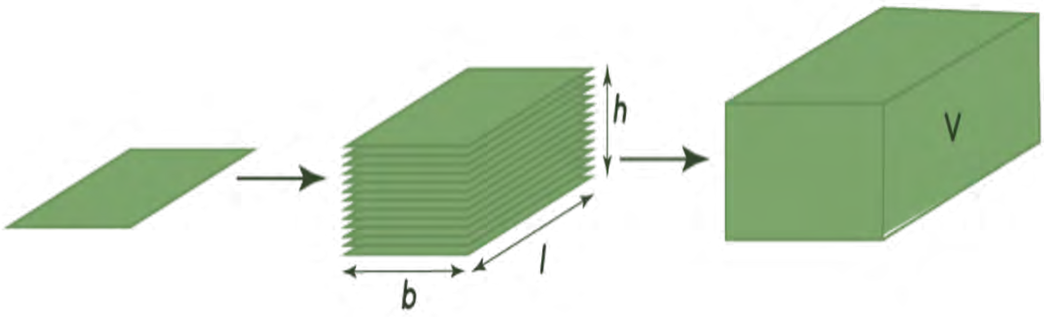
Volume is the amount of space occupied by a three-dimensional object. We make use of the concept of volume in our everyday life. When we fill our cups with water to drink or pack books into boxes, we can talk about the amount of space that has been taken by the substances. That amount of space is volume. It is measured in cubic units, such as cubic centimetres (cm^3), cubic metres (m^3), or cubic inches (in^3).

Demonstrating Volume

Volume of a cuboid

Suppose we have some rectangular sheets with length **‘l’** and width <**b**’. If we stack them one on top of the other up to height **‘h’**, we get a cuboid of dimensions

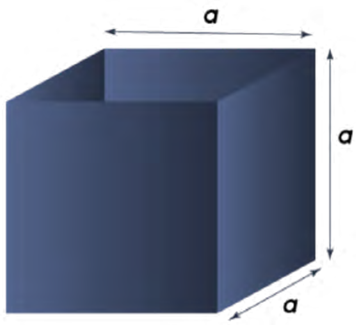
l, b, h. This can be seen in the following figure which shows the length, width (breadth), and height of the cuboid thus formed.



To calculate the amount of space enclosed by this cuboid, we use the formula: **Volume of a Cuboid = l × b × h**

Volume of a cube

A cube is a special case of a cuboid where all three sides are equal in length. If we represent this equal value as 'a', then the volume of this cube can then be calculated with the formula: **Volume of a Cube = a × a × a = a^3.** Observe the following figure to see the equal sides of a cube and the space it occupies.



Find the Volume of Boxes Including Finding How Many Cubes of Sizes 1cm³ Each Contains

Example 1

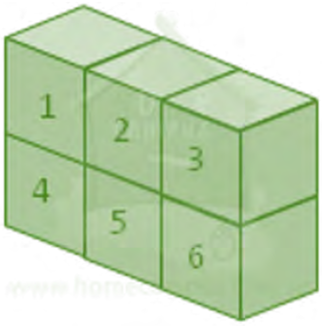
What is a cubic unit?

1 cubic unit is the amount of space that a unit cube occupies.

Or simply,

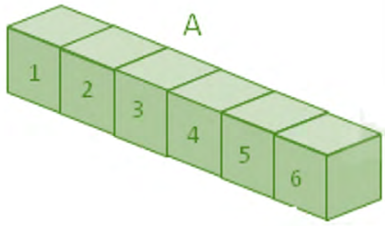
1 cubic unit = the volume of a unit cube = 1 unit^3

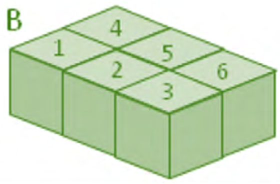
The object below is made of 6 unit cubes.

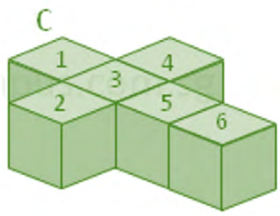


Its volume is 6 cubic units.

Here are some other solids that have the same volume (6 cubic units).

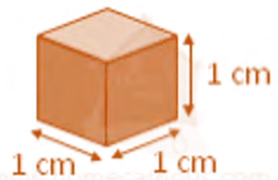






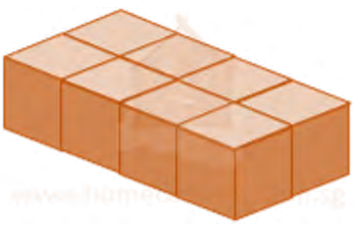
Example 2

What is 1 cm^3?



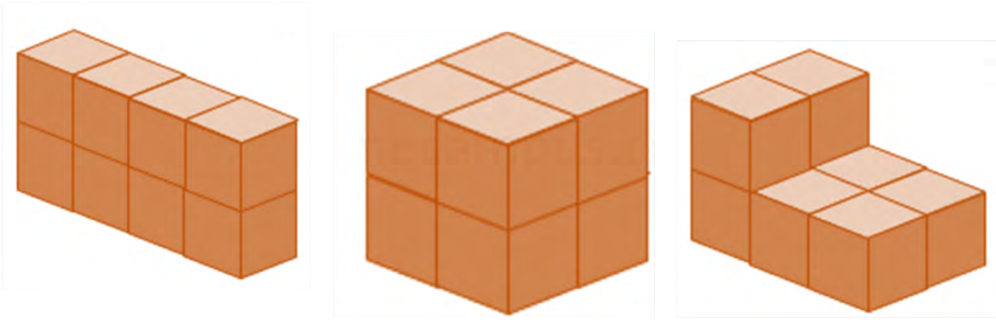
1 cm^3 = the volume of a cube of 1cm sides

The object below is made of eight 1cm^3 units.



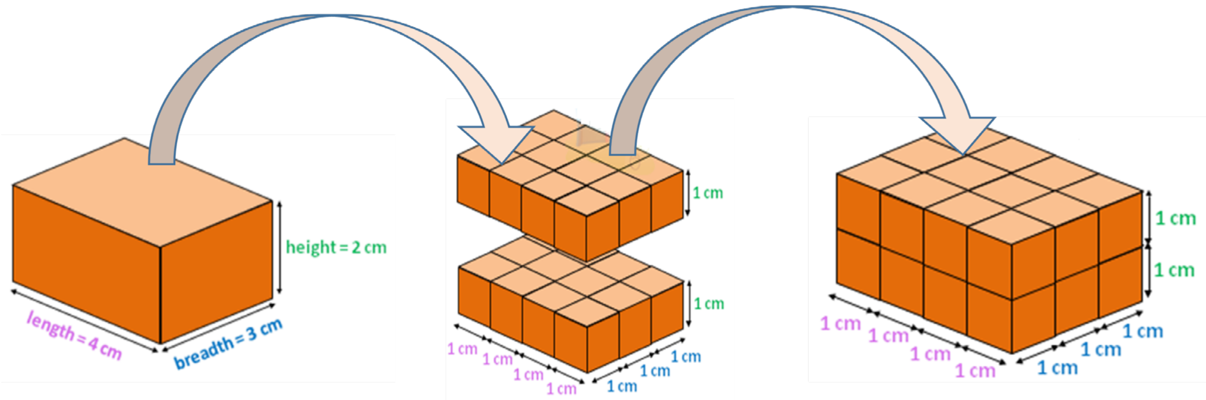
Its volume is 8 cm^3 or 8 cubic centimetres.

