10 Properties of Triangles

Exercise 10.1

1. Since, sum of the angles of a triangle is 180.

Let the unknown angle be $x°$.

Then,

(a) $x° + 57° + 42° = 180°$
$x° = 180° - (42° + 57°)$
$x° = 180° - 99°$
$x° = 81°$

(b) $x° + 92° + 27° = 180°$
$x° = 180° - (92° + 27°)$
$x° = 180° - 119°$
$x° = 61°$

(c) $x° + 72° + 30° = 180°$
$x° = 180° - (72° + 30°)$
$x° = 180° - 102°$
$x° = 78°$

(d) $x° + 90° + 25° = 180°$
$x° = 180° - (90° + 25)$
$x° = 180° - 115°$
$x° = 65°$

(e) $x° + 71° + 48° = 180°$
$x° = 180° - (71° + 48°)$
$x° = 180° - 119°$
$x° = 61°$

(f) $x° + 40° + 20° = 180°$
$x° = 180° - (40° + 20°)$
$x° = 180° - 60°$
$x° = 120°$

2. Let the measure of the third angle be $x°$ of a triangle.

(a) $x° + 72° + 45° = 180°$
$x = 180° - (72° + 45°)$
$x° = 180° - 117°$
$x = 63°$

(b) $x° + 125° + 30° = 180°$
$x° = 180° - (125° + 30°)$
$x° = 180° - 155°$
$x° = 25°$

(c) $x° + 70° + 75° = 180°$
$x° = 180° - (70° + 75°)$
$x° = 180° - 145°$
$x° = 35°$

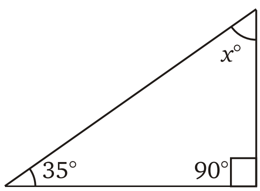
(d) $x° + 48° + 72° = 180°$
$x° = 180° - (48° + 72°)$
$x° = 180° - 20°$
$x = 60°$

(e) $x° + 30° + 108° = 180°$
$x° = 180° - (30° + 108°)$
$x° = 180° - 138°$
$x° = 42°$

(f) $x° + 60° + 60° = 180°$
$x° = 180° - (60° + 60°)$
$x° = 180° - 120°$
$x° = 60°$

3. Let the other acute angle be $x°$.

$$x° + 35° + 90° = 180°$$
$$x° = 180° - (35° + 90°)$$
$$x° = 180° - 125°$$
$$x° = 55°$$



Hence, the other acute angle is 55°.

4. If the sum of all three angles is 180°, then we can construct a triangle.

(a) $45° + 72° + 50° = 167$, not possible
(b) $32° + 58° + 85° = 175$, not possible
(c) $57° + 77° + 90° = 224$, not possible
(d) $96° + 29° + 55° = 180°$, possible

5. (a) True, because the sum of three angles of a triangle is 180°. If one angle of a triangle is 90°, then the sum of two angles is equal to 90.

(b) False, since the sum of three angles of a triangle cannot exceed 180°, therefore, such a triangle is not possible.

(c) False, such a triangle is not possible as the sum of the angles cannot be less than 180.

(d) False, since, the sum of three angle of a triangle cannot exceed 180°, there, such a triangle is not possible.

6. Given ratio between the angles of the triangle $= 4:5:6$

Sum of the terms of ratio $= 4+5+6 = 15$

Sum of angles of a triangle $= 180°$

1st angle $= \frac{4}{15} \times 180° = 48°$

2nd angle $= \frac{5}{15} \times 180° = 60°$

3rd angle $= \frac{6}{15} \times 180° = 72°$

Hence, the angle of the triangle are 48°, 60° and 72°.

7. $\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 =$ The sum of all angles of three triangles.

$= 3 \times 180° = 540°$

8. $\angle ACB + \angle ACD = 180°$ (Linear pair)

$\therefore \quad 115° + \angle ACD = 180°$

$\angle ACD = 180° - 115°$

$\angle ACD = 65°$

In ΔACD,

Since, the sum of the angles of a triangle is 180°.

$\therefore \quad \angle ACD + \angle CAD + \angle ADC = 180°$

$50° + 65° + \angle ADC = 180°$

$\angle ADC = 180° - (50° + 65°)$

$\angle ADC = 65°$

In ΔACB,

$\angle BAC + \angle ACB + \angle ABC = 180°$

$\angle BAC + 45° + 115° = 180°$

$\angle BAC = 180° - (45° + 115°)$

$\angle BAC = 180° - 160°$

$\angle BAC = 20°$

Since, sum of angles on a straight line $= 180°$

$\therefore \quad \angle CAB + \angle CAD + \angle DAE = 180°$

$20° + 50° + \angle DAE = 180°$

$\angle DAE = 180° - (20° + 50°)$

$\angle DAE = 180° - 70°$

$\angle DAE = 110°$

Hence, $\angle ACD = 65°$, $\angle ADC = 65°$ and $\angle DAE = 110°$.

9. Given ratio between the angles of the triangle $= 1:4:5$

Sum of the terms of the ratio $= 1+4+5 = 10$

Sum of angles of a triangle $= 180°$

$$1\text{st angle} = \frac{1}{10} \times 180° = 18°$$
$$2\text{nd angle} = \frac{4}{10} \times 180° = 72°$$
$$3\text{rd angle} = \frac{5}{10} \times 180° = 90°$$

Hence, the angle of the triangle are 18°, 72° and 90°.

10. Let the two acute angles of a right angled triangle be $2x$ and $3x$.
Then, in a right angled triangle.

$$2x° + 3x° + 90° = 180° \ (\because \text{third angle are given.})$$
$$5x° + 90° = 180°$$
$$5x° = 180° - 90°$$
$$x° = 90° \div 5 = 18°$$

So, the angles are :

$$2x° = 2 \times 18° = 36°$$
$$3x° = 3 \times 18° = 54°$$

11. Since, $LM \parallel BC$ and $\angle ABC = 90°$

So, $\angle ALM = 90°$ (Corresponding angle)

Since, sum of angles on a straight line $= 180°$

$$\therefore \quad \angle AML + \angle LMC = 180°$$
$$\angle AML + 140° = 180°$$
$$\angle AML = 180° - 140°$$
$$\angle AML = 40°$$

In ΔAML,

$$\angle MAL + \angle AML + \angle ALM = 180°$$
$$\angle MAL + 40° + 90° = 180°$$
$$\angle MAL = 180° - (90° + 40°)$$
$$\angle MAL = 180° - 130°$$
$$\angle MAL = 50°$$

Similarly, in ΔABC,

$$\angle MAL + \angle ACB + \angle ABC = 180°$$
$$50° + \angle ACB + 90° = 180°$$
$$\angle ACB = 180° - (90° + 50°)$$
$$\angle ACB = 180° - 140°$$
$$\angle ACB = 40°$$

Hence, $\angle ALM = 90°$, $\angle AML = 40°$ and $\angle ACB = 40°$.

Exercise 10.2

1. $\angle PQR$, $\angle QRP$ and $\angle RPQ$ are interior angles.
And, $\angle PRZ$, $\angle RQX$ and $\angle QPY$ are exterior angles.

2. $\angle ACD = \angle BAC + \angle ABC$ [By exterior angle of a triangle]

$\angle ACD = 65° + 42$

$\angle ACD = 107°$

3. Since, sum of angles on a straight line $= 180°$

$$\therefore \quad \angle CBA + \angle CBD = 180°$$

$$x° + 65° = 180°$$
$$x° = 180° - 65°$$
$$x° = 115°$$

In ΔABC,

$$\angle CAB + \angle CBA + \angle ACB = 180° \text{ [Angle sum property of a triangle]}$$
$$35° + y° + x° = 180°$$
$$35° + y° + 115° = 180°$$
$$y° = 180° - (115° + 35°)$$
$$y° = 180° - 150°$$
$$y° = 30°$$

Hence, the measures of x and y is 115° and 30° respectively.

4. (i) By exteriror angle of a triangle.

$$\angle DAC = \angle ABC + \angle ACB$$
$$117° = a° + 47°$$
$$a° = 117° - 47°$$
$$a = 70°$$

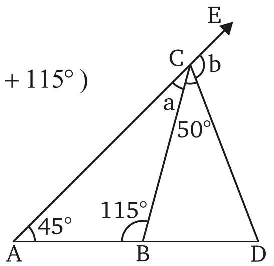
By angle sum property of a triangle

$$\angle BAC + \angle ABC + \angle ACB = 180°$$
$$a° + b° + 47° = 180°$$
$$70° + b° + 47° = 180°$$
$$b° = 180° - (70° + 47°)$$
$$b° = 180° - 117°$$
$$b° = 63°$$

(ii) Let the name of the vertex of given figure be A, B and D.

