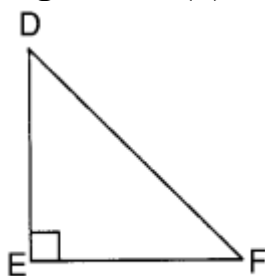


Exercise

1. The sides of a triangle have lengths (in cm) 10, 6.5 and a , where a is a whole number. The minimum value that a can take is
(a) 6 (b) 5 (c) 3 (d) 4

Hence, the correct option is (d).

(d) They are supplementary angles



Hence, the correct option is (c).

(a) 35° (b) 45° (c) 55° (d) 70°

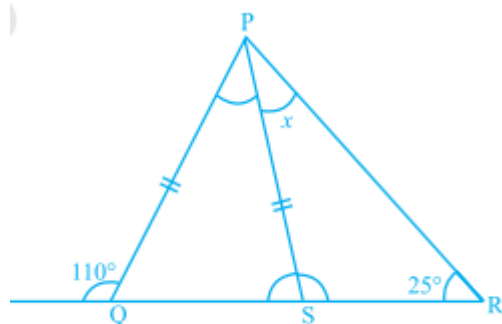
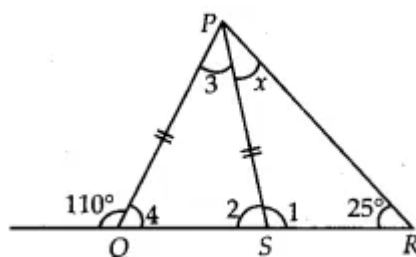


Fig. 6.7

Solution:



See the above figure, in triangle PQS, $\angle 2 + \angle 3 = 110^\circ \dots(i)$ [Exterior angle property of a triangle]

$$\angle 2 + \angle 3 + \angle 4 = 180^\circ$$

[Angle sum property of a triangle]

$$\angle 4 = 180^\circ - 110^\circ$$

[Using equation (i)]

$$\text{So, } \angle 4 = 70^\circ$$

$$\text{Now, } PQ = PS$$

[Given]

$$\angle 2 = \angle 4 = 70^\circ$$

$\dots(ii)$

Now, in $\triangle PRS$:

$$\angle 2 = x + 25^\circ$$

[Exterior angle property of a triangle]

$$x = 70^\circ - 25^\circ$$

$$x = 45^\circ$$

[Using equation (ii)]

Hence, the correct option is (b).

4. In a right-angled triangle, the angles other than the right angle are

(a) obtuse (b) right (c) acute (d) straight

Solution:

As we know that the sum of angles other than right angle in a right-angled triangle is 90°

So, both angles other than the right angle must be acute.

Hence, the correct option is (c).

5. In an isosceles triangle, one angle is 70° . The other two angles are of

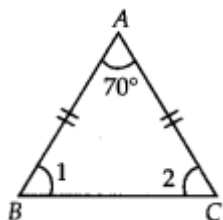
(i) 55° and 55° (ii) 70° and 40° (iii) any measure

In the given option(s) which of the above statement(s) are true?

- (a) (i) only (b) (ii) only (c) (iii) only (d) (i) and (ii)

Solution:

Case I: Let $\triangle ABC$ is an isosceles triangle in which $AB = AC$ and vertex angle is 70° .
 $\angle 1 = \angle 2$... (i) [$AB = AC$]



Now, $\angle 1 + \angle 2 + \angle A = 180^\circ$

$$2(\angle 1) = 180^\circ - 70^\circ$$

$$2(\angle 1) = 110^\circ$$

$$\angle 1 = \frac{110^\circ}{2}$$

$$\angle 1 = 55^\circ$$

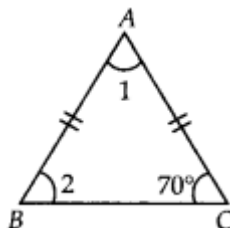
$$\text{So, } \angle 1 = \angle 2 = 55^\circ$$

Therefore, (i) is true.

[Angle sum property]

[Using equation (i)]

Case II: Let $\triangle ABC$ is an isosceles triangle in which $AB = AC$ and base angle is 70° .
 $\angle 2 = 70^\circ$ [$AB = AC$]



$$\text{Now, } \angle 1 + \angle 2 + \angle C = 180^\circ$$

$$\angle 1 = 180^\circ - \angle 2 - \angle C$$

$$\angle 1 = 180^\circ - 70^\circ - 70^\circ$$

$$\angle 1 = 40^\circ$$

$$\text{So, } \angle 1 = 40^\circ \text{ and } \angle 2 = 70^\circ$$

Therefore, (ii) is also true.

Hence, the correct option is (d).

6. In a triangle, one angle is of 90° . Then

(i) The other two angles are of 45° each

(ii) In remaining two angles, one angle is 90° and other is 45°

(iii) Remaining two angles are complementary

In the given option(s) which is true?

- (a) (i) only (b) (ii) only (c) (iii) only (d) (i) and (ii)

Solution:

As we know that in a triangle, if one angle is of 90° , the remaining two angles are complementary.

Hence, the correct option is (c).

7. Lengths of sides of a triangle are 3 cm, 4 cm and 5 cm. The triangle is

- (a) Obtuse angled triangle (b) Acute-angled triangle
(c) Right-angled triangle (d) An Isosceles right triangle

Solution:

Given: Lengths of sides of a triangle are 3 cm, 4 cm and 5 cm.

Now, $3^2 + 4^2 = 9 + 16 = 25 = 5^2$

As we know that sum of squares of two sides is equal to square of third side. Therefore, triangle is right angled triangle.

Hence, the correct option is (c).

8. In Fig. 6.8, $PB = PD$. The value of x is

- (a) 85° (b) 90° (c) 25° (d) 35°

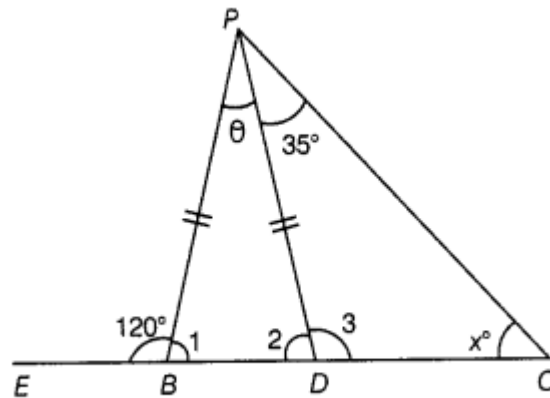


Fig. 6.8

Solution:

See the given figure in the question,

$$\angle PBE = \angle PDB + \angle BPD$$

$$120^\circ = \angle PDB + \theta$$

[Exterior angle property]

...(i)

Now, in triangle PBD,

$$\angle PBD + \angle BPD + \angle PDB = 180^\circ$$

$$\angle PBD + \theta + \angle PDB = 180^\circ$$

$$\angle PBD = 180^\circ - 120^\circ = 60^\circ$$

And $PB = PD$ [Given]

$$\text{So, } \angle PDB = \angle PBD = 60^\circ$$

[Angle sum property]

[Using equation (i)]

...(ii)

Now, in $\triangle PDC$,

$$\angle PDB = \angle DCP + \angle DPC$$

[Exterior angle property]

$$60^\circ = x + 35^\circ$$

[Using equation (ii)] [Given: $\angle DCP = x$, $\angle DPC = 35^\circ$]

$$x = 60^\circ - 35^\circ$$

$$x = 25^\circ$$

Hence, the correct option is (c).

