TEST 9 Perimeter and Area of Simple Geometric Figures

Marks: /60

Time: 1 hour 30 minutes

Name: ..... Date: .....

INSTRUCTIONS TO CANDIDATES

Section A (30 marks) **Time: 45 minutes**

1. Answer **all** the questions in this section.
2. Calculators may **not** be used in this section.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [ ] at the end of each question.

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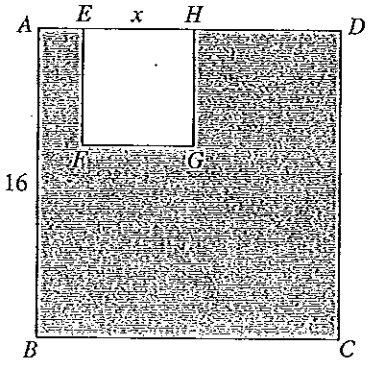
1 *ABCD* is a square of side 16 cm and *EFGH* is a square of side x cm. Given that the shaded area is 220 cm^2, find the value of x.



Answer $x =$ ..... [3]

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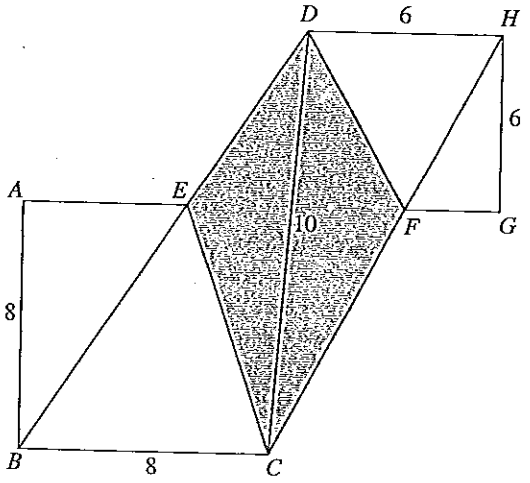
2 In the diagram, $ABCE$ and $DFGH$ are trapeziums. AE, BC, DH and FG are parallel. $A\hat{B}C = B\hat{C}D = C\hat{D}H = D\hat{H}G = 90°$. $AB = BC = 8$ cm, $DH = HG = 6$ cm and $CD = 10$ cm. Calculate the area of the shaded region.

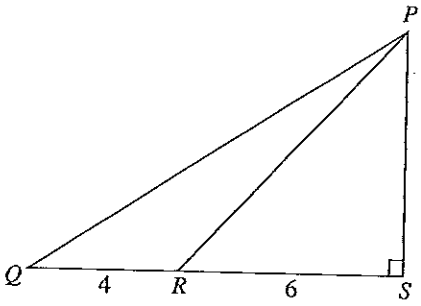


Answer ..... cm^2 [3]

3 In the diagram, $QR = 4$ cm, $RS = 6$ cm and QRS is perpendicular to PS. The area of the triangle PQR is 12.4 cm^2. Calculate

(a) the length of PS,

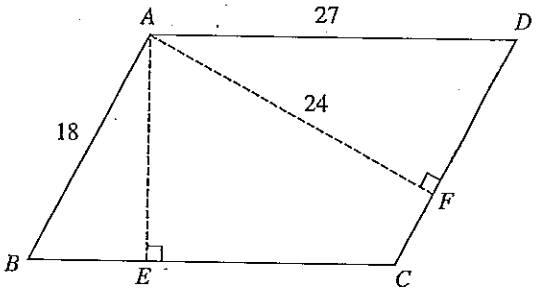
(b) the area of triangle PRS.



Answer (a) PS = ... cm [2]

(b) ..... cm^2 [1]

4 $ABCD$ is a parallelogram. Given that $AB = 18$ cm, $AD = 27$ cm and $AF = 24$ cm, find the length of AE.



Answer $AE =$ ..... cm [2]

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5 The area of a trapezium is 126 cm^2. If its height is 12 cm and one of its parallel sides is 15 cm, find the length of the other parallel side.