In ΔABC,

$$\angle ACB + \angle ABC + \angle CAB = 180°$$
$$a° + 45° + 115° = 180°$$
$$a° = 180° - (45° + 115°)$$
$$a° = 180° - 160°$$
$$a° = 20°$$



In ΔACD,

$$\angle CAD + \angle ACD + \angle CDA = 180°$$
$$45° + (a° + 50)° + \angle CDA = 180°$$
$$45° + a° + 50° + \angle CDA = 180°$$
$$45° + 20° + 50° + \angle CDA = 180°$$
$$\angle CDA = 180° - (45 + 20 + 50)°$$
$$\angle CDA = 180° - 115°$$
$$\angle CDA = 65°$$

Now, by exterior angle of a triangle

$$\angle ECD = \angle CAD + \angle CDA$$
$$\angle ECD = 45° + 65°$$
$$\angle ECD = 110°$$

5.
$$\angle ABE + \angle ABC = 180° \text{ [Linear pair]}$$
$$120° + \angle ABC = 180°$$
$$\angle ABC = 180° - 120°$$
$$\angle ABC = 60°$$

Similarly, $\angle ACD + \angle ACB = 180°$ [Linear pair]

$110° + \angle ACB = 180°$

$\angle ACB = 180° - 110°$

$\angle ABC = 70°$

In ΔABC,

$\angle ABC + \angle ACB + \angle BAC = 180°$

[By angle sum property of a triangle]

$60° + 70° + \angle BAC = 180°$

$\angle BAC = 180° - (60° + 70)°$

$\angle BAC = 180° - 130°$

$\angle BAC = 50°$

6. $\angle EAF = \angle BAC$ [Vertically opposite angles]

$\therefore$ $x° = 45°$

$\angle ACD + \angle ACB = 180°$ [Linear pair]

$120° + z° = 180°$

$z° = 180° - 120°$

$z° = 60°$

In ΔABC,

$\angle BAC + \angle ABC + \angle ACB = 180°$

$x° + y° + z° = 180°$

$45° + y° + 60° = 180°$

$y° = 180° - (45° + 60°)$

$y° = 180° - 105°$

$y° = 75°$

7. In ΔABD,

$\angle BAD + \angle DBA + \angle ADB = 180°$

$3\angle DBA + \angle DBA + 108° = 180°$

$4\angle DBA + 108° = 180°$

$4\angle DBA = 180° - 108°$

$4\angle DBA = 72°$

$\angle DBA = 72° \div 4$

$= 18°$

$\angle BAD = 3\angle DBA$

$= 3 \times 18° = 54°$

In ΔABC,

$(\angle ABD + \angle DBC) + \angle BAD + \angle ACB = 180°$

$(18° + \angle DBC) + 54° + 75° = 180°$

$\angle DBC + 147° = 180°$

$\angle DBC = 180° - 147°$

$\angle DBC = 33°$

In ΔBDC,

$\angle CDB + \angle DBC + \angle DCB = 180°$

$\angle CDB + 33° + 75° = 180°$

$\angle CDB = 180° - (33° + 75°)$

$\angle CDB = 180° - 108° = 72°$

$$\angle ABC = \angle DBA + \angle DBC$$
$$= 18° + 33° = 51°$$

Hence, $\angle CDB = 72°$, $\angle DBC = 33°$ and $\angle ABC = 51°$.

8. Let the interior opposite angles be $7x$ and $8x$ respectively.

Then, $7x° + 8x° = 135°$ [By exterior angle of a triangle]

$$15x° = 135°$$
$$x° = 135° \div 15$$
$$x° = 9°$$

So, the interior opposite angles are :

$$7x° = 7 \times 9° = 63°$$
$$8x° = 8 \times 9° = 72°$$

9. Let the interior opposite angles be $2x°$ and $5x°$ respectively.

Then, $2x° + 5x° = 140°$

$$7x° = 140°$$
$$x° = 140° \div 7$$
$$x = 20°$$

So, the interior opposite angles are : $2x° = 2 \times 20° = 40°$

$$5x° = 5 \times 20° = 100°$$

10. Let the interior opposite angles be $2x°$ and $3x°$ respectively.

Then, $2x° + 3x° = 125°$

$$5x° = 125°$$
$$x° = 125° \div 5$$
$$x° = 25°$$

So, the interior opposite angles are : $2x° = 2 \times 25° = 50°$

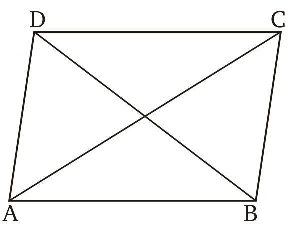
$$3x° = 3 \times 25° = 75°$$

Exercise 10.3

1. Since, the sum of the lengths of any two sides of a triangle is greater than the length of the third side.

(a) Yes, (b) Yes (c) Yes (d) Yes

2. In ΔABC,



Since, the sum of the lengths of any two sides of a triangle is greater than the length of the third side.

$\therefore$ $AB + BC > AC$ ... (i)

Similarly,

In ΔBCD,

$BC + CD > BD$ ... (ii)

Adding the equation No. (i) & (ii), we get

$$AB + BC + CD + DA > AC + BD$$

3. (a) Yes (b) Yes (c) Yes (d) Yes (e) Yes

4. No

5. If x cm be the length of the third side, we should have :

$$15 + 20 > x \,;\, x + 15 > 20 \,;\, x + 20 > 15$$

$\therefore$ $35 > x, x > 5, x > -5$

The numbers between 35 and 5 satisfy these.

$\therefore$ the length of the third side could be any length between 5 cm and 35 cm.

6. Suppose such a triangle is possible. Then the sum of the length of any two sides would be greater than the length of the third side. Let us check this.

(a) Is $3+6>7$? Yes (b) Is $6+7>3$? Yes

(c) Is $7+3>6$? Yes

$\therefore$ the triangle is possible.

(b) Is $3+6>5$? Yes

Is $6+5>3$? Yes

Is $5+3>6$? Yes

$\therefore$ the triangle is possible.

(c) Is $2+3>5$? No

$\therefore$ the triangle is not possible.

Exercise 10.4

1. (a) $5^2 = 25, 12^2 = 144$ and $13^2 = 169$

Also, $5^2 + 12^2 = 25 + 44 = 169$

$\Rightarrow \quad 5^2 + 12^2 = 13^2$

Hence, 5, 12, 13 are the sides of a right triangle.

(b) $6^2 = 36, 8^2 = 64$ and $10^2 = 100$

Also, $6^2 + 8^2 = 36 + 64 = 100$

$\Rightarrow \quad 6^2 + 8^2 = 10^2$

Hence, 6, 8 and 10 are the sides of a right triangle.

(c) $5^2 = 25, 7^2 = 49$ and $11^2 = 121$

Also, $5^2 + 7^2 = 25 + 49 = 74$

$\Rightarrow \quad 5^2 + 7^2 \neq 11^2$

Hence, 5, 7 and 11 are not sides of a right triangle.

(d) $8^2 = 64, 15^2 = 225$ and $17^2 = 289$

Also, $8^2 + 15^2 = 64 + 225 = 289$

$\Rightarrow \quad 8^2 + 15^2 = 17^2$

Hence, 8, 15, 17 are the sides of a right triangle.

2. If the square of one side is equal to the sum of the squares of the remaining two sides, then the triangle is a right angled triangle.

(a) $5^2 + 12^2 = 13^2$

$25 + 144 = 169$

$169 = 169$

So, it is a right angled triangle.

(b) $8^2 + 15^2 = 17^2$

$64 + 225 = 289$

$289 = 289$

So, it is a right angled triangle.

(c) $21^2 + 28^2 = 35^2$

$441 + 784 = 1225$

$1225 = 1225$

So, it is a right angled triangle.

(d) $6^2 + 8^2 = 10^2$

$36 + 64 = 100$

$100 = 100$

So, it is a right angled triangle.

3. By pythagoras theorem

(a) $MN^2 = ML^2 + LN^2$

$MN^2 = 14^2 + 48^2$

$MN^2 = 196 + 2304$

(b) $AC^2 = AB^2 + BC^2$

$AC^2 = 20^2 + 15^2$

$AC^2 = 400 + 225$

$MN^2 = 2500$

$MN = \sqrt{2500} = 50\,\text{cm}$

$AC^2 = 625$

$AC = \sqrt{625} = 25\,\text{cm}$

(c) $PQ^2 = PR^2 + QR^2$

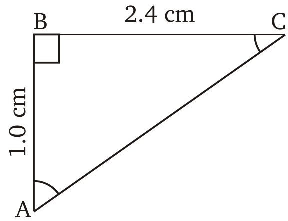
$PQ^2 = 12^2 + 9^2$

$PQ^2 = 144 + 81$

$PQ^2 = 225$

$PQ = \sqrt{225} = 15\,\text{cm}$

(d) Let the vertex be A, B and C respectively of given figure.



$AC^2 = AB^2 + BC^2$

$AC^2 = (1.0)^2 + (2.4)^2$

$AC^2 = 1 + 5.76$

$AC^2 = 6.76$

$AC = \sqrt{6.76}$

$= 2.6\,\text{cm}$

(e) $AC^2 = AE^2 + EC^2$

$37^2 = AE^2 + 12^2$

$1369 = AE^2 + 144$

$AE^2 = 1369 - 144$

$AE = \sqrt{1225}$

$AE = 35\,\text{cm}$

(f) $PR^2 = PQ^2 + QR^2$

$20^2 = PQ^2 + 12^2$

$400 = PQ^2 + 144$

$PQ^2 = 400 - 144$

$PQ^2 = 256$

$PQ = \sqrt{256} = 16\,\text{cm}$

4. By pythagoras theorem

$(\text{Hypotenuse})^2 = (\text{Base})^2 + (\text{Perpendicular})^2$

or $H^2 = a^2 + b^2$

(a) $H^2 = 24^2 + 10^2 = 576 + 100 = 676$

$H^2 = 26^2$ $\therefore$ Hypotenuse $= 26\,\text{cm}$

(b) $H^2 = a^2 + b^2 = (4.5)^2 + (5.2)^2 = 20.25 + 27.04 = 47.29$

$H^2 = (6.88)^2$ $\therefore$ Hypotenuse $= 6.88\,\text{cm}$

5. If the square of one side is equal to the sum of the squares of the remaining two sides, then the triangle is a right angled triangle.

So, $(1.5)^2 + (2)^2 = 2.5^2$

$2.25 + 4 = 6.25$

$6.25 = 6.25$

Since, both sides are equal. So, it is a right angled triangle.

6. (a) $\text{hypotenuse}^2 = 20^2 + 21^2 = 400 + 441 = 841$

$\therefore$ $\text{hypotenuse}^2 = 29^2$

$\therefore$ $\text{hypotenuse} = 29\,\text{cm}$

(b) $\text{hypotenuse}^2 = 8.4^2 + 1.3^2 = 70.56 + 1.69 = 72.25$

$\text{hypotenuse}^2 = 8.5^2$

$$\text{hypotenuse} = 8.5\text{ cm}$$

7. Let the length of each side be x cm.

Then, $H^2 = B^2 + P^2$

$$(50) = x^2 + x^2$$
$$2x^2 = 50$$
$$x^2 = 50 \div 2$$
$$x^2 = 25$$
$$x^2 = 5^2$$

$\therefore$ Each side $= 5\text{ cm}$

8. If $c^2 = a^2 + b^2$, then, given integer are pythagorean triplet.

(a) $13^2 = 5^2 + 12^2$

$169 = 25 + 144$

$169 = 169$

So, it is a pythagorean triplets.