Here are some other solids that have the same volume (8 cm^3).



Example 3

What is the volume of the cuboid below?



Each layer in the cuboid above has **4** × **3** = 12 cubes

Since there are **2** layers in the cuboid, there are 2 × 12 = **24 cubes altogether**.

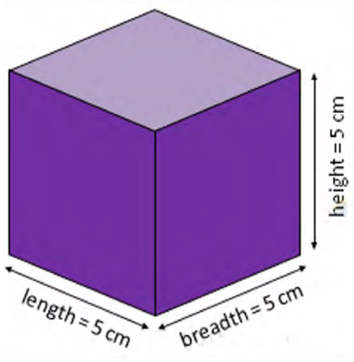
Each of the 24 cubes has a volume of **1 cm^3**.
So, the volume of the cuboid is 24 × 1 cm^3 = **24 cm^3**.

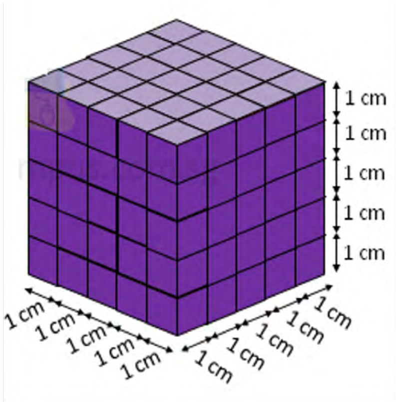
Volume of a cuboid = length × breadth × height

Applying this formula in the example above, we get:
Volume of the given cuboid
= **4 cm** × **3 cm** × **2 cm**
= **24 cm^3**

Example 4

What is the volume of the cube below?





A cube is a cuboid with the same length, breadth and height.

Volume of a cube

= length × breadth × height

= **length × length × length**

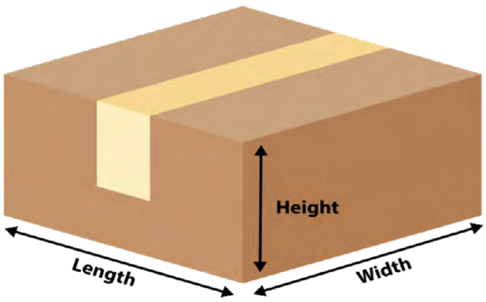
Volume of the given cube

= 5 cm × 5 cm × 5 cm

= 125 cm³

Example 5

Calculate the volume of the box with length 40 cm, height 10 cm and width 20 cm.



Solution

Volume of the given box

$= 40 \text{ cm} \times 10 \text{ cm} \times 20 \text{ cm}$

$= 4 \times 1 \times 2 \times 1000 = 8000$ (multiply the first digits and attach the 3 zeros)

$\mathbf{= 8000 \text{ cm}^3}$

ACTIVITY 4.6: Individual/Pair/Group Work

Hands-on Practical Activity: Determining Volume Using Cubes and Cuboids

Activity: Measuring the Volume of Cubes and Cuboids

Materials Needed:

- Small uniform cubes (e.g., building blocks or sugar cubes)
- A large cuboid-shaped box (e.g., a shoebox)
- A cube-shaped box (e.g., a small gift box)
- Ruler or measuring tape
- Notebook and pencil



Instructions:

1. **Understanding Volume:**
   - Volume is the amount of space inside a 3D object.
   - We measure volume in cubic units, such as cubic centimetres (cm^3) or cubic inches (in^3).

2. **Measuring the Volume of a Cube:**
   - Take the small cube-shaped box. Use your ruler to measure the length of one side of the cube in centimetres (cm).
   - Since all sides of a cube are equal, the length, width, and height will be the same.
   - Write down the measurement of the side.
   - To find the volume of the cube, multiply the length of the side by itself three times (length × width × height).

     Record the volume in your notebook.

Example:

- If the side length of your cube is 4 cm, the volume is: Volume $= 4\,\text{cm} \times 4\,\text{cm} \times 4\,\text{cm} = 64\,\text{cm}^3$

3. **Measuring the Volume of a Cuboid:**
   - Now, take the cuboid-shaped box (e.g., a shoebox). Use your ruler to measure the length, width, and height of the cuboid in centimetres (cm).
   - Write down each measurement in your notebook.
   - To find the volume of the cuboid, multiply the length, width, and height together (length × width × height).

   Record the volume in your notebook.

   Example:

   - If the length of the cuboid is 10 cm, the width is 5 cm and the height is 3 cm, the volume is:

     Volume $= 10\,\text{cm} \times 5\,\text{cm} \times 3\,\text{cm} = 150\,\text{cm}^3$

4. **Using Small Cubes to Fill the Objects:**
   - Take the small uniform cubes (e.g., building blocks or sugar cubes) and see how many of them you can fit inside each of the boxes (cube and cuboid).
   - Count how many cubes fit perfectly inside the cube-shaped box. This should match the volume you calculated earlier.
   - Do the same for the cuboid-shaped box. Compare this number with the volume you calculated.

5. **Real-Life Application:**
   - Think of real-life objects that are shaped like cubes or cuboids (e.g., a dice for a cube or a brick for a cuboid).
   - Discuss why knowing the volume of these objects might be useful. For example, you might need to know the volume of a box to figure out how many items can fit inside or the volume of a sink to determine how much liquid it will hold.

6. **Challenge Activity:**
   - Create your own cuboid using the small cubes. Build a structure, measure its dimensions, and calculate its volume. Compare the calculated volume with the number of cubes you used to build it.

FOCAL AREA 2: CONSTRUCTING DIFFERENT SOLID SHAPES WITH DIFFERENT DIMENSIONS BUT THE SAME VOLUME

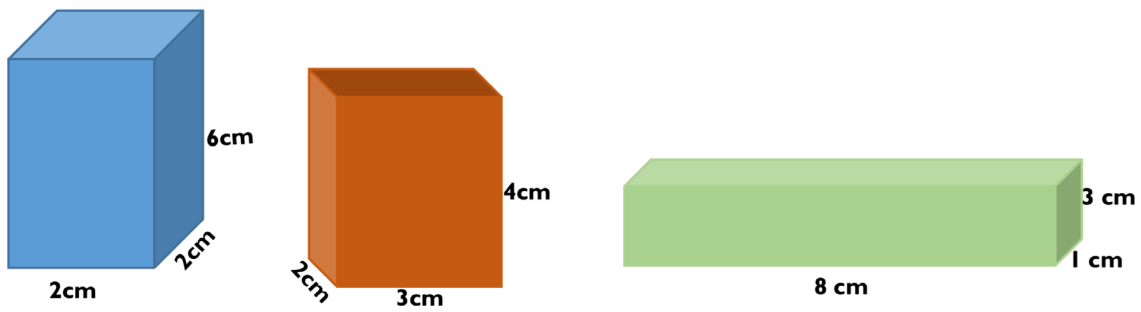
Understanding that different solid shapes can have the same volume despite having different dimensions is an important concept in geometry. This principle highlights the diversity and flexibility in three-dimensional space and deepens comprehension of volume.