Answer ..... cm [2]

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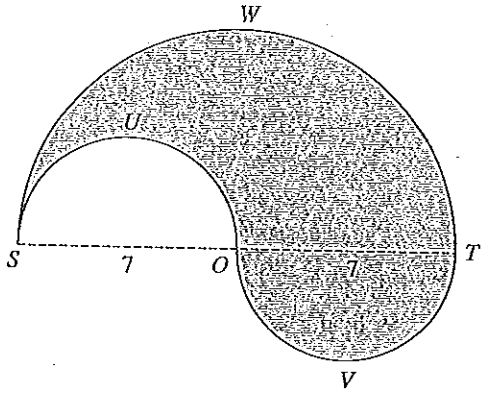
6 In the diagram, SUO, OVT and SWT are semicircles. Given that $SO = OT = 7$ cm, calculate
(a) the perimeter,
(b) the area of the shaded figure.

[Take π to be $\frac{22}{7}$.]



Answer (a) ..... cm [2]

(b) ..... cm^2 [1]

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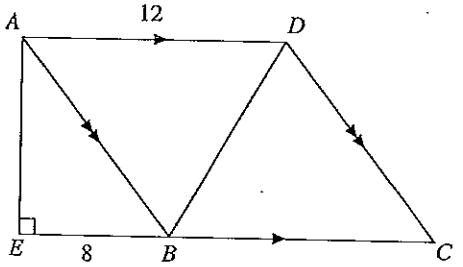
7 $ABCD$ is a parallelogram. AE is perpendicular to CB produced. $AD = 12$ cm, $BE = 8$ cm and the area of triangle ABD is 54 cm^2. Calculate
(a) the area of parallelogram $ABCD$,
(b) the length of AE,
(c) the area of $AECD$.



Answer (a) ..... cm^2 [1]

(b) AE = ... cm [1]

(c) ..... cm^2 [1]

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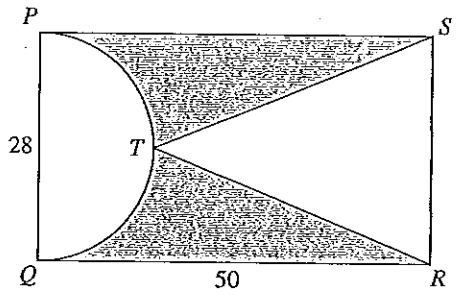
8 $PQRS$ is a rectangle of length 50 cm and breadth 28 cm. T is the midpoint of semicircular arc PTQ and STR is a triangle. Find the total area of the shaded parts.

[Take π to be $\frac{22}{7}$.]



Answer ..... cm^2 [2]

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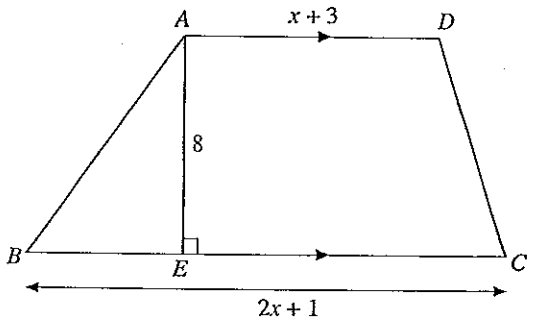
9 In the diagram $ABCD$ is a trapezium where AD is parallel to BC. Given that $AD = (x + 3)$ cm, $BC = (2x + 1)$ cm, $AE = 8$ cm and the area of the trapezium $ABCD$ is 88 cm^2, find the value of x.



Answer $x =$ ..... cm [4]

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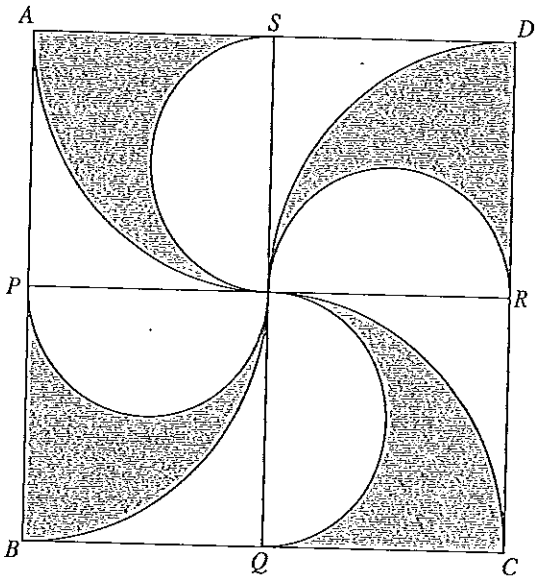
10 $ABCD$ is a square of side 28 cm. P, Q, R and S are the midpoints of the lines AB, BC, CD and AD respectively. Straight lines and arcs of semicircles and quadrants of circles form the pattern in the square.
Calculate
(a) the area of the shaded region,
(b) the perimeter of the shaded region.