9. In $\triangle PQR$,

- (a) $PQ - QR > PR$ (b) $PQ + QR < PR$ (c) $PQ - QR < PR$ (d) $PQ + PR < QR$

Solution:

In a triangle PQR ,

$PQ + QR > PR$; $QR + PR > PQ$; $PR + PQ > QR$ [Sum of any two sides of a triangle is greater than the third side]

And: $PQ - QR < PR$; $QR - PR < PQ$

$PR - PQ < QR$ [Difference of any two sides of a triangle is less than the third side].

Hence, the correct option is (c).

10. In $\triangle ABC$,

- (a) $AB + BC > AC$ (b) $AB + BC < AC$ (c) $AB + AC < BC$ (d) $AC + BC < AB$

Solution:

In a $\triangle ABC$,

$AB + BC > AC$; $BC + AC > AB$; $AC + AB > BC$ [$\because$ Sum of two sides is greater than third side in a triangle]

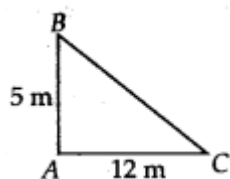
Hence, the correct option is (a).

11. The top of a broken tree touches the ground at a distance of 12 m from its base. If the tree is broken at a height of 5 m from the ground then the actual height of the tree is

- (a) 25 m (b) 13 m (c) 18 m (d) 17 m

Solution:

According to the question, let BC is the broken part of tree and AB is the unbroken part of tree.



$\triangle ABC$ is right angled triangle. So,

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

$$\begin{aligned}(BC)^2 &= (5)^2 + (12)^2 \\(BC)^2 &= 25 + 144 = 169 \\(BC)^2 &= 13^2 \\BC &= 13 \text{ m}\end{aligned}$$

So, actual height of tree is $AB + BC = (5 + 13) \text{ m} = 18 \text{ m}$
Hence, the correct option is (c).

12. The triangle ABC formed by $AB = 5 \text{ cm}$, $BC = 8 \text{ cm}$, $AC = 4 \text{ cm}$ is
(a) an isosceles triangle only (b) a scalene triangle only
(c) an isosceles right triangle (d) scalene as well as a right triangle

Solution:

Let in $\triangle ABC$, $AB = 5 \text{ cm}$, $BC = 8 \text{ cm}$, $AC = 4 \text{ cm}$

$$\text{Now, } 5^2 + 4^2 = 25 + 16 = 41 \neq 8^2$$

And all sides of triangle are unequal.

So, $\triangle ABC$ is a scalene triangle only.

Hence, the correct option is (b).

13. Two trees 7 m and 4 m high stand upright on a ground. If their bases (roots) are 4 m apart, then the distance between their tops is
(a) 3 m (b) 5 m (c) 4 m (d) 11 m

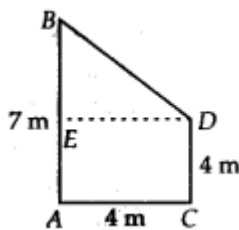
Solution:

Suppose AB and CD are the given trees of height 7 m and 4 m respectively.

So, $AC = DE = 4 \text{ m}$

$$BE = AB - AE = (7 - 4) \text{ m} = 3 \text{ m}$$

$$[AE = CD = 4 \text{ m}]$$



Now, $\triangle BED$ is a right angled triangle

$$\begin{aligned}(BD)^2 &= (BE)^2 + (DE)^2 \\(BD)^2 &= (3)^2 + (4)^2 = 9 + 16 \\(BD)^2 &= 25 \\(BD)^2 &= 5^2 \\BD &= 5 \text{ m}\end{aligned}$$

Therefore, the distance between the tops of trees is 5 m.

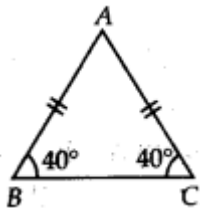
Hence, the correct option is (b).

14. If in an isosceles triangle, each of the base angles is 40° , then the triangle is

- (a) Right-angled triangle (b) Acute angled triangle
(c) Obtuse angled triangle (d) Isosceles right-angled triangle

Solution:

Suppose triangle ABC be the given isosceles triangle in which $AB = AC$ and each base angle is 40° .



Now, $\angle A + \angle B + \angle C = 180^\circ$ [Angle sum property]

$$\angle A = 180^\circ - \angle B - \angle C$$

$$\angle A = 180^\circ - 40^\circ - 40^\circ \quad [\angle B = \angle C = 40^\circ]$$

$$\angle A = 100^\circ$$

Therefore, triangle ABC is an obtuse angled triangle.

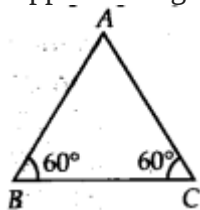
Hence, the correct option is (c).

15. If two angles of a triangle are 60° each, then the triangle is

- (a) Isosceles but not equilateral (b) Scalene (c) Equilateral (d) Right-angled

Solution:

Suppose triangle ABC be the given triangle in which two angles are of 60° each.



Now, $\angle A + \angle B + \angle C = 180^\circ$ [Angle sum property]

$$\angle A = 180^\circ - 60^\circ - 60^\circ$$

$$\text{So, } \angle A = 60^\circ$$

Thus, all angles are of 60°

Therefore, triangle ABC is an 60° equilateral triangle

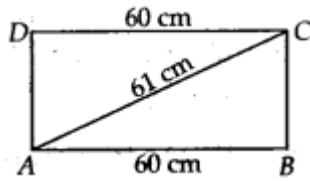
Hence, the correct option is (c).

16. The perimeter of the rectangle whose length is 60 cm and a diagonal is 61 cm is

- (a) 120 cm (b) 122 cm (c) 71 cm (d) 142 cm

Solution:

Suppose ABCD be the given rectangle such that $AB = CD = 60$ cm and $AC = 61$ cm.