(b) $25^2 = 7^2 + 24^2$

$625 = 49 + 576$

$625 = 625$

So, it is a pythagorean triplets.

(c) $29^2 = 20^2 + 21^2$

$841 = 400 + 441$

$841 = 841$

So, it is a pythagorean triplets.

(d) $11^2 = 10^2 + 9^2$

$121 = 100 + 81$

$121 \neq 181$

So, it is not a pythagorean triplets.

(e) $24^2 = 22^2 + 10^2$

$576 = 484 + 100$

$576 \neq 584$

So, it is not pythagorean triplets.

(f) $17^2 = 8^2 + 15^2$

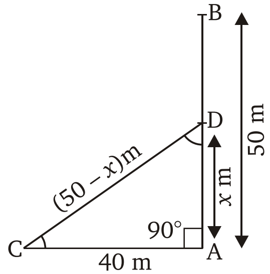
$289 = 64 + 225$

$289 = 289$

So, it is pythagorean triplets.

9. By pythagorean theorem

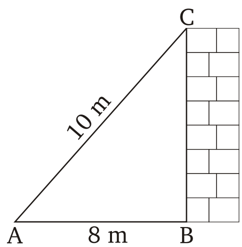
$$DC^2 = AC^2 + AD^2$$
$$(50 - x)^2 = 40^2 + x^2$$
$$2500 + x^2 - 2 \times 50x = 1600 + x^2$$
$$2500 - 100x = 1600$$
$$100x = 2500 - 1600$$
$$100x = 900$$
$$x = 900 \div 100$$
$$x = 9\text{ m}$$



Hence, 9 m is the height of the point from the ground.

10. By pythagoras theorem

$$AC^2 = AB^2 + BC^2$$
$$10^2 = 8^2 + BC^2$$
$$BC^2 = 100 - 64$$
$$BC^2 = 36$$
$$BC^2 = 6^2$$
$$BC = 6\text{ m}$$



Hence, the height of the wall is 6 m.

11. By the pythagoras theorem

$$\begin{aligned} AC^2 &= AB^2 + BC^2 \\ 13^2 &= 5^2 + BC^2 \\ 169 &= 25 + BC^2 \\ BC^2 &= 169 - 25 \\ BC^2 &= 144 \text{ cm}^2 \\ BC^2 &= 12^2 \text{ cm}^2 \\ BC &= 12 \text{ cm} \end{aligned}$$

Hence, the height of the wall is 12 cm.

12. $AB = 30\text{ m}$, $DC = 15\text{ m}$ and $AC = 36\text{ m}$

Join BD

Then,

$$\begin{aligned} DE &= AC = 36\text{ m} \\ BE &= AB - DC \\ BE &= (30 - 15)\text{ m} \\ BE &= 15\text{ m} \end{aligned}$$

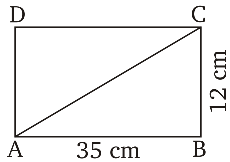
Now, ΔBDE is a right-angled triangle.

By pythagoras theorem

$$\begin{aligned} BD^2 &= BE^2 + DE^2 \\ BD^2 &= 36^2 + 15^2 \\ BD^2 &= 1296 + 225 \\ BD^2 &= 1521 \\ BD &= 39\text{ m} \end{aligned}$$

13. By pythagoras theorem

$$\begin{aligned} AC^2 &= AB^2 + BC^2 \\ AC^2 &= 35^2 + 12^2 \\ AC^2 &= 1225 + 144 \\ AC^2 &= 1369 \\ AC &= 37\text{ m} \end{aligned}$$



Hence, the length of diagonal is 37 cm.

MCQs

1. (b) **2.** (b) **3.** (a) **4.** (b) **5.** (c) **6.** (b)

11 Congruence

Exercise 11.1

1. Line segment $AB = 5.4$ cm = line segment LM.

So, (a) and (d) are congruent.

2. $\angle DEF = \angle pqr = \angle xyz = 50°$ So, (a), (c) and (d) are congruent.

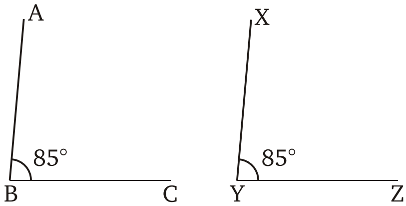
3. (a), (b), (c), (e) and (f) are congruent.

4. Since, $\angle ABC \cong \angle XYZ$

$\therefore \quad \angle ABC = \angle XYZ$

$\therefore \quad \angle ABC = \angle XYZ$

$\qquad\qquad = 85°$



5. Yes, As $\angle BOC$ is added in both sides.

6. (a) True (b) True (c) False (d) True
(e) False (f) True (g) False (h) False

Exercise 11.2

1. (a) If $\Delta ABC \cong \Delta PQR$

So, $A \leftrightarrow P, B \leftrightarrow Q, C \leftrightarrow R$; $\angle A = \angle P, \angle B = \angle Q, \angle C = \angle R$
and $AB = PQ, BC = QR$ and $AC = PR$

(b) If $\Delta LMN \cong \Delta CBA$

So, $L \leftrightarrow C, M \leftrightarrow B, N \leftrightarrow A$;
$LM = CB, MN = BA, LN = CA$;
$\angle L = \angle C, \angle M = \angle B$ and $\angle N = \angle A$

(c) If $\Delta DEF \cong \Delta XZY$

So, $D \leftrightarrow X, E \leftrightarrow Z, F \leftrightarrow Y$;
$DE = XZ, EF = ZY, DF = XY$;
$\angle D = \angle X, \angle E = \angle Z$ and $\angle F = \angle Y$

(d) It $\Delta ABD \cong \Delta RST$

$A \leftrightarrow R, B \leftrightarrow S, D \leftrightarrow T$;
$AB = RS, BD = ST, AD = RT$;
$\angle A = \angle R, \angle B = \angle C, \angle D = \angle T$

2. (a) $\Delta ABC \cong \Delta PQR$ [By SAS congruence condition]

(b) $\Delta XYZ \cong \Delta DEF$ [By ASA congruence condition]

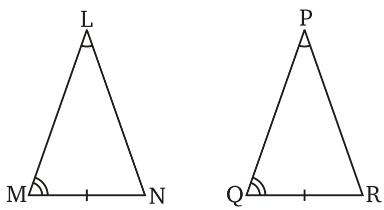
(c) $\Delta PQR \ncong \Delta XYZ$ because every angles of both triangles are not equal to each other.

3. Since, $MN = OR$

$\angle L = 90° = \angle P$

$\angle M = \angle Q = 30°$

Thus, the correspondence
$LMN \leftrightarrow PQR$ gives a congruence.
Therefore, by ASA congruence condition,
Yes $\Delta LMN \cong \Delta PQR$



4. In ΔLMN and ΔLPN, we have

(a) Since, $LM = LP = 8.5$ cm (Given)
$\angle MLN = \angle PLN = 45°$ (Given)
And $LN = NL$ (Common)
Thus, the correspondence $LMN \leftrightarrow LPN$ gives a congruence.
Therefore, by SAS congruence condition.
$\Delta LMN \cong \Delta LNP$

(b) In ΔBCA and ΔEDF, we have

$BC = DE$ (Given)

$AC = DF$ (Given)

And $\angle C = \angle D = 40°$ (Given)

Hence, by SAS congruence condition $\Delta BCA \cong \Delta EDF$

(c) In ΔQPS and ΔSRQ, we have

$\angle P = \angle R = 90°$ (Given)

$PS = QR = 5\,\text{cm}$ (Given)

$QS = SQ = 7\,\text{cm}$ (Common)

Hence, by SAS congruence condition $\Delta QPS \cong \Delta SRQ$

5. In ΔABC and ΔEFD, we have

$\angle B = \angle F = 90°$ (Given)

and $BC = FD$ (Given)

To make the two trianglies congruent their hypotenuse should be equal.

i.e., AC must be equal to DE.

6. (a) $AB = QR$ (Given)

$\angle A = \angle Q$ (Given)

$\angle B = \angle P$ (Given)

Hence, by ASA congruence condition $\Delta ABC \cong \Delta QPR$.

(b) $\angle A = \angle S = 40°$ (Given)

$\angle AOB = \angle COS = 40$ (Given)

But $BO \neq SO$

ASA condition are not satisfy. So, there are not congruent.

(c) $\angle D = \angle B = 100°$ (Given)

$\angle A = \angle C = 20°$ Alternate angle (Given)

And $AC = CA$ (Common)

Hence, by ASA congruence condition $\Delta ABC \cong \Delta FDE$

(d) $BC = PQ = 6.2$ cm (Given)

$\angle ACB = \angle RPQ = 30°$ (Given)

$\angle ABC = \angle RQP = 130°$ (Given)

Hence, by ASA congruence condition $\Delta BCA \cong \Delta QPR$

7. (a) $BC = DE = 7.2$ cm (Given)

$EF = CA = 4.1$ cm (Given)

And $AB = FD = 5.8$ cm (Given)

Hence, by SSS congruence condition $\Delta ABC \cong \Delta FDE$.

(b) Since, $PQ = RS = 7.3$ cm (Given)

$RT = TS = 3.1$ cm (Given)

$RT = TQ = 3.5$ cm (Given)

Hence, by SSS congruence condition $\Delta RST \cong QPT$.

8. (a) In ΔPZY and ΔXYZ, we have

$XY = PZ = 4.5$ cm (Given)

$YZ = ZY = 8.5\,\text{cm}$ (Common)

And $\angle X = \angle P = 90$ (Given)

Hence, by SAS congruence condition.