[Take π to be $\frac{22}{7}$.]



Answer (a) ..... cm^2 [2]

(b) ..... cm [3]

INSTRUCTIONS TO CANDIDATES

Section B (30 marks) **Time: 45 minutes**

1. Answer all the questions in this section.
2. Calculators may be used in this section.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [ ] at the end of each question.

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11 **(a)** The length of a rectangle is 5 cm longer than its width. Given that the perimeter of the rectangle is 58 cm, find

(i) its length,

(ii) its area.

(b) A room with a rectangular floor measuring 16 m long and 12 m wide is to be covered with carpet leaving a border of 0.65 m all around. If the carpet costs \$28 per square metre, find the cost of carpeting the floor.

Answer (a) (i) ..... cm [2]

(ii) ..... cm^2 [1]

(b) \$ ..... [3]

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12 (a) A wheel has a diameter of 55 cm. Find the number of complete revolutions made by the wheel after it has covered a distance of 1.6 km.

(b) The minute hand of a clock is 20 cm long. Find the distance moved by the tip of the minute hand in 15 minutes.

(c) A circular flower bed has a diameter of 6 m. It has a circular footpath around it which is 1.5 m wide. Calculate the area of the footpath, giving your answer correct to 1 decimal place.

[Take π to be 3.142.]

Answer (a) ..... revolutions [2]

(b) ..... cm [1]

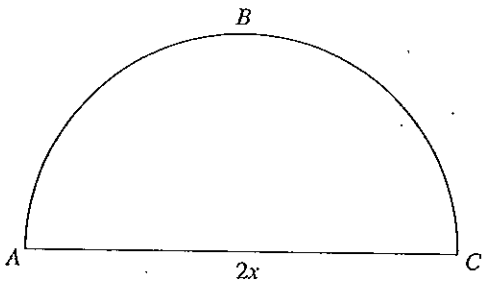
(c) ..... m^2 [3]

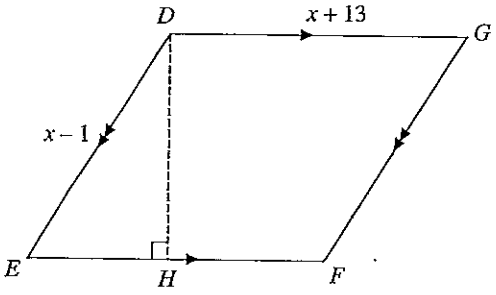
13 The perimeter of the semicircle ABC is equal to the perimeter of the parallelogram $DEFG$. The diameter of the semicircle is $2x$ cm, $DE = (x - 1)$ cm and $DG = (x + 13)$ cm.

(a) Form an equation in x and find the value of x.

(b) Given that the area of the semicircle is 132 cm^2 more than the area of the parallelogram, find the length of DH.

$\left[\text{Take } \pi \text{ to be } \frac{22}{7}.\right]$





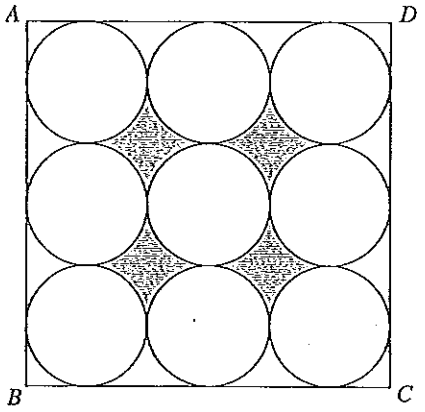
Answer (a) $x =$ ..... [4]

(b) $DH =$ ..... cm [3]

14 (a) A wire in the shape of a circle of diameter 56 cm is bent to form a rectangle. The length of the rectangle is thrice its width. Find the area of the rectangle.

[Take π to be $\frac{22}{7}$.]

(b) In the diagram, $ABCD$ is a square with 9 identical circles drawn inside it. Given that the radius of each circle is 15 cm, find the total area of the shaded parts.
[Take π to be 3.142.]