Now, in triangle ABC,

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

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

$$(BC)^2 = 3721 - 3600$$

$$(BC)^2 = 121$$

$$(BC)^2 = 11^2$$

$$BC = 11 \text{ cm}$$

$$\begin{aligned} \text{So, perimeter of rectangle ABCD} &= 2(AB + BC) \\ &= 2(60 + 11) \\ &= 2(71) \\ &= 142 \text{ cm} \end{aligned}$$

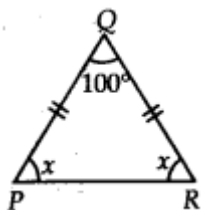
Hence, the correct option is (d).

17. In $\triangle PQR$, if $PQ = QR$ and $\angle Q = 100^\circ$, then $\angle R$ is equal to

(a) 40° (b) 80° (c) 120° (d) 50°

Solution:

According to the question:



$$\text{Let } \angle R = x$$

$$PQ = QR \text{ [given]}$$

$$\text{SO, } \angle R = \angle P = x$$

Now, in triangle POR

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

$$x + 100^\circ + x = 180^\circ$$

$$2x = 180^\circ - 100^\circ$$

$$2x = 80^\circ$$

$$x = \frac{80^\circ}{2}$$

$$x = 40^\circ$$

$$\text{Thus, } \angle R = 40^\circ$$

[Angle sum property]

Hence, the correct option is (a).

18. Which of the following statements is not correct?

- (a) The sum of any two sides of a triangle is greater than the third side
- (b) A triangle can have all its angles acute
- (c) A right-angled triangle cannot be equilateral
- (d) Difference of any two sides of a triangle is greater than the third side

Solution:

As we know that the difference of any two sides of a triangle is less than the third side.
Hence, the correct option is (d).

19. In Fig. 6.9, $BC = CA$ and $\angle A = 40^\circ$. Then, $\angle ACD$ is equal to

- (a) 40°
- (b) 80°
- (c) 120°
- (d) 60°

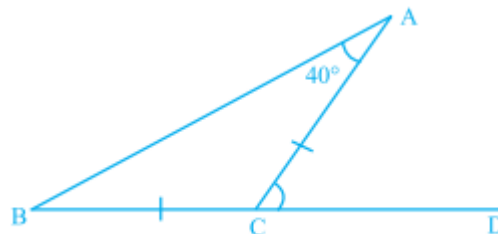


Fig. 6.9

Solution:

$BC = CA$ [given]

$\angle A = \angle B = 40^\circ$ [Angles opposite to equal sides are equal]

Now, $\angle ACD = \angle A + \angle B$ [Exterior angle property]

$$\angle ACD = 40^\circ + 40^\circ$$

$$\angle ACD = 80^\circ$$

Hence, the correct option is (b).

20. The length of two sides of a triangle are 7 cm and 9 cm. The length of the third side may lie between

- (a) 1 cm and 10 cm
- (b) 2 cm and 8 cm
- (c) 3 cm and 16 cm
- (d) 1 cm and 16 cm

Solution:

Given: Length of two sides of a triangle are 7 cm and 9 cm.

Suppose the length of third side be x cm.

As we know that sum of two sides is greater than third side in a triangle.

$$\text{So, } 7 + 9 > x, 7 + x > 9, 9 + x > 7$$

$$16 > x, x > 2, x > -2$$

Since, side length cannot be negative.

So, $2 < x < 16$

Therefore, the third side may lie between 2 cm and 16 cm.

Hence, the correct option is (c).

21. From Fig. 6.10, the value of x is

- (a) 75° (b) 90° (c) 120° (d) 60°

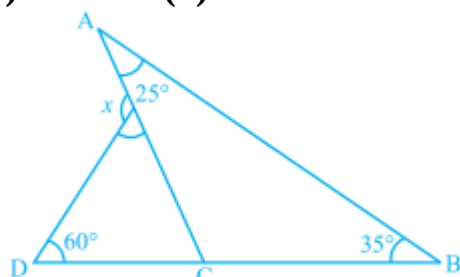


Fig. 6.10

Solution:

In $\triangle ABC$,

$\angle ACD = \angle CAB + \angle ABC$ [Exterior angle property]

$$\angle ACD = 25^\circ + 35^\circ$$

$$\angle ACD = 60^\circ$$

...(i)

Now, $x = \angle D + \angle ACD$, [Exterior angle property]

$$x = 60^\circ + 60^\circ \text{ [Using equation (i)] .}$$

$$x = 120^\circ$$

Hence, the correct option is (c).

22. In Fig. 6.11, the value of $\angle A + \angle B + \angle C + \angle D + \angle E + \angle F$ is

- (a) 190° (b) 540° (c) 360° (d) 180°

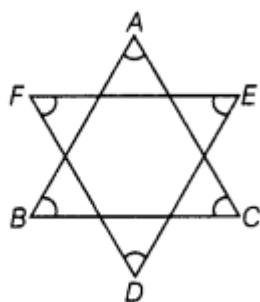


Fig. 6.11

Solution:

See the given figure in the question, in $\triangle ABC$:

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

...(i) [Angle sum property]

In $\triangle DEF$:

$$\angle D + \angle E + \angle F = 180^\circ$$

...(ii) [Angle sum property]

Adding equation (i) and (ii), get:

$$\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 180^\circ + 180^\circ$$

$$\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 360^\circ$$

Hence, the correct option is (c).

23. In Fig. 6.12, $PQ = PR$, $RS = RQ$ and $ST \parallel QR$. If the exterior angle RPQ is 140° , then the measure of angle TSR is
(a) 55° (b) 40° (c) 50° (d) 45°

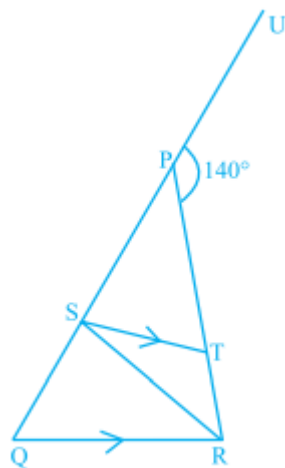


Fig. 6.12

Solution:

Given: $PQ = PR$

So, $\angle PRQ = \angle PQR$

See the given figure in the question, in $\triangle PQR$:

$\angle RPU = \angle PRQ + \angle PQR$ [Exterior angle property]

$$140^\circ = 2\angle PQR \quad [\angle PRQ = \angle PQR]$$

$$\angle PQR = \frac{140^\circ}{2}$$

$$\angle PQR = 70^\circ$$

$ST \parallel QR$ and PS is a transversal.

So, $\angle PST = \angle PQR = 70^\circ$

... (ii) [Corresponding angles]

Now, in $\triangle QSR$ $RS = RQ$ (given).

So, $\angle SQR = \angle RSQ = 70^\circ$

Now, PQ is a straight line.

So, $\angle PST + \angle TSR + \angle RSQ = 180^\circ$

$$70^\circ + \angle TSR + 70^\circ = 180^\circ$$

[Using (ii) and (iii)]

$$\angle TSR = 180^\circ - 70^\circ - 70^\circ$$

$$\angle TSR = 180^\circ - 140^\circ$$

$$\angle TSR = 40^\circ$$

Hence, the correct option is (b).

