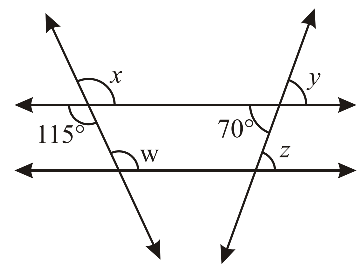
9. $y = 70°$ (Vertically opp. angles)



$\because$ $z = y$ (corresponding angles)

$\Rightarrow$ $z = 70°$

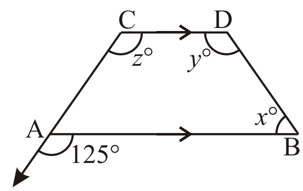
$\because$ $x = 115°$ (vertically opp. angles)

$\Rightarrow$ $w = x$ (corresponding angles)

$w = 115°$

Hence, $x = 115°$, $y = 70°$, $w = 115°$

10. $AB \| CD$



$\therefore$ $z = 125°$ (corresponding angles)

In Trapezium $ABCD$,

$x + z = 180°$ (sum of opposite $\angle s = 180°$

$\Rightarrow$ $x + 125 = 180$

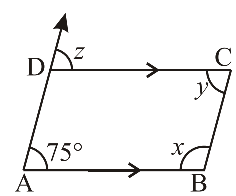
$\Rightarrow$ $x = 180° - 125° = 55°$

$x + y = 180$ (sum of co-interior $\angle s$)

$55 + y = 180°$

$\Rightarrow$ $y = 180° - 55° = 125°$

11. $DC \| AB$



$\Rightarrow$ $z = 75°$ (corresponding$\angle s$)

$y = z$ (Alternative $\angle s$)

$\therefore$ $y = 75°$

Again $DC \| AB$ & BC is a transversal

$\therefore$ $x + y = 180$ (sum of co-interiors $\angle s$)

$x + 75° = 180°$

$\Rightarrow$ $x = 180 - 75 = 105°$

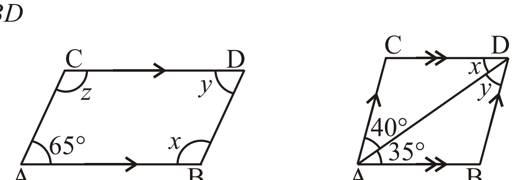
Hence, $x = 105°$, $y = 75°$, $z = 75°$

12. Given $AB \| CD$, $AC \| BD$

(i) $z + 65 = 180°$ (sum of co-interior angles)

$z = 180° - 65$ $z = 115°$

$AC \| BD$



$\therefore$ $x = 180 - 65$

$x = 115°$

again, $CD \| AB$

$\therefore$ $y + x = 180$ (sum of co-interior angles)

$y = 180° - x$

$y = 180 - 115 = 65°$

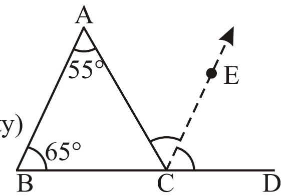
Hence, $x = 115°$, $y = 65°$, $z = 115°$

(ii) $CD \| AB$ and AD is a transversal

$\therefore$ $x = 35°$ (Alternate $\angle s$)

and $y = 40°$ (Alternate $\angle s$)

13. Given $CE \parallel BA$, $\angle ABC = 65°$, $\angle BAC = 55°$



$\angle ACE = \angle BAC$ (Alternate angles)

$= 55°$

$ACD = \angle A + \angle B$ (exterior angle property)

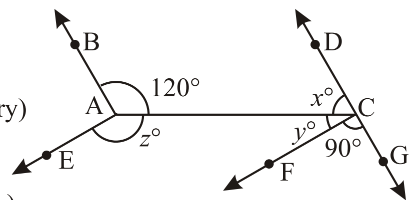
$= 55° + 65° = 120°$

Now, $ACD = \angle ACE + \angle ECD$

$120 = 55 + \angle ECD$

$\Rightarrow \angle ECD = 120 - 55 = 65°$

14. Given $AB \parallel CD$, $AE \parallel CF$ and $\angle FCG = 90°$



$\because$ $AB \parallel CD$ and AC is a transversal

$\therefore$ $x + 120° = 180$

(co-interior angles are supplementry)

$x = 180 - 120 = 60°$

Now, $x + y = 90° = 180°$

(Angles at a point on a straight line)

$60 + y = 90 = 180°$

$\Rightarrow$ $y = 180 - 150 = 30°$

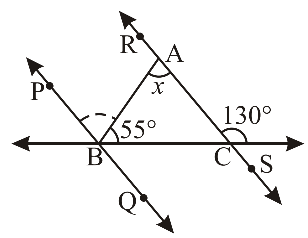
Similarly, $AE \parallel CF$ and AC is a transversal

$\therefore$ $z + y = 180$ (co-interior angles are supplementary)

$z + 30 = 180°$

$\Rightarrow$ $z = 180 - 30 = 150°$

15. Given $PQ \parallel RS$



In ΔABC, we know that

$x + 55 = 130°$

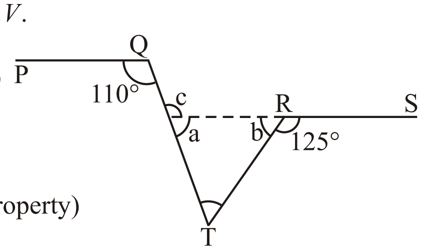
(exterior angle property)

$x = 130 - 55$

$x = 75°$

16. Given, $PQ \parallel RS$

produce RS towards QT which meet QT at point V.



Now, $PQ \parallel VR$ and QT is a transversal

$\therefore$ $\angle C = 110°$ (alternate angles)

VS is a straight line

$\therefore$ $b + 125 = 180$ (linear pair)

$b = 180 - 125 = 55°$

Now, $c = x + b$ (exterior angle property)

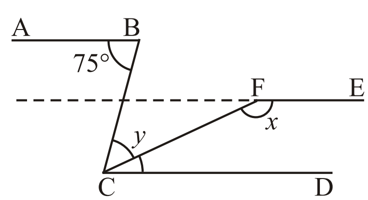
$\Rightarrow$ $110 = x + 55$

$\Rightarrow$ $x = 110 - 55 = 55°$

Hence, $x = 55°$

17. Given, $AB \parallel CD \parallel EF$ $CD \parallel EF$ and CE is a transversal

$\therefore$ $x + 25 = 180°$ (co-interior angles)



$x = 180° - 25° = 155°$

$\because$ $AB \parallel CD$ and BC is a transversal

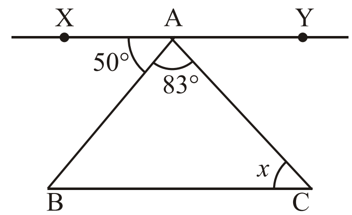
$\angle ABC = \angle BCD$ [$\because \angle BCD = y + 25°$]

$75 = y + 25$

$75 - 25 = y$

$\Rightarrow$ $y = 50°$

18. Given $XY \parallel BC$

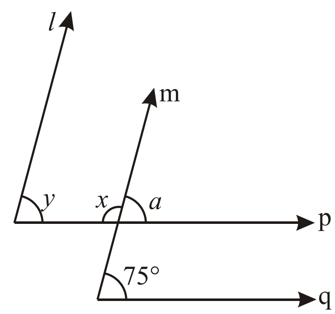


$\therefore \quad \angle B = 50 \quad$ (alternate angle)

Now In $\Delta\, ABC$,

$$A + B + C = 180$$
$$83 + B + x = 180$$
$$\Rightarrow \quad 83 + 50 + x = 180$$
$$\Rightarrow \quad 133 + x = 180$$
$$\Rightarrow \quad x = 180° - 133°$$
$$x = 47°$$

19. Given $l \parallel m$ and $p \parallel q$



$\because \quad p \parallel q$

$\therefore \quad a = 75 \quad$ (corresponding angles)

now, $\quad x + a = 180° \quad$ (linear pair)

$$x + 75 = 180°$$
$$\Rightarrow \quad x = 180 - 75 = 105°$$

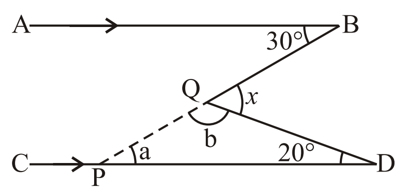
again, $l \parallel m$ and P is a transversal

$$x + y = 180°$$

(sum of the interior angles on the same side of the transversal is 180°)

$$105 + y = 180°$$
$$y = 180 - 105 = 75°$$

20. Produce BQ which meet CD at point P.



Now $AB \parallel CD$ and BP is a transversal

$\therefore \quad \angle a = 30°$

(alternate angles)

Now, In $\Delta\, PQD$,

$$\angle b + \angle a + 20 = 180°$$

(sum of all the angles of a triangle)

$$\Rightarrow \quad b + 30 + 20° = 180°$$
$$\Rightarrow \quad b = 180° - 50° = 130°$$

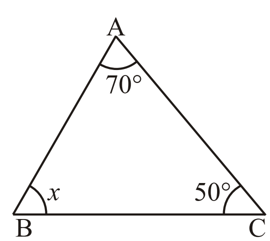
MCQ's

1. (a) **2.** (b) **3.** (b) **4.** (a) **5.** (b) **6.** (b) **7.** (c) **8.** (b).

10. Triangles and Its Properties

Exercise 10.1

1. (a) In $\Delta\, ABC$



$$\angle A + \angle B + \angle C = 180°$$

(sum of the angles of a triangle is 180°)

$$70 + 50 + x = 180$$
$$\Rightarrow \quad x = 180 - 120$$
$$\Rightarrow \quad x = 60°$$

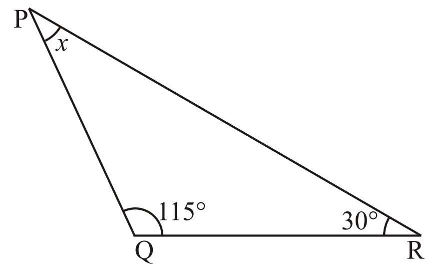
(b) In PQR,

$\angle P + \angle Q + \angle R = 180$

$x + 115 + 30 = 180$

$x = 180 - 145$

$x = 35°$



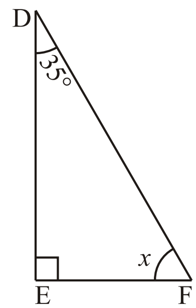
(c) In ΔDEF,

$\angle D + \angle E + \angle F = 180°$

$35° + 90° + x = 180°$

$x = 180° - 125°$

$x = 55°$



(d) In ΔXYZ,

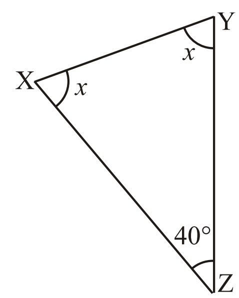
$X + Y + Z = 180°$

$x + x + 40 = 180°$

$2x = 180 - 40$

$2x = 140°$

$x = \frac{140}{2} = 70°$



(e) In ΔLMN,

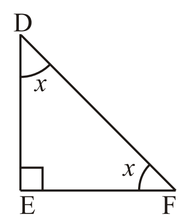
$\angle L + \angle M + \angle N = 180°$

$x + 90 + x = 180°$

$2x = 180° - 90°$

$2x = 90°$

$x = \frac{90°}{2} = 45°$



(f) $x = 74°$ (vertically opposite angle)

Now, In ΔABC

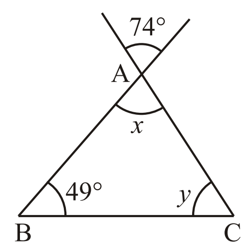
$\angle A + \angle B + \angle C = 180$

$x + 49 + y = 180$

$74 + 49 + y = 180$

$y = 180 - 23 = 57°$

$\therefore$ $x = 74°, y = 57°$



(g) $x = 50$ (vertices opposite angle)