Different shapes, like a cylinder, cube, rectangular prism, cone and sphere, can have different dimensions yet occupy the same volume. This concept demonstrates the variability in shapes that can contain the same amount of space.

Example 1:

Given the volume 24 cm^3, construct three different shapes for the given volume.

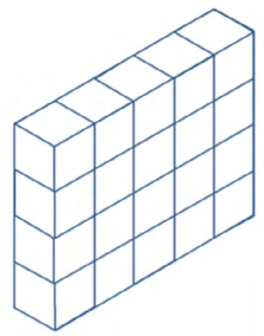
Solution

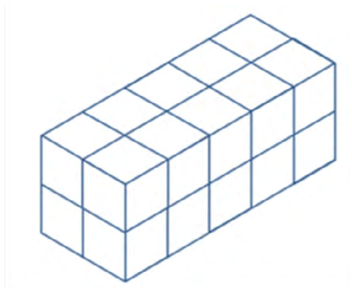


Example 2

Given the volume 20 cm^3, construct two different shapes for the given volume.

Solution





ACTIVITY 4.7: Individual/Pair/Group Work

Hands-on Practical Activity: Constructing Solid Shapes with the Same Volume Using Grid Paper

Activity: Building Different Solid Shapes with the Same Volume

Materials Needed:

- Grid paper (with squares of equal size)
- Ruler
- Pencil
- Eraser
- Coloured pencils or markers (optional)

Instructions:

1. **Understanding the Volume:**
   - Volume is the amount of space inside a 3D object. For this activity, you will create different solid shapes with the same volume but different dimensions.
2. **Determine the Volume:**
   - Decide on a specific volume for your shapes. For example, you might choose a volume of 24 cubic units.
3. **Constructing Shapes:**

   a. **Drawing 2D Base Shapes:**
   - On your grid paper, start by drawing the base shapes for different 3D shapes (e.g., rectangles for cuboids, squares for cubes).
   - Ensure that the base shapes are drawn to scale and fit within the grid squares.

   b. **Building Cuboids:**
   - Choose different dimensions for cuboids that will result in the same volume. For a volume of 24 cubic units, you could create cuboids with dimensions such as:
     - 3 units $\times$ 4 units $\times$ 2 units
     - 2 units $\times$ 6 units $\times$ 2 units
     - 4 units $\times$ 3 units $\times$ 2 units

- Draw the base rectangles on grid paper for each cuboid.
- Use coloured pencils or markers to shade the base rectangles.

c. **Drawing the 3D Cuboids:**

- Draw the 3D representation of each cuboid using dashed lines to show the edges that are not visible.
- Make sure to label each shape with its dimensions.

4. **Constructing a Cube:**
   - Using the same volume, you can also create a cube if the volume allows. For example, for a volume of 27 cubic units, you would create a cube with dimensions of 3 units × 3 units × 3 units.
   - Draw the base square on the grid paper and then create the 3D representation.
5. **Challenge:**
   - Create other solid shapes with the same volume, such as a triangular prism or a pyramid. Use the grid paper to draw the base shapes and then build the 3D shapes by adding the height.
6. **Compare Your Shapes:**
   - Compare the different shapes you've constructed. Discuss how the dimensions of each shape affect its appearance but keep the volume constant.
7. **Discuss Real-Life Applications:**
   - Think about where you might encounter objects with different dimensions but the same volume in real life (e.g., different-sized boxes with the same amount of contents).

FOCAL AREA 3: DETERMINE DIFFERENT SIZES OF BOXES THAT HAVE THE SAME VOLUME

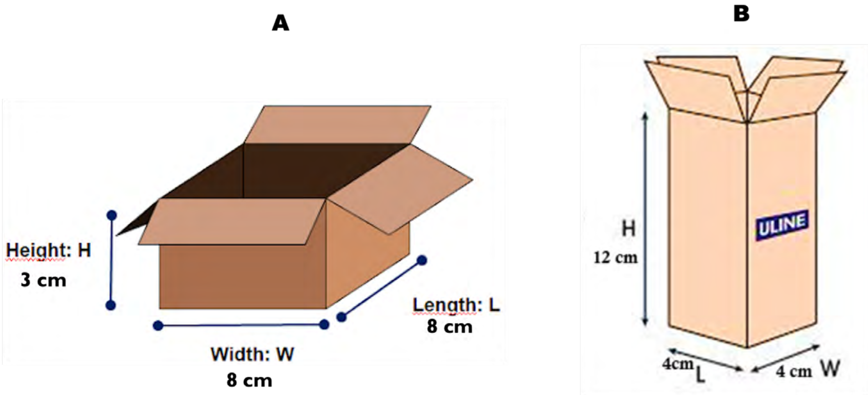
In our everyday lives, we come into contact with containers and boxes that look obviously different in terms of their structure but they have the same volume.

Let's take a look at this example.

The two boxes look different and have different dimensions. However, their volumes are the same.

Example

Let's calculate to confirm.



Solution

Volume of Box A = $3cm \times 8cm \times 8cm = 192\ cm^3$

Volume of Box B = $12cm \times 4cm \times 4cm = 192\ cm^3$

Hence, we can conclude that even though the two boxes are of different shapes and have different dimensions, they have the same volume.

ACTIVITY 4.8: Individual/Pair/Group Work

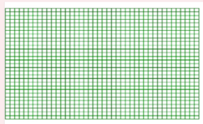
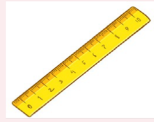
Hands-on Practical Activity: Determining the Volume of Different Shapes of Boxes with the Same Volume

Activity: Exploring Box Volumes Using Grid Paper

Materials Needed:

- Grid paper (with squares of equal size)
- Ruler

- Pencil
- Eraser
- Coloured pencils or markers (optional)

Instructions:

1. **Understanding Volume:**
   - Volume is the amount of space a 3D object occupies. For this activity, you will be using grid paper to draw and calculate the volume of different boxes that all have the same volume.

2. **Choose a Volume:**
   - Decide on a specific volume for your boxes. For this activity, you will work with a volume of 36 cubic units.

3. **Drawing and Calculating:**

   a. **Draw Cuboids with Different Dimensions:**
   - On your grid paper, you will draw several cuboids (rectangular boxes) with the same volume but different dimensions.