24. In Fig. 6.13, $\angle BAC = 90^\circ$, $AD \perp BC$ and $\angle BAD = 50^\circ$, then $\angle ACD$ is
 (a) 50° (b) 40° (c) 70° (d) 60°

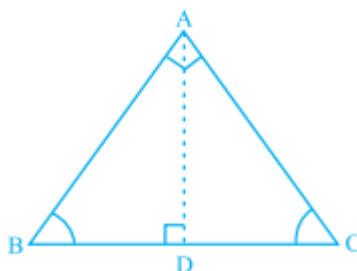


Fig. 6.13

Solution:

Given: $\angle BAC = 90^\circ$ and $\angle BAD = 50^\circ$

So, $\angle DAC = \angle BAC - \angle BAD$

$$\angle DAC = 90^\circ - 50^\circ$$

$$\angle DAC = 40^\circ$$

Now, in triangle ADC:

$$\angle ADB = \angle DAC + \angle ACD \text{ [Exterior angle property]}$$

$$90^\circ = 40^\circ + \angle ACD \text{ [AD} \perp \text{BC]}$$

$$\angle ACD = 90^\circ - 40^\circ$$

$$\angle ACD = 50^\circ$$

Hence, the correct option is (a).

25. If one angle of a triangle is equal to the sum of the other two angles, the triangle is

(a) obtuse (b) acute (c) right (d) equilateral

Solution:

Suppose angles of a triangle be x , y , z .

such that $x = y + z$... (i)

$$\text{Now, } x + y + z = 180^\circ \quad \text{[Angle sum property]}$$

$$x + x = 180^\circ \quad \text{[Using equation (i)]}$$

$$2x = 180^\circ$$

$$x = \frac{180^\circ}{2}$$

$$x = 90^\circ$$

Thus, triangle is right angled.

Hence, the correct option is (c).

26. If the exterior angle of a triangle is 130° and its interior opposite angles are equal, then measure of each interior opposite angle is

(a) 55° (b) 65° (c) 50° (d) 60°

Solution:

Let interior opposite angles are x and x .

So, $130^\circ = x + x$ [Exterior angle property]

$$2x = 130^\circ$$

$$x = \frac{130^\circ}{2}$$

$$x = 65^\circ$$

Therefore, each interior opposite angle is of 65°

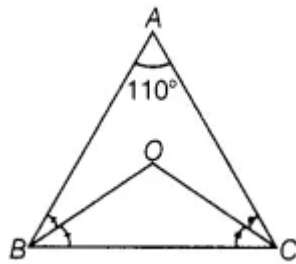
Hence, the correct option is (b).

27. If one of the angles of a triangle is 110° , then the angle between the bisectors of the other two angles is

(a) 70° (b) 110° (c) 35° (d) 145°

Solution:

Suppose triangle ABC be the given triangle such that $\angle A = 110^\circ$ and OB, OC are the angle bisectors of $\angle B, C$ respectively.



In triangle ABC,

$$\angle A + \angle B + \angle C = 180^\circ \quad [\text{Angle sum property}]$$

$$\angle B + \angle C = 180^\circ - 110^\circ$$

$$\angle B + \angle C = 70^\circ$$

$$\frac{1}{2}\angle B + \frac{1}{2}\angle C = \frac{70^\circ}{2} \quad [\text{Divided by 2 in the above equation}]$$

$$\frac{1}{2}\angle B + \frac{1}{2}\angle C = 35^\circ$$

Now, in triangle BOC:

$$\angle BOC + \angle OBC + \angle OCB = 180^\circ \quad [\text{Angle sum property of a triangle}]$$

$$\angle BOC + \frac{1}{2}(\angle B + \angle C) = 180^\circ$$

As given, OB and OC are the bisector of $\angle B$ and $\angle C$, so, $\angle OBC = \frac{1}{2}\angle B$ and

$$\angle OCB = \frac{1}{2}\angle C$$

Then,

$$\angle BOC + 35^\circ = 180^\circ$$

$$\angle BOC = 180^\circ - 35^\circ$$

$$\angle BOC = 145^\circ$$

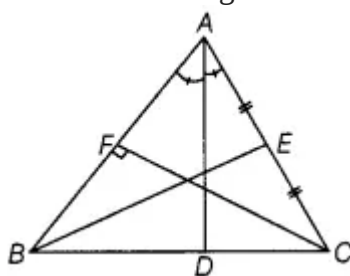
Hence, the correct option is (d).

28. In $\triangle ABC$, AD is the bisector of $\angle A$ meeting BC at D, $CF \perp AB$ and E is the mid-point of AC. Then median of the triangle is

- (a) AD (b) BE (c) FC (d) DE

Solution:

As we know that median of a triangle bisects the opposite sides.



So, the median is BE as $AE = EC$.

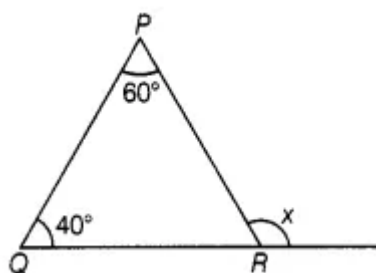
Hence, the correct option is (b).

29. In $\triangle PQR$, if $\angle P = 60^\circ$, and $\angle Q = 40^\circ$, then the exterior angle formed by producing QR is equal to

- (a) 60° (b) 120° (c) 100° (d) 80°

Solution:

As we know that the measure of exterior angle is equal to the sum of opposite two interior angles.



In triangle PQR,

$\angle x$ is the exterior angle.

$$\text{So, } \angle x = \angle p + \angle Q$$

$$\angle x = 60^\circ + 40^\circ$$

$$\angle x = 100^\circ$$

Hence, the correct option is (c).

30. Which of the following triplets cannot be the angles of a triangle?

(a) $67^\circ, 51^\circ, 62^\circ$ (b) $70^\circ, 83^\circ, 27^\circ$ (c) $90^\circ, 70^\circ, 20^\circ$ (d) $40^\circ, 132^\circ, 18^\circ$

Solution:

As we know that, the sum of the interior angles of a triangle is 180° .

So, verifying the given triplets as:

(a) $67^\circ + 51^\circ + 62^\circ = 180^\circ$

(b) $70^\circ + 83^\circ + 27^\circ = 180^\circ$

(c) $90^\circ + 70^\circ + 20^\circ = 180^\circ$

(d) $40^\circ + 132^\circ + 18^\circ = 190^\circ$

Clearly, triplets in option (d) cannot be the angles of a triangle.

Hence, the correct option is (d).