In ΔABC,

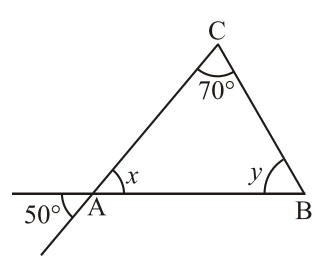
$x + y + 70 = 180$

$50 + y + 70 = 180$

$y = 180 - 120$

$y = 60°$

Thus, $y = 60°, x = 50°$



(h) $y = 30$ (vertical opposite angle)

In ΔPQR

$\angle P + \angle Q + \angle R = 180°$

$2x + x + y = 180°$

$3x + 30 = 180°$

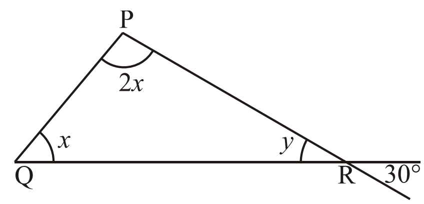
$\Rightarrow \quad 3x = 180 - 30$

$3x = 150°$

$\Rightarrow \quad x = \frac{150}{3}$

$x = 50°$

Thus, $x = 50°$, $y = 30°$



(i) $a = x$ (vertical opposite angles)

$b = x$ (vertical opposite angles)

$y = x$ (vertical opposite angles)

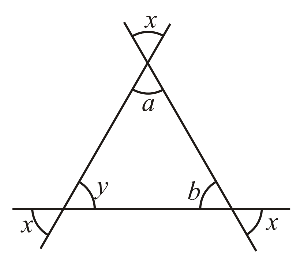
Now, $\angle y + \angle a + \angle b = 180$

$x + x + x = 180$

$3x = 180$

$\Rightarrow \quad x = \frac{180°}{3} = 60°$

$\therefore \quad y = 60°$ and $x = 60°$



(j) In PQR,

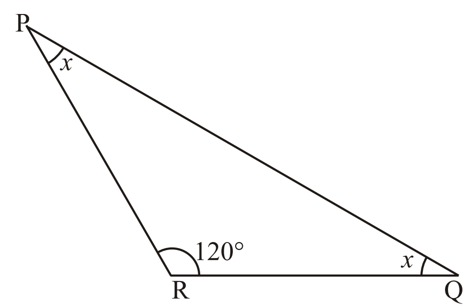
$120 + x + x = 180$

$2x = 180 - 120$

$2x = 60$

$x = \frac{60}{2} = 30°$

Thus, $x = 30°$



2. Let $A = 30°$, $B = 70°$, $C = ?$

In ΔABC,

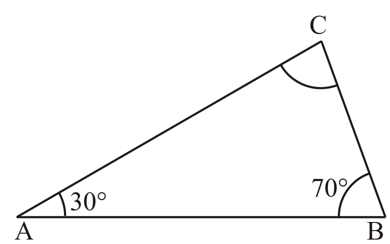
$\angle A + \angle B + \angle C = 180°$ (Angle sum property)

$\Rightarrow \quad 30 + 70 + \angle C = 180°$

$\Rightarrow \quad \angle C = 180 - 100$

$\Rightarrow \quad \angle C = 18°.$

Hence, the third angle is 80°



3. Let the angles be $x, 2x$ and $3x$.

then $x + 2x + 3x = 180°$ (Angle sum property)

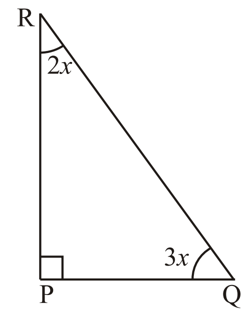
$6x = 180°$

$\Rightarrow \quad x = \frac{180}{6}$

$x = 30°$

Hence angles are : 30°, 60°, 90°

4. Let the acute angles be $2x$ and $3x$



Then In ΔPQR,

$$\angle P + \angle Q + \angle R = 180°$$

$\Rightarrow$ $90 + 3x + 2x = 180$

$\Rightarrow$ $5x = 180 - 90 = 90$

$\Rightarrow$ $x = \frac{90°}{5}$

$x = 18°$

Hence acute angles are 36° , 54°

5. Let third angle be $x°$.

Then first angle = $\frac{x}{3}$ and second angle = $\frac{x}{3}$

Then $x + \frac{x}{3} + \frac{x}{3} = 180°$

$$\frac{3x + x + x}{3} = 180°$$

$$5x = 180° \times 3$$

$$x = \frac{\overset{36}{180} \times 3}{5} \quad x = 108°$$

$\therefore$ First angle = $\frac{108}{3}$ = 36°, Second angle = $\frac{108}{3}$ = 36° and Third angle = 108°.

6. Let the given triangle ΔPQR.

Let $\angle P = \angle Q = x°$ and $\angle R = 50°$

Then, $\angle P + \angle Q + \angle R = 180$ (sum of three angles of a triangle is 180°)

$x + x = 50 = 180°$

$2 = 180° - 50° = 130°$

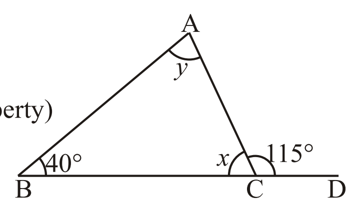
$x = \frac{130}{2} = 65°$

$\therefore$ $\angle P = \angle Q = x° = 65°$

$\angle R = 50°$

7. (a) $x + 115° = 180$ (by linear pair)

$x = 180 - 115 = 65°$



In ΔABC,

$y + 40 + x = 180°$ (Angle sum property)

$y + 40 + 65 = 180$

$y = 180 - 105 = 75°$

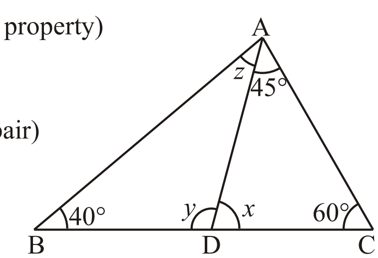
Hence, $x = 65°$ $y = 75°$

(b) In ΔACD,

$x + 45° + 60° = 180°$ (angle sum property)

$x = 180 - 105$

$x = 75°$



$y + x = 180$ (by linear pair)

$y + 75° = 180°$

$y = 180 - 75$

$y = 105°$

Now, In Δ ABD, we have

$z + 40 + y = 180°$ (angle sum property)

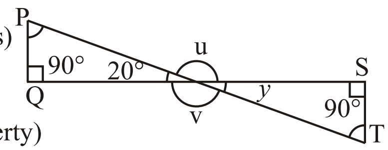
$z + 40° + 105° = 180°$

$z = 180 - 145 = 35°$

Hence, $x = 75°$, $y = 105°$, $z = 35°$

(c) $\angle SRT = \angle PRQ$

(vertically opposite angles)



$\therefore$ $y = 20°$

In Δ PRQ,

$x + 20 + 90 = 180$ (angle sum property)

$x + 110° = 180°$

$x = 180 - 110 = 70°$

Hence, $x = 70°$, $y = 20°$

$20 + 4 = 180$ (linear pair)

$\Rightarrow$ $u = 180 - 20 = 160°$

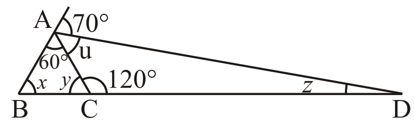
$V = u$ (vertically opposite angles)

$= 160°$

(d) $y + 120 = 180$ (linear pair)

$y = 180° - 120° = 60°$

In Δ ABC,



$\angle A + \angle B + \angle C = 180°$

$60 + x + y = 180°$

$6 + x + 60 = 180$

$x = 180 - 120 = 60°$

$60 + 4 + 70 = 180$

(sum of all the angles at a point of a straight line is 180°)

$u = 180° - 130° = 50°$

In Δ ACD,

$u + 120 + z = 180°$ (angle sum property)

$50° + 120° + z = 180°$

$z = 180° - 170° = 10°$

Hence, $x = 60°$, $y = 60°$, $u = 50$, and $z = 10$

8. Given $DE \parallel BC$,

In Δ ABC,

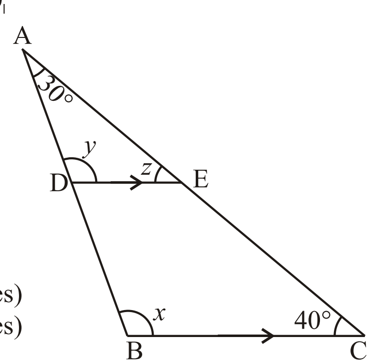
$\angle A + \angle B + \angle C = 180°$

(angle sum property)

$30° + x + 40° = 180°$

$x = 180° - 70°$

$x = 110°$



Since $DE \parallel BC$ and AB is a transversal

$\therefore$ $y = x$ (corresponding angles)

$y = 110°$ and $z = 40$ (corresponding angles)

Hence, $x = 110°$ $y = 110°$ $z = 40°$

9. (a) Yes, sum of three angles of a triangle is 180°. If one of the angle is obtuse angle then the other two are less than 90°.

(b) No, obtuse angle > 90° and as sum of three angles is equal to 180°. Therefore, two angles a can never be $\geq 90°$.

(c) No, same as above.

(d) No, as sum of three angles = 180° and sum of angle > 60° is greater than 180°. Therefore, it is not possible to have all angles > 60°.

(e) No, if all angles < 60°, their sum will be < 180°.

(f) Yes.

10. One of the angles of a triangle is 75°,

$$\angle A = \angle 75°.$$

Then $\angle B + \angle C = 180$

$$\angle A = 180 - 75 = 105.$$

Now, the possible measures of the other two angles can be (90°, 15), (60°, 45°), $(100°, 5°)$ and so on.

11. Let $ABCD$ be a quadrilateral.

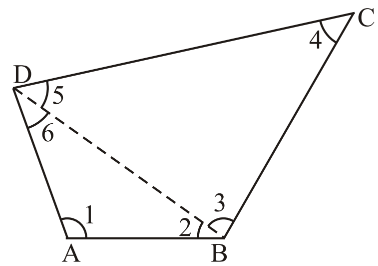
Join B to D. Now, we have two triangles $\Delta\ ABD$ and $\Delta\ BCD$.

We know that, in $\Delta\ ABD$

$$\angle A + \angle B + \angle D = 180°$$

(sum of all the angles of a triangle is 180°)

$\therefore \quad 1 + 2 + 6 = 180° \quad \ldots(1)$



again, in $\Delta\ BCD$

$$\angle B + \angle C + \angle D = 180°$$

$\therefore \quad 3 + 4 + 5 = 180° \quad \ldots(2)$

adding (1) and (2), we get

$\Rightarrow \quad 1 + 2 + 6 + 3 + 4 + 5 = 180° + 180°$

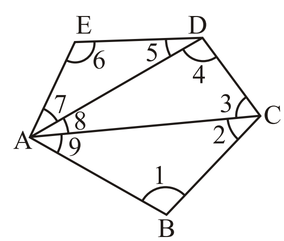
$\Rightarrow \quad 1 + (2 + 3) + 4 + (5 + 6) = 360°$

$\Rightarrow \quad \angle A + \angle B + \angle C + \angle D = 360°$

$\therefore$ sum of all the angles of a quadrilateral.

12. Let $ABCDEA$ be a pentagon.

Join A to C and D. Now we have three triangles.



In $\Delta\ ABC$,

$\angle A + \angle B + \angle C = 180°$ (Angle sum property)

$9 + 1 + 2 = 180° \quad \ldots(1)$

Similarly, In $\Delta\ ACD$, we have

$8 + 3 + 4 = 180° \quad \ldots(2)$

and In $\Delta\ ADE$, we have

$7 + 5 + 6 = 180° \quad \ldots(3)$

Adding (1), (2) & (3), we get

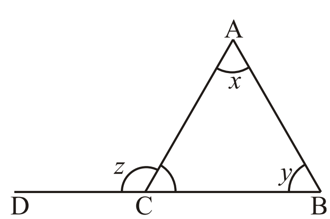
$$(9 + 1 + 2) + (8 + 3 + 4) + (7 + 5 + 6) = 180° + 180° + 180°$$

$$(9 + 8 + 7) + 1 + (2 + 3) + (4 + 5) + 6 = 540°$$

$$\angle A + \angle B + \angle C + \angle D + \angle E = 540°$$

Hence, sum of all the angles of a pentagon is 540°.