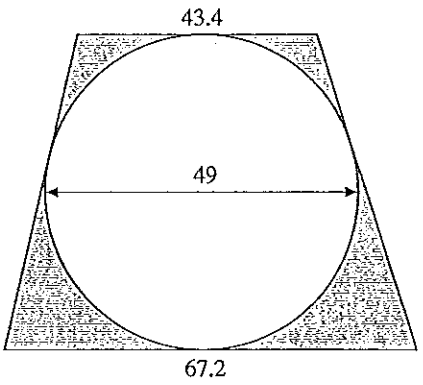


Answer (a) ..... cm^2 [3]

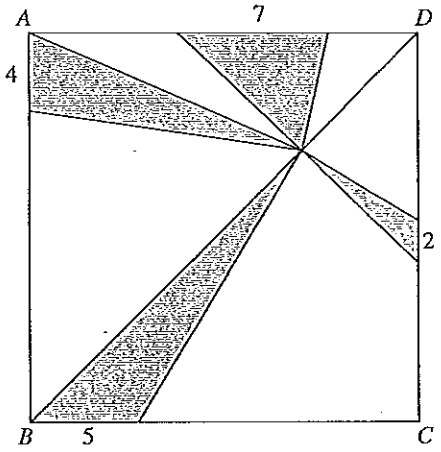
(b) ..... cm^2 [2]

15 (a) The diagram shows a circle enclosed in a trapezium. The diameter of the circle is 49 cm. The parallel sides of the trapezium are of lengths 43.4 cm and 67.2 cm respectively. Calculate the area of the shaded region.

$\left[\text{Take } \pi \text{ to be } \frac{22}{7}.\right]$



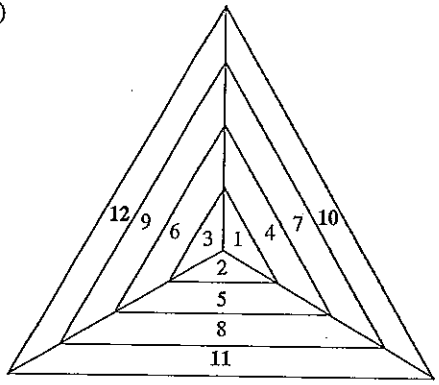
(b) In the diagram, *ABCD* is a square of side 20 cm. The vertex of the shaded triangles meet at the diagonal of the square. The base of the triangles are 4 cm, 5 cm, 2 cm and 7 cm respectively. Find the area of the shaded region.



Answer (a) ..... cm^2 [2]

(b) ..... cm^2 [4]

9. (a)



Teacher's Tip

The numbers are consecutive numbers starting from 10.

(b) 3, 6, 9, 12, ...

20th term $= 3 + (20 - 1)(3)$

$= 3 + 19(3)$

$= 3 + 57$

$= 60$

The largest number in the 20th triangle will fall on the left side of the triangle.

$\therefore$ the largest number in the 20th triangle is **60**.

(c) (i) $S_4 = 10 + 11 + 12 = \mathbf{33}$

(ii) $S_m = 6 + (m - 1)9$

$= 6 + 9m - 9$

$S_m = \mathbf{9m - 3}$

Teacher's Tip

6, 15, 24, 33, ...

+9 +9 +9

The sum of the numbers on each triangle is 9 more than the previous triangle.

(iii) $S_{100} = 9(100) - 3$

$= 900 - 3$

$= \mathbf{897}$

(iv) $9m - 3 = 2589$

$9m = 2592$

$m = \frac{2592}{9}$

$= 288$

$\therefore$ the sum of the three numbers is equal to 2589 in triangle **288**.

Test 9: Perimeter and Area of Simple Geometric Figures

Section A

1. Area of shaded region $= 220$ cm^2

Area of $ABCD$ – Area of $EFGH = 220$ cm^2

$16^2 - x^2 = 220$

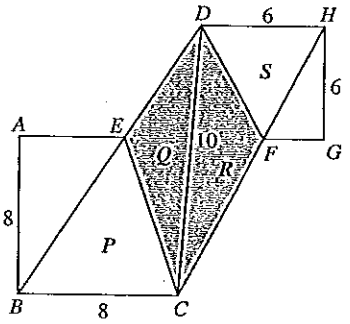
$256 - x^2 = 220$

$x^2 = 36$

$x = \sqrt{36}$

$= \mathbf{6}$

2.