     Example Dimensions:
     - **Cuboid 1:** Dimensions of 2 units × 3 units × 6 units
     - **Cuboid 2:** Dimensions of 2 units × 9 units × 2 units
     - **Cuboid 3:** Dimensions of 4 units × 3 units × 3 units
     - **Cuboid 4:** Dimensions of 1 unit × 12 units × 3 units

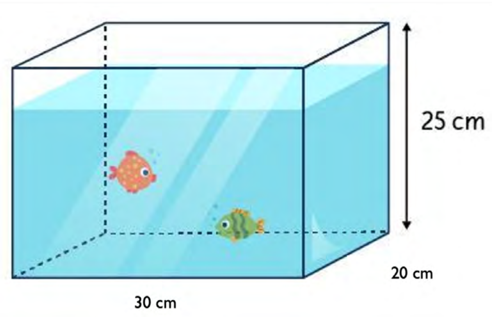
   b. **Drawing the Base Shapes:**
   - For each cuboid, draw the base rectangle on grid paper. For example, for a cuboid with dimensions 2 units × 3 units × 6 units, draw a rectangle that is 2 units high and 3 units wide on your grid paper.
   - Use coloured pencils or markers to shade the base rectangles.

   c. **Drawing the 3D Representation:**
   - Extend your base rectangle to show the height of the cuboid. Use dashed lines to indicate the edges that are not visible.
   - Label each drawing with its dimensions and the calculated volume.

4. **Calculate the Volume:**
   - For each cuboid, calculate the volume by multiplying its length, width, and height. Use the formula: Volume = Length × Width × Height
   - Ensure that all the cuboids you draw have the volume of 36 cubic units.
5. **Constructing Different Shapes:**
   - Challenge yourself to create and draw more cuboids with different dimensions that still have a volume of 36 cubic units.
6. **Compare and Discuss:**
   - Compare the different cuboids you've drawn. Notice how changing the dimensions affects the shape but not the volume.
   - Discuss real-life examples where objects of different dimensions can hold the same amount of content (e.g., different-sized boxes for packaging the same quantity of items).

FOCAL AREA 4: SOLVING WORD PROBLEMS INVOLVING VOLUME OF CUBES AND CUBOIDS

1. Sarah has a small fish tank in the shape of a rectangular prism. The tank measures 30 centimetres in length, 20 centimetres in width and 25 centimetres in height. She wants to fill the tank with water.



Calculate the Volume of the Fish Tank:

- How many cubic centimetres of water will Sarah need to fill the tank completely?

Solution

Calculating the Volume:

- Volume of a cuboid = Length × Width × Height
- Volume = 30 cm × 20 cm × 25 cm
- Volume = 15 000 cubic centimetres

Sarah will need 15 000 cubic centimetres of water to fill the tank completely.

2. Sarah has a big storage box in the shape of a cube. Each side of the cube measures 2 metres.

   Find the volume of Sarah's storage box.

Solution

Volume of a cube = Side length × Side length × Side length

Volume = 2 m × 2 m × 2 m

Volume = 8 cubic metres

2. John wants to fill his new sandbox with sand. The sandbox is in the shape of a cuboid and measures 3 metres in length, 2 metres in width and 0.5 metres in height.

Solution

Volume of a rectangular prism = Length × Width × Height

Volume = 3 m × 2 m × 0.5 m

Volume = 3 cubic metres or $3m^3$

ACTIVITY 4.9: Individual/Pair/Group Work

Hands-on Practical Activity: Solving Word Problems on Volume Measurement

Activity: Solving Real-Life Volume Problems

Objective: Apply your understanding of volume measurement to solve real-life word problems involving cubes and cuboids.

Materials Needed:

- Grid paper (with squares of equal size)
- Ruler
- Pencil
- Eraser
- Calculators (optional)
- Small boxes or cuboids (optional, for visualisation)

Instructions:

1. **Read and Understand the Problem:**
   - Carefully read each word problem. Identify the key information you need: the dimensions of the objects and what you are being asked to find (e.g., the volume, total volume, or dimensions).

2. **Solve the Problems:**

   Problem 1:

   - **Scenario:** You have a rectangular box that is 5 units long, 3 units wide and 2 units high. You want to fill this box with small cube-shaped blocks, each with a side length of 1 unit. How many blocks can fit inside the box?
   - **Steps:**
     1. Calculate the volume of the large box.
     2. Calculate the volume of one small cube.

3. Divide the volume of the large box by the volume of one small cube to find the number of cubes that fit inside.

Problem 2:

- **Scenario:** You have a fish tank shaped like a cuboid. It is 4 units wide, 6 units long and 5 units high. If the fish tank is filled with water up to a height of 3 units, what is the volume of water in the tank?

- **Steps:**
  1. Calculate the volume of the water in the tank.
  2. Use the formula for volume: Volume = length × width × height.

Problem 3:

- **Scenario:** A box is 8 units long, 4 units wide, and 3 units high. If you want to fill the box with small rectangular boxes that are 2 units long, 1 unit wide, and 1 unit high, how many small boxes will fit into the large box?

- **Steps:**
  1. Calculate the volume of the large box.
  2. Calculate the volume of one small rectangular box.
  3. Divide the volume of the large box by the volume of one small rectangular box to find the number of small boxes that fit inside.

Problem 4:

- **Scenario:** You have two cuboids. The first cuboid has dimensions 5 units × 4 units × 2 units, and the second cuboid has dimensions 2 units × 2 units × 5 units. If you combine both cuboids, what is the total volume of the combined shape?

- **Steps:**
  1. Calculate the volume of each cuboid.
  2. Add the volumes of the two cuboids to find the total volume.

3. **Draw and Calculate:**
   - Use grid paper to draw diagrams of the boxes or shapes mentioned in the problems.
   - Label the dimensions and calculate the volume for each problem.

4. **Discuss and Reflect:**
   - Share your solutions with a partner or in small groups.
   - Discuss how you approached each problem and the strategies you used to solve them.
   - Reflect on how understanding volume helps in real-life situations, such as packing, filling containers, or designing.

MEASURING TIME IN EVERYDAY LIFE

FOCAL AREA 1: MEASUREMENT OF TIME

Imagine you're helping to organise a sports day at your school. There are several events planned, like a 100-metre race, a long jump competition and a relay race. To ensure everything runs smoothly, it's essential to know how long each event will take. This information helps in scheduling the events, avoiding overlaps and ensuring that participants have enough time to rest between activities.

For example, if the 100-metre race starts at 10:00 AM and ends at 10:05 AM, you know it took 5 minutes to conduct the race. If you know how long each event takes, you can create a schedule that fits everything in, ensures the day runs smoothly and prevents delays.

In real life, knowing how to determine the time taken to conduct an event is crucial. Whether you're organising an event, planning a trip or managing your daily routine, being able to calculate the duration of activities helps you use your time effectively. It ensures that you don't miss important appointments, allows you to plan breaks and helps you avoid unnecessary stress.

REINFORCEMENT ACTIVITIES

Understanding the Concept of Time

Objective: Before we learn about measuring time, let's first explore what time means and how we experience it in our daily lives. **Activity Instructions:**

1. **Observe and Record:**
   - Look around your classroom or home and identify any objects that show time.

     This could be a clock on the wall, a wristwatch, a mobile phone or even the schedule on the board.

- Write down the current time from each of these objects.

2. **Discuss with a Partner:**
   - Pair up with a classmate and discuss the following questions:
     - What do you use time for in your daily life?
     - Why is it important to know what time it is?
     - How do you know how long something takes?