Exercise 10.2



1. An exterior angle of a triangle is equal to the sum of its interior opposite angles.

In this case,

$$\angle ACD = Z = \text{exterior angle.}$$

$\angle CAB$ and $\angle ABC$ is interior angles.

2. No, the exterior angle of a triangle can't be a straight angle.

3. (a) Interior oposite angles are acute.

(b) One of the interior opposite angle may be obtuse (figure 1) or both may be acute angle (figure 2) or one of them is right angle.

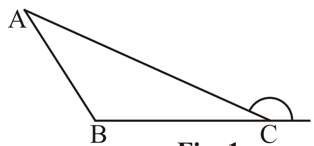


Fig. 1

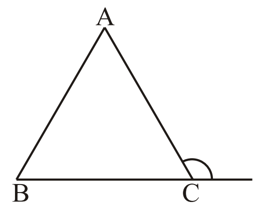
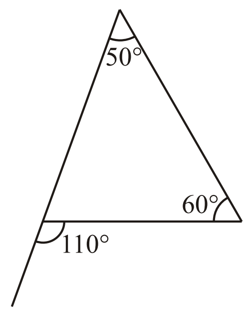


Fig. 2

(c) Sum of interior opposite angles is 90°, i.e., each interior angle < 90°.

4. (a) Yes, since $110 = 50 + 60 = 110°$

$\therefore$ external angle = sum of the interior angles.



(b) Yes, since $95° = 55 + 40 = 95°$

i.e., external angle = sum of the interior angles.

(c) No, since $70 = 70 + 70 \neq 140°$

external angle ≠ sum of interior angles.

(d) Yes, since $120° = 70° + 50° = 120°$

external angle = sum of interior angles.

5. (a) exterior angle = 40 + 55 = 95°

(b) exterior angle = 60 + 85 = 145°

(c) exterior angle = 75 + 20 = 95°

6. Let other interior opposite angle be $x°$ then, we know that

$$\text{exterior angle} = 60 + x°$$

$$\Rightarrow \quad 130° - 60° = x$$

$$\Rightarrow \quad 70° = x$$

$$\Rightarrow \quad x = 70°$$

7. exterior angle = 85°

one interior angle = 25°

Let other interior angle be $x°$ then,

$$85° = x + 25°$$

$$\Rightarrow \quad x = 85° - 25°$$

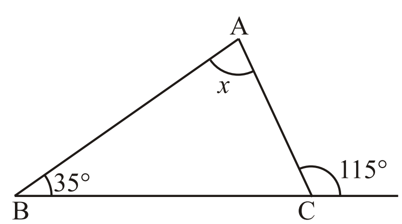
$$x = 60°$$

8. (a) by exterior angle property

$$x + 35 = 115°$$

$$x = 115 - 35$$

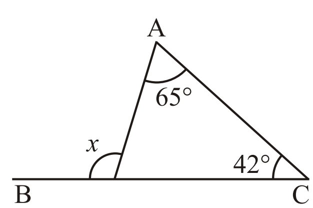
$$x = 80°$$



(b) by exterior angle property

$$x = 65 + 42$$

$$x = 107°$$

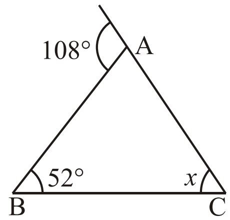


(c) by exterior angle property

$108° = 52° + x$

$108 - 52 = x$

$\Rightarrow \quad x = 56°$



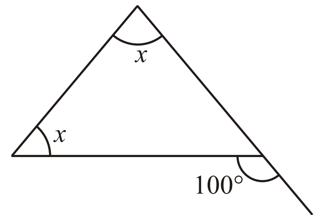
(d) by exterior angle property

$x + x = 100°$

$2x = 100$

$x = \frac{100}{2} = 50°$

$x = 50°$

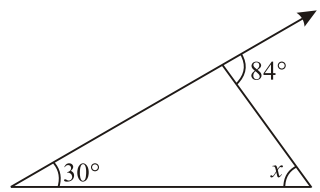


(e) by exterior angle property

$30 + x = 84$

$x = 84 - 30$

$x = 54°$

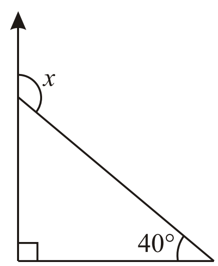


(f) $\angle A = 90°, \angle B = 40°,$

$\therefore$ by exterior angle property

$x = 90 + 40 = 130°$

$x = 130°$



9. (a) exterior angle = 100°

$x + 100 = 180$ (linear pair)

$x = 180 - 100$

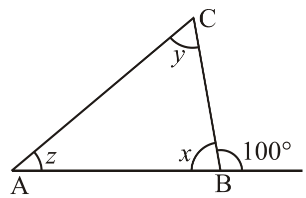
$x = 80°$

Let one interior opposite angle be y

Then the other interior opposite angle be $z\,(100 - y)$

$\Rightarrow \quad y + z = 100$

So, posible values of y & z can be (60°, 40°), (25°, 75°), (90°, 10°), (80, 20°)



(b) exterior angle = 80°

$\therefore \quad x + 80° = 180°$ (linear pair)

$x = 180 - 80$

$x = 100°$

Let one interior opposite angle by y then the other interior opposite angle be $z = (80 - y)$

$\Rightarrow \quad y + z = 80$

so, possible values of y and z can be (40°, 40°), (30°, 50°), (60°, 20°), (25°, 55°) and (35°, 45°)

10. Let interior opposite angles be $3x$ and $4x$.

exterior angle = 140°

Therefore, by the exterior angle property

$$3x + 4x = 140 \quad \Rightarrow \quad 7x = 140$$

$$\Rightarrow \quad x = \frac{140}{7} = 20$$

Hence, interior opposite angles are 60° and 80°.

11. Exterior angle = 110°

Let both interior opposite angles = $x°$

$$\therefore \quad x + x = 110° \quad \Rightarrow \quad 2x = 110°$$

$$\Rightarrow \quad x = \frac{110}{2} = 55°$$

Hence, each interior opposite angle is 55°.

12. Exterior angle = 120°

Let interior oppisite angle are $1x$ and $2x$.

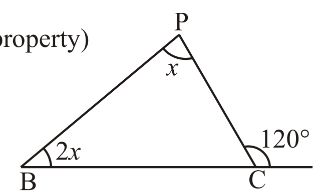
$\therefore \quad 1x + 2x = 120$ (by exterior angle property)

$$3x = 120$$

$$x = \frac{120}{3} = 40$$

$$\therefore \quad \angle A = 1 \cdot x = 1 \times 40 = 40$$

$$\angle B = 2 \cdot x = 2 \times 40 = 80$$



13. PS is the bisector of $\angle QPR$

$$\therefore \quad x = y$$

In ΔPRS, we have

$105 = y + 60$ (exterior angle property)

$$y = 105 - 60 = 45°$$

$\therefore \quad x = 45°$ $[\because x = y]$

In ΔPRS, $y + z + 60 = 180$ (Angle sum property)

$$45 + z + 60 = 180°$$

$$z = 180 - 105°$$

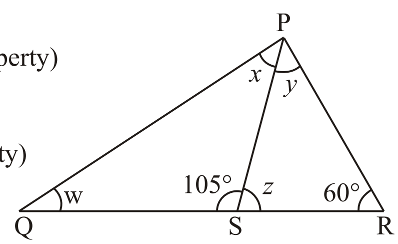
$$z = 75°$$

In ΔPQS, we have

$$w + x = z \quad \Rightarrow \quad w + 45 = 75$$

$$w = 75 - 45 \quad \Rightarrow \quad w = 30°$$

Hence, $x = y = 45°$, $w = 30°$, $z = 75°$



14. In ΔABC, we know that

$\angle A + \angle B + \angle C = 180°$ (sum of all the angles of a triangle)

$$50 + 60 + \angle C = 180°$$

$$\angle C = 180 - 170° = 70°$$

Now, $\angle ACB + \angle ACD = 180°$ (by linear pair)

$$70 + \angle ACD = 180°$$

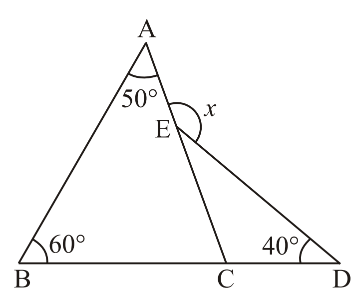
$$\angle ACD = 180 - 70 = 110°$$

In ΔECD, x is the exterior angle so,

$$x = b + 40$$

$$= \angle ACD + 40$$

$$= 110° + 40 = 150°$$



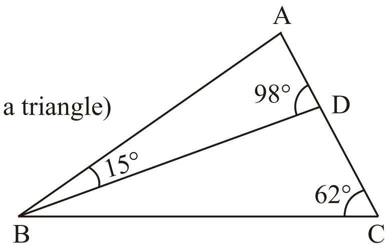
15. In $\Delta\, ABD$, we know that

$$\angle A + \angle B + \angle C = 180°$$

(sum of all the angles of a triangle)

$$\angle A + 15° + 98° = 180°$$
$$\angle A = 180 - 113 = 67°$$

Hence, $\angle BAC = 67°$



16. (a) $a + 116° = 180$ (by linear pair)

$a = 180° - 116° = 64°$

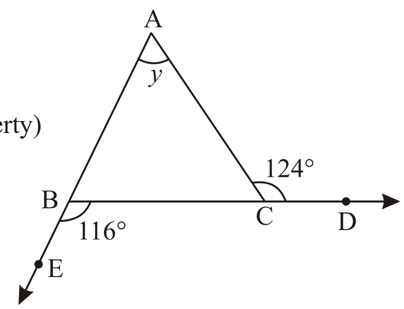
now, $y + a = 124$

(by exterior angle property)

$y + 64 = 124$

$y = 124 - 64$

$y = 60°$



(b) $b + 135° = 180°$ (by linear pair)

$b = 180 - 135$

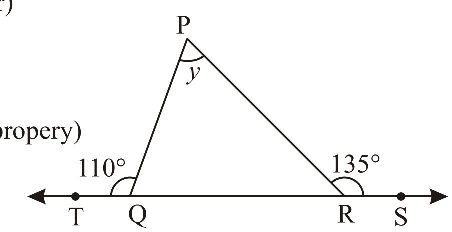
$b = 45°$

Now, $y + b = 110°$

(by exterior angle propery)

$y + 45° = 110°$

$\Rightarrow$ $y = 110 - 45° = 65°$



Exercise 10.3

1.

