AREA & VOLUME (Q 1, PAPER 2)

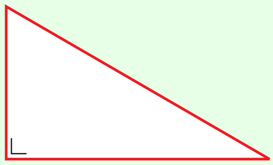
LESSON NO. 1: AREA OF REGULAR FLAT SHAPES

2007

1 (a) The right-angled triangle shown in the diagram has sides of length 10 cm and 24 cm.

(i) Find the length of the third side.

(ii) Find the length of the perimeter of the triangle.



SOLUTION

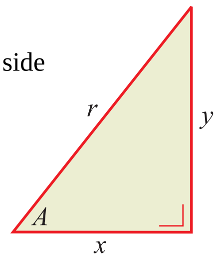
1 (a) (i)

3. **RIGHT-ANGLED TRIANGLES**

PYTHAGORAS

One of the angles in a right-angled triangle is 90°. The side opposite this angle is called the **hypotenuse**.
Pythagoras' theorem applies to right-angled triangles.

$x^2 + y^2 = r^2$ **3**



$r^2 = 10^2 + 24^2$

$\Rightarrow r^2 = 100 + 576 = 676$

$\therefore r = \sqrt{676} = 26$

1 (a) (ii)

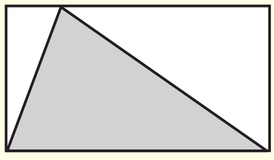
Perimeter P = 10 cm + 24 cm + 26 cm = 60 cm

2006

1 (a) The diagram shows a rectangle of length 42 cm.
The area of the rectangle is 966 cm^2.

(i) Find the height of the rectangle.

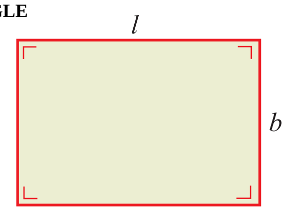
(ii) Find the area of the shaded triangle.



SOLUTION

1 (a) (i)

1. **RECTANGLE**



l: Length
b: Breadth

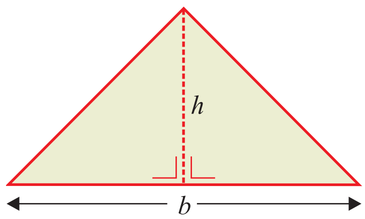
$A = l \times b$
$P = 2l + 2b = 2(l + b)$ **1**

$A = 966$ cm^2
$l = 42$ cm
$b = ?$

$$A = l \times b \Rightarrow b = \frac{A}{l} = \frac{966}{42} = 23 \text{ cm}$$

1 (a) (ii)

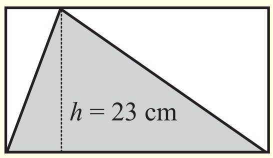
4. **NON RIGHT-ANGLED TRIANGLES**



b: Base
h: Height

$A = \frac{1}{2}bh$ **4**

$$A = \tfrac{1}{2}bh = \tfrac{1}{2}(42)(23) = 483 \text{ cm}^2$$

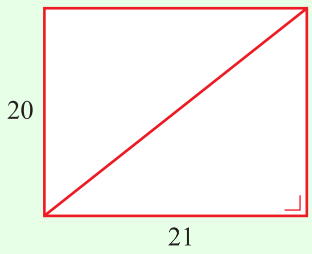


2005

1 (a) A rectangle has length 21 cm and width 20 cm.

(i) Find the area of the rectangle.

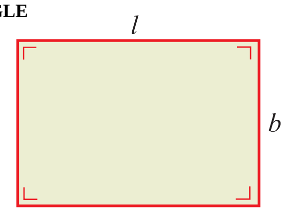
(ii) Find the length of the diagonal.



SOLUTION

1 (a) (i)

1. **RECTANGLE**



l: Length
b: Breadth

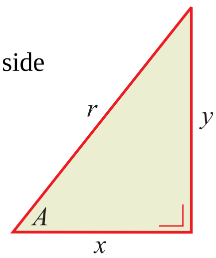
$A = l \times b$
$P = 2l + 2b = 2(l + b)$ 1

$l = 21$ cm, $b = 20$ cm

$A = l \times b = 21 \times 20 = 420 \text{ cm}^2$

3. **RIGHT-ANGLED TRIANGLES**
PYTHAGORAS
One of the angles in a right-angled triangle is 90°. The side opposite this angle is called the **hypotenuse**.
Pythagoras' theorem applies to right-angled triangles.