       For example, how long does it take to eat lunch or walk to school?

3. **Share Your Thoughts:**
   - After your discussion, share with the class one example of when knowing the time is important.
   - Explain why you think measuring time is helpful in that situation.

4. **Reflection:**
   - Think about how your day would be different if you didn't know what time it was or how long something took.

     Write a few sentences on how it would affect your daily activities.

DETERMINE THE TIME TAKEN TO CONDUCT AN EVENT

When we talk about determining the time taken for an event, we focus on several key aspects:

1. **Start Time and End Time:** Identifying when the event begins and when it ends.
2. **Time Intervals:** Calculating the difference between the start and end times to find the total duration.
3. **Units of Time:** Understanding and converting between different units of time such as seconds, minutes, hours and days.
4. **Tools and Methods:** Using various methods, such as clocks, stopwatches and mathematical calculations, to determine the time taken.



What is Time?

Time is a fundamental concept that measures the ongoing sequence of events from the past through the present to the future. It is a continuous, irreversible progression that allows us to order and compare events, understand durations and coordinate activities. In everyday life, time helps us structure our day, plan our activities and keep track of when things happen.

Units of time and their relationships

Time is measured in various units, each serving different purposes and scales of duration. The basic units of time include seconds, minutes, hours, days, weeks, months and years. Here's how these units relate to each other:

- **Seconds (s):** The smallest standard unit of time commonly used in everyday activities. It is the base unit in the International System of Units (SI).
- **Minutes (min):** 1 minute is equal to 60 seconds.
- **Hours (h):** 1 hour is equal to 60 minutes or 3 600 seconds.
- **Days:** 1 day is equal to 24 hours.
- **Weeks:** 1 week is equal to 7 days.
- **Months:** Typically, 1 month is around 30 or 31 days, but it varies (e.g., February has 28 or 29 days).
- **Years:** 1 year is equal to 12 months or approximately 365.25 days, accounting for leap years.

Relationships Among the Units

- 1 minute = 60 seconds
- 1 hour = 60 minutes = 3 600 seconds
- 1 day = 24 hours = 1 440 minutes = 86 400 seconds

- 1 week = 7 days = 168 hours = 10 080 minutes = 604 800 seconds
- 1 month = 30 days (varies) = 720 hours = 43 200 minutes = 2 592 000 seconds
- 1 year = 12 months = 365.25 days = 8 766 hours = 525 960 minutes = 31 557 600 seconds

Converting Between Units

Understanding the relationships between these units allows us to convert time from one unit to another.

Example 1: Converting Hours to Minutes

Problem: Convert 3 hours to minutes.

Solution

Step-by-Step

1. **Understand the conversion factor:**
   1 hour = 60 minutes
2. **Multiply the number of hours by the conversion factor:**
   3 hours × 60 minutes/hour = 180 minutes

Answer: 3 hours is equal to 180 minutes.

Example 2: Converting Minutes to Seconds

Problem: Convert 45 minutes to seconds.

Solution

Step-by-Step

Understand the conversion factor:

1 minute=60 seconds

Multiply the number of minutes by the conversion factor:

45 minutes × 60 seconds/minute = 2 700 seconds

Answer: 45 minutes is equal to 2 700 seconds.

Example 3: Converting Seconds to Hours

Problem: Convert 7 200 seconds to hours.

Solution:

Step-by-Step

1. **Understand the conversion factor:**
   1 hour=3 600 seconds
2. **Divide the number of seconds by the conversion factor:** 7 200 seconds ÷ 3 600 seconds/hour = 2 hours

Answer: 7 200 seconds is equal to 2 hours.

Example 4: Converting Hours to Seconds

Problem: Convert 1.5 hours to seconds.

Solution:

Step-by-Step

1. **Understand the conversion factors:**
   1 hour = 60 minutes
   1 minute = 60 seconds
2. **First, convert hours to minutes:**
   1.5 hours × 60 minutes/hour = 90 minutes
3. **Then, convert minutes to seconds:**
   90 minutes × 60 seconds/minute = 5 400 seconds

Answer: 1.5 hours is equal to 5 400 seconds.

ACTIVITY 4.10: Individual/Pair/Group Work

Hands-On Practical Activity: Units of Time and Their Relationships & Converting Between Units

Purpose: In this activity, you will explore different units of time, understand their relationships, and practice converting between them.

Materials Needed:

- Stopwatch or timer (you can use a mobile phone)
- Worksheet or notebook

- Pen or pencil

Activity Instructions:

1. **Understanding Units of Time:**
    - Start by listing out the different units of time we commonly use. These include seconds, minutes, hours, days, weeks, months, and years.
    - For each unit of time, write down how it relates to the next unit. For example:
        - 1 minute = 60 seconds
        - 1 hour = 60 minutes
        - 1 day = 24 hours
        - 1 week = 7 days
        - 1 month ≈ 30 days (or 4 weeks)
        - 1 year = 12 months
2. **Measuring Time:**
    - Using a stopwatch or timer, measure how long it takes you to perform a simple task, such as writing your name five times or walking across the room.
    - Record the time in seconds.
3. **Converting Time:**
    - Convert the time you recorded from seconds into minutes. Remember, 1 minute = 60 seconds.
    - If your time was less than a minute, you can express it as a fraction of a minute (e.g., 45 seconds = 45/60 minutes or 0.75 minutes).
4. **Group Challenge:**
    - Work with your classmates in small groups. Each group should think of an activity that takes about 1 hour, 30 minutes, and 15 minutes to complete.
    - After discussing as a group, convert these times into seconds.
5. **Real-Life Application:**
    - Imagine you need to plan a day's schedule. You have 4 hours of free time and want to spend it on the following activities:
        - Watching a movie (2 hours)

- Reading a book (45 minutes)
- Playing a game (30 minutes)
- Taking a walk (25 minutes)

- Convert each activity's duration into minutes, then calculate the total time in minutes.
- Check if your activities fit into the 4 hours available. If the total time exceeds 4 hours, suggest changes to your plan.

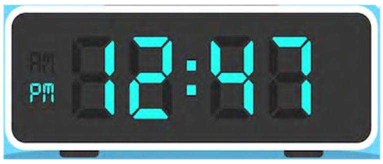
6. **Reflection:**
   - Write a short paragraph about why it's important to know how to convert between units of time. How does this skill help you in planning and managing your day?

FOCAL AREA 2: CALCULATING THE DIFFERENCE BETWEEN THE START AND END TIMES TO FIND THE TOTAL DURATION

We can calculate the time spent for an event when we know the starting and ending times of the events.

For example, study the clocks carefully;

Start Time



End Time

The two clocks show a starting time and an ending time. To calculate the time spent we will follow these steps:

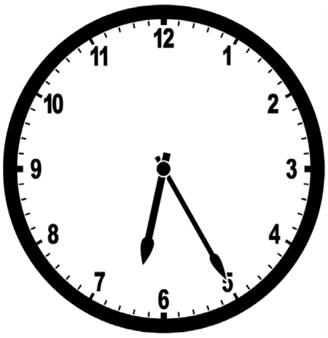
Step-by-Step Solution:

1. **Write down the start time and end time:**
   - Start time: 7:12
   - End time: 12:47
2. **Calculate the difference in minutes:**
   - From 7:12 to 12:12 is 5 hours (300 minutes)
   - From 12:12 to 12:47 is 35 minutes.