S.No.	Equal Sides	Equal Angles
(a)	In $\Delta\, ABC$; $AB = AC$	$\angle C = \angle B$
(b)	In $\Delta\, ABC$, $BC = AC$	$\angle A = \angle B$
(c)	In $\Delta\, PQR$, $PQ = PR$	$\angle Q = \angle R$
(d)	In $\Delta\, ABC$, $AB = BC$	$\angle C = \angle A$
(e)	In $\Delta\, XYZ$, $XY = YZ$	$\angle Z = \angle X$
(f)	In $\Delta\, DEF$, $DF = DE$	$\angle E = \angle F$

2. (a) Given, $AB = AC$ $\Rightarrow$ $45° = x$ $\Rightarrow$ $x = 45°$

(b) Given, $PQ = PR$ $\Rightarrow$ $60° = x$ $\Rightarrow$ $x = 60°$

(c) Given, $DF = DE$ $\Rightarrow$ $55° = F$ $\Rightarrow$ $F = 55°$

Now, In $\Delta\, DEF$

$$\angle D + \angle E + \angle F = 180°$$
$$y + 55 + 55 = 180$$
$$y = 180° - 110° = 70°$$

(d) Given, $PQ = QR \quad \Rightarrow \quad 45° = P \quad \Rightarrow \quad P = 45°$

Now, In ΔPQR, we have

$$\angle P + \angle Q + \angle R = 180°$$
$$45 + z + 45 = 180$$
$$\Rightarrow \quad z = 180 - 90 = 90°$$

(e) Given, $AB = AC$

$\angle C = \angle B \quad \therefore \quad \angle C = x°$

(f) Given, $DE = DF \quad \Rightarrow \quad \angle F = 62°$

Now, $y = \angle E + \angle F$ (by exterior angle property)

$y = 62 + 62 = 124°$

(g) Given $PQ = PR \quad \Rightarrow \quad PRQ = \angle PQR$

$\angle QPR = 80°$ (vertically opposite angle)

In ΔPQR, we have

$$\angle P + \angle Q + \angle R = 180°$$
$$80° + \angle Q + \angle R = 180° \quad [\because \angle R = \angle Q \text{ by } (1)]$$
$$2\angle Q = 180° - 80°$$
$$\angle Q = \frac{100}{2} = 50° \quad \therefore \angle R = 50°$$

Now, $\angle P + \angle Q = x$ (by exterior angle property)

$$80 + 50 = x$$
$$130° = x$$
$$x = 130°$$

(h) Given, $AB = AC$

$\Rightarrow$ ΔABC, we have

$$\angle A + \angle B + \angle C = 180°$$
$$30° + \angle C + \angle C = 180°$$
$$2\angle C = 180 - 30$$
$$\angle C = \frac{150}{2} = 75°$$

Now, $y = \angle A + \angle C$ (by exterior angle property)

$\Rightarrow \quad y = 105°$

(i) Given, $QR = PR$

$\angle P = \angle Q \quad \ldots(1)$

$\angle QRP = 98° \quad \ldots(2)$ (vertically apposite angle)

In ΔPQR, $\angle P + \angle Q + \angle R = 180°$

$$\angle Q + \angle Q + 98° = 180° \quad [\text{from } (1) \ \& \ (2)]$$
$$2\angle Q = 180° - 98° = 82°$$
$$\angle Q = \frac{82}{2} = 41°$$

$\therefore \quad x = \angle Q$ (vertically opposite angle)

$\Rightarrow \quad x = 41°$

(j) Given, $QR = PR$

$\Rightarrow \quad \angle x = \angle R \quad \ldots(1)$

$y + 106° = 180°$ (by linear pair)

$y = 180 - 106 = 74° \quad \ldots(2)$

In ΔPQR, we have

$$\angle P + \angle Q + \angle R = 180°$$

$$x + x + y = 180°$$
$$2x + 74° = 180 \quad [(\text{from (1) \&(2)}]$$
$$2x = 180° - 74° = 106°$$
$$x = \frac{106}{2} = 53°$$

Hence, $x = 53°,\ y = 74°$

(k) Given, $AB = DB = BC$

since $AB = DB \Rightarrow Z = 40°$

Now, $\angle A + \angle Z = \angle x$ (by exterior angle property)

$\Rightarrow 40 + 40 = x \Rightarrow x = 80°$

again, $DB = BC \Rightarrow \angle C = \angle y$ …(1)

But in ΔBCD, we have

$$\angle x + \angle y + \angle c = 180°$$
$$80 + y + y = 180° \quad [\text{by (1)}]$$
$$2y = 180 - 80 = 100°$$
$$y = \frac{100}{2} = 50°$$

3. Given, $AB = AC \Rightarrow \angle C = \angle B$ …(1)

In ΔABC, we have

$$\angle A + \angle B + \angle C = 180°$$
$$30° + \angle B + \angle B = 180° \quad [\text{by (1)}]$$
$$2\angle B = 180 - 30 = 150°$$
$$\angle B = \frac{150}{2} = 75°$$

$\therefore$ $\angle C = \angle B = 75°$

Now, $\angle ABC + x = 180°$ (by linera pair)

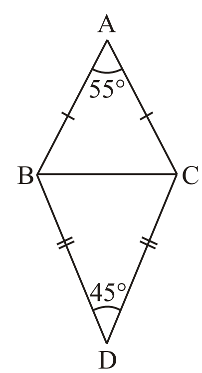
$$75° + x = 180°$$
$$x = 180° - 75° = 105°$$

again, $\angle ACB + y = 180°$

$$75° + y = 180°$$
$$y = 180° - 75° = 105°$$

4. Given, $AB = AC$

$\Rightarrow x = y$ …(1)



In ΔABC, we have

$$\angle A + \angle B + \angle C = 180°$$
$$55° + x + y = 180°$$
$$x + x = 180° - 55° \quad [\text{by (1)}]$$
$$2x = 125 = \frac{125°}{2}$$

by $y = x = 62\frac{1}{2}°$ or $62.5°$

Now, In ΔBCD,

$$BD = CD$$

$\Rightarrow W = Z$ …(2)

In ΔBCD, we have

$$\angle B + \angle D + \angle C = 180°$$
$$Z + 45 + W = 180°$$

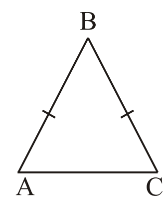
$$W + 45 + W = 180 \qquad \text{[by (2)]}$$
$$2W = 180 - 45 = 135°$$
$$W = \frac{135°}{2} = 67\frac{1}{2} \text{ or } 67.5$$
$$\Rightarrow \qquad Z = W = \frac{135°}{2}$$

Now, $\angle ABD = x + z = \frac{125}{2} + \frac{135}{2}$

$$= \frac{125 + 135}{2} = \frac{260}{2} = 130°$$

and $\angle ACD = y + w = \frac{125}{2} + \frac{135}{2} = \frac{260}{2} = 130°$

5. Given, $AB = BC$ and $\angle B = 2\angle A$ …(1)



Since $AB = BC$

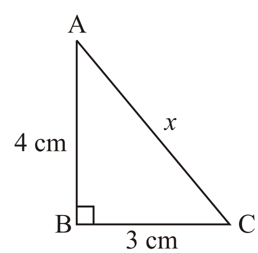
$\Rightarrow$ $\angle C = \angle A$ …(2)

In $\Delta\, ABC$, we know that

$$\angle A + \angle B + \angle C = 180°$$
$$\angle A + 2\angle A + \angle A = 180° \qquad \text{[from (1) \& (2)]}$$
$$4\angle A = 180°$$
$$\Rightarrow \qquad \angle A = \frac{180°}{4} = 45°$$
$$\therefore \qquad \angle B = 2 \times 45 = 90°$$
$$\angle C = \angle A = 45°$$

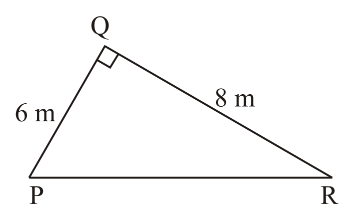
Exercise 10.4

1. (a) In right $\Delta\, ABC$,



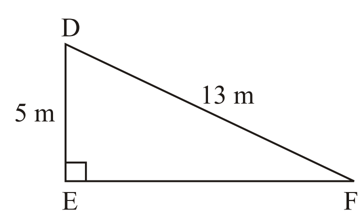
$$AC^2 = AB^2 + BC^2 \text{ by}$$
$$x^2 = (4)^2 + (3)^2$$
$$x^2 = 16 + 9 = 25$$
$$x = \sqrt{25}$$
$$x = 5\,\text{cm}$$

(b) In right $\Delta\, PQR$



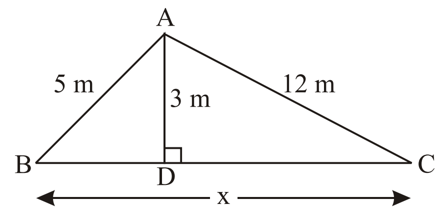
$$PR^2 = 6^2 + 8^2$$
$$= 36 + 64$$
$$= 100$$
$$PR = \sqrt{100} = 10\,\text{m}$$

(c) In right $\Delta\, DEF$,



$$13^2 = 5^2 + x^2$$
$$169 - 25 = x^2$$
$$\sqrt{144} = x$$
$$\Rightarrow \qquad x = 12\,\text{m}$$

(d) In right $\Delta\, ACD$



$$(12)^2 = 3^2 + DC^2$$
$$144 - 9 = DC^2$$
$$135 = DC^2 \qquad \ldots(1)$$

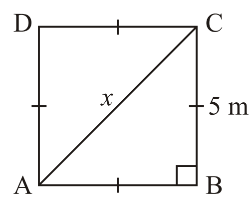
In right $\Delta\, ABD$,

$$5^2 = 3^2 + BD^2$$
$$25 - 9 = BD^2$$
$$\Rightarrow \qquad BD = \sqrt{16} = 4$$
$$DC = x - 4 \qquad \ldots(2)$$

From (1) & (2)

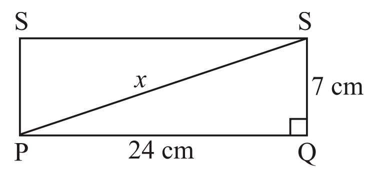
$$135 = (x-4)^2$$
$$\sqrt{135} = x - 4$$
$$\Rightarrow \qquad x = 4 + \sqrt{135}$$

(e) In right $\Delta\, ABC$



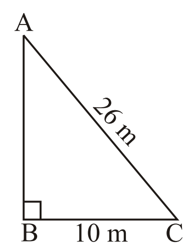
$$x^2 = 5^2 + 5^2 = 50$$
$$x = \sqrt{50}$$
$$x = 5\sqrt{2}$$

(f) In right $\Delta\, PQR$



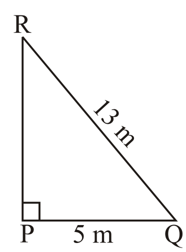
$$x^2 = 24^2 + 7^2$$
$$= 576 + 49$$
$$x^2 = 625$$
$$x = \sqrt{625}$$
$$x = 25\,\text{cm}$$

2. In right angled $\Delta\, ABC$



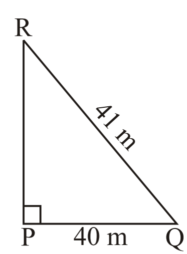
$$(26)^2 = AB^2 + 10^2$$
$$676 - 100 = AB^2$$
$$576 = AB$$
$$\Rightarrow \qquad AB = \sqrt{576}$$
$$= 24\,\text{m}$$

3. In right angled $\Delta\, PQR$



$$(13)^2 = PR^2 + (5)^2$$
$$\Rightarrow \qquad 169 - 25 = PR^2$$
$$\Rightarrow \qquad PR = \sqrt{144}$$
$$PR = 12\,\text{m}$$

4. Let $QR = 41\,\text{m}$, $PQ = 40\,\text{m}$



Then, $\qquad PR^2 = (41)^2 - (40)^2$

$$= 1681 - 1600$$
$$\therefore \qquad PR = \sqrt{81}$$
$$PR = 9\,\text{m}$$

5. (a) 8 cm, 15 cm, 17 cm

Let $a = 8\,\text{cm}$, $b = 15$ cm, $c = 17\,\text{cm}$

$$a^2 + b^2 = 8^2 + 15^2 = 64 + 225 = 289$$

$$c^2 = 17^2 = 289$$

Since, $\quad 8^2 + 15^2 = 17^2$

i.e., $\quad a^2 + b^2 = c^2$

Hence, these are the sides of a right-angled triangle. (By the converse of Pythagoras property)

(b) 3 cm, 3 cm, 9 cm

Let $a = 3$, $b = 3$, $c = 9$

$$a^2 + b^2 = (3)^2 + (3)^2 = 9 + 9 = 18$$

$$c^2 = 9^2 = 81$$

Since $\quad a^2 + b^2 \neq c^2$

(c) Let $a = 2.5$ cm, $b = 6.5$ cm, $c = 6$ cm

$$a^2 + c^2 = (2.5)^2 + (6)^2 = 6.25 + 36 = 42.25\,\text{cm}^2$$

$$b^2 = (6.5)^2 = 42.25\,\text{cm}^2$$

Since, $\quad a^2 + c^2 = b^2$

$\Rightarrow$ These sides can be the sides of a right triangle.