Area of P + Area of $Q = \frac{1}{2} \times 8 \times 10 = 40$ cm^2

Area of R + Area of $S = \frac{1}{2} \times 6 \times 10 = 30$ cm^2

Area of $P = \frac{1}{2} \times 8 \times 8 = 32$ cm^2

Area of $S = \frac{1}{2} \times 6 \times 6 = 18$ cm^2

Area of shaded region $= 40 + 30 - 32 - 18$

$= \mathbf{20\ cm^2}$

3. (a) Area of $\triangle PQR = 12.4$ cm^2

$\frac{1}{2} \times 4^2 \times PS = 12.4$

$2PS = 12.4$

$PS = \frac{12.4}{2} = \mathbf{6.2\ cm}$

(b) Area of $\triangle PRS = \frac{1}{2} \times 4 \times 6.2$

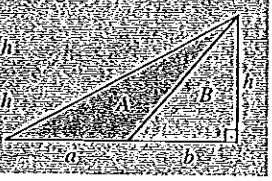
$= \mathbf{18.6\ cm^2}$

Teacher's Tip

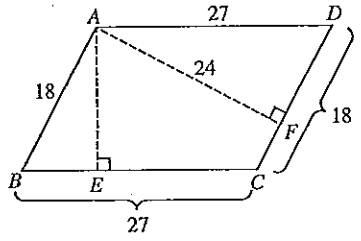
Area of triangle $= \frac{1}{2} \times$ base $\times$ height

Area of $\triangle A = \frac{1}{2} \times a \times h$

Area of $\triangle B = \frac{1}{2} \times b \times h$



4.



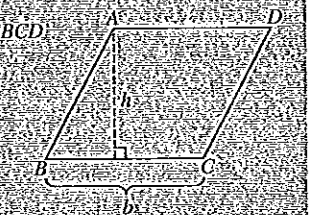
Area of parallelogram $ABCD$
$= BC \times AE = CD \times AF$
$27 \times AE = 18 \times 24$

$$\therefore AE = \frac{{}^{2}\cancel{18} \times \cancel{24}^{8}}{\cancel{27}_{3_1}}$$

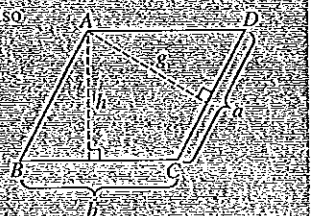
$= 16$ cm

Teacher's Tip

Area of parallelogram $ABCD$
A = base × height
$= b \times h$



Similarly, its area can also be expressed as
$A = a \times g$
$\therefore A = bh = ag$



5. Let the length of the other parallel side be x cm.

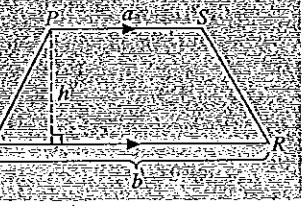
Area of trapezium $= \frac{1}{2} \times$ height × sum of parallel sides

$$126 = \frac{1}{\cancel{2}_1} \times \cancel{12}^{6} \times (15 + x)$$
$$126 = 90 + 6x$$
$$6x = 36$$
$$x = \frac{36}{6} = 6$$

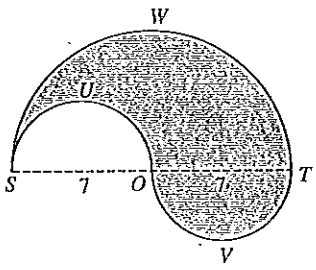
$\therefore$ the length of the other parallel side is **6 cm**.

Teacher's Tip

Area of trapezium $PQRS$
$= \frac{1}{2} \times$ height × sum of parallel sides
$= \frac{1}{2} \times h \times (a + b)$



6. (a)

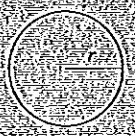


Perimeter of shaded figure

$$= 2 \times \frac{22}{\cancel{7}_1} \times \cancel{3.5}^{0.5} + \frac{1}{\cancel{2}_1} \times {}^{1}\cancel{2} \times \frac{22}{\cancel{7}_1} \times \cancel{7}^{1}$$
$= 22 + 22$
$= 44$ cm