$x^2 + y^2 = r^2$ 3

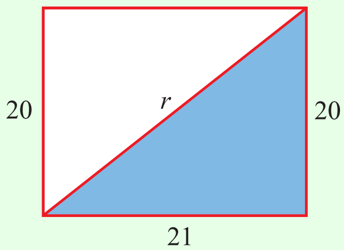


1 (a) (ii)

$r^2 = 20^2 + 21^2$

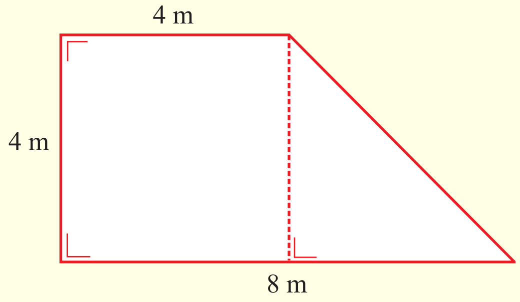
$\Rightarrow r^2 = 400 + 441 = 841$

$\therefore r = \sqrt{841} = 29 \text{ cm}$

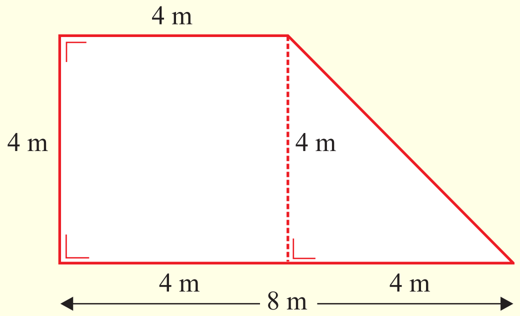


2004

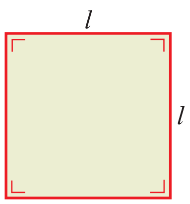
1 (a) Calculate the area of the figure in the diagram.



SOLUTION



2. SQUARE



l: Length

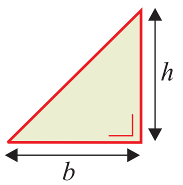
$A = l \times l = l^2$

$P = 4l$ **2**

AREA OF A RIGHT-ANGLED TRIANGLE

You can find the area, A, by multiplying half the base, b, by the perpendicular height, h.

$A = \frac{1}{2}bh$ **4**



Area of figure = Area of square + Area of right-angled triangle

Area of square: $A_1 = l \times l = 4 \times 4 = 16 \text{ m}^2$

Area of right-angled triangle: $A_2 = \frac{1}{2}bh = \frac{1}{2}(4)(4) = 8 \text{ m}^2$

Total Area: $A = A_1 + A_2 = 16 + 8 = 24 \text{ m}^2$

2003

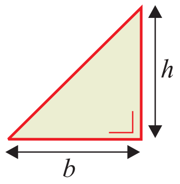
1 (a) A right-angled triangle has sides of length 8 cm, 15 cm and 17 cm. Find its area.

SOLUTION

AREA OF A RIGHT-ANGLED TRIANGLE

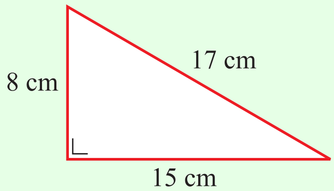
You can find the area, A, by multiplying half the base, b, by the perpendicular height, h.

$A = \frac{1}{2}bh$ **4**



The longest side is the hypotenuse.

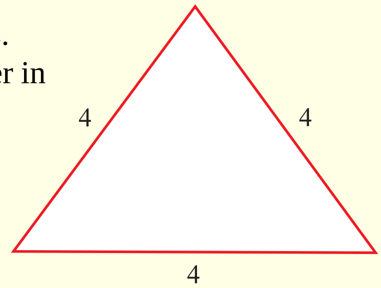
$A = \frac{1}{2}bh = \frac{1}{2}(15)(8) = 60 \text{ cm}^2$



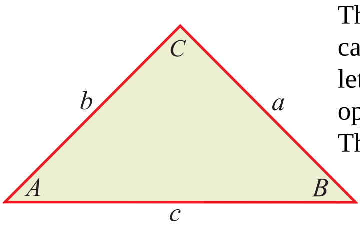
2002

1 (a) Each side of an equilateral triangle measures 4 units. Calculate the area of the triangle, giving your answer in surd form.