(d) Let $a = 16\,\text{cm}$, $b = 30\,\text{cm}$, $c = 34$ cm

$$a^2 + b^2 = (16)^2 + (30)^2 = 256 + 900 = 1156$$

$$c^2 = (34)^2 = 1156$$

6. Let 0 be the Isha's initial Position.

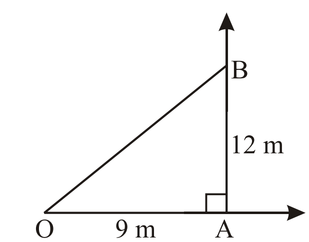
$OA = 9\,\text{m}$, $AB = 12\,\text{cm}$

$$OB^2 = A^2 + AB^2$$

$$OB^2 = 9^2 + 12^2$$

$$= 81 + 144 = 225$$

$$OB = \sqrt{225} = 15\,\text{m}$$



(Isha's initial position)

7. In right $\Delta\, ABC$,

$$(61)^2 = b^2 + 60^2$$

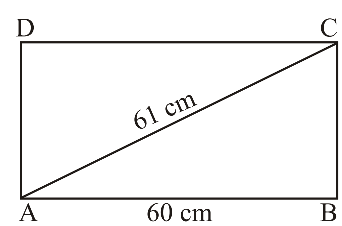
$\Rightarrow \quad 3721 - 3600 = b^2$

$\Rightarrow \quad 121 = b^2$

$\Rightarrow \quad b = 11$

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

$$= 2(60 + 11) = 2 \times 71 = 142\,\text{cm}$$



8. Let the actual height of the tree = AB where $AC = A'C$

In right $\Delta\, A'BC$,

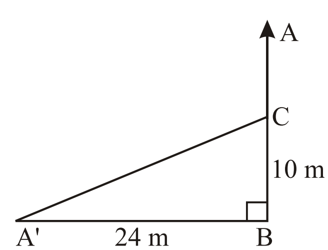
$$(A'C)^2 = (10)^2 + (24)^2 = 100 + 576$$

$$A'C = \sqrt{676} = 26\,\text{m}$$

$\therefore \quad AC = A'C = 26\,\text{m}$

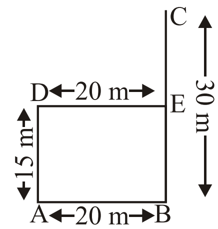
Hence, the actual height of the tree = $AC + BC$

$$= 26 + 10 = 36\,\text{m}$$



9. $CE = BC - BE = BC - AD \quad (\because BE = AD = 15\,\text{m})$

$$CE = 30 - 15 = 15$$

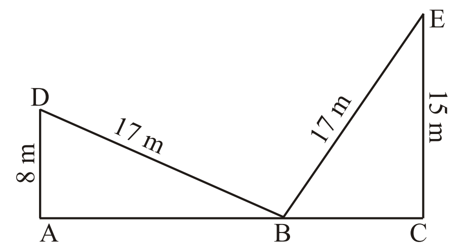


In right ΔCDE,

$$DC^2 = 20^2 + 15^2$$
$$= 400 + 225$$
$$DC = \sqrt{625}$$
$$DC = 25\,\text{m}$$

10. Let AC be the width of the road and B be the foot of the ladder.

In right ΔBCE,



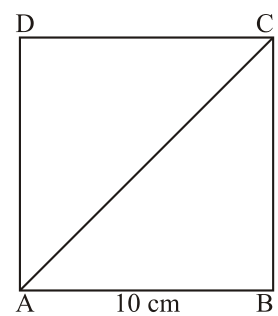
$$(17)^2 - (15)^2 = BC^2$$
$$289 - 225 = BC^2$$
$$\Rightarrow \quad BC^2 = 64$$
$$\Rightarrow \quad BC = \sqrt{64} = 8\,\text{m}$$

In right ΔABD,

$$(17)^2 - (8)^2 = AB^2$$
$$\Rightarrow \quad 289 - 64 = AB^2$$
$$\Rightarrow \quad 225 = AB^2$$
$$\Rightarrow \quad AB = \sqrt{225} = 15\,\text{m}$$

Hence, width of the road $= AC = AB + BC$

$$= 15 + 8 = 23\,\text{m}$$

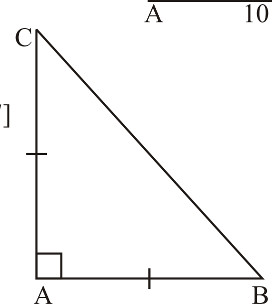


11. In right ΔABC,

$$AC^2 = AB^2 + BC^2$$
$$= (10)^2 = (10)^2$$
$$= 200$$
$$AC = \sqrt{200} = 10\sqrt{2}$$

12. Given $BC^2 = 162\,\text{cm}^2$, $AB = AC$

In right ΔABC

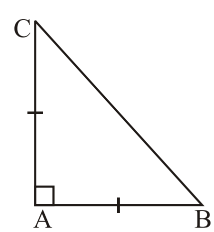


$$BC^2 = AC^2 + AB^2 \qquad [\because AB = AC]$$
$$162 = AC^2 + AC^2$$
$$2AC^2 = 162$$
$$AC = \sqrt{81}$$
$$AC = 9\,\text{cm}$$

Hence, $AB = AC = 9\,\text{cm}$.

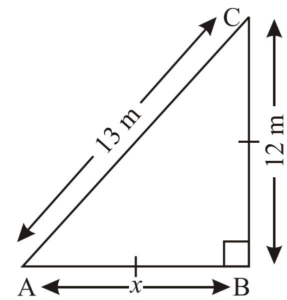
13. Given $BC^2 = 98\,\text{cm}$ $AB = AC$

In right ΔABC, we have



$$BC^2 = AC^2 + AB^2$$
$$\Rightarrow \quad 98 = AC^2 + AC^2$$
$$\Rightarrow \quad AC^2 = \frac{98}{2} = 49$$
$$\Rightarrow \quad AC = \sqrt{49} = 7\,\text{cm} \qquad \therefore \qquad AB = AC = 7\,\text{cm}$$

14. Let BC is the wall and AC is the ladder.



In right $\Delta\, ABC$, we have

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

$\Rightarrow \quad (13)^2 = (12)^2 + x^2$

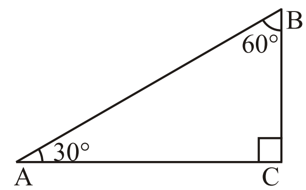
$\Rightarrow \quad 169 - 144 = x^2$

$\Rightarrow \quad 25 = x^2$

$\Rightarrow \quad x = \sqrt{25} = 5\,\text{m}$

Hence, the distance of the foot of the ladder from the wall is 5 m.

15. Given, $\angle A = 30°, \angle B = 60, \angle B = 60°$



then $\quad \angle C = 180 - (60 + 30)$

$= 180° - 90°$

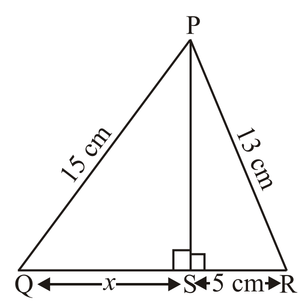
$\angle C = 90°$

In right $\Delta\, ABC$, we have

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

Which is true for condition (a).

16. In right $\Delta\, PRS$



$$PS^2 = (PR)^2 - (SR)^2$$

$= 13^2 - 5^2$

$= 169 - 25 = 144$

$PS = \sqrt{144} = 12$

In right $\Delta\, PQS$

$$QS^2 = PQ^2 - PS^2$$

$x = 15^2 - 12^2$

$= 225 - 144 = 81$

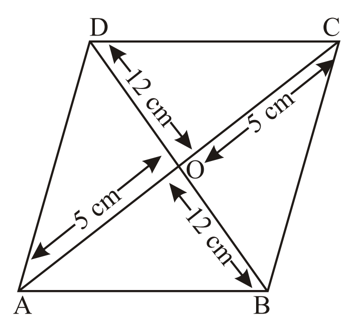
$\therefore \quad x = \sqrt{81} = 9\,\text{cm}$

17. Let $ABCD$ be a rhombus whose diagonals are $AC = 10\,\text{cm}$ and $BD = 24$ cm

Since diagonals of a rhombus bisect each other at right angles.

$\therefore \quad AO = OC = \dfrac{AC}{2} = \dfrac{10}{2} = 5\,\text{cm}$

$BO = OD = \dfrac{BD}{2} = \dfrac{24}{2} = 6\,\text{cm}$



In right $\Delta\, AOB$,

$$AB^2 = AO^2 + BO^2$$

$\Rightarrow \quad AB^2 = (5)^2 + (12)^2$

$= 25 + 144 = 169$

$\Rightarrow \quad AB = \sqrt{169} = 13\,\text{cm}$

Hence, $AB = BC = CD = DA = 13\,\text{cm}$

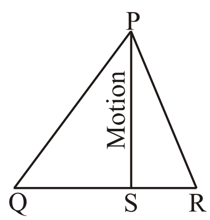
Now, $\quad P = AB + BC + CD + DA$

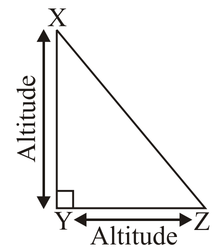
$= 13 + 13 + 13 + 13$

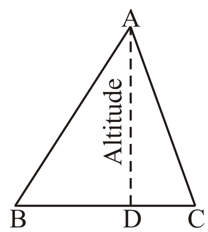
$P = 52\,\text{cm}$

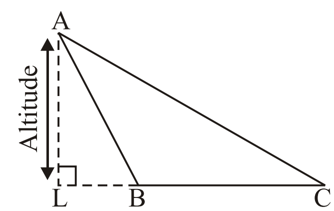
Exercise 10.5

1. **Fill in the blanks :**
   (a) The altitude of a triangle is the **perpendicular** from vertex to the **opposite** side.
   (b) Median of a triangle is a line segment that joins a **vertex** to the **mid-point** of the opposite side.
   (c) If $\Delta\, ABC$ is right angled at C, then $\boldsymbol{BC}$ and $\boldsymbol{AC}$ are two of the altitudes of the triangle.
   (d) In $\Delta\, DEF$, P is the mid-point of EF.
   DP is **median** $\qquad$ DQ is **Altitude**
   $EP = \dfrac{\boldsymbol{EE}}{\mathbf{2}}$

2. (a)


(b)


(c)


(d)


MCQ's

1. (c) **2.** (c) **3.** (b) **4.** (c) **5.** (b) **6.** (a) **7.** (d) **8.** (b) **9.** (a) **10.** (c).

11. Congruence of Triangle

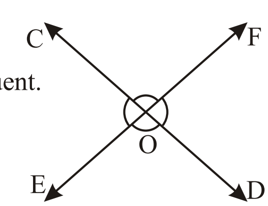
Exercise 11.1

1. $\overline{XY} = 4.2$ cm,
∵ $\overline{MN} \cong \overline{XY}$
∴ $\overline{MN} = \overline{XY} = 4.2$

2. ∵ R is the mid point of $\overline{PQ}$
∴ $\overline{PR} = \overline{RQ}$
If two line segments are equal in length, they are called identical.
∵ Identical line segments are said to be congruent.
∴ $\overline{PR} \cong \overline{RQ}$

3. Figure (i), (ii), (iii), (vii), (viii), (ix), (x), (xi), (xiii) are congruent.

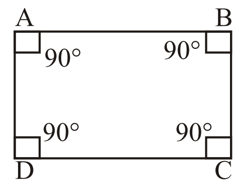
4. Here, $\angle COF = \angle EOD$ (Vertical opposite angle)
and $\angle COE = \angle FOD$ (Vertical opposite angle)
So, $\angle COF \cong \angle EOD$ and $\angle COE \cong \angle FOD$



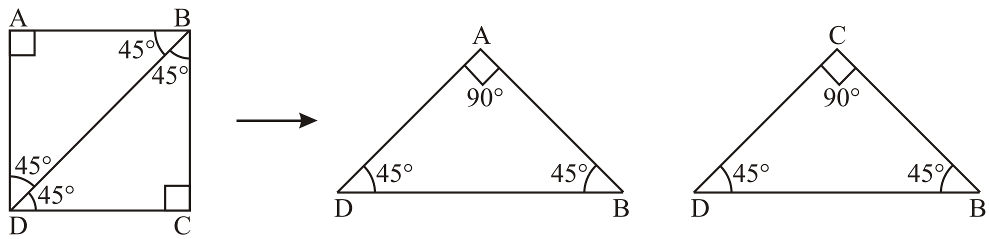
5. Yes, $\because$ each of the angle of a rectangle measures 90°.