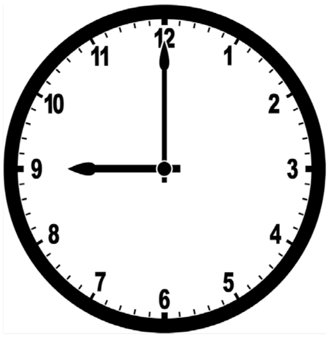
3. **Add the minutes together:**
   300 minutes + 35 minutes = 335 minutes
4. **Convert minutes to hours and minutes (optional):**
   335 minutes = 5 hours and 35 minutes

Answer: The time duration is 5 hours and 35 minutes.

Let's take a look at another example. Take a look at the two clocks carefully;



Start Time



End Time

For clocks, your first task is to be able to read the clock. The start time is 6:25 a.m. and the end time is 9:00 a.m.

Solution

Starting time is 6:25 a.m. and ending time is 9:00 a.m. How long is the time duration?

Step-by-Step Solution:

1. **Write down the start time and end time:**
   - Start time: 6:25 a.m.
   - End time: 9:00 a.m.
2. **Calculate the difference in minutes:**
   - From 6:25 a.m. to 8:25 a.m. is 2 hours (120 minutes).
   - From 8:25 a.m. to 9:00 a.m. is 35 minutes.
3. **Add the minutes together:**
   60 minutes + 60 minutes + 35 minutes = 155 minutes
4. **Convert minutes to hours and minutes (optional):** 155 minutes=2 hours and 35

Answer: The time duration is 2 hours and 35 minutes.

The use of clocks can be very tricky. You must always take into consideration the use of a.m. and p.m. In our above example, the ending time is 9:00 a.m. Assuming the end time was 9:00 p.m., the calculation would have been different. Let's take a look at the calculation.

Starting time is 6:25 a.m. and ending time is 9:00 p.m. How long is the time duration?

Step-by-Step Solution:

1. **Write down the start time and end time:**
   - Start time: 6:25 a.m.
   - End time: 9:00 p.m.
2. **Understand the difference between a.m. and p.m.:**
   - a.m. stands for "ante meridiem," which means before midday (midnight to noon).
   - p.m. stands for "post meridiem," which means after midday (noon to midnight).
3. **Calculate the time duration in two parts:**
   - From 6:25 a.m. to 12:00 p.m. (noon) is the first part.
   - From 12:00 p.m. to 9:00 p.m. is the second part.

   A. **Calculate the difference in the first part:**
      - From 6:25 a.m. to 12:00 p.m. is 5 hours and 35 minutes (6:25 a.m. to 7 a.m. is 35 minutes, 7 am to 12pm is 5 hours).

   B **Calculate the difference in the second part:**
      - From 12:00 p.m. to 9:00 p.m. is 9 hours.
4. **Add the two parts together:** 5 hours and 35 minutes + 9 hours = 14 hours and 35 minutes

Answer: The time duration is 14 hours and 35 minutes.

Explanation:

- When the end time is 9:00 a.m., it means the calculation is within the same a.m. period, spanning just a few hours.
- When the end time is 9:00 p.m., it spans from the a.m. period into the p.m. period, covering almost the entire day. This adds significantly more hours to the duration.

ACTIVITY 4.11: Individual/Pair/Group Work

Calculating the Difference Between Start and End Times to Find the Total Duration

Purpose: In this activity you will practice calculating the total duration of events by finding the difference between their start and end times.

Materials Needed:

- Clock or watch (with minute and hour hands)
- Worksheet or notebook
- Pen or pencil

Activity Instructions:

1. **Understanding Time Difference:**
   - Begin by reviewing how to read the time on a clock. Make sure you can identify the hour hand and the minute hand.
   - Discuss with your classmates why it's important to know how long an event lasts. For example, if you're cooking, you need to know when to start and stop to avoid burning the food and have it ready on time.
2. **Practice Reading Times:**
   - With a partner, take turns setting a time on a clock or watch. The other person should read the time out loud and write it down. Do this several times to make sure you're comfortable reading the time.
3. **Simple Time Difference Calculation:**
   - Choose a start time and an end time for a simple event, such as the time you start and finish a homework assignment.
   - Write down the start time and the end time. For example:
     - Start Time: 3:15 PM
     - End Time: 4:45 PM
   - Calculate the difference by counting the hours and minutes between these two times. For the example above:
     - From 3:15 PM to 4:15 PM is 1 hour.
     - From 4:15 PM to 4:45 PM is 30 minutes.
     - Total Duration = 1 hour + 30 minutes = 1 hour 30 minutes.

4. **Group Activity: Planning a School Day:**
   - In small groups, plan a mock school day. Choose start and end times for different activities like maths class, break time, lunch, and physical education.
   - Write down the start and end times for each activity.
   - Calculate the total duration of each activity by finding the difference between the start and end times.
   - Example:
     - Maths Class: Start Time: 9:00 AM, End Time: 10:30 AM. Duration = 1 hour 30 minutes.
     - Break Time: Start Time: 10:30 AM, End Time: 10:45 AM. Duration = 15 minutes.

5. **Real-Life Application:**
   - Think about an event you participated in recently, such as a birthday party, a trip or a game.

     Write down when the event started and when it ended.
   - Calculate how long the event lasted by finding the difference between the start and end times.

6. **Reflection:**
   - Reflect on why it's important to calculate the duration of events.

     How does knowing how long something takes help you manage your time better?

FOCAL AREA 3: WORD PROBLEMS INVOLVING AMOUNT OF TIME USED TO COMPLETE EVENTS

Example 1

A group of boys went to the community park to play at 10:25 a.m. They played until 11:50 a.m. How long did they play?

Solution:

1. **Write down the start time and end time:**
   - Start time: 10:25 a.m.
   - End time: 11:50 a.m.

2. **Convert the times to a 24-hour format (optional):**
   - Start time: 10:25
   - End time: 11:50
3. **Calculate the difference in minutes:**
   - From 10:25 to 11:25 is 60 minutes (1 hour).
   - From 11:25 to 11:50 is 25 minutes.
4. **Add the minutes together:**
   60 minutes+25 minutes = 85 minutes
5. **Convert minutes to hours and minutes (optional):**
   85 minutes=1 hour and 25 minutes

Answer: They walked for 1 hour and 25 minutes.

Example 2

Lisa started her homework at 4:15 p.m. and finished at 6:05 p.m. How long did she spend on her homework?

Step-by-Step Solution:

1. **Write down the start time and end time:**
   - Start time: 4:15 p.m.
   - End time: 6:05 p.m.
2. **Convert the times to a 24-hour format (optional):**
   - Start time: 16:15
   - End time: 18:05
3. **Calculate the difference in minutes:**
   - From 16:15 to 17:15 is 60 minutes (1 hour).
   - From 17:15 to 18:05 is 50 minutes.
4. **Add the minutes together:** 60 minutes + 50 minutes = 110 minutes
5. **Convert minutes to hours and minutes (optional):**
   110 minutes=1 hour and 50 minutes

Answer: She spent 1 hour and 50 minutes on her homework.