(b) $\angle A = \angle Z = 90°$ (Given)

$AC \neq YZ$ (Given)

Hence, it is not congruent.

9. $DE = QP = 6\,\text{cm}$ (Given)

$\angle E = 33^\circ = \angle P$ (Given)

And $EF = RP = 5.4$ cm (Given)

So, $\Delta DEF \cong \Delta QRP$

And

$DE = QP = LM = 6\,\text{cm}$ (Given)

$\angle E = \angle P = \angle L = 33^\circ$ (Given)

But $\angle F = \angle R \neq \angle M$

Hence, (a), (b) are congruent by SAS condition.

10. $\angle 1 = \angle 2$ (Given)

$\angle 3 = \angle 4$ (Given)

$AL = AM$ (Given)

$LB = MB$ (Given)

Hence, $\Delta LAB \cong \Delta MAB$ are in congruent by ASA or SAS condition.

11. Since, $AB \,||\, CD$ and $AB = CD$

$\therefore$ $\angle ABO = \angle DCO$ (Alternate angle)

$\therefore$ $AO = OD$ and $BO = CD$ $\therefore$ By SSS rule of congruency.

Hence proved, $\Delta AOB \cong \Delta DOC$

12. Since, $PQ \,||\, RS$, $PQ = RS$ and $PR = QS$ are in given.

So, $RQ = QR$ (Common)

$\therefore$ By SSS rule of congruency.

Hence proved, $\Delta PQS \cong \Delta SRP$

Similarly,

Since, $PQ \,||\, RS$ (Given)

$PQ \,||\, RS$ (Given)

And $PR = QS$ (Given)

So, $PS = SP$ (Common)

$\therefore$ By SSS rule of congruency.

Hence, proved, $\Delta PQS \cong \Delta SRP$

MCQs

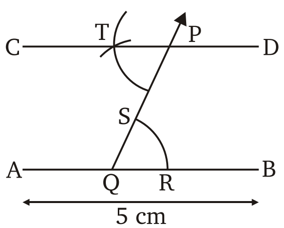
1. (a) **2.** (c) **3.** (b) **4.** (d)

12 Constructions

Exercise 12.1

1. Steps of construction :

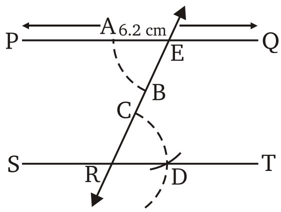
1. Draw a line segment $AB = 5\,\text{cm}$.
2. Make a point P outside this line segment any where in the plane.
3. Draw a line segment passing through P intersecting AB at Q, making angle PQB with AB.



4. With Q as centre and convenient radius, draw an arc cutting PQ and QB at S and R.
5. With P as centre and with the same radius draw an arc on the opposite side of PQ cutting PQ at S.
6. With a pair of compasses take a radius equal to the length of SR (distance from R to S).
7. With the above radius, cut an arc from S on the arc from S intersecccting at T.
8. Join PT and produce.

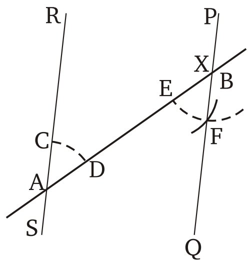
Hence, CD is the required parallel line segment.

2. Steps of construction :



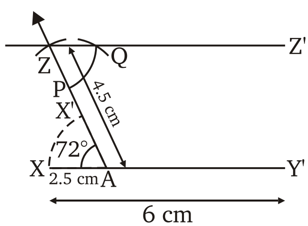
1. Draw a line segment $PQ = 6.2$ cm.
2. Mark a point R below this line any where in a plane.
3. Draw a line segment passing through R intersecting PQ at E, making angle REP with PQ.
4. With E as centre and a convenient radius, draw an arc cutting RE and EP at A and B.
5. With R as centre and with the same radius draw an arc on the opposite side of RE cutting RE at C.
6. With a pair of compasses take a radius equal to the length of AB (distance from A to B).
7. With the above radius, cut an arc from C on the arc from G intersecting at D.
8. Join R, D and produce. ST is the required parallel line.

3. Steps of construction :



1. Draw a slanting line RS.
2. Mark a point X outside this slanting line anywhere in the plane.
3. Draw a line passing through X intersecting RS at A, making angle XAR with RS.
4. With A as centre and a convenient radius, draw an arc cutting AB and AR at C and D.
5. With X as centre and with the same radius draw an arc on the opposite side of AB cutting AB at E.
6. With a pair of compasses take a radius equal to the length of CD (distance from C to D).
7. With the above radius, cut an arc from E on the arc from E intersecting at F.
8. Join BF and produce. PQ is the required parallel line.

4. Steps of constructions :



1. Draw a line segment $XY = 6$ cm.
2. With X as centre and 2.5 cm radius, draw an arc cutting XY at A.
3. At point A, draw $\angle ZAY = 72°$.
4. With A as centre and 4.5 cm radius, draw an arc cutting at Z.
5. With A as centre and a convenient radius, draw an arc cutting AZ at X'.

6. With Z as centre and with the same radius draw an arc on the opposite side of AZ cutting AZ at P.
7. With a pair of compasses take a radius equal to the length of XX' (distance from X to X').
8. With the above radius, cut an arc from P on the arc from P intersecting at Q.
9. Join ZZ' and produce. ZZ' is the required parallel line.

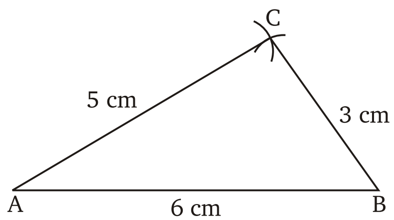
5. Do it yourself.

Exercise 12.2

1. Steps of construction :

1. Draw a line segment $AB = 6$ cm.
2. With A as centre and radius 5.5 cm, draw an arc.
3. With B as centre and radius 3 cm, draw another arc cutting the first arc at point C.
4. Join AC and BC.

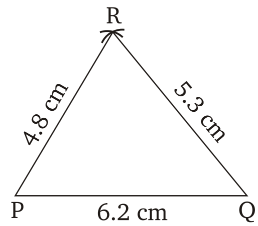
Then, ΔABC is the required triangle.



2. Steps of construction :

1. Draw a line segment $PQ = 6.2$ cm.
2. With P as centre and radius 4.8 cm, draw an arc.
3. With Q as centre and radius 5.3 cm, draw another arc cutting the first arc at point R.
4. Join PR and QR.

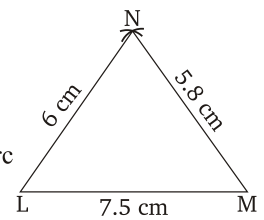
Then, ΔPQR is the required triangle.



3. Steps of construction :

1. Draw a line segment $LM = 7.5$ cm.
2. With L as centre and radius 6 cm, draw an arc.
3. With M as centre and radius 5.8 cm, draw another arc cutting first arc at N.
4. Join LN and MN.

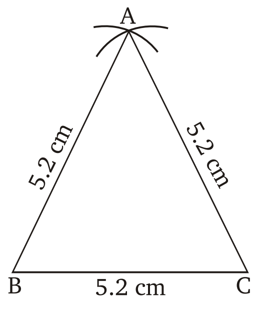
Then, ΔLMN is the required triangle.



4. Steps of construction :

1. Draw a line segment $BC = 5.2$ cm.
2. With B as centre and radius 5.2 cm, draw an arc.
3. With C as centre and 5.2 cm, draw another arc cutting the first arc at point A.
4. Join AB and AC.

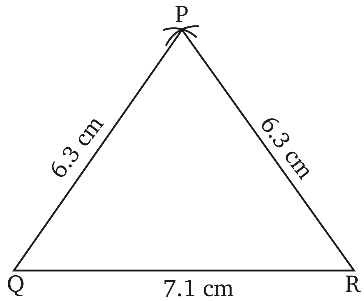
Then, ΔABC is the required triangle.



5. Steps of construction :

1. Draw a line segment $QR = 7.1$ cm.
2. With Q as centre and radius 6.3 cm, draw an arc.
3. With R as centre and radius 6.3 cm, draw another arc cutting the first arc at point P.
4. Join PQ and PR.

Then, ΔPQR is the required triangle.

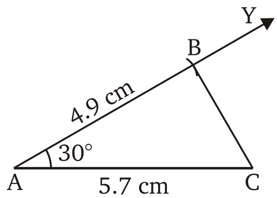


Exercise 12.3

1. Steps of construction :

1. Draw a line segment $AC = 5.7$ cm.
2. At A, draw angle of 30° with the help of a protractor.
3. With A as centre and radius 4.9 cm, draw an arc cutting AY at B.
4. Join BC.

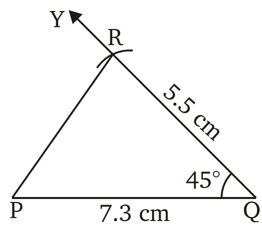
Then, ΔABC is the required triangle.



2. Steps of construction :

1. Draw a line segment $PR = 7.3$ cm.
2. At Q, draw an angle of 45° with the help of a protractor.
3. With Q as centre and radius 5.5 cm, draw an arc cutting QY at R.
4. Join PR.

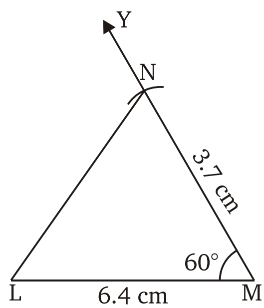
Then, ΔPQR is the required triangle.



3. Steps of construction :

1. Draw a line segment $LM = 6.4$ cm.
2. At M, draw an angle of 60° with the help of a protractor.
3. With M as centre and radius 3.7 cm, draw an arc cutting MY at N.
4. Join LM.

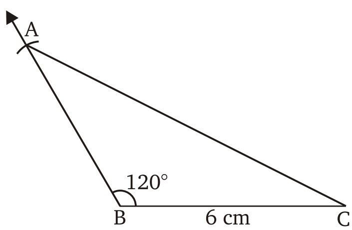
Then, ΔLMN is the required triangle.