Note: Area of a triangle $= \frac{1}{2}ab\sin C$.



SOLUTION



The angles in triangles are represented by capital letters. Sides are represented by small letters. Side a is opposite angle A, side b is opposite angle B and so on.

The area, A, is given by the formula:

$A = \frac{1}{2}ab\sin C$ **5**

This formula is on page 6 of the tables.

REMEMBER IT AS:

Area = $\frac{1}{2} \times$ Product of 2 sides $\times$ Sine of the included angle

Formula **5** can be written in three ways:

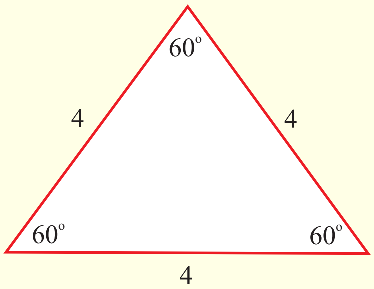
$$\text{Area } = \frac{1}{2}ab\sin C = \frac{1}{2}ac\sin B = \frac{1}{2}bc\sin A$$

All the angles are the same in an equilateral triangle.

$A = \frac{1}{2}(4)(4)\sin 60^\circ$

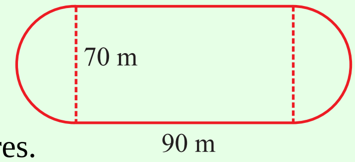
$\Rightarrow A = 8\sin 60^\circ = 8 \times \frac{\sqrt{3}}{2}$

$\therefore A = 4\sqrt{3}$ square units



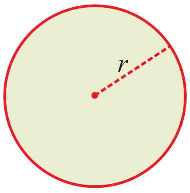
2001

1 (a) A running track is made up of two straight parts and two semicircular parts as shown in the diagram. The length of each of the straight parts is 90 metres. The diameter of each of the semicircular parts is 70 metres. Calculate the length of the track correct to the nearest metre.



SOLUTION

6. **CIRCLE**



L: Length of Circumference
r: Radius

$L = 2\pi r$ 7

$A = \pi r^2$ 8

PERIMETER OF THE TRACK:

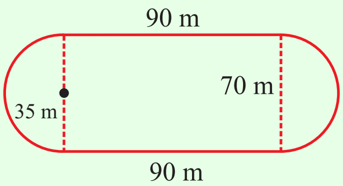
Straight parts = 90 m + 90 m = 180 m

Two half-circles = Full circle: r = 35 m

$L = 2\pi r \Rightarrow L = 2\pi(35)$

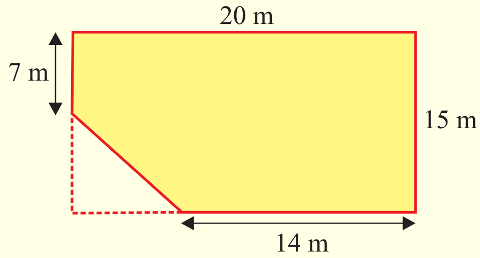
$\therefore L = 70\pi = 219.9$ m

Perimeter $P = 180 + 219.9 = 400$ m



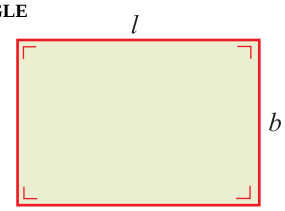
2000

1 (a) Calculate the area of the shaded region in the diagram.



SOLUTION

1. **RECTANGLE**



l: Length
b: Breadth

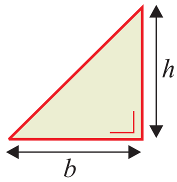
$A = l \times b$

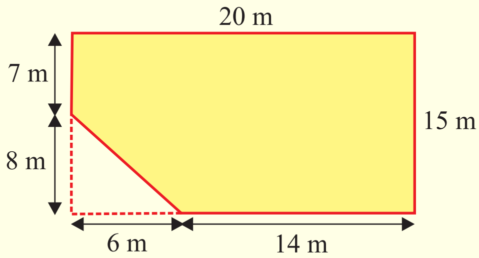
$P = 2l + 2b = 2(l + b)$ 1

AREA OF A RIGHT-ANGLED TRIANGLE

You can find the area, *A*, by multiplying half the base, *b*, by the perpendicular height, *h*.