$\therefore \quad \angle A = \angle B = \angle C = \angle D = 90°$

then any two angles of a rectangle are congruent.



6. A diagonal divides a square into two isosceles triangles.

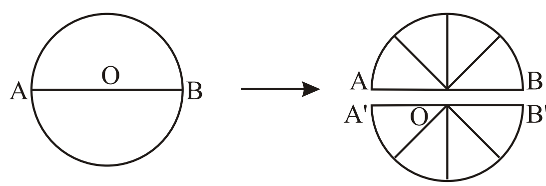


In ΔABD and ΔDCB

	$AD = DC$	(edges of square)
	$AB = CB$	(edges of square)
	$\angle DAB = \angle DCB = 90°$	(angle of square) DB common line segment.
$\because$	$AB \parallel DC$	
$\therefore$	$\angle ABD = \angle BDC$	(Alternate angle)
$\therefore$	$\angle CBD = \angle ADB$	(Alternate angle)

Hence, $\angle ABD \cong \angle DCB$

7.



Yes, diameter divide the circle into two equal (congruent) parts called semicircle.

8. **Fill in the blanks :**

(a) Two circles are congruent, if they have the same **radius.**

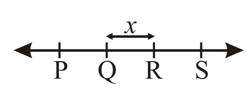
(b) Two angles are congruent, if they are equal in **degree** measure.

(c) If two figures have the same **shape** and **dimension**, they are congruent.

(d) Two rectangles will be **congruent**, if their respective lengths and breadths are equal.

(e) If ΔABC is superimposed over ΔDEF and ΔDEF is covered completely, then the two triangles are **congruent.**

9. $\because \quad \overline{PQ} \cong \overline{RS}$



$PQ = PS - QS$

and $\quad RS = PS - PR$

$\because \quad PQ = \overline{RS}$

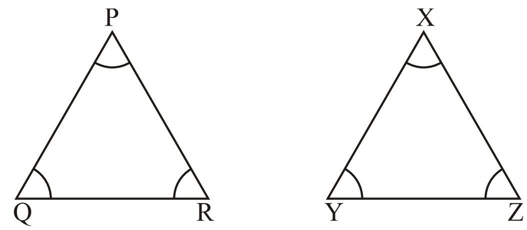
then $\quad PS - QS = PS - PR$

$\therefore \quad \underline{QS} = PR$

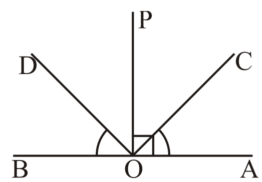
Hence $\quad \overline{PR} \cong QS \qquad (\because QS = PR)$

10. No, because their angles will be used but sides may or may not be equal.

11. $\because \Delta PQR \cong \Delta XYZ \therefore \overline{PQ} = \overline{XY}$



12. In the figure, $\overline{OP} \perp \overline{BOA}$ $\angle AOC = \angle BOD$



$\because \angle POB = \angle POA = 90°$ $(\because \overline{OP} \perp \overline{BOA})$

$(\because \angle POB = \angle POD + \angle BOD$

and $\angle POA = \angle POC + \angle COA)$

then $\angle POD + \angle DOB = \angle POC + \angle DOB$

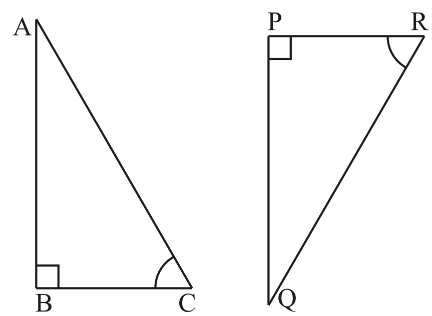
$(\because \angle COA = \angle DOB$ Given)

$\angle POD + \angle POC + \angle DOB - \angle DOB$

$\angle POD = \angle POC$

Hence, $\angle POD \cong \angle POC$.

Exercise 11.2



1. Here, $BC = PR$

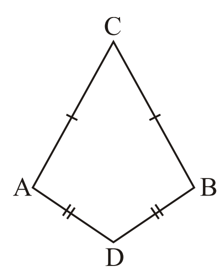
$AC = QR$

$\angle C = \angle R$

(Included angles)

$\therefore$ $\Delta ABC \cong \Delta PQR$

(by SAS rule of congruence)



2. Considering ΔACD and ΔCDB, we have

$AC = CB$ (Given)

$AD = DB$ (Given)

$CD = CD$ (Common side)

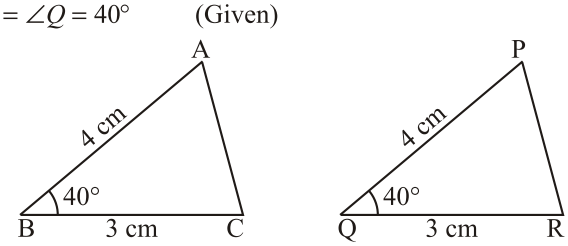
$\therefore$ $\Delta ACD \cong \Delta CDB$ (By SSS rule of congruence)

3. (a) Considering ΔABC and ΔPQR we have

$AB = PQ = 4$ cm (Given)

$BC = QR = 3$ cm

$\angle B = \angle Q = 40°$ (Given)



$\therefore$ $\Delta ABC \cong \Delta PQR$ (By SAS rule of congruence)

(b) Considering $\Delta\, ABC$ and $\Delta\, DEF$

We have $AB = DE = 6$ (Given)

$\angle B = \angle E = 50°$ (Given)

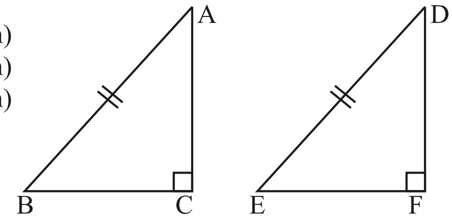
$\angle C = \angle F = 90°$ (Given)

$\angle A = \angle D$

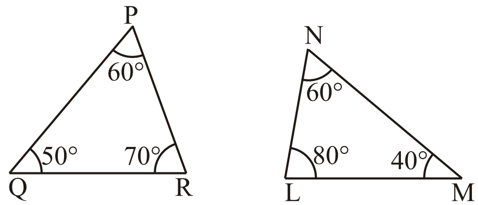
($\because$ two angles of triangles are equal)

$\therefore$ $\Delta\, ABC \cong \Delta\, DEF$

(By Angle side Angle rule of)



(c) Considering $\Delta\, PQR$ and $\angle LMN$



$\angle P = \angle N = 60°$ (Given)

$\angle Q \neq \angle L$

$\angle R \neq \angle M$

$\therefore$ triangles cannot be congruence.

4. $AO = OB$ (Given)

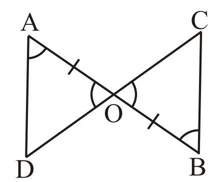
$AD \,||\, CB$ (Given)

$\angle AOD = \angle BOC$ (Vertical opposite angles)

$\angle CBO = \angle OAD$ ($\because AD \,||\, CB$ Alternate angles)

then $\Delta\, AOD \cong \Delta\, COB$ (By ASA rule of congruence)

Hence, $OD = OC$ ($\because \Delta\, AOD \cong \Delta\, COB$)



5. Two right triangles congruent, if the hypotenuse and one side of the first triangle are respectively equal to the hypotenuse and one side of the second.

Here $\angle P = \angle X = 90°$

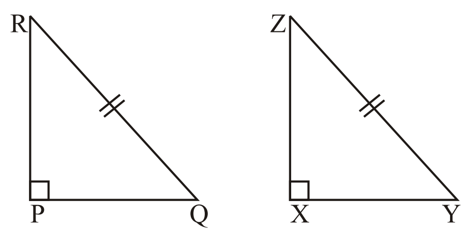
and $DR = YZ$ (Given)

So, the triangle are congruent under

RHS congruent condition

if either $PR = XZ$

or $PQ = XY$



6. Considering $\Delta\, ABCD$ and ADC

We have, $AB = AC$

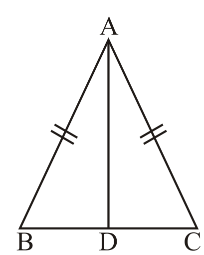
$\angle BAD = \angle DAC$

$AD = AD$

(common side)

$\therefore$ $\Delta\, ABD \cong \Delta\, ADC$

(by SAS rule of congruent)



7. Considering $\Delta\, BOX$ and $\Delta\, MAN$

We have, $\angle BOY = \angle MAN = 90°$ (Given)

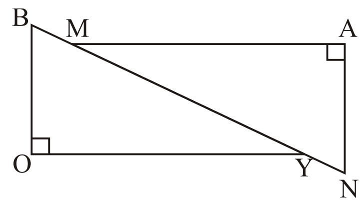
$OY = AM$ (Given)

$BM = YN$ (Given)

$BY = BN - YN$ ...(i)

and $MN = BN - BM$

$BN = MN + BM$



Put the value of BN is the equation (i)

then $BY = BN - YN$

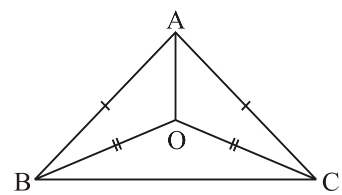
$= MN + BM - YN$ $(\because BN = MN + BM)$

$BY = MN + YN - YN$ $(\because BM = YN)$

$\therefore$ $BY = MN$

So, $\Delta BYO \cong \Delta NMA$ (By RHS congruent rule)

8. Considering ΔOAB and ΔOAC we have,



$BO = OC$ (Given)

$AB = AC$ (Given)

$AO = OA$ (Common side)

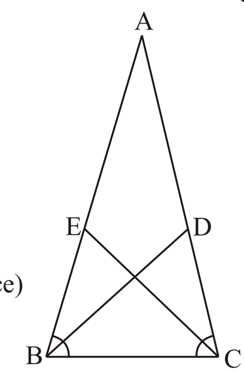
So, $\Delta DAB \cong \Delta DAC$

(by SSS rule of congruence)

Then, $\Delta ABO = \angle ACO$

$(\because \Delta AOB \cong \Delta AOC)$

9. Considering ΔBDC and ΔCEB



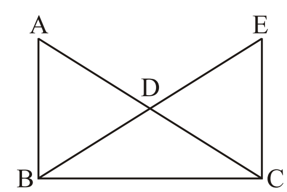
We have $BC = BC$ (Common side)

$\angle EBC = \angle BCD$ (isosceles triangle)

$\angle BCE = \angle DBC$ (bisect angle are equal)

So, $\Delta BDC \cong \Delta CEB$ (By ASA rule of congruence)

10. (a) Consider ΔADB and ΔCDE



We have $BD = DE$ (Given)

$AD = DC$ (Given)

$\angle ADB = \angle CDE$ (vertical opposite angle)

$\therefore$ $\Delta ADB \cong \Delta CDE$

(By SAS rule of congruence)

(b) Consider ΔABC and ΔECB $BC = BC$ (common side)

$\angle A = \angle E$ $(\because \Delta ABD \cong \Delta CDE)$

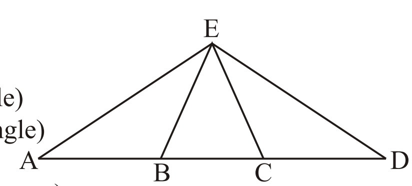
$AB = CE$ $(\because \Delta ABD \cong \Delta CDE)$

$\therefore$ $\Delta ABC \cong \Delta FCB$ (BY

(c) $\because$ $\Delta BCA \cong \Delta BCE$

Hence, $\angle BCE = \angle ABC = 90°$

11. Consider ΔABE and CDE we have



$CD = AB$ (Given)

$ED = EA$ (Given isosceles triangle)

$\angle EAB = \angle EDC$ (angle of isosceles triangle)

$\therefore$ $\Delta ABE \cong \Delta CED$

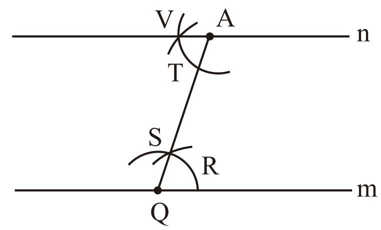
(By SAS rule of congruence)

$\therefore$ $BE = EC$ Hence, Δ BEL is also a isosceles triangle.