4. Steps of construction :

1. Draw a line segment $BC = 6$ cm.
2. At B, draw an angle of 120° with the help of a protractor.
3. With M as centre and radius 6 cm, draw an arc cutting BY at A.
4. Join AC.

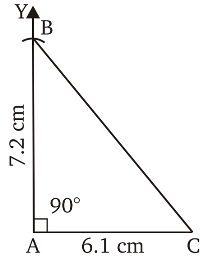
Then, ΔABC is the required triangle.



5. Steps of construction :

1. Draw a line segment $AC = 6.1$ cm.
2. At A, draw an angle of $90°$ with the help of a protractor.
3. With A as centre and radius 7.2 cm, draw an arc cutting AY at B.
4. Join BC.

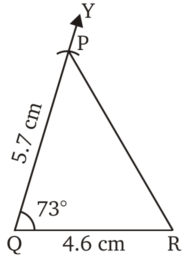
Then, ΔABC is the required triangle.



6. Steps of construction :

1. Draw a line segment $QR = 4.6$ cm.
2. At Q, draw an angle of $73°$ with the help of a protractor.
3. With Q as centre and radius 5.7 cm, draw an arc cutting QY at P.
4. Join PR.

Then, ΔPQR is the required triangle.

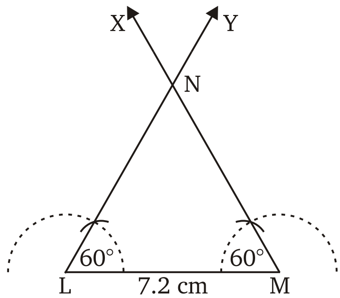


Exercise 12.4

1. Steps of construction :

1. Draw a line segment $LM = 7.2$ cm.
2. At point L, draw $\angle MLY = 60°$.
3. At point M, draw $\angle LMX = 60°$.
4. LY and MX intersect at Point N.

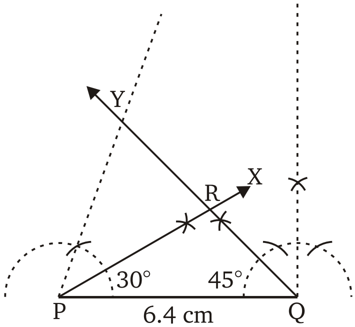
Thus, ΔLMN is the required triangle.



2. Steps of construction :

1. Draw a line segment $PQ = 6.4$ cm.
2. At point P, draw $\angle QPR = 30°$.
3. At point Q, draw $\angle PQR = 45°$.
4. PX and QY intersect at point R.

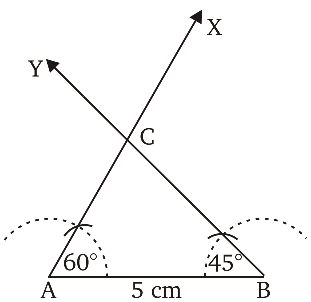
Thus, ΔPQR is the required triangle.



3. Steps of construction :

1. Draw a line segment $AB = 5$ cm.
2. At point A, draw $\angle BAX = 60°$.
3. At point B, draw $\angle ABY = 45°$.
4. BY and AX intersect at point C.

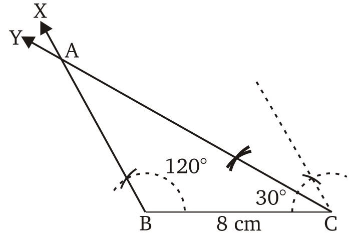
Thus, ABC is the required triangle.



4. Steps of construction :

1. Draw a line segment $BC = 8$ cm.
2. At point B, draw $\angle CBA = 120°$.
3. At point C, draw $\angle BCA = 30°$.
4. BX and CY intersect at point A.

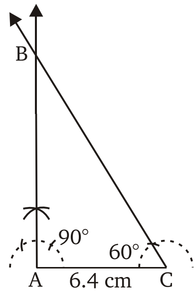
   Thus, ΔABC is the required triangle.



5. Steps of construction :

1. Draw a line segment $AC = 6.4$ cm.
2. At point A, draw $\angle CAB = 90°$.
3. At point C, draw $\angle ACB = 60°$.
4. AX and CY intersect at point C.

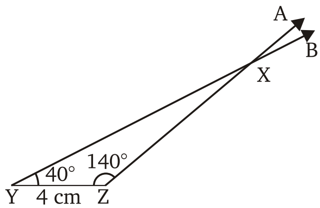
   Thus, ΔABC is the required triangle.



6. Steps of construction :

1. Draw a line segment $YZ = 4$ cm.
2. At point Y, draw $\angle ZYX = 40°$.
3. At point Z, draw $\angle YZX = 140°$.
4. YB and ZA intersect at point X.

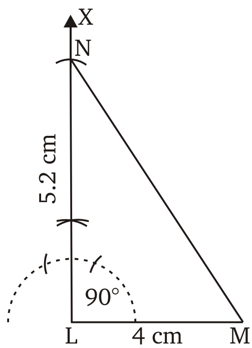
   Thus, ΔXYZ is the required triangle.



Exercise 12.5

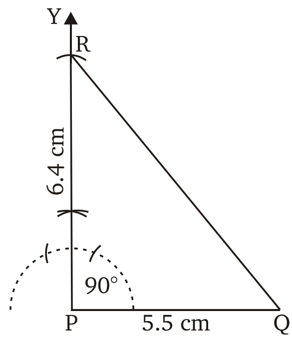
1. Steps of construction :

1. Draw a line segment $LM = 4$ cm.
2. At L, draw $\angle MLN = 90°$.
3. From LX, cut off $LN = 5.2$ cm.
4. Join BC.

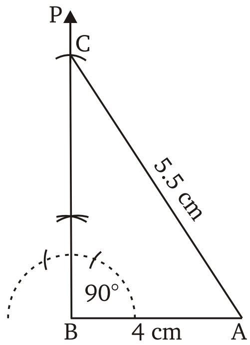


2. Steps of construction :

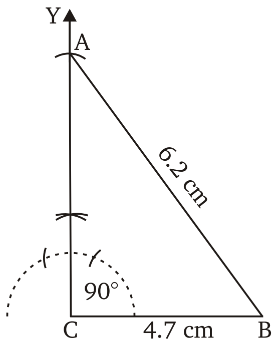
1. Draw a line segment $AB = 5.5$ cm.
2. At P, draw $\angle QPR = 90°$.
3. From PY, cut off $PR = 6.4$ cm.
4. Join RQ.



3. Steps of construction :
1. Draw a line segment $AB = 4$ cm.
2. At B, draw $\angle ABC = 90°$.
3. From A, cut off $AC = 5.5$ cm.
4. Join AC.



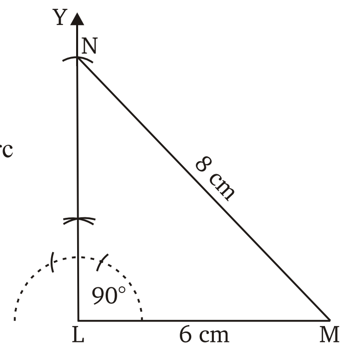
4. Steps of construction :
1. Draw a line segment $B = 4.7$ cm.
2. At C, draw $\angle BCA = 90°$.
3. From CY, cut off $AB = 6.2$ cm.
4. Join AB.



Exercise 12.6

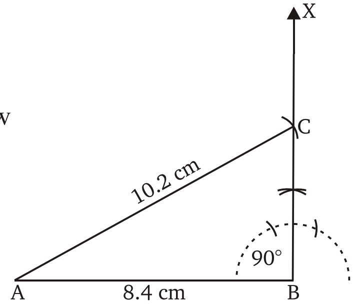
1. Steps of construction :
1. Draw a line segment $LM = 6$ cm.
2. At L, draw $\angle MLN = 90°$.
3. With M as centre and radius 8 cm, draw an arc cutting LY at N.
4. Join MN.

   Then, ΔLMN is the required triangle.



2. Steps of construction :
1. Draw a line segment $AB = 8.4$ cm.
2. At B, draw $\angle ABC = 90°$.
3. With A as centre and radius 10.2 cm, draw an arc cutting BX at C.
4. Join AC.

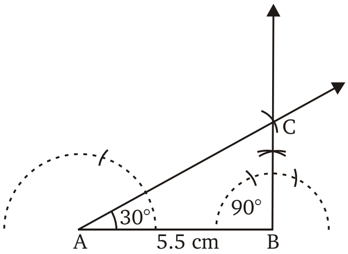
   Then, ΔABC is the required triangle.



3. Steps of construction :

1. Draw a line segment $AB = 5.5$ cm.
2. At B, draw $\angle ABC = 90°$.
3. With A as centre make another angle $\angle CAB = 30°$.
4. Join AC and their measure is 6.4 cm.

   Then, ΔABC is the required triangle.

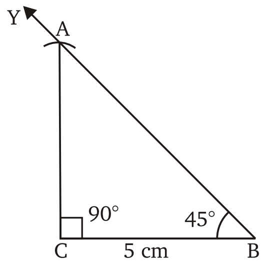


4. Steps of construction :

1. Draw a line segment $CB = 5$ cm.
2. At B, draw $\angle CBA = 90°$.
3. With B as centre and radius 5 cm, draw an arc cutting BY at A.
4. Join AC.

   Then, ΔABC is the required triangle.

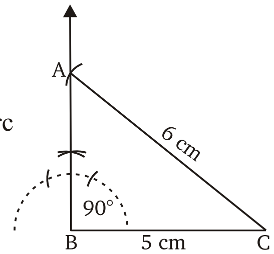
   Yes, this is a right angled triangle.



5. Steps of contruction :

1. Draw a line segment $BC = 5$ cm.
2. At B, draw $\angle CBA = 90°$.
3. With C as centre and radius 6 cm, draw an arc cutting BY at A.
4. Join AC.