Teacher's Tip

The two semicircles, SUO and OVT, are identical and form a circle of diameter 3.5 cm.
Circumference of a circle $= 2\pi r$
where r = radius



(b) Area of shaded figure

$$= \frac{1}{\cancel{2}} \times \frac{\overset{11}{\cancel{22}}}{\cancel{7}_1} \times \cancel{7}^{1}$$
$= 77$ cm^2

Teacher's Tip

The area of the shaded figure is the same as the area of semicircle SWT, since the area of semicircles SUO and OVT are equal.
Area of a circle $= \pi r^2$ where r = radius

7. (a) Area of parallelogram $ABCD$
$= 2 \times$ Area of $\triangle ABD$
$= 2 \times 54$
$= 108$ cm^2

Teacher's Tip

The diagonal of a parallelogram divides it into 2 triangles, each having the same area.

(b) Area of $\triangle ABD = 54$ cm^2

$$\frac{1}{2} \times AD \times AE = 54$$
$$\frac{1}{\cancel{2}_1} \times \cancel{12}^{6} \times AE = 54$$
$$AE = \frac{54}{6}$$
$= 9$ cm

(c) Area of $AECD = \frac{1}{2} \times AE \times (AD + EC)$

$= \frac{1}{2} \times 9 \times (12 + 20)$

$= \frac{1}{2_1} \times 9 \times 32^{16}$

$= \mathbf{144\ cm^2}$

$BC = AD = 12$ cm

$EC = 8 + 12 = 20$ cm

Alternative method:

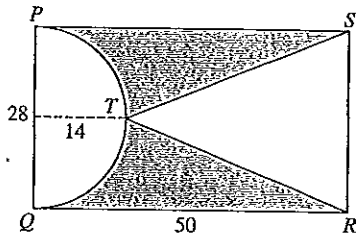
Area of $AECD$ = Area of $\triangle AEB$ + Area of parallelogram $ABCD$

$= \left(\frac{1}{2_1} \times 8^4 \times 9\right) + 108$

$= 36 + 108$

$= \mathbf{144\ cm^2}$

8.



Height of $\triangle STR = 50 - 14$

$= 36$ cm

Total area of shaded parts

= Area of $PQRS$ – Area of semicircle PTQ – Area of $\triangle STR$

$= (50 \times 28) - \left(\frac{1}{2_1} \times \frac{22}{7_1} \times 14^1 \times 14\right) - \left(\frac{1}{2_1} \times 28^{14} \times 36\right)$

$= 1400 - 308 - 504$

$= \mathbf{588\ cm^2}$

9. Area of trapezium $ABCD = 88\ cm^2$

$\frac{1}{2} \times AE \times (AD + BC) = 88$

$\frac{1}{2_1} \times 8^4 \times [(x + 3) + (2x + 1)] = 88$

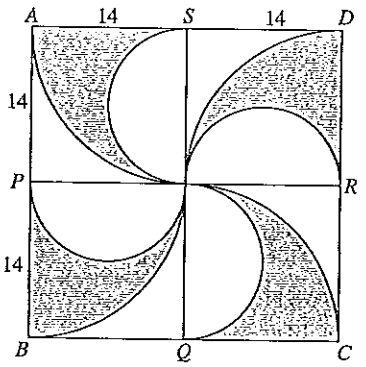
$3x + 4 = \frac{88}{4}$

$3x + 4 = 22$

$3x = 18$

$x = \frac{18}{3} = \mathbf{6\ cm}$

10.



(a) Area of shaded region

$= \left(\begin{matrix}\text{Area of circle} \\ \text{of radius 14 cm}\end{matrix}\right) - 2\left(\begin{matrix}\text{Area of circle} \\ \text{of radius 7 cm}\end{matrix}\right)$

$= \frac{22}{7_1} \times 14^2 \times 14 - 2 \times \frac{22}{7_1} \times 7^1 \times 7$

$= 616 - 308$

$= \mathbf{308\ cm^2}$

(b) Perimeter of shaded region

$= \left(\begin{matrix}\text{Circumference of} \\ \text{circle of radius} \\ \text{14 cm}\end{matrix}\right) + 2\left(\begin{matrix}\text{Circumference of} \\ \text{circle of diameter} \\ \text{14 cm}\end{matrix}\right) + 4(14)$

$= \left(2 \times \frac{22}{7_1} \times 14^2\right) + \left(2 \times \frac{22}{7_1} \times 14^2\right) + 56$

$= 88 + 88 + 56$

$= \mathbf{232\ cm}$

Section B

11. (a) Let the width of the rectangle be x cm.