Example 3

A movie started at 7:45 p.m. and ended at 9:20 p.m. How long was the movie?

Step-by-Step Solution:

1. **Write down the start time and end time:**
   - Start time: 7:45 p.m.
   - End time: 9:20 p.m.
2. **Convert the times to a 24-hour format (optional):**
   - Start time: 19:45
   - End time: 21:20
3. **Calculate the difference in minutes:**
   - From 19:45 to 20:45 is 60 minutes (1 hour).
   - From 20:45 to 21:20 is 35 minutes.
4. **Add the minutes together:** 60 minutes + 35 minutes = 95 minutes
5. **Convert minutes to hours and minutes (optional):**
   95 minutes = 1 hour and 35 minutes

Answer: The movie was 1 hour and 35 minutes long.

Calculating Start and End Time of Events

Sometimes, we are required to determine the start or end time of events. In this case you are provided with either the end or start time and the duration (length) of the event.

Let's take a look at some examples.

Example 1

A family plans a picnic which will take 4 hours and 30 minutes. If they want to finish their picnic by 3:00 p.m., what time should they start?

Step-by-Step Solution:

1. **Write down the end time and the duration of the event:**
   - End time: 3:00 p.m.
   - Duration: 4 hours and 30 minutes.

2. **Subtract the duration from the end time to find the start time:**
3. **Subtract the minutes first:**
   - From 3:00 p.m., subtract 30 minutes:
     - 3:00 p.m. - 30 minutes = 2:30 p.m.
4. **Subtract the hours next:**
   - From 2:30 p.m., subtract 4 hours:
     - 2:30 p.m. - 4 hours = 10:30 a.m.

Answer: The family should start their picnic at 10:30 a.m. to finish by 3:00 p.m.

Example 2

A movie starts at 7:15 p.m. and lasts for 2 hours and 45 minutes. What time will the movie end?

Step-by-Step Solution:

1. **Write down the start time and the duration of the event:**
   - Start time: 7:15 p.m.
   - Duration: 2 hours and 45 minutes.
2. **Add the duration to the start time to find the end time:**
3. **Add the minutes first:**
   - From 7:15 p.m., add 45 minutes:
     - 7:15 p.m. + 45 minutes = 8:00 p.m.
4. **Add the hours next:**
   - From 8:00 p.m., add 2 hours:
     - 8:00 p.m. + 2 hours = 10:00 p.m.

Answer: The movie will end at 10:00 p.m.

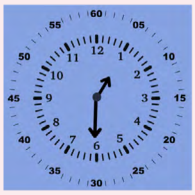
ACTIVITY 4.12: Individual/Pair/Group Work

Calculating Ending Time and Starting Time of Events

Purpose: In this activity, you will learn how to calculate the starting time or ending time of events by using the duration of the event.

Materials Needed:

- Clock or watch (with minute and hour hands)
- Worksheet or notebook
- Pen or pencil



Activity Instructions:

1. **Understanding Time Calculation:**
   - Discuss with your classmates why it's important to know how to calculate the ending or starting time of an event. For example, if you know a movie is 2 hours long and it starts at 7:00 PM, you can figure out when it will end.

2. **Practice with Duration:**
   - Work with a partner. One of you will choose a start time and a duration for an event. The other will calculate the end time.
   - Example:
     - Start Time: 2:30 PM
     - Duration: 1 hour 45 minutes
     - Calculate the end time:
     - From 2:30 PM, add 1 hour to reach 3:30 PM.
     - Then add 45 minutes to reach 4:15 PM.
     - End Time: 4:15 PM.

3. **Calculating Ending Time:**
   - Your teacher will give you a start time and a duration. Your task is to calculate the ending time.
   - Example:
     - Start Time: 11:00 AM
     - Duration: 2 hours 30 minutes
     - End Time: (Calculate and write down the answer)
   - Repeat this with different start times and durations.

4. **Calculating Starting Time:**
   - Now, you'll do the reverse. Your teacher will give you an end time and a duration. Your task is to calculate the starting time.

- Example:
  - End Time: 5:00 PM
  - Duration: 2 hours 15 minutes
  - Start Time: (Calculate and write down the answer)
- Repeat this with different end times and durations.

5. **Real-Life Scenario:**
   - Imagine you have a sports practice that lasts 1 hour and 20 minutes. If you want to be done by 6:00 PM, what time should you start?
   - Write down the end time (6:00 PM) and subtract the duration (1 hour 20 minutes) to find the start time.

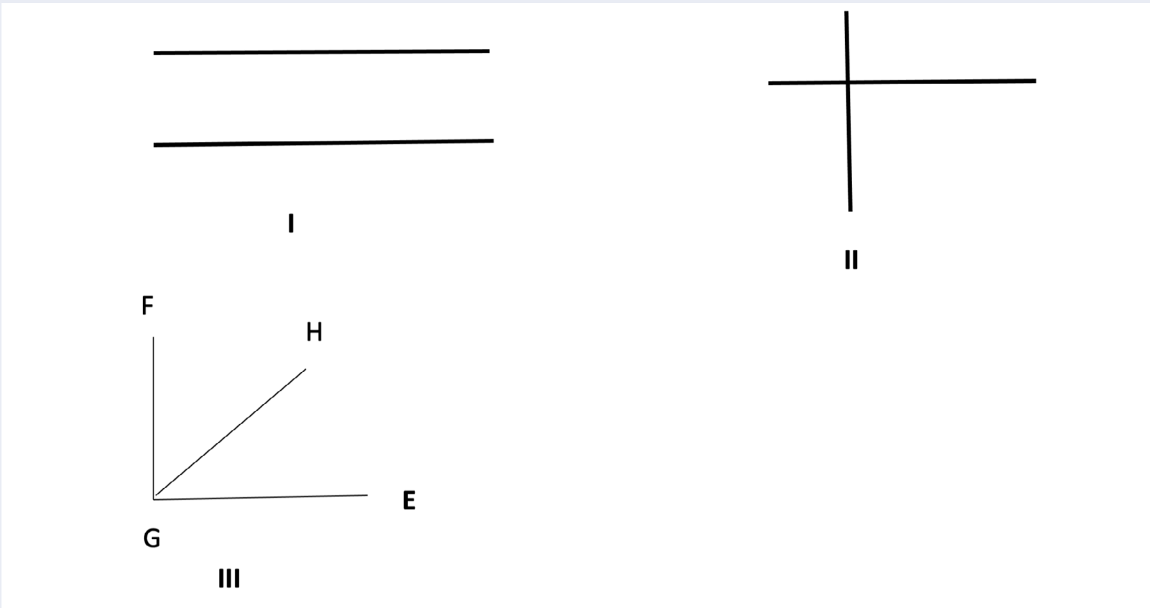
6. **Group Activity: Event Planning:**
   - In groups, plan a day with several activities like a study session, break and playtime.
   - Decide how long each activity will last.
   - Calculate the start and end times for each activity based on the duration.
   - Example:
     - Study Session: 9:00 AM - 10:30 AM (Duration: 1 hour 30 minutes)
     - Break: 10:30 AM - 10:45 AM (Duration: 15 minutes)
     - Playtime: Calculate when playtime starts and ends if it lasts for 1 hour.