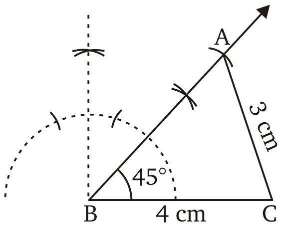
   Then, ΔABC is the required triangle.



6. Steps of construction :

1. Draw a line segment $BC = 4$ cm.
2. At B, draw $\angle CBA = 45°$.
3. With C as centre and radius 3 cm, draw an arc cutting BX at A.
4. Join AC.

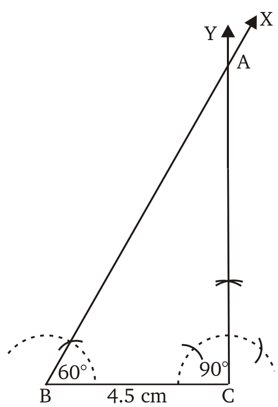
   Then, ΔABC is the required triangle.



7. Steps of construction :

1. Draw a line segment $BC = 4.5$ cm.
2. At B, draw $\angle CBA = 60°$.
3. At C, draw $\angle BCA = 90°$.
4. BX and CY intersect at point A.

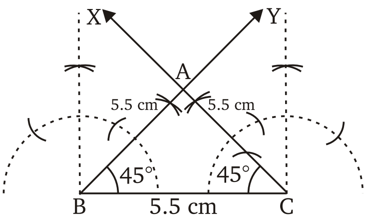
   Thus, ΔABC is the required triangle.



8. Steps of construction :

1. Draw a line segment $BC = 5.5$ cm.
2. At B, draw $\angle CBA = 45°$.
3. At C, draw $\angle BCA = 45°$.
4. BY and CX intersect at point A.

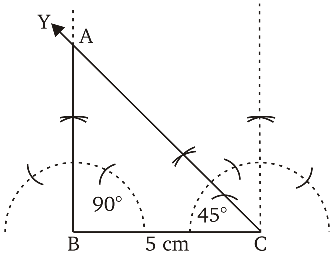
Thus, ΔABC is the required triangle.



9. Steps of construction :

1. Draw a line segment $BC = 5$ cm.
2. At B, draw $\angle CBA = 90°$.
3. With C as centre and radius 7 cm, draw an arc cutting CY at A.
4. Join AC.

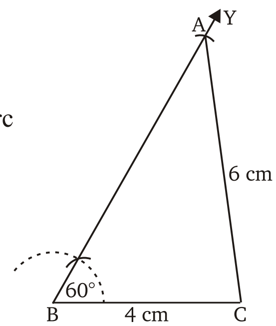
Then, ΔABC is the required triangle.



10. Steps of construction :

1. Draw a line segment $BC = 4$ cm.
2. At point B, draw $\angle CBA = 60°$.
3. With C as centre and radius 6 cm, draw an arc cutting BY at A.
4. Join AC.

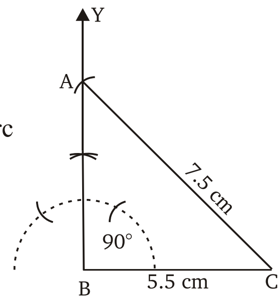
Then, ΔABC is the required triangle.



11. Steps of construction :

1. Draw a line segment $BC = 5.5$ cm.
2. At point B, draw $\angle CBA = 90°$.
3. With C as centre and radius 7.5 cm, draw an arc cutting BY at A.
4. Join AC.

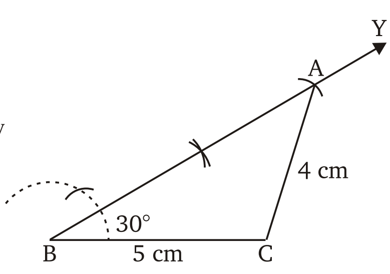
Then, ΔABC is the required triangle.



12. Steps of construction :

1. Draw a line segment $BC = 5$ cm.
2. At point B, draw $\angle CBA = 30°$.
3. With C as centre and radius 4 cm, draw an arc cutting BY at A.
4. Join AC.

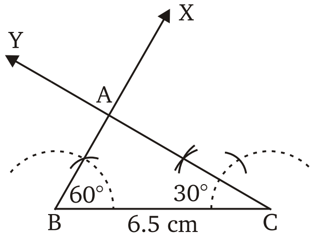
Then, ΔABC is the required triangle.



13. Steps of construction :

1. Draw a line segment $BC = 6.5$ cm.
2. At point B, draw $\angle CBA = 60°$.
3. At point C, draw $\angle BCA = 30°$.
4. BX and CY intersect at point A.

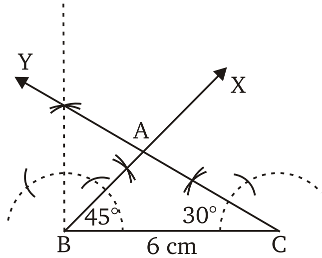
Thus, ΔABC is the required triangle.



14. Steps of construction :

1. Draw a line $BC = 6$ cm.
2. At point B, draw $\angle CBA = 45°$.
3. At point C, draw $\angle BCA = 30°$.
4. BX and CY intersect at point A.

Thus, ΔABC is the required triangle.



13 Perimeter and Area

Exercise 13.1

1. Since, the area of the rectangle $= l \times b$

And the perimeter of the rectangle $= 2(l + b)$

(a) Given, $l = 4.3$ m, $b = 206$ cm $= 2.06$ m ($\because$ 1 m = 100 cm)

$\therefore$ Area $= (4.3 \times 2.06)\text{ m}^2 = 8.858\text{ m}^2$

Perimeter $= 2(4.3 + 2.06)$ m $= 12.72$ m

(b) Given, $l = 340$ cm $= 3.40$ m, $b = 3100$ mm $= 3.10$ m

$\therefore$ Area $= (3.40 \times 3.10)\text{ m}^2 = 10.54\text{ m}^2$

Perimeter $= 2(3.40 + 3.10)$ m $= 2 \times 6.5$ m $= 13$ m

(c) Given, $l = 2$ m 22 cm $= 2.22$ m, $b = 7.2$ dm $= 7.2$ m

$\therefore$ Area $= 2.22 \times 0.72)\text{ m}^2 = 1.5984\text{ m}^2$

Perimeter $= 2(2.22 + 0.72)$ m $= 2 \times 2.94$ m $= 5.88$ m

2. Since, the area of the square $= \text{side}^2$

And the perimeter of the square $= 4$ side

(a) Given, side $= 3.6$ m $= 3.6 \times 100 = 360$ cm ($\because$ 1 m = 100 cm)

$\therefore$ Area $= (360)^2\text{ cm}^2 = 129600\text{ cm}^2$

perimeter $= 4$ side $= 4 \times 360$ cm $= 1440$ cm

(b) Given, side $= 44000$ mm $= 4400$ cm

$\therefore$ Area $= (4400)^2\text{ cm}^2 = 19360000\text{ cm}^2$

Perimeter $= 4 \times 4400$ cm $= 17600$ cm

(c) Given, side $= 1$ m 73 cm $= 173$ cm

$\therefore$ Area $= (173)^2\text{ cm}^2 = 29929\text{ cm}^2$

Perimeter $= 4$ side $= 4 \times 173$ cm $= 692$ cm

3. (a) Area $= 256\,m^2$

$\because$ Area $= side^2$

$\therefore$ $256\ m^2 = side^2$

side $= \sqrt{256}\ m$

side $= 16\,m$

And, Perimeter $= 4 \times 16\,m$

$= 64\ m$

(b) Area $= 12.25\,m^2$

$\therefore$ $12.25\ m^2 = side^2$

side $= \sqrt{12.25}\ m$

side $= 3.5\,m$

And, Perimeter $= 4 \times$ side

$= 4 \times 3.5\,m$

$= 14\ m$

(c) Area $= 28900\,cm^2$

$\therefore$ $28900\ cm^2 = side^2$

side $= \sqrt{28900}\ cm$

$= 170\,cm$

And, perimeter $= 4 \times 170\,cm$

$= 680\,cm$

4. The perimeter of a square $= 48\,cm$

Let the length of a square be l cm.

$\therefore$ 4 side $= 48\,cm$

$4 \times l = 48\,cm$

$l = 48 \div 4\ cm = 12\,cm$

Hence, the length of a square is 12 cm.

5. (a) The perimeter of the given figure

$= (17 + 2 + 5 + 2 + 4 + 2 + 8 + 6)\,cm$

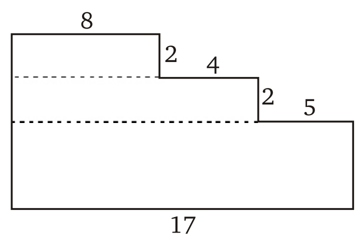
$= 46\,cm$

And the area of the given figure

$= [17 \times 2 + 12 \times 2 + 8 \times 2]\,cm^2$

$= (34 + 24 + 16)\,cm^2$

$= 74\ cm^2$



(b) The perimeter of the given figure

$= (9 + 3 + 3 + 2 + 3 + 2 + 3 + 3)\,cm$

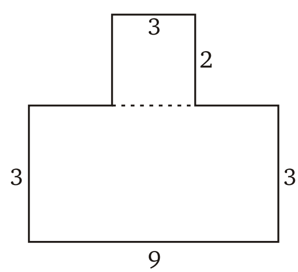
$= 28\,cm$

And the area of the given figure

$= [9 \times 3 + 3 \times 2]\,cm^2$

$= (27 + 6)\,cm^2$

$= 33\,cm^2$



(c) The perimeter of the given figure

$= (8+2+5+3+3+2+3+3+5+2+8+12)$ cm

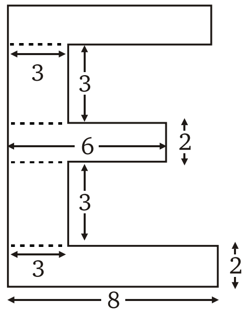
$= 56$ cm

And the area of the given figure

$= [8\times 2+3\times 3+6\times 2+3\times 3+8\times 2]\ \text{cm}^2$

$= [16+9+12+9+16]\ \text{cm}^2$

$= 62\ \text{cm}^2$



6. Let the breadth of a rectangular hallway be x m.

Then, the length of a rectangular hallway is $3x$ m.