12. Practical Geometry

Exercise 12.1

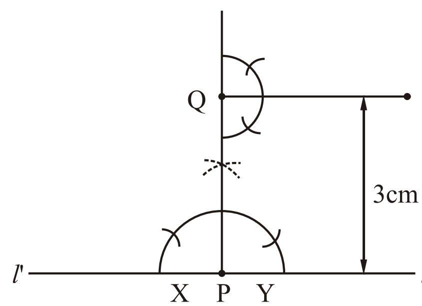
1. **Steps to construct :**



(a) Draw a line m using a ruler and mark a point A outside m.
(b) Take any point Q on m. Join AQ.
(c) With Q as centre and a suitable radius drawn an arc using compas to cut m at R and QA at S.
(d) With A as centre and the same radius drawn an arc, cutting AQ at T.
(e) Now place the pointed tip of the compass at R and adjust the opening so that the pencil tip is at S.
(f) With T as centre and the same radius RS, draw an arc cutting the previous arc at V.

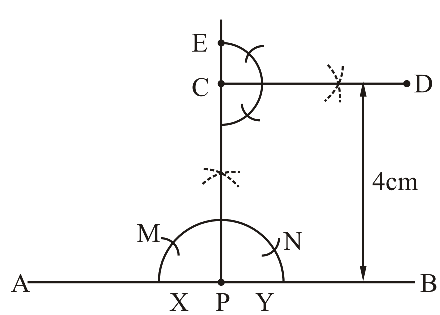
(g) Join AV and produce it on both sides to get the required line n parallel to m.
(b) Infinite number of lines can be drawn from the point A.
(c) One and only one line would be parallel to the line m, which is line n.

2. **Step to construct :**



(a) Draw a line (i.e., $l'l$ using a ruler).
(b) Mark a point P on l and with P as centre, draw an arc intersecting l at X and Y.
(c) AGain taking X as centre and with the same radius, draw an arc intersecting the previous arc XY at M.
(d) Taking M as the centre and with the same radius, draw another arc intersecting arc XY at N.
(e) With M and N as centres and with the same radius, draw arcs such that they intersect each other at point K. Join P and K such that $\angle KPl' = 90° = \angle KPl$.
(f) Now mark a point Q on perpendicular PK such that $QP = 3$ cm.
(g) Again construct a right angle at Q by following the steps a to e.
Since $\angle EQD = \angle QPl = 90°$ (corresponding angles)
so, QD is parallel to l or $l'l$.
(h) Line QD. thus constructed, is at a distance of 3 cm away from $l'l$ and is parallel to line l i.e., $QD \,||\, l$.

3. **Steps to construct :**



(a) Draw a line AB using a ruler.
(b) Mark a point P on AB and with P as centre, draw an arc intersecting AB at X and Y.
(c) Again taking X as centre and with the same radius, draw an arc intersecting the previous arc XY at M.
(d) Taking M as the centre and with the same radius, draw another arc intersecting arc XY at N.

(e) With M and N as centres and with the same radius, draw arcs such that they intersect each other at point Q. Join P and Q such that $\angle QPA = 90° = \angle QPB$.

(f) Now mark a point C on perpendicular as PQ such that $PC = 3$ cm.

(g) Again construct a right angle at C by following the steps a to e.

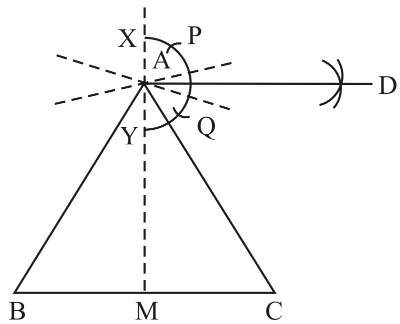
Since $\angle ECD = \angle CPB = 90°$ (corresponding angles)

so, CD is parallel to AB.

(h) Line CD, thus constructed, is at a distance of 4 cm from AB and is parallel to line AB, i.e., $CD \parallel AB$.

4. Do yourself.

5. **Steps to construct :**



(a) Draw a line BC using a ruler.

(b) With B as centre and radius more than half of BC, draw an arc on one the uspsid by BC.

(c) Similarly, with C as centre and radius more than half of CB, draw an arc intersecting the first arc at A.

(d) Join B to A and C to A.

(e) Draw perpendicular AM on side BC.

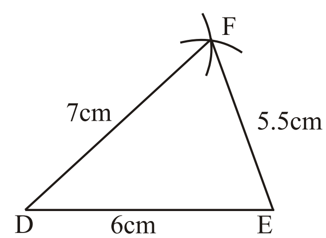
(f) Now with A as centre draw two arcs on produced perpendicular AM intersecting AM at X and Y.

(g) Construct a right angle at A by drawing necessary arcs which intersect at point D.

(h) Join AD. Thus AD is parallel to BC.

Exercise 12.2

1. **Steps to construct :**



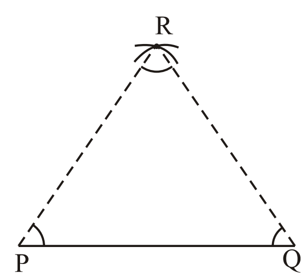
(a) Draw a line segment DE of length 6 cm.

(b) With D as centre and radius 7 cm, draw an arc using a compass.

(c) With E as centre and radius 5.5 cm, draw another arc, cutting the previous arc at F.

(d) Join FD and FE. Then ΔDEF is the required triangle.

2. **Steps to construct :** given $PQ = QR = RP = 6.5$ cm.



(a) Draw a line segment $PQ = 6.5$ cm.

(b) With P as centre and radius 6.5 cm, draw an arc using a compass.

(c) With Q as centre and radius 6.5 cm, draw another arc. Cutting the previous arc at R.

(d) Join RP and RQ. Then ΔPQR is the required triangle.

(e) Measuring $\angle P, \angle Q$ and $\angle R = 60°$.

Thus, we can conclude that in equilateral triangle all the three sides are same and all the three angles are of equal measurement.

3. Given an isosceles Δ in which $AB = AC = 4.5$ cm, $BC = 5.5$ cm.

First draw a rough sketch of ΔABC.

Steps to construct :

(a) Draw a line segment $BC = 5.5$ cm.

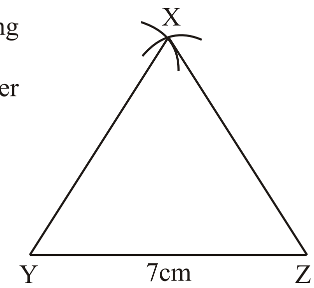
(b) With B as centre and radius 4.5 cm, draw an arc using a compass.

(c) With C as centre and same radius 4.5 cm, draw another arc, cutting the previous arc at A.

(d) Join AB and AC.

Then $\Delta\ ABC$ is the required triangle.

(e) Measuring $\angle B$ and $\angle C$ with the help of protractor.



4. Given $\Delta\ XYZ$ with $XY = 6\,\text{cm}$, $YZ = 7\,\text{cm}$, $ZX = 5.5$ cm.

Steps to construct :

(a) Draw a line segment $YZ = 7\,\text{cm}$.

(b) With Y as centre and radius 6 cm, draw an arc using a compass.

(c) With Z as centre and radius 5.5 cm draw another arc, cutting the previous arc a X.

(d) Join XY and XZ.

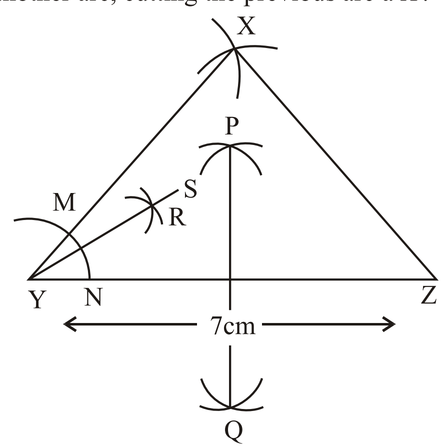
then $\Delta\ XYZ$ is the required triangle.

(e) Now Y and Z as centre respectively and radius more than half of radius YZ (i.e., length of YZ) draw two arc cutting each other on both sides as given in

(f) With Y as centre draw an arc of any radius which intersect the side XY and side YZ at point. M, N respectively.

(g) Now taking M and N as centre, draw two arcs of same radius or radius more than half of MN, which intersect each other at point R.

(h) Finally, produce YR to S. This line segment YS. Bisect $LXYZ$.



5. (a) Let $a = 8\,\text{cm}$, $b = 4$ cm, $c = 3\,\text{cm}$ $a + b = 8 + 4 = 13\,\text{cm} > 3$

$\Rightarrow$ $b + c < a$

$b + c = 4 + 3 = 7 < 8$

$\Rightarrow$ $b + c < a$

$c + a = 3 + 8 = 11 > 4$

$c + a > b$

Since, the sum of two side of the three sides < the third triangle.

Hence, with these sides this triangle can't be constructed.

(b) $7 + 15 > 5$

$15 + 5 > 7$

$5 + 7 < 15$

$\therefore$ with these sides triangle can't be constructed.

(c) $14 + 6 > 9$

$6 + 9 > 14$

$9 + 14 > 6$

$\therefore$ With these sides triangle can be constructed.

(d) $10 + 10 = 20$ (third side)

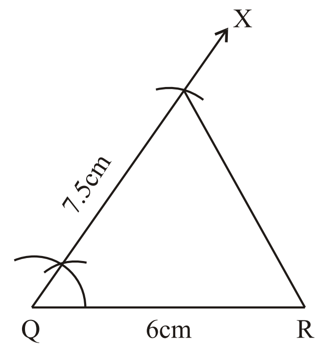
$20 + 10 > 10$ (first side)

$10 + 20 > 10$ (second side)

$\therefore$ With these sides triangle can't be constructed.

Exercise 12.3

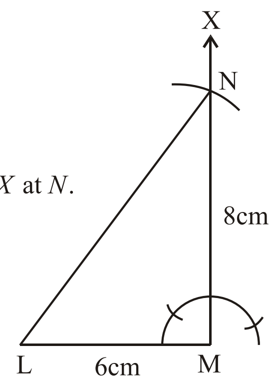
1. First we draw a rough sketch of ΔPQR.



Steps to construct :

(a) Draw a line segment $QR = 6$ cm.
(b) *ATQ*, construct $\angle XQR = 55°$.
(c) With Q as centre and radius 7.5 cm, draw an arc cutting QX at P.
(d) Join PR.
Then, ΔPQR is the required triangle.

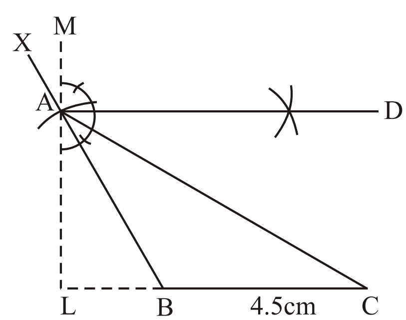
2. First draw a rough sketch of ΔLMN as given below.