$A = \frac{1}{2}bh$ 4





Shaded area (A) = Area of rectangle (A_1) – Area of right-angled triangle (A_2)

Area of rectangle: $A_1 = l \times b = 20 \times 15 = 300 \text{ m}^2$

Area of right-angled triangle: $A_2 = \frac{1}{2}bh = \frac{1}{2}(6)(8) = 24 \text{ m}^2$

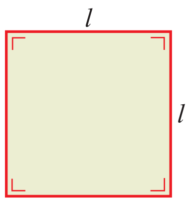
Shaded Area: $A = A_1 - A_2 = 300 - 24 = 276 \text{ m}^2$

1999

1 (a) The area of a square is 36 cm^2.
Find the length of a side of the square.

SOLUTION

2. **SQUARE**



l: Length

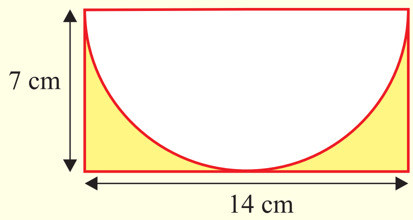
$A = l \times l = l^2$
$P = 4l$ **2**

$A = l^2 \Rightarrow 36 = l^2$

$\therefore l = \sqrt{36} = 6$ cm

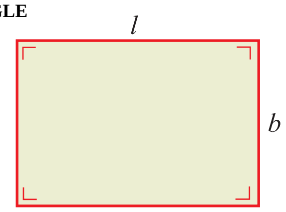
1998

1 (a) A rectangular piece of metal measures 7 cm by 14 cm.
A semi-circular section with radius of length 7 cm is removed.
Calculate the area of the remaining piece of metal.
Take $\pi = \frac{22}{7}$.



SOLUTION

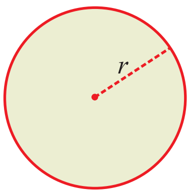
1. **RECTANGLE**



l: Length
b: Breadth

$A = l \times b$
$P = 2l + 2b = 2(l + b)$ **1**

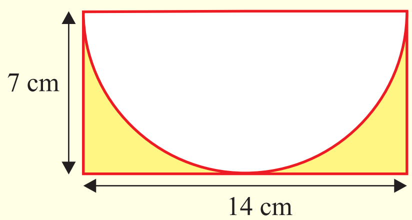
6. **CIRCLE**



L: Length of Circumference
r: Radius

$L = 2\pi r$ **7**

$A = \pi r^2$ **8**



Shaded area (A) = Area of rectangle (A_1) – Area of half the circle (A_2)

Area of rectangle: $A_1 = l \times b = 14 \times 7 = 98$ cm^2

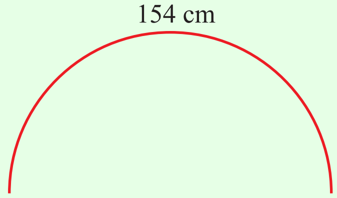
Area of half circle: $A_2 = \frac{1}{2}\pi r^2 = \frac{1}{2}(\frac{22}{7})(7)^2 = 77$ cm^2

Shaded area: $A = A_1 - A_2 = 98 - 77 = 21$ cm^2

1996

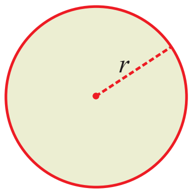
1 (a) A piece of wire of length 154 cm is in the shape of a semicircle. Find the radius length of the semicircle.

Take $\pi = \frac{22}{7}$.



SOLUTION

6. **CIRCLE**



L: Length of Circumference
r: Radius

$L = 2\pi r$ **7**

$A = \pi r^2$ **8**

The length of the circumference of a semicircle is given by the formula πr.

SEMICIRCLE: $L = 154$ cm, $\pi = \frac{22}{7}$

$L = \pi r \Rightarrow 154 = \frac{22}{7} r$

$\therefore r = \dfrac{154 \times 7}{22} = 49$ cm