So, the perimeter of a rectangular hallway $= 2(l+b)$

$$48\text{ m} = 2(x+3x)$$
$$48\text{ m} = 2\times 4x$$
$$8x = 48\text{ m}$$
$$x = 48\text{ m} \div 8$$
$$x = 6\text{ m}$$

Hence, the length $= 3x = 3\times 6\text{ m} = 18$ m and breadth $= x = 6$ m.

7. We have, length $= 6.8$ m

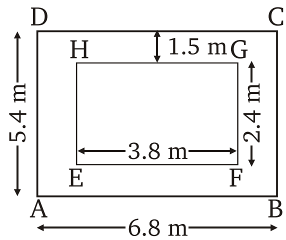
breadth $= 5.4$ m

Area of $ABCD = 6.8\times 5.4\ \text{m}^2$

$= 36.72\ \text{m}^2$

Area of $EFGH = 3.8\times 2.4\ \text{m}^2$

$= 9.12\ \text{m}^2$



(a) So, the area of the flower bed = Area of $ABCD$ – Area of $EFGH$

$= (36.72 - 9.12)\ \text{m}^2 = 27.6$ sq m.

(b) Since, the cost of 1 sq. m of growing grass = ₹ 7

$\therefore$ the cost of 9.12 sq. m of growing grass = ₹ 7 × 9.12 = ₹ 63.84

8. We have, length of a room $= 8.4$ m

breadth of a room $= 4$ m

Therefore, the area of a room $= 8.4\times 4\ \text{m}^2 = 33.6\ \text{m}^2$

$= 33.6\times 10000\ \text{cm}^2 = 336000\ \text{cm}^2$

The area of one piece of marble $= 60\times 40\ \text{cm}^2$

$= 2400\ \text{cm}^2$

(a) The number of marble pieces $= \dfrac{\text{The area of a room}}{\text{The area of one marble piece}}$

$= \dfrac{336000}{2400} = 140$

(b) The cost of 1 marble piece of flooring = ₹ 35.50

$\therefore$ the cost of 140 marble pieces = ₹ 140 × 35.50

= ₹ 4970

9. (a) The area of the shaded part $= 1.5 \times 4 \text{ cm}^2$

$= 6.0 \text{ cm}^2$

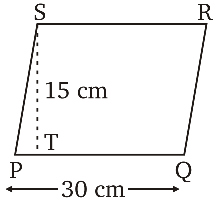
(b) The area of the shaded part $= 4 \times (38.5 \times 33.5) \text{ m}^2$

$= 4 \times 1289.75 \text{ m}^2$

$= 5159 \text{ m}^2$

Exercise 13.2

1. Since,



Area of the parallelogram $=$ (base $\times$ height)

$\therefore$ Area of $PQRS = PQ \times ST$

$= 30 \times 15 \text{ cm}^2$

$= 450 \text{ cm}^2$

2. The area of the parallelogram $ABCD = AB \times CT$

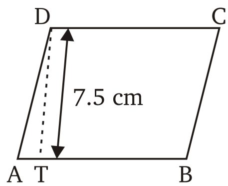
$= 6.5 \times 3.5 \text{ cm}^2$

$= 22.75 \text{ cm}^2$

3. The corresponding length of the parallelogram

$= (71.25 \div 7.5) \text{ cm}$

$= 9.5 \text{ cm}$



4. The side of a square $= 40 \text{ m}$

$\therefore$ the area of a square $= \text{side}^2$

$= 40^2 \text{ m}^2 = 1600 \text{ m}^2$

$\because$ the area of a square $=$ the area of a parallelogram

$\therefore$ $1600 \text{ m}^2 =$ base $\times$ altitude

$1600 \text{ m}^2 = 50 \times$ altitude

altitude $= (1600 \div 50) \text{ m} = 32 \text{ m}$

Hence, the corresponding height of the parallelogram is 32 m.

5. The height of parallelogram $= (2880 \div 120) \text{ cm} = 24 \text{ cm}$

Since, $PS = RQ = 26$ cm and $ST = 24$ cm

$\therefore$ by pythagoras theorem

$PS^2 = ST^2 + PT^2$

$26^2 = 24^2 + PT^2$

$676 = 576 + PT^2$

$PT^2 = 676 - 576$

$PT^2 = 100$

$PT = \sqrt{100}$

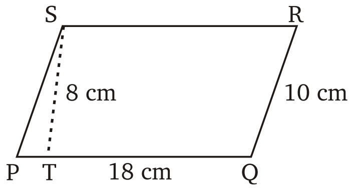
$PT = 10 \text{ cm}$

6. The area of parallelogram

$= PQ \times ST$

$= 18 \times 8\ cm^2$

$= 144\ cm^2$



Therefore, the distance between PS and QR.

$=$ Area of parallelogram $\div QR$

$= (144 \div 10)\ cm = 14.4\ cm$

7. The height of smaller side = Area of the parallelogram $\div AB$

$= (12900 \div 172)\ m = 75\ m$

Similarly,

The height of bigger side $=$ Area of the parallelogram $\div BC$

$= (12900 \div 150)\ m = 86\ m$

Hence, the corresponding height of bigger and smaller sides is 86 m and 75 m respectively.

Exercise 13.3

1. Since, the area of the triangle $= \frac{1}{2}$ base $\times$ altitude

(a) Given, base $= 35\ cm$,

altitude $= 15\ cm$

$\therefore$ the area of the triangle $= \frac{1}{2} \times 35 \times 15\ cm^2$

$= 35 \times 7.5\ cm^2$

$= 262.5\ cm^2$

(b) Given, base $= 47\ m$,

altitude $= 33\ m$

$\therefore$ Area of the triangle $= \frac{1}{2} \times 47 \times 33\ m^2$

$= 47 \times 16.5\ m^2$

$= 775.5\ m^2$

2. The area of a triangle $= 220\ cm^2$

altitude $= 11\ cm^2$

base $= ?$

$\therefore$ base $=$ the area of a triangle $\div$ altitude

$= (220 \div 11)\ cm = 20\ cm$

Hence, the length of the base of a triangle is 20 cm.

3. base $= 60\ m$,

altitude $= 15\ m$

The area of cloth $= \frac{1}{2} \times 60 \times 15\ m^2$

$= 30 \times 15\ m^2 = 450\ m^2$

$\because$ the cost of printing 1 m^2 of cloth $=$ ₹ 1.50

$\therefore$ the cost of printing 450 m^2 of cloth $= ₹\ 1.50 \times 4.50 = ₹\ 675$

4. Each side of an equilateral triangle $= 20\,cm$

The area of an equilateral triangle $= \frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4}(20)^2\ cm^2$

$= \frac{\sqrt{3}}{4} \times 400\,cm^2$

$= \sqrt{3} \times 100\,cm^2 = 173.20\,cm^2$

And the height of the triangle $= (2 \times 173.20 \div 20)\,cm$

$= (346.4 \div 20)\,cm$

$= 17.32\,cm$

5. The area of a triangle $= 216\,cm^2$

base $= 24\ cm$

altitude $= ?$

$\therefore$ altitude $=$ area of a triangle $\div$ base

$= (216 \div 24)\,cm$

$= 9\,cm$

6. Let the altitude of a triangle be x m.

Then, the base is $4x$ m.

$$\frac{1}{2}x \times 4x = (900 \div 4.5)$$

$$\frac{1}{2} \times 4x^2 = 200$$

$$2x^2 = 200$$

$$x^2 = 200 \div 2$$

$$x^2 = 100$$

$$x = \sqrt{100}$$

$$x = 10\,m$$

Hence, the altitude of triangular field is 10 m.

7. The perimeter of an equilateral triangle $= 18\,cm$

$\therefore$ 3 side $= 18\,cm$

side $= (18 \div 3)\,cm$

$= 6\,cm$

$\therefore$ the area of an equilateral triangle $= \frac{\sqrt{3}}{4}\,side^2$

$= \frac{\sqrt{3}}{4} \times 6^2\ cm^2$

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

$= 15.58\,cm^2$

8. Let the base and height of a triangle be $3x$ and $2x$ respectively.

Therefore, $\frac{1}{2}3x \times 2x = 108\,cm^2$

$$3x^2 = 108\,cm^2$$

$$x^2 = 36\,cm^2$$
$$x = \sqrt{36}\,cm$$
$$x = 6\,cm$$

So, its base $= 3x = 3 \times 6\,cm$
$$= 18\,cm$$

height $= 2x = 2 \times 6\,cm = 12\,cm$

9. The area of the parallelogram $=$ Area of $\Delta PSR +$ Area of ΔPQR
$$= \left(\frac{1}{2} \times 72 \times 24 + \frac{1}{2} \times 72 \times 24\right) cm^2$$
$$= (72 \times 12 + 72 \times 12)\,cm^2$$
$$= 1728\,cm^2$$

10. Let the height of a triangular field be x m.
Then, the base of a triangular field is $4x$.

So, the area of a triangular field $= \frac{1}{2} x \times 4x$
$$6609.90 \div 367.20 = 2x^2$$
$$18 = 2x^2$$
$$x^2 = 18 \div 2 = 9\,\text{hectare}$$
$$x = \sqrt{90000}\ (\because 1\text{ hectare} = 10000\,m^2)$$
$$x = 300\,m$$

Thus, the base are :
$$4x = 4 \times 300\,m = 1200\ m$$

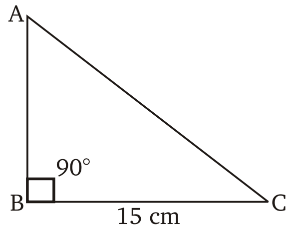
the height are : $= x = 300\,m$

11. The area of right triangle board $= (1050 \div 4.80)\,m^2 = 218.75\,m^2$

$\therefore$ the base of the triangle $= 2 \times$ the area of right triangle $\div$ height
$$= (2 \times 218.75 \div 17.5)\,m$$
$$= (437.5 \div 17.5)\,m = 25\,m$$

Hence, the base of the triangle is 25 m.