31. Which of the following can be the length of the third side of a triangle whose two sides measure 18 cm and 14 cm?

(a) 4 cm (b) 3 cm (c) 5 cm (d) 32 cm

Solution:

Suppose third side of the triangle be x cm.

As we know that, sum of any two sides of a triangle is always greater than the third side.

So, $18 + x > 14$, $14 + x > 18$, $18 + 14 > x$

$x > -4$, $x > 4$, $32 > x$

Since, length can't be negative.

Thus, $4 < x < 32$

Therefore, third side of triangle can be 5 cm.

Hence, the correct option is (c).

32. How many altitudes does a triangle have?

(a) 1 (b) 3 (c) 6 (d) 9

Solution:

A triangle has 3 altitudes.

Hence, the correct option is (b).

33. If we join a vertex to a point on opposite side which divides that side in the ratio 1:1, then what is the special name of that line segment?

(a) Median (b) Angle bisector (c) Altitude (d) Hypotenuse

Solution:

As, median is a line segment which divides the opposite side in the ratio 1 : 1.

Hence, the correct option is (a).

34. The measures of $\angle x$ and $\angle y$ in Fig. 6.14 are respectively
(a) $30^\circ, 60^\circ$ (b) $40^\circ, 40^\circ$ (c) $70^\circ, 70^\circ$ (d) $70^\circ, 60^\circ$

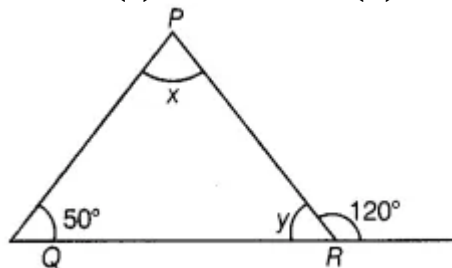
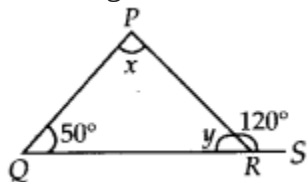


Fig. 6.14

Solution:

Given figure is,



In $\triangle PQR$,

$\angle PRS = \angle RPQ + \angle RPQ$ [Exterior angle property]

$$120^\circ = x + 50^\circ$$

$$x = 120^\circ - 50^\circ = 70^\circ$$

Now, $x + y + 50^\circ = 180^\circ$ [Angle sum property]

$$70^\circ + y + 50^\circ = 180^\circ$$

$$y = 180^\circ - 70^\circ - 50^\circ$$

$$y = 180^\circ - 120^\circ$$

$$y = 60^\circ$$

Therefore, $x = 70^\circ, y = 60^\circ$

Hence, the correct option is (d).

35. If length of two sides of a triangle are 6 cm and 10 cm, then the length of the third side can be

(a) 3 cm (b) 4 cm (c) 2 cm (d) 6 cm

Solution:

Suppose third side of the triangle be x cm.

As we know that, sum of any two side of a triangle is greater than third side.

$$\text{So, } 6 + x > 10; 10 + x > 6; 10 + 6 > x$$

$$x > 4; x > -4; x < 16$$

Since, the length can't be negative.

Thus, $4 < x < 16$

Therefore, third side can be 6 cm.

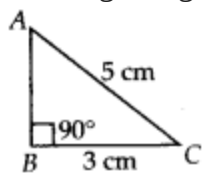
Hence, the correct option is (d).

36. In a right-angled triangle ABC, if angle B = 90°, BC = 3 cm and AC = 5 cm, then the length of side AB is

(a) 3 cm (b) 4 cm (c) 5 cm (d) 6 cm

Solution:

In the right angled triangle ABC,



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

$$5^2 = (AB)^2 + 3^2$$

$$(AB)^2 = 25 - 9 = 16 = 4^2$$

$$AB = 4 \text{ cm}$$

Hence, the correct option is (b).

37. In a right-angled triangle ABC, if angle B = 90°, then which of the following is true?

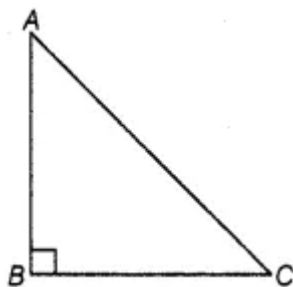
(a) $AB^2 = BC^2 + AC^2$ (b) $AC^2 = AB^2 + BC^2$ (c) $AB = BC + AC$ (d) $AC = AB + BC$

Solution:

According to Pythagoras theorem,

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

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



Hence, the correct option is (b).

38. Which of the following figures will have its altitude outside the triangle?

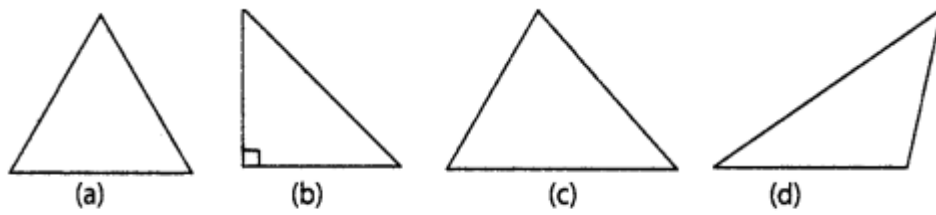
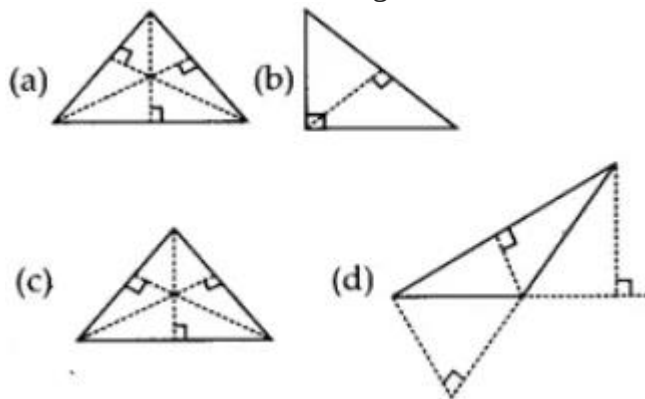


Fig. 6.15

Solution:

As we know, the perpendicular line segment from a vertex of a triangle to its opposite side is called an altitude of the triangle.



Hence, the correct option is (d).

39. In Fig. 6.16, if $AB \parallel CD$, then

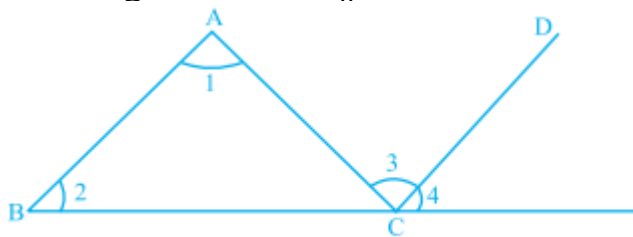


Fig. 6.16

- (a) $\angle 2 = \angle 3$ (b) $\angle 1 = \angle 4$ (c) $\angle 4 = \angle 1 + \angle 2$ (d) $\angle 1 + \angle 2 = \angle 3 + \angle 4$

Solution:

Given, $AB \parallel CD$

So, $\angle 2 = \angle 4$... (i) (Corresponding angles)

And $\angle 1 = \angle 3$... (ii) [Alternate interior angles]

Adding equation (i) and (ii), get

$$\angle 1 + \angle 2 = \angle 3 + \angle 4$$

Hence, the correct option is (d).