Then the length of the rectangle is $(x + 5)$ cm.

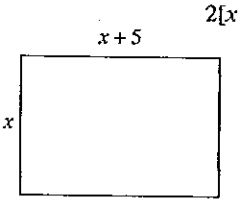
(i) Perimeter of rectangle = 58 cm

$2[x + (x + 5)] = 58$

$2x + 5 = 29$

$2x = 24$

$x = \frac{24}{2} = 12$



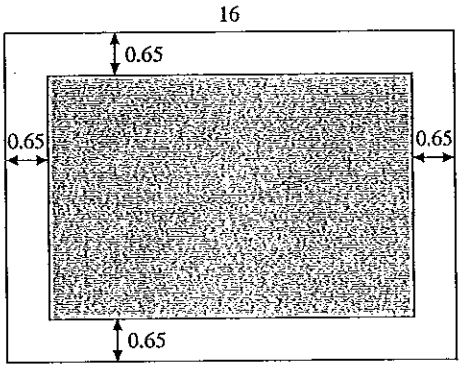
Length of rectangle $= 12 + 5 = \mathbf{17\ cm}$

(ii) Area of rectangle

$= 12 \times 17$

$= \mathbf{204\ cm^2}$

(b)



Length of carpet = 16 − 2(0.65) = 14.7 m
Width of carpet = 12 − 2(0.65) = 10.7 m
Area of carpet = 14.7 × 10.7
= 157.29 m²
Cost of carpeting the floor
= 157.29 × $28
= **$4404.12**

12. (a)

Teacher's Tip
The distance travelled in one revolution is the same as the circumference of the wheel.

Circumference of wheel = 3.142 × 55
= 172.81 cm

$$\text{No. of revolutions} = \frac{\text{Distance travelled}}{\text{Circumference}}$$

$$= \frac{1.6 \text{ km}}{172.81 \text{ cm}}$$

$$= \frac{160\,000}{172.81}$$

= 925.87 ...
∴ no. of complete revolutions = **925**

Circumference of circle = $2\pi r$ or πd
where r = radius and d = diameter.
1 km = 100 000 cm

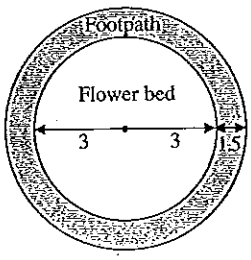
(b) Distance moved

$$= \frac{1}{4} \times (2 \times 3.142 \times 20)$$

= **31.42 cm**

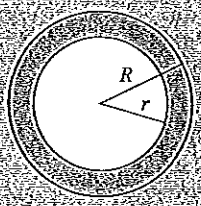
Teacher's Tip
In 15 minutes, the minute hand moved $\frac{1}{4}$ of a circle.

(c)



Area of footpath
= $\pi(4.5)^2 - \pi(3)^2$
= $\pi(4.5^2 - 3^2)$
= $3.142(4.5^2 - 3^2)$
= 35.3475
≈ **35.3 m²** (correct to 1 d.p.)

Teacher's Tip
To find the area of an annulus, i.e. the area between concentric circles, subtract the area of the smaller circle from the bigger circle.



Area of annulus = $\pi R^2 - \pi r^2$
$= \pi(R^2 - r^2)$
where R = radius of bigger circle and
r = radius of smaller circle.

13. (a) Perimeter of semicircle
= Perimeter of parallelogram

$$2x + \left(\frac{1}{\cancel{2}_1} \times \frac{22}{7} \times \frac{1}{\cancel{2}x}\right) = 2[(x - 1) + (x + 13)]$$

$$2x + \frac{22}{7}x = 2[2x + 12]$$

$$2x + \frac{22}{7}x = 4x + 24$$

$$1\frac{1}{7}x = 24$$

$$x = \frac{24}{1\frac{1}{7}}$$

= **21**

(b) Area of semicircle

$$= \frac{1}{2} \times \frac{22}{7} \times (21)^2$$

Radius = x = 21 cm

= 693 cm²
Area of parallelogram
= Area of semicircle − 132 cm²
$EF \times DH = 693 - 132$
$(21 + 13) \times DH = 561$

