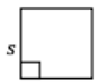
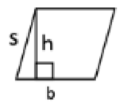
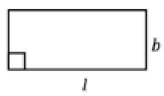
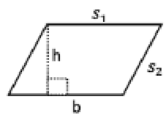
Mathematics, Grade 9, Perimeter and Area

Revision

- Perimeter of a polygon: The sum of lengths of its sides or the distance along the sides of a shape.
- Area of a polygon: The amount of space covered by the polygon or the size of the flat surface enclosed by the polygon.
- $1cm = 10mm$ then $1cm^2 = 10mm \times 10mm = 100mm^2$
- $1m = 100\ cm$ then $1m^2 = 100cm \times 100cm = 10000cm^2$

Name	Shape	Perimeter	Area
Square		$P = 4s$	$A = s^2$
Rhombus		$P = 4s$	$A = base \times height$ $= b \times h$
Rectangle		$P = 2(l \times b)$	$A = length \times breadth$ $= l \times b$
Parallelogram		$P = 2(s_1 \times s_2)$	$A = base \times height$ $= b \times h$

Note

- A square is a regular polygon (All sides and all angles are equal). The formulae for calculating the perimeter of a square and a rhombus are the same.
- A rectangle, a parallelogram and a rhombus are irregular polygons. The formulae for calculating the perimeter of a square and a rhombus are the same.
- The formulae for calculating the perimeter of a square and a rhombus are the same.

Activity 1: Worked examples:

Example 1:

a) Calculate the perimeter and area of square with a length of 8 cm.

b) Convert answers in (a) to mm or mm^2

Solutions:

a) Perimeter $= 4s = 4 \times 8\ cm = 32cm$ and
Area $= s^2 = (8\ cm)^2 = 64\ cm^2$

b) $32\ cm = (32\ \times 10)mm = 320\ mm$ and
$64\ cm^2 = (64\ \times 100)mm^2 = 6\ 400\ mm^2$

Example 2: The area of a rectangle is $72\ cm^2$ and its length is 8 cm.

a) What is its breadth?

b) Express the answer in m.

Solution:

a) $(length \times breadth = Area\ of\ a\ rectangle$

$$8\ cm \times breadth = 72\ cm^2$$

$$breadth = \frac{72\ cm^2}{8cm}$$

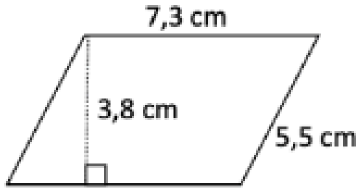
$$= 9\ cm$$

b) $9\ cm = \left(\frac{9}{100}\right)m = 0{,}09\ m$

Example 3: The diagram alongside shows a parallelogram with sides 7,3 cm; 5,5 cm and height 3,8 cm.

a) Calculate the perimeter and area of the parallelogram.

b) Convert area to m^2



Solution:

a) Perimeter = $2(s_1 + s_2)\ = 2(7{,}3\ cm + 5{,}5\ cm) = 25{,}6\ cm$
Area $= b \times h = 7{,}3\ cm \times 3{,}8\ cm = 27{,}74\ cm^2$

b) $27{,}74\ cm^2 = 27{,}74 \times 0{,}0001\ m^2 = 0{,}002774m^2$

Activity 2:

Calculate the perimeter and the height of a rhombus with base length 3,9 cm and area $= 31{,}2\ cm^2$.

Solution: $Perimeter = 4s$

$$= 4 \times 3{,}9\ cm$$

$$= 15{,}6\ cm$$

$$base \times height = Area\ of\ rhombus$$

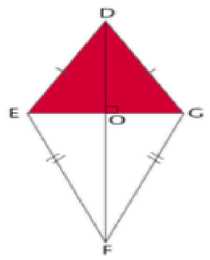
$$3{,}9\ cm \times height = 31{,}2\ cm^2$$

$$height = \frac{31{,}2\ cm^2}{3{,}9\ cm}$$

$$= 8\ cm$$

Kite

To calculate the area of a kite, we use one of its properties, namely that the diagonals of a kite are perpendicular.