40. In $\triangle ABC$, $\angle A = 100^\circ$, AD bisects $\angle A$ and $AD \perp BC$. Then, $\angle B$ is equal to
(a) 80° (b) 20° (c) 40° (d) 30°

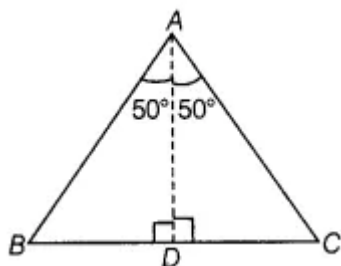
Solution:

Given: AD bisects, $\angle A$.

$$\angle BAD = \angle DAC = \frac{1}{2} \angle BAC$$

$$\angle BAD = \frac{100^\circ}{2}$$

$$\angle BAD = 50^\circ$$



Now, $AD \perp BC$

So, $\angle ADC = 90^\circ$

Now, in $\triangle ABD$,

$\angle ADC = \angle ABD + \angle BAD$ [Exterior angle property]

$$90^\circ = \angle ABD + 50^\circ$$

$$\angle ABD = 90^\circ - 50^\circ = 40^\circ$$

Therefore, $\angle B = 40^\circ$

Hence, the correct option is (c).

41. In $\triangle ABC$, $\angle A = 50^\circ$, $\angle B = 70^\circ$ and bisector of $\angle C$ meets AB in D (Fig. 6.17). Measure of $\angle ADC$ is.

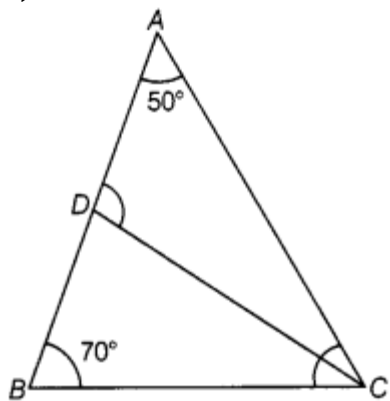


Fig. 6.17

(a) 50° (b) 100° (c) 30° (d) 70°

Solution:

In $\triangle ABC$, $\angle A + \angle B + \angle C = 180^\circ$ [Angle sum property]
 $\angle C = 180^\circ - 70^\circ - 50^\circ$
 $\angle C = 60^\circ$

Since, CD bisects $\angle C$.

$$\text{So, } \angle DCB = \angle ACD = \frac{1}{2} \angle C = \frac{60^\circ}{2} = 30^\circ$$

Now, in $\triangle BDC$, $\angle ADC = \angle DBC + \angle DCB$ [Exterior angle property]
 $\angle ADC = 70^\circ + 30 = 100^\circ$

Hence, the correct option is (b).

42. If for $\triangle ABC$ and $\triangle DEF$, the correspondence $CAB \leftrightarrow EDF$ gives a congruence, then which of the following is not true?

- (a) $AC = DE$ (b) $AB = EF$ (c) $\angle A = \angle D$ (d) $\angle C = \angle E$

Solution:

Given: $\triangle CAB \cong \triangle EDF$

So, $AC = DE$, $AB = DF$, $BC = FE$, $\angle A = \angle D$, $\angle C = \angle E$, $\angle B = \angle F$

Hence, the correct option is (b).

43. In Fig. 6.18, M is the mid-point of both AC and BD. Then

- (a) $\angle 1 = \angle 2$ (b) $\angle 1 = \angle 4$ (c) $\angle 2 = \angle 4$ (d) $\angle 1 = \angle 3$

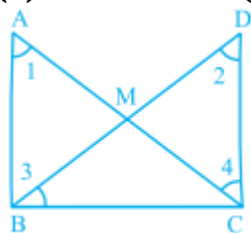


Fig. 6.18

Solution:

In $\triangle AMB$ and $\triangle CMD$,

$AM = CM$ [M is mid-point of AC]

$BM = DM$ [M is mid-point of BD]

$\angle AMB = \angle CMD$ [Vertically opposite angles]

So, $\triangle AMB \cong \triangle CMD$ [SAS criterion]

So, $\angle 1 = \angle 4$ [By C.P.C.T]

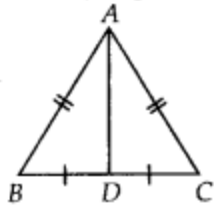
Hence, the correct option is (b).

44. If D is the mid-point of the side BC in $\triangle ABC$ where $AB = AC$, then $\angle ADC$ is

- (a) 60° (b) 45° (c) 120° (d) 90°

Solution:

In $\triangle ABD$ and $\triangle ACD$,
 $AD = AD$ [common]
 $AB = AC$ [given]
 $BD = CD$ [D is mid-point of BC]



So, $\triangle ABD = \triangle ACD$ [SSS criterion]
 As, $\angle ADB = \angle ADC$ [By C.P.C.T.]...(i)
 But $\angle ADB + \angle ADC = 180^\circ$ [BC is a straight line]
 $\angle ADC + \angle ADC = 180^\circ$ [By using equation (i)]
 $2 \angle ADC = 180^\circ$
 $\angle ADC = 90^\circ$
 Hence, the correct option is (d).

45. Two triangles are congruent, if two angles and the side included between them in one of the triangles are equal to the two angles and the side included between them of the other triangle. This is known as the
 (a) RHS congruence criterion (b) ASA congruence criterion
 (c) SAS congruence criterion (d) AAA congruence criterion

Solution:

As we know, under ASA congruence criterion, two triangles are congruent, if two angles and the side included between them in one of the triangles are equal to the two angles and the side included between them of the other triangle.
 Hence, the correct option is (b).

46. By which congruency criterion, the two triangles in Fig. 6.19 are congruent?

(a) RHS (b) ASA (c) SSS (d) SAS

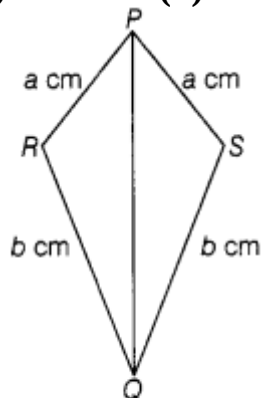


Fig. 6.19

Solution:

In $\triangle PRQ$ and $\triangle PSQ$,

$PQ = PQ$ [common]

$PR = PS = a$ cm [given]

$QR = QS = b$ cm [given]

So, $\triangle PRQ = \triangle PSQ$ [SSS criterion]

Hence the correct option is (c).