12. The area of the right angled triangle
$$= \frac{1}{2}\,\text{base} \times \text{height}$$
$$= \left(\frac{1}{2} \times 15 \times 12\right) cm^2$$
$$= 15 \times 6 = 90\,cm^2$$



13. The area of a right-angled triangle $= 103.35\,cm^2$

one side $= 15.9\,cm$

other side $= ?$

$\because$ the area of a right-angled triangle $= \frac{1}{2}$ one side $\times$ other side

$\therefore$ $103.35 = \frac{1}{2}\,15.9 \times$ other side

$\therefore$ other side $= (206.70 \div 15.9)$ m

other side $= 13$ m

Hence, the other side of given triangle is 13 m.

14. The area of quadrilateral $ABCD$ = area of ΔADC + area of ΔABC

$$= \left(\frac{1}{2} \times 36 \times 18 + \frac{1}{2} \times 36 \times 16\right) \text{cm}^2$$

$$= (36 \times 9 + 36 \times 8)\ \text{cm}^2$$

$$= (324 + 288)\ \text{cm}^2 = 612\ \text{cm}^2$$

15. Since, the area of a triangle = the area of square.

$$\therefore \quad \frac{1}{2} \times \text{base} \times \text{altitude} = \text{side}^2$$

$$\frac{1}{2} \times 72 \times \text{altitude} = 48^2$$

$$36 \times \text{altitude} = 2304\ \text{cm}^2$$

$$\text{altitude} = (2304 \div 36)\ \text{cm} = 64\ \text{cm}$$

Exercise 13.4

1. Since, the circumference of the circle $= 2\pi r = \pi D$

(a) $D = 21$ cm (Given)

$\therefore$ the circumference of the circle $= \frac{22}{7} \times 21\ \text{cm} = 22 \times 3\ \text{cm} = 66\ \text{cm}$

(b) $D = 6.3$ cm (Given)

$\therefore$ the circumference of the circle $= \frac{22}{7} \times 6.3\ \text{cm} = 22 \times 0.9\ \text{cm} = 19.8\ \text{cm}$

2. (a) The circumference of a circle $= 2\pi r$

$$6.38 = 2 \times \frac{22}{7} \times r$$

$$7 \times 6.38 = 44r$$

$$r = \frac{44.66}{44}\ \text{cm}$$

$$r = 1.015\ \text{cm}$$

$\therefore$ the diameter $= 2 \times r = 2 \times 1.015$ cm

$= 2.03$ cm.

(b) The circumference of a circle $= 2\pi r$

$$2\pi r = 28.6\ \text{cm}$$

$$2 \times \frac{22}{7} \times r = 28.6\ \text{cm}$$

$$44r = 28.6 \times 7\ \text{cm}$$

$$r = \frac{28.6 \times 7}{44}\ \text{cm} = 4.55\ \text{cm}$$

$\therefore$ the diameter $= 2 \times r = 2 \times 4.55\ \text{cm} = 9.10$ cm.

3. The circumference of first circle $= 2\pi r_1$

$\therefore$ $2\pi r_1 = 44$ cm

$$2 \times \frac{22}{7} \times r_1 = 44$$

$$\frac{44}{7} \times r_1 = 44$$

$$r_1 = 7\text{ cm}$$

The circumference of second circle $= 2\pi r_2$

$$2\pi r_2 = 110\text{ cm}$$

$$2 \times \frac{22}{7} \times r_2 = 110\text{ cm}$$

$$r_2 = 2.5 \times 7 = 17.5\text{ cm}$$

So, the difference $= 17.5 - 7 = 10.5$ cm

4. The ratio between the diameter of two circles $5:6$

$$D_1 : D_2 = 5:6$$

So, the ratio between circumference $= \pi D_1 : \pi D_2 = D_1 : D_2 = 5:6$

5. The diameter of a wheel $= 1.26$ m

$\therefore$ the circumference of a wheel $= 2\pi r$

$$= \pi D$$

$$= \frac{22}{7} \times 1.26\text{ m} = 22 \times 0.18\text{ m} = 3.96\text{ m}$$

$\therefore$ the distance covered by wheel in 500 revolutions

$$= 500 \times 3.96\text{ cm} = 1980\text{ cm}$$

6. The perimeter of a triangular wire $=$ the circumference of a circle

$$28.26\text{ cm} = 2\pi r$$

$$28.26\text{ cm} = \pi D \quad (\because D = 2r)$$

$$28.26\text{ cm} = \frac{22}{7} D$$

$$D = \frac{28.26 \times 7}{22}$$

$$D = 8.99\text{ cm} = 9\text{ cm}$$

Hence, the diameter of the circle is 9 cm.

7. The radius of circular park $= 420$ m

$\therefore$ the circumference of circular park $= 2\pi r$

$$= 2 \times \frac{22}{7} \times 420\text{ m}$$

$$= 2 \times 22 \times 60\text{ m} = 44 \times 60\text{ m} = 2640\text{ m}$$

$\therefore$ the distance covered by a boy in one round $= 2640$ m

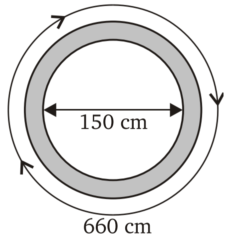
$\therefore$ the distance covered by a boy in 4 round $= 2640 \times 4$ m $= 10560$ m $= 10.560$ km

But, speed $= 3$ km/h (Given)

$$\text{Time} = \frac{\text{Total distance covered by 4 round}}{\text{Speed}}$$

$$= \frac{10.560}{3}\text{ hours} = 3.52\text{ hours}$$

8. The circumference of outer edge $= 2\pi R$



$\therefore \quad 660 = D_1 \times \frac{22}{7}$

$30 \times 7 = D_1$

$D_1 = 210\,\text{cm}$

Since, $D_2 = 150\,\text{cm}$

and $D_1 > D_2$

So,

the width of the parapet $= \frac{(D_1 - D_2)}{2}$

$= \frac{210 - 150)}{2}\,\text{cm} = \frac{60}{2}\,\text{cm} = 30\,\text{cm}$

$= (210 - 150)\,\text{cm}/2 = 60\,\text{cm}/2 = 30\,\text{cm}$

9. $r = 4.2\,\text{cm}$ (Given)

The area of a circle $= \pi r^2$

$= \frac{22}{7} \times (4.2)^2$

$= \frac{22}{7} \times 4.2 \times 4.2 = 55.44\ \text{cm}^2$

10. The area of a circle $= 1386\,\text{cm}^2$

$\therefore \quad 2r = D = ?$

The area of a circle $= \pi r^2$

$\pi r^2 = 1386$

$\frac{22}{7} \times r^2 = 1386$

$r^2 = \frac{1386 \times 7}{22}$

$r^2 = 63 \times 7$

$r^2 = 441$

$r = \sqrt{441} = 21\,\text{cm}$

$D = 2r = 2 \times 21\,\text{cm} = 42\,\text{cm}$

Hence, the diameter of a circle is 42 cm.

11. $r_1 = 15\,\text{cm}, r_2 = 18\,\text{cm}$

Since, $r_1 < r_2$

So, we know that,

the area of a ring $= \pi (r_2^2 - r_1^2)$

$= \frac{22}{7} \times (18^2 - 15^2)$

$= \frac{22}{7} \times (324 - 225)$

$= \frac{22}{7} \times 99 = 310.86\,\text{cm}^2$

12. The circumference of a circle $= 110\,\text{cm}$

$$2\pi r = 110\,\text{cm}$$
$$2 \times \frac{22}{7} r = 110\,\text{cm}$$
$$\frac{22}{7} r = 55\,\text{cm}$$
$$\frac{2}{7} r = 55\,\text{cm}$$
$$\frac{2}{7} r = 5\,\text{cm}$$
$$r = \frac{5 \times 7}{2}$$
$$r = \frac{35}{2}\,\text{cm}$$

$\therefore$ the area of a circle $= \frac{22}{7} \times \left(\frac{35}{2}\right)^2\,\text{cm}^2$

$$= \frac{22}{7} \times \frac{35 \times 35}{4} = \frac{11 \times 5 \times 35}{2}\,\text{cm}^2$$
$$= \frac{55 \times 35}{2}\,\text{cm}^2 = 962.5\,\text{cm}^2$$

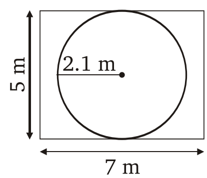
13. The given ratio of radii of the two circles $= 3 : 5$

i.e., $r_1 : r_2 = 3 : 5$

$\therefore$ the ratio of their areas $= \pi r_1^2 : \pi r_2^2 = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{3}{5}\right)^2 = 9 : 25$

14. The area of a rectangular sheet $= 7\,\text{m} \times 5\,\text{m}$

$$= 35\,\text{m}^2$$



And the area of a circle $= \pi r^2$

$$= \frac{22}{7} \times 2.1 \times 2.1$$
$$= 22 \times 0.3 \times 2.1 = 13.86\,\text{m}^2$$

So, the area of the remaining sheet = the area of complete sheet – the area of a circle

$$= (35 - 13.86)\,\text{m}^2 = 21.14\,\text{m}^2$$

15. Let the outer and inner radii of the well be R meter and r meter respectively.

Then, $2\pi R = 660$

$$R = 660 \times \frac{7}{22} \times \frac{1}{2} = 105\,\text{m}$$

And $2r = 150\,\text{m}$

$$r = 75\,\text{m}$$

The width of the well $= (R - r) = (105 - 75)\,\text{m} = 30\,\text{m}$

Hence, width of the well is 30 cm.

MCQs

1. (d) **2.** (a) **3.** (a) **4.** (b) **5.** (c) **6.** (a)