7. **Reflection:**
   - Reflect on how calculating starting and ending times helps you plan your day effectively. How can this skill help you in managing your daily activities better?

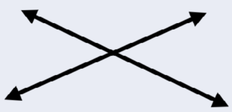
REVIEW QUESTIONS

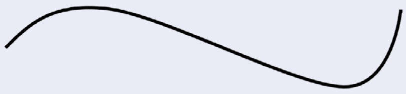
A

1. Name two types of lines commonly used in geometry.
2. Look at the diagram below and state the types of lines they represent.



3. State whether the following is TRUE or FALSE.
   i. A line is a set of points in a straight path that extends in opposite directions without ending.
   ii. A line has a fixed length.
   iii. Horizontal lines are parallel to the y-axis
   iv. A ray extends in one direction.
4. Match the following lines with their definition.

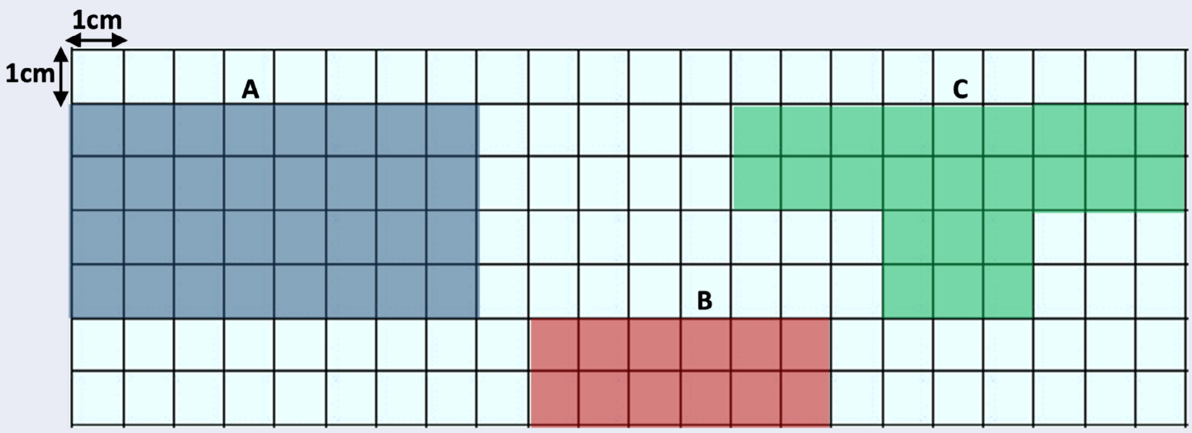
a. 	Vertical line
b. 	Curved line

c. 	Intersecting lines
d. 	Parallel lines

5. Compare and contrast a straight line and a curved line. What are the main differences and similarities?
6. What is the difference between parallel lines and perpendicular lines? Provide an example of each.
7. Compare a vertical line and a horizontal line.
8. What are the applications of lines and their properties in real life? Create a real-life situation using properties of lines.

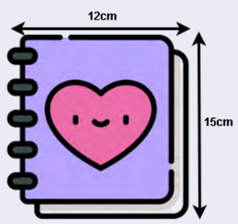
B.

1. Determine the area of the following shapes



Solve the following word problems:

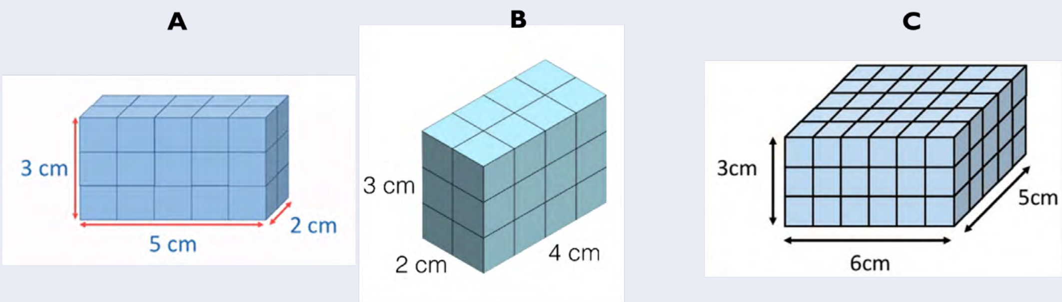
2. Korkor wants to cover the entire face of her pocket notebook with a decorative sticker. If the face of the notebook has dimensions 15cm by 12cm, calculate the area of the sticker needed to cover the notebook.



3. A large rectangular dining table has sides of 7 m and 4 m. What is the perimeter of the table? What is its area?

4. A square-shaped play ground has length 23 m. What is the area of that play ground?

5. Determine the volume of the following shapes



6. Calculate the volume of the following boxes.

7. Solve the following word problems

   i. Mansa has an aquarium in the shape of a cuboid. The aquarium measures 2 metres in length, 1 metre in width and 1.5 metres in height. What is the volume of the aquarium in cubic metres?

   ii. John uses a rectangular storage container to keep his toys. The container has a length of 3 metres, a width of 2 metres and a height of 1.5 metres. What is the volume of the storage container in cubic metres?

   iii. A shipping company uses a rectangular box to send packages. The dimensions of the box are 300 cm in length, 200 cm in width, and 150 cm in height.

   What is the volume of the shipping box in cubic centimetres?

iv. A community centre has a rectangular swimming pool that measures 25 metres in length, 10 metres in width and 2 metres in depth. What is the volume of the swimming pool in cubic metres?

v. A cereal box is in the shape of a cuboid with a length of 20 centimetres, a width of 8 centimetres and a height of 30 centimetres. What is the volume of the cereal box in cubic centimetres?

C

1. Deledem left home for school at half past six in the morning. She walked for 55minutes to get to her school. At what time did Deledem get to school?
2. Sarah started her homework at 4:20 p.m. and finished it at 6:55 p.m. How long did she spend on her homework?
3. A football match started at 3:30 p.m. and lasted for 1 hour and 45 minutes. What time did the match end?
4. John began his morning run at 6:45 a.m. He ran for 1 hour and 20 minutes. What time did he finish his run?
5. The school bus picks up students at 7:15 a.m. and drops them off at school at 8:05 a.m. How long is the bus ride?
6. A workshop is scheduled to last for 3 hours and 15 minutes. If it needs to end by 2:30 p.m., what time should it start?

ACKNOWLEDGEMENTS

Ghana Education Service (GES)

List of Contributors

Name	Institution
Gideon Kwame Ahiadziefe	OLA SHS
Evelyn Adjei	St. Vincent College of Education, Yendi
Adablah Mensah	St. Paul's Senior High School and Minor Seminary
Juliana Opare	St. Paul's Senior High School and Minor Seminary