Area of a kite DEFG = Area of ΔDEG + Area of ΔEFG

$= \frac{1}{2}(b \times h) + \frac{1}{2}(b \times h)$

$= \frac{1}{2}(EG \times OD) + \frac{1}{2}(EG \times OF)$ Take out common factor

$= \frac{1}{2} EG(OD + OF)$ OD + OF = DF

$= \frac{1}{2} EG \times DF$

Explain the above statement practically using flash cards to show how to derive a formula for the area of a kite

Area of a kite = $\frac{1}{2}(diagonal\ 1 \times diagonal\ 2)$

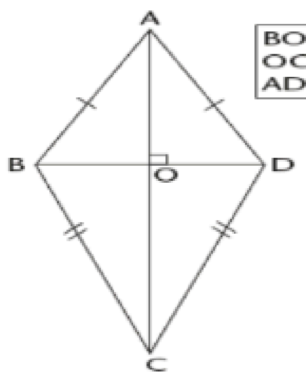
1. Calculate the area of kite with the following diagonals. Give your answers in m^2
   (a) $150\ mm$ and $200\ mm$ (b) $25\ cm$ and $40\ cm$

   Solutions:

   (a) Area= $\frac{1}{2}(d_1 \times d_2)$
   $= \frac{1}{2}(150\ mm \times 200\ mm)$
   $= 15\ 000\ mm^2$
   $= 0{,}015\ m^2$

   (b) Area= $\frac{1}{2}(d_1 \times d_2)$
   $= \frac{1}{2}(25\ cm \times 40\ cm)$
   $= 500\ cm^2$
   $= 0{,}05\ m^2$

2. Calculate the area of the following kite.



BO = OD = 6 cm
OC = 15 cm
AD = 10 cm

Solution: $AO^2 + DO^2 = AD^2$ Pythagoras

$AO^2 = (10\ cm)^2 - (6\ cm)^2$

$= 100\ cm^2 - 36 cm^2$

$= 64\ cm^2$

$\therefore \quad AO = 8\ cm$

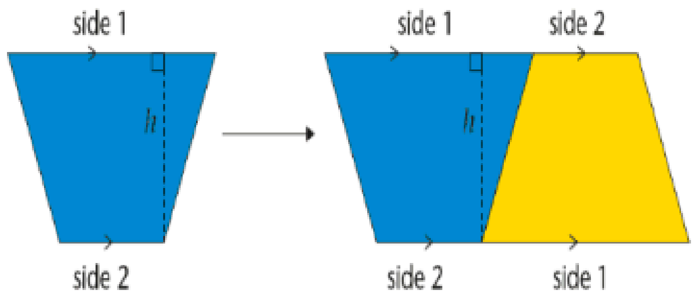
Area= $\frac{1}{2}(d_1 \times d_2)$

$= \frac{1}{2}((6+6)\ cm \times (15+8) cm)$

$= \frac{1}{2}(12\ cm \times 23\ cm)$

$= 138\ cm^2$

A trapezium has two parallel sides. If tessellate (tile) two trapeziums as shown in the diagram below, we form a parallelogram. The yellow trapezium is the size of the blue one.

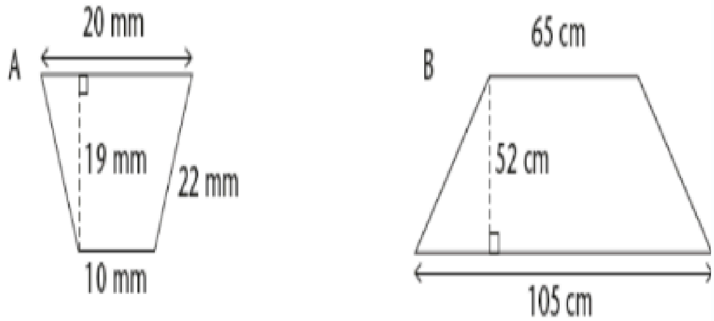


Use the formula for the area of a parallelogram to work out the formula for the area of a trapezium as follows:

Area of parallelogram= base x height
= (side 1 + side 2) x height
Area of a trapezium = $\frac{1}{2}$ $area\ of\ parallelogram$ = $\frac{1}{2}$ $(side\ 1 + side\ 2) \times height$

Are of a trapezium = $\frac{1}{2}(sum\ of\ parallel\ sides) \times height$

Activity: Calculate the area of the following trapeziums:



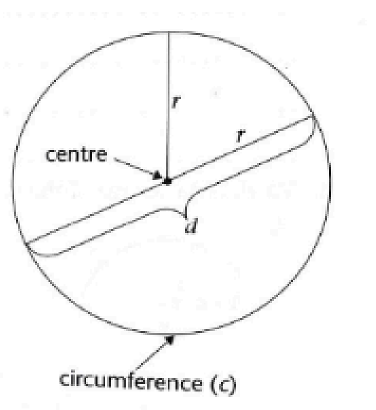
Solution: Figure A

Area = $\frac{1}{2}$(sum of parallel sides)× height
$= \frac{1}{2}(10\ mm + 20\ mm) \times 19mm$
$= \frac{1}{2}(30\ mm \times 19\ mm)$
$= 285mm^2$
$= 2{,}85cm^2$

Figure B
Area = $\frac{1}{2}$(sum of parallel sides)× height
$= \frac{1}{2}(105\ cm + 65\ cm) \times 52\ cm$
$= \frac{1}{2}(170\ cm \times 52\ cm)$
$= 4420\ cm^2$
$= 442\ 000\ mm^2$

- The perimeter of a circle is called the **circumference** of a circle.
- **Radius** (r) : distance from the centre
- **Diameter** (d) distance across the circle through the centre

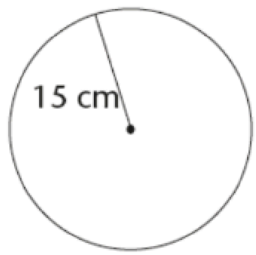
Ask learners to name parts of the circle.



Note: Emphasise the following:

- d = 2r and r = $\frac{1}{2}d$
- Circumference of a circle (c) = $2\pi r$
- Area of a circle (A) = πr^2
- $\pi \approx 3{,}14 \; or \; \frac{22}{7}$

1. Calculate:



a) the perimeter (circumference) of the circle.
b) area of the circle below:

Solutions:

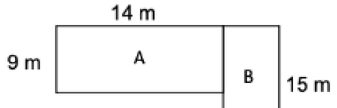
a) P = $2\pi r$
$= 2 \times 3{,}14 \times 15 \; cm$
$= 94{,}2 \; cm$

b) A = πr^2
$= \pi(3{,}14 \; cm)^2$
$= 3{,}14 \times 225 \; cm^2$
$= 706{,}5 \; cm^2$

2. Calculate the radius of the circle with a circumference of $206 \; mm$. (round off answer to one decimal place)

Solution: $2\pi r = P$
$2 \times 3{,}14 \times r = 206 \; mm$
$6{,}28r = 206 \; mm$
$r = 32{,}8 \; mm$

3. Use the figure below to:



$$= 46\ m + 46\ m - 18\ m$$
$$= 74\ m$$

b) $A =$ Area of rectangle D + Area of rectangle E

$$= (l \times b) + (l \times b)$$
$$= (9\ m \times 14\ m) + (15\ m \times 8\ m)$$
$$= 126\ m^2 + 120\ m^2$$
$$= 246\ m^2$$

Present the following activity to learners:

- The square below measures $1\ cm \times 1\ cm$:

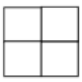
Calculate the perimeter and area of the square.
Solution:

$Perimeter = 4s$ and $Area = s^2$

$= 4 \times 1\ cm$ $\quad$ $= (1\ cm)^2 \quad or\ 1\ cm \times 1\ cm$

$= 4cm$ $\quad$ $= 1\ cm^2$

- Now if we double (**Doubling means to multiply by 2)** the dimensions of original square, the new square measures $2\ cm \times 2cm$. The shape of the new square would be as follows:



Calculate the perimeter and the area of the new square.

Solution:

$Perimeter = 4s$ and $Area = s^2$

$= 4 \times 2\ cm$ $\quad$ $= (2\ cm)^2 \quad or\ 2\ cm \times 2\ cm$

$= 8\ cm$ $\quad$ $= 4\ cm^2$

- What do you observe about the perimeter and the area of original square and the new square?
  Solution:
  - The perimeter of the new square is $2 \times$ perimeter of the original square.
  - The area of the new square is $4 \times$ area of the original square.

- Is the observation **TRUE** for **ALL** 2D figures?