$$DH = \frac{561}{34}$$

= **16.5 cm**

14. (a) Length of wire = Circumference of circle

$$= \frac{22}{7} \times 56$$

= 176 cm

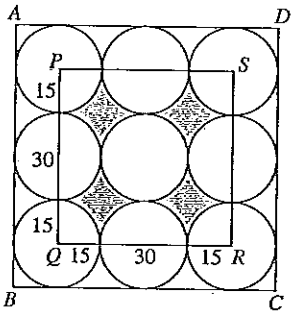
Let x cm be the width of the rectangle.
Then the length of the rectangle is $3x$ cm.
Perimeter of rectangle = 176 cm
$2(x + 3x) = 176$
$8x = 176$

$$x = \frac{176}{8}$$

= 22

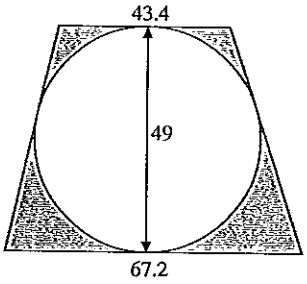
Area of rectangle $= x(3x)$
$= 3x^2$
$= 3(22)^2$
$= \mathbf{1452\ cm^2}$

(b)



Total area of shaded parts
= Area of square $PQRS$ – Area of 4 circles
$= 60^2 - 4 \times 3.142 \times 15^2$
$= \mathbf{772.2\ cm^2}$

15. (a)



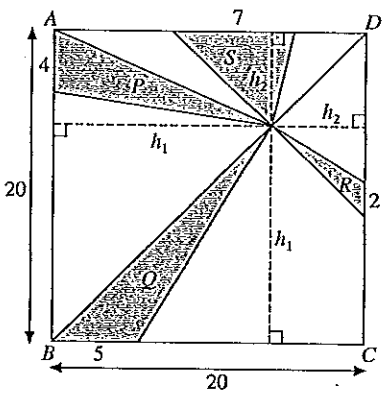
Teacher's Tip
The diameter of the circle is the height of the trapezium.

Area of shaded region
= Area of trapezium – Area of circle

$$= \left[\frac{1}{2} \times 49 \times (43.4 + 67.2)\right] - \frac{22}{7} \times \left(\frac{49}{2}\right)^2$$

$= 2709.7 - 1886.5$
$= \mathbf{823.2\ cm^2}$

(b)



Area of shaded region
= Area of ΔP + Area of ΔQ + Area of ΔR + Area of ΔS

$$= \left(\frac{1}{2} \times 4 \times h_1\right) + \left(\frac{1}{2} \times 5 \times h_1\right) + \left(\frac{1}{2} \times 2 \times h_2\right) + \left(\frac{1}{2} \times 7 \times h_2\right)$$

$$= 2h_1 + \frac{5}{2}h_1 + h_2 + \frac{7}{2}h_2$$

$$= \frac{9}{2}h_1 + \frac{9}{2}h_2$$

$$= \frac{9}{2}(h_1 + h_2)$$

$$= \frac{9}{2}(20) \qquad h_1 + h_2 = 20\ \text{cm}$$

$= \mathbf{90\ cm^2}$

Test 10: Volume and Surface Area

Section A

1. Volume of rectangular block
$= 20 \times 21 \times 22$
$= 9240\ \text{cm}^3$

Volume of each cylindrical coin

$$= \frac{22}{7} \times 7 \times 7 \times 2$$

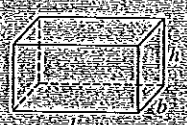
$= 308\ \text{cm}^3$

No. of coins

$$= \frac{9240}{308}$$

$= \mathbf{30}$

Teacher's Tip
Volume of cuboid, $V = lbh$
where l = length, b = breadth and h = height



Volume of cylinder, $V = \pi r^2 h$
where r = radius and h = height

2. (a) Density $= \dfrac{\text{Mass}}{\text{Volume}}$

$\therefore$ Volume $= \dfrac{\text{Mass}}{\text{Density}}$

$$= \frac{160\ \text{g}}{2.5\ \text{g/cm}^3}$$

$= 64\ \text{cm}^3$

Volume of cube $= 64\ \text{cm}^3$
$x^3 = 64$
$x = \sqrt[3]{64} = 4$