Perimeter and Area of Plane Figure

Units of Area

$1\ cm^2 = 100\ mm^2$

$= \frac{1}{10\,000}\ m^2$

$1\ m^2 = 10\,000\ cm^2$

$= \frac{1}{10\,000}\ ha$

$= \frac{1}{1\,000\,000}\ km^2$

$1\ ha = 10\,000\ m^2$

$1\ km^2 = 100\ ha$

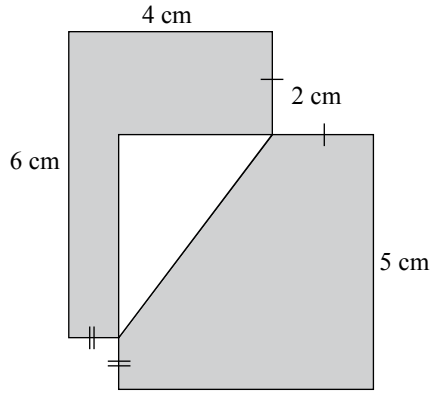
$= 1\,000\,000\ m^2$

Perimeter and Area of Plane Figures

	Shape	***Area*** (A)	***Perimeter*** (P)
(a)	**Square**	A = length × length $= \boldsymbol{x^2}$	P = 4 × length $= \boldsymbol{4x}$
(b)	**Rectangle**	A = length × breadth $= \boldsymbol{l \times b}$	P = 2(length + breadth) $= \boldsymbol{2(l + b)}$
(c)	**Triangle**	$A = \frac{1}{2} \times$ base × height $= \boldsymbol{\frac{1}{2} \times b \times h}$	P = sum of all the 3 sides $= \boldsymbol{a + b + c}$
(d)	**Circle**	$A = \frac{1}{2} \times \pi \times$ radius^2 $= \boldsymbol{\frac{1}{2}\pi r^2}$	P = 2 × π × radius or π × diameter $= \boldsymbol{2\pi r}$ or $\boldsymbol{\pi d}$
(e)	**Parallelogram**	A = base × height $= \boldsymbol{b \times h}$	P = sum of all the 4 sides $= \boldsymbol{2(a + b)}$
(f)	**Trapezium**	$A = \frac{1}{2} \times$ height × sum of parallel sides $= \boldsymbol{\frac{1}{2}(a + b)h}$	P = sum of all the 4 sides $= \boldsymbol{a + b + c + d}$

Example 1

A square paper is partially overlapped with a rectangular card as shown in the figure.



Find
(a) the area of the unshaded region,
(b) the area of the shaded region.

Solution: (a) Base of the unshaded triangle = (5 − 2) cm
= 3 cm

Height of the unshaded triangle = (6 − 2) cm
= 4 cm

Area of the unshaded region = area of the unshaded triangle
$= \frac{1}{2} \times$ base × height
$= \frac{1}{2} \times 3$ cm × 4 cm
= 6 cm^2

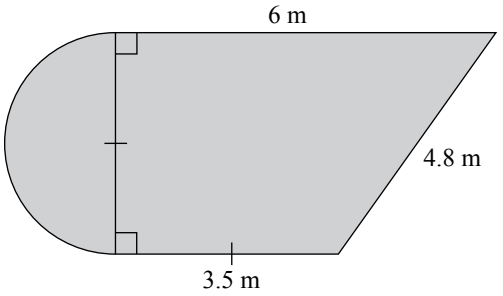
(b) Area of the rectangular card = length × breadth
= 4 cm × 6 cm
= 24 cm^2

Area of the square paper = 5 cm × 5 cm
= 25 cm^2

Area of the shaded region = area of the rectangular card + area of the square paper − 2 × area of the unshaded triangle
= 24 + 25 − 2 × 6
= 24 + 25 − 12
= 37 cm^2

Example 2

The figure shows a hall comprising two parts, a semicircle and a trapezium.



Find
(a) the perimeter of the hall,
(b) the area of the hall.

[Take $\pi = \frac{22}{7}$]

Solution: (a) Radius of the semicircle = (3.5 ÷ 2) m
= 1.75 m

Circumference of the semicircle (curved) $= \frac{1}{2} \times 2 \times \pi \times$ radius
$= \frac{22}{7} \times 1.75$
= 5.5 m

Perimeter of the hall = 5.5 + 3.5 + 4.8 + 6
= 19.8 m

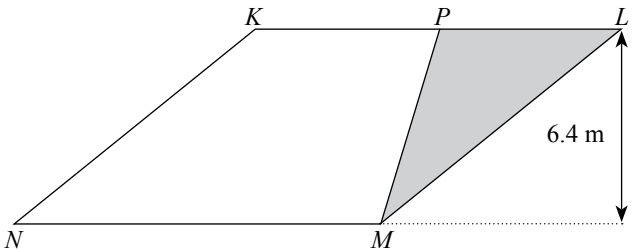
(b) Area of the semicircle $= \frac{1}{2}\pi r^2$
$= \frac{1}{2} \times \frac{22}{7} \times 1.75^2$
$= 4\frac{13}{16}$ m^2

Area of the trapezium $= \frac{1}{2} \times (a + b) \times h$
$= \frac{1}{2} \times (3.5 + 6) \times 3.5$
$= 16\frac{5}{8}$ m^2

Area of the hall = area of the semicircle + area of the trapezium
$= 4\frac{13}{16} + 16\frac{5}{8}$
$= 21\frac{7}{16}$ m^2
= 21.4 m^2 (3 s.f.)

Example 3

In the figure, the area of the parallelogram $KLMN$ is 76.8 m^2.
The area of the trapezium $KPMN$ is $\frac{3}{4}$ of the area of the parallelogram.



Find
(a) the length of NM,
(b) the length of KP.

Solution: (a) Area of the parallelogram = base × height

$$NM \times 6.4 = 76.8 \text{ m}^2$$
$$NM = \frac{76.8}{6.4}$$
$$= 12 \text{ m}$$

(b) Area of the trapezium = $\frac{3}{4}$ × area of the parallelogram

$$= \frac{3}{4} \times 76.8$$
$$= 57.6 \text{ m}^2$$

Area of the trapezium = $\frac{1}{2} \times (KP + NM) \times$ height

$$\frac{1}{2} \times (KP + NM) \times \text{height} = 57.6 \text{ m}^2$$
$$\frac{1}{2} \times (KP + 12) \times 6.4 = 57.6$$
$$KP + 12 = \frac{57.6 \times 2}{6.4}$$
$$KP + 12 = 18$$
$$KP = 18 - 12$$
$$= 6 \text{ m}$$