47. By which of the following criterion two triangles cannot be proved congruent?

- (a) AAA (b) SSS (c) SAS (d) ASA

Solution:

As, by AAA criterion two triangles cannot be proved congruent.

Hence, the correct option is (a).

48. If $\triangle PQR$ is congruent to $\triangle STU$ (Fig. 6.20), then what is the length of TU ?

- (a) 5 cm (b) 6 cm (c) 7 cm (d) cannot be determined

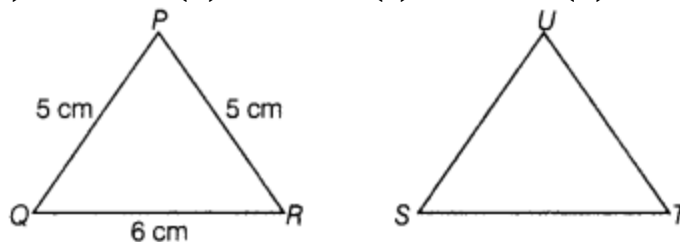


Fig. 6.20

Solution:

Given that

$\triangle PQR \cong \triangle STU$

So, $TU = QR = 6$ cm

Hence, the correct option is (b).

49. If $\triangle ABC$ and $\triangle DBC$ are on the same base BC , $AB = DC$ and $AC = DB$ (Fig. 6.21), then which of the following gives a congruence relationship?

- (a) $\triangle ABC \cong \triangle DBC$ (b) $\triangle ABC \cong \triangle CBD$ (c) $\triangle ABC \cong \triangle DCB$ (d) $\triangle ABC \cong \triangle BCD$

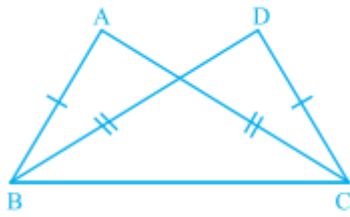


Fig. 6.21

Solution:

In $\triangle ABC$ and $\triangle DCB$,

$AB = DC$ (given)

$AC = DB$ (given)

$BC = CB$ (common)

So, $\triangle ABC \cong \triangle DCB$ (SSS criterion)

Hence, the correct option is (c).

In questions 50 to 69, fill in the blanks to make the statements true.

50. The _____ triangle always has altitude outside itself.

Solution:

The obtuse-angled triangle always has altitude outside itself.

51. The sum of an exterior angle of a triangle and its adjacent angle is always -----.

Solution:

The sum of an exterior angle of a triangle and its adjacent angle is always 180° .

52. The longest side of a right angled triangle is called its _____.

Solution:

The longest side of a right angled triangle is called its hypotenuse.

53. Median is also called ----- in an equilateral triangle.

Solution:

Median is also called altitude in an equilateral triangle.

54. Measures of each of the angles of an equilateral triangle is _____.

Solution:

Measures of each of the angles of an equilateral triangle is 60° .

55. In an isosceles triangle, two angles are always _____.

Solution:

In an isosceles triangle, two angles are always equal.

56. In an isosceles triangle, angles opposite to equal sides are _____.

Solution:

In an isosceles triangle, angles opposite to equal sides are equal.

57. If one angle of a triangle is equal to the sum of other two, then the measure of that angle is _____.

Solution:

Suppose angles of triangle be x , y and z .

Given that $x = y + z \dots(i)$

Now, $x + y + z = 180^\circ$ [Angle sum property]

$x + x = 180^\circ$ [Using equation (i)]

$2x = 180^\circ$

$x = 90^\circ$

Hence, if one angle of a triangle is equal to the sum of other two, then the measure of that angle is 90° .

58. Every triangle has at least _____ acute angle (s).

Solution:

Every triangle has at least two acute angle(s).

59. Two line segments are congruent, if they are of _____ lengths.

Solution:

Two line segments are congruent, if they are of equal lengths.

60. Two angles are said to be _____, if they have equal measures.

Solution:

Two angles are said to be congruent, if they have equal measures.

61. Two rectangles are congruent, if they have same _____ and _____.

Solution:

Two rectangles are congruent, if they have same length and breadth.

62. Two squares are congruent, if they have same _____.

Solution:

Two squares are congruent, if they have same side.

63. If $\triangle PQR$ and $\triangle XYZ$ are congruent under the correspondence $QPR \leftrightarrow XYZ$, then

(i) $\angle R =$ _____

(ii) $QR =$ _____

(iii) $\angle P =$ _____

(iv) $QP =$ _____

(v) $\angle Q =$ _____

(vi) $RP =$ _____

Solution:

Given: $\triangle QPR = \triangle XYZ$

(i) $\angle R = \angle Z$

(ii) $QR = XZ$

(iii) $\angle P = \angle Y$

(iv) $QP = XY$

(v) $\angle Q = \angle X$

(vi) $RP = ZY$

64. In Fig. 6.22, $\triangle PQR \cong \triangle$ _____

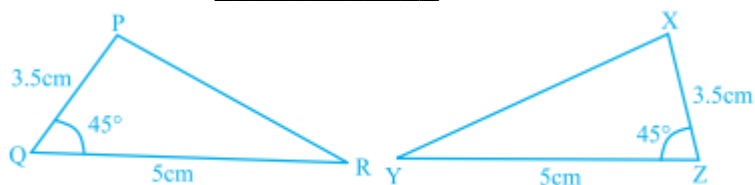


Fig. 6.22

Solution:

$\triangle XZY$: In $\triangle PQR$ and $\triangle XZY$,

$PQ = XZ = 3.5\text{ cm}$

$\angle PQR = \angle XZY = 45^\circ$

$QR = ZY = 5\text{ cm}$

So, $\triangle PQR \cong \triangle XZY$ [SAS criterion]

65. In Fig. 6.23, $\triangle PQR \cong \triangle$ _____

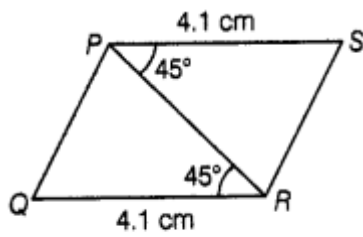


Fig. 6.23

Solution:

RSP: In $\triangle PQR$ and $\triangle RSP$,

$QR = SP = 4.1 \text{ cm}$

$\angle PRQ = \angle RPS = 45^\circ$

$PR = RP$ [common]

So, $\triangle PQR \cong \triangle RSP$ [SAS criterion]

66. In Fig. 6.24, $\triangle \underline{\hspace{1cm}} \cong \triangle PQR$

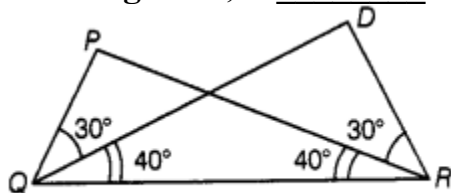


Fig. 6.24

Solution:

DRQ: In $\triangle PQR$ and $\triangle DRQ$,

$\angle PRQ = \angle DQR = 40^\circ$

$\angle PQR = \angle DRQ = 30^\circ + 40^\circ = 70^\circ$

$QR = RQ$ [common]

So, $\triangle PQR \cong \triangle DRQ$ [ASA criterion]

67. In Fig. 6.25, $\triangle ARO \cong \triangle \underline{\hspace{1cm}}$

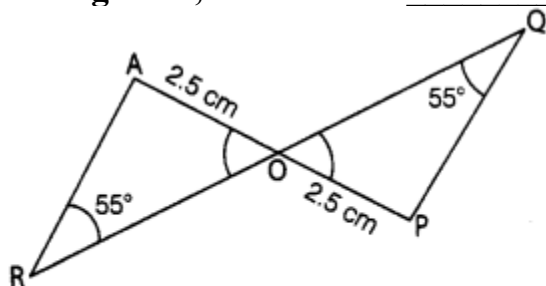


Fig. 6.25

Solution:

PQO: In $\triangle ARO$ and $\triangle PQO$,

$\angle ARO = \angle PQO = 55^\circ$

$\angle AOR = \angle POQ$ [Vertically opposite angles]

So, $\angle RAQ = \angle QPO$ [If two angles of a triangle are equal to two angles of another triangle then third angle is also equal]

$AO = PO = 2.5$ cm

So, $\triangle ARO \cong \triangle PQO$ [ASA criterion]

68. In Fig. 6.26, $AB = AD$ and $\angle BAC = \angle DAC$. Then

(i) $\triangle \underline{\hspace{2cm}} \cong \triangle ABC$.

(ii) $BC = \underline{\hspace{2cm}}$.

(iii) $\angle BCA = \underline{\hspace{2cm}}$.

(iv) Line segment AC bisects $\underline{\hspace{2cm}}$ and $\underline{\hspace{2cm}}$.

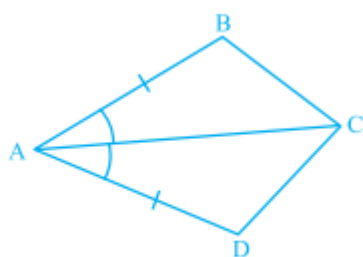


Fig. 6.26

Solution:

In $\triangle ABC$ and $\triangle ADC$,

$AC = AC$ [common]

$\angle BAC = \angle DAC$ [given]

$AB = AD$ [given]

So, $\triangle ABC \cong \triangle ADC$ [SAS criterion]

So, $BC = DC$ [By C.P.C.T.]

and $\angle BCA = \angle DCA$ [By C.P.C.T.]

(i) $\triangle \underline{ADC} \cong \triangle ABC$

(ii) $BC = \underline{DC}$

(iii) $\angle BCA = \angle \underline{DCA}$

(iv) Line segment AC bisects $\underline{\angle BAD}$ and $\underline{\angle BCD}$.

69. In Fig. 6.27,

(i) $\angle TPQ = \angle \underline{\hspace{1cm}} + \angle \underline{\hspace{1cm}}$

(ii) $\angle UQR = \angle \underline{\hspace{1cm}} + \angle \underline{\hspace{1cm}}$

(iii) $\angle PRS = \angle \underline{\hspace{1cm}} + \angle \underline{\hspace{1cm}}$

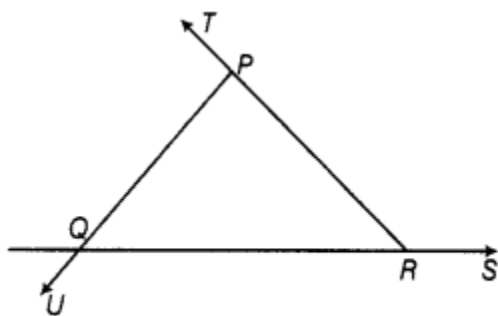


Fig. 6.27

Solution:

- (i) PQR, PRQ: $\angle TPQ = \angle PQR + \angle PRQ$ [Exterior angle property]
- (ii) QPR, QRP: $\angle UQR = \angle QPR + \angle QRP$ [Exterior angle property]
- (iii) RPQ, ROP: $\angle PRS = \angle RPQ + \angle ROP$ [Exterior angle property]

In questions 70 to 106 state whether the statements are True or False.

70. In a triangle, sum of squares of two sides is equal to the square of the third side.

Solution:

As we know, in a right-angled triangle, sum of squares of two sides is equal to the square of the third side.

Hence, the given statement is false.

71. Sum of two sides of a triangle is greater than or equal to the third side.

Solution:

As we know that sum of two sides of a triangle is greater than the third side.

Hence, the given statement is false.

72. The difference between the lengths of any two sides of a triangle is smaller than the length of third side.

Solution:

As we know, the difference between the lengths of any two sides of a triangle is smaller than the length of third side.

Hence, the given statement is true.

73. In $\triangle ABC$, $AB = 3.5$ cm, $AC = 5$ cm, $BC = 6$ cm and in $\triangle PQR$, $PR = 3.5$ cm, $PQ = 5$ cm, $RQ = 6$ cm. Then $\triangle ABC \cong \triangle PQR$.

Solution:

In $\triangle ABC$ and $\triangle POR$,
 $AB = PR = 3.5$ cm
 $AC = PQ = 5$ cm
 $BC = RO = 6$ cm
So, $\triangle ABC \leftrightarrow \triangle PRQ$ [SSS congruency]
Hence, the given statement is false.

74. Sum of any two angles of a triangle is always greater than the third angle.

Solution:

As we know, sum of any two angles of a triangle is may or may not be greater than the third angle.
Hence, the given statement is false.

75. The sum of the measures of three angles of a triangle is greater than 180° .

Solution:

As we know that, the sum of the measures of three angles of a triangle is equal to 180° .
Hence, the given statement is false.

76. It is possible to have a right-angled equilateral triangle.

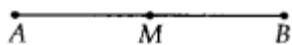
Solution:

As we know, an equilateral triangle cannot be a right-angled triangle.
Hence, the given statement is false.

77. If M is the mid-point of a line segment AB, then we can say that AM and MB are congruent.

Solution:

Given: M is mid-point of AB.



So, $AM = MB$
 $AM = MB$
Hence, the given statement is true.

78. It is possible to have a triangle in which two of the angles are right angles.

Solution:

Suppose two angle of a triangle be 90° and third angle be x .
Now, $90^\circ + 90^\circ + x = 180^\circ$ [Angle sum property]

$$x = 180^\circ - 180^\circ