Steps to construct :

(a) Draw a line segment $LM = 6$ cm.
(b) *ATM*, construct $\angle XML = 90°$.
(c) With M as centre and radius 8 cm, draw an arc cutting MX at N.
(d) Join NL.
Then, ΔLMN is the required triangle.

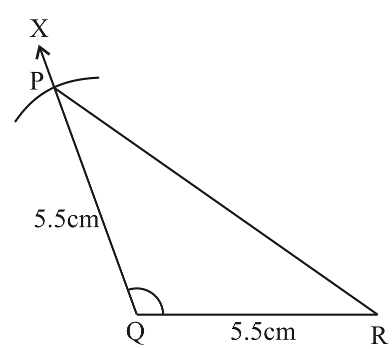
3. First draw a rough sketch of ΔABC as given below.



Steps to construct :

(a) Draw a line segment $BC = 4.5$ cm.
(b) At B, construct $\angle XBC = 120°$.
(c) With B as centre and radius 5 cm, draw an arc cutting BX at A.
(d) Join AC.
(e) Produce BC to L and draw a line LY passing through point A.
(f) Now make angle of 90° at A by necessary arcs.
(g) Produce A to D to get the required line AD parallel to BC.

4. First draw a rough sketch of ΔPQR.



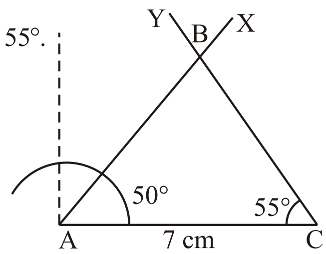
Let $QR = PQ = 5.5$, $LQ = 110°$.

Steps to construct :

(a) Draw a line segment $QR = 5.5$ cm.
(b) At Q, construct $\angle RQX = 110°$.
(c) With Q as centre and radius 5.5 cm. draw an arc cutting QX at P.
(d) Join PR.
Then, ΔPQR is the required triangle.

Exercise 12.4

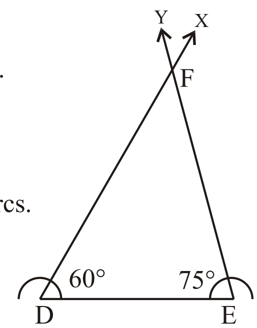
1. Given : A ΔABC is which $AC = 7$ cm, $\angle A = 50°$, $\angle C = 55°$.



Steps to construct :

(a) Draw AC oflength 7 cm.
(b) At A construct $\angle XAC = 50°$ by using protractor.
(c) At C draw $\angle YCA = 55°$ by using protractor.
(d) Let AX and CY intersect at B.
Then ΔABC as the required triangle.

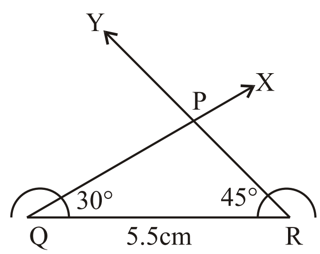
2. Given : A ΔDEF in which $DE = 5$ cm, $\angle D = 60°$, $\angle E = 75°$.



Steps to construct :

(a) Draw DE of length 5 cm.
(b) At D construct $\angle XDE = 60°$.
(c) At E draw $\angle YED = 75°$ by using protractor or by using arcs.
(d) Let DX and EY intersect at F.
Then ΔDEF is the required triangle.

3. **Given :** A ΔPQR in which $QR = 5.5$ cm,
$\angle P = 45°$, $\angle Q = 30°$.



(a) Draw a line segment $QR = 5.5$ cm.
(b) At Q & R
draw $\angle XQR = 30°$ and $\angle YRQ = 45°$ respectively by using protractor or by using arcs.
(c) Let QX and RY intersect at P.
Then ΔPQR is the required triangle.

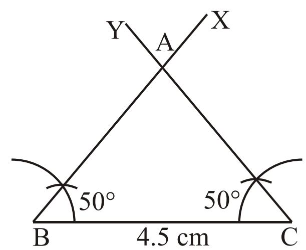
4. Given : $\angle X = 1056$, $\angle X = 75°$, $XY = 5.8$ cm.

$\angle X + \angle Y + \angle Z = 180°$ (Angle sum property of triangles)
$105 + 75 + \angle Z = 180$
$\angle Z = 180 - 180 = 0°$
$\angle Z = 0°$

But it is not possible that any angle of a triangle be 0°. So, ΔXYZ can't be constructed.

5. **Given :** ΔABC in which $BC = 4.5$ cm,

$\angle B = \angle C = 50°$
$\angle A = 180° - (\angle B + \angle C)$
$= 180 - (50 + 50)$
$= 180 - 100 = 80°$
$\angle A = 80°$

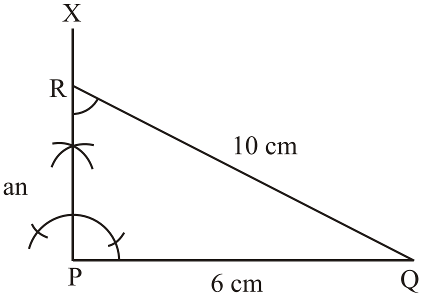


Steps to construct :

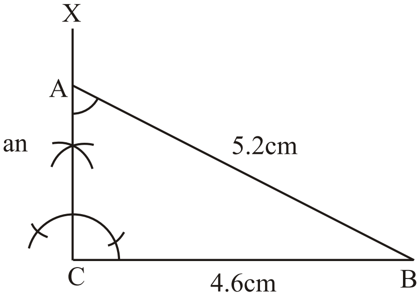
(a) Draw a line segment $BC = 4.5$ cm.
(b) At B construct $\angle XBC = 50°$ by using protractor or by drawing arcs.
(c) At C draw $\angle YCB = 50°$ by provides manner.
(d) Let BX and CY intersect at A.
Then ΔABC is the required triangle.

Exercise 12.5

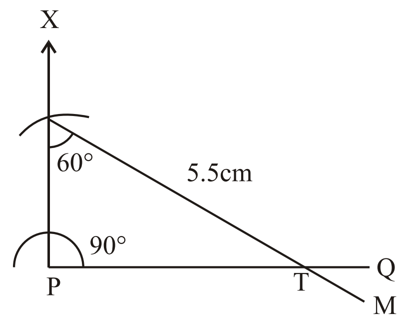
1. **Steps to construct :**
   (a) Draw a line segment $PQ = 6$ cm.
   (b) At P, construct $\angle QPX = 90°$.
   (c) With Q as centre and radius 10 cm, draw an arc cutting PX at R.
   (d) Join RQ.
   Then, $\Delta\, PQR$ is the required triangle.



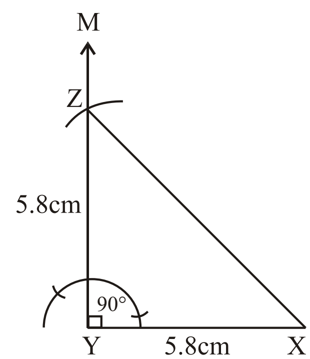
2. **Steps to construct :**
   (a) Draw a line $BC = 4.6$ cm.
   (b) At C, construct $\angle BCX = 90°$.
   (c) With B as centre and radius 5.2 cm, draw an arc cutting CX at A.
   (d) Join AB.
   Then, $\Delta\, ABC$ is the required triangle.



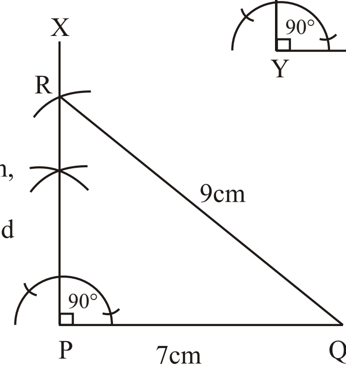
3. **Steps to constructs :**
   (a) Draw a line PQ of any length.
   (b) At P, construct$\angle QPX = 90°$.
   (c) With R as centre, construct $\angle MRP = 60°$ and radius 5.5 cm draw an arc cutting PQ at T.
   (d) Thus, $\Delta\, PRT$ is the required triangle.



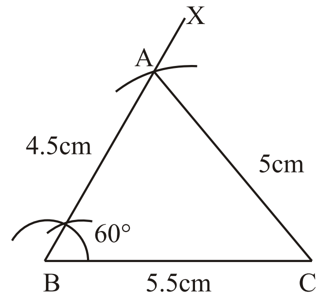
4. **Steps to construct :**
   (a) Draw a line segment $XY = 5.8$ cm.
   (b) At Y, construct $\angle XYM = 90°$.
   (c) With Y as centre and radius 5.8 cm, draw an arc cutting YM at Z.
   (d) Join ZX, then, $\Delta\, XYZ$ is the required isosceles right angle triangle.



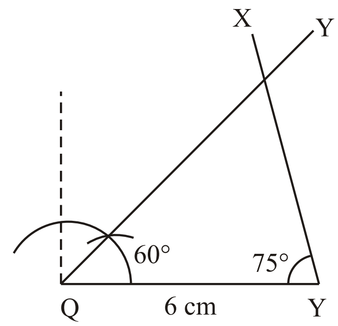
5. **Steps to construct :**
   (a) Draw a line segment $PQ = 7$ cm.
   (b) At P, construct $\angle QPX = 90°$.
   (c) With Q as centre and radius 9 cm, draw an arc cutting PX at R.
   (d) Join RQ. Then, $\Delta\, PQR$ is the required triangle.



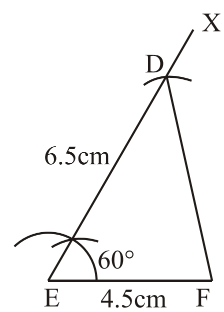
6. **Steps to construct :**
(a) Draw a line segment *BC* =5.5 cm.
(b) At *B*, construct an angle of any degree, here, we construct $\angle CBX = 60°$ for convenience.
(c) With *B* as centre and radius 4.5 cm, draw an arc cutting *BX* at *A*.
(d) Similarly, with *C* as centre and radius 5 cm, draw an another arc cutting *BX* at *A*.
(e) Join *AC* then, $\Delta\, ABC$ is the required triangle.



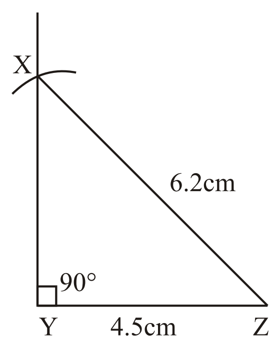
7. **Steps to construct :**
(a) Draw $QP = 6$ cm.
(b) At *Q*, construct $\angle XQP = 45°$.
(c) At *P*, draw $\angle YPQ = 75°$.
(d) Let *QX* and *PY* intersect at *R* then $\Delta\, PQR$ is the required triangle.



8. **Steps to construct :**
(a) Draw a line segment $EF = 4.5$ cm.
(b) At *E*, construct $\angle XEF = 60°$.
(c) With *E* as centre and radius 6.5 cm, draw an arc cutting *EX* at *D*.
(d) Join *DF*.
Then, $\Delta\, DEF$ is the required triangle..



9. **Steps to construct :**
(a) Draw a line segment of length $YZ = 4.5$ cm.
(b) At *Y* construct $\angle XYZ = 90°$.
(c) With *Z* as centre and radius 6.2, draw an arc cutting *ZX* at *X*.
(d) Join *XZ*. Then, $\Delta\, XYZ$ is the required triangle.



Formative Assessment-3

1. (a) **2.** (b) **3.** (b) **4.** (a) **5.** (a) **6.** (a) **7. 8.** (b) **9.** (c) **10.** (c) **11.** (b) **12.** (c) **13.** (c)
14. (b) **15.** (b) **16.** (a) **17.** (b) **18.** (c) **19.** (c) **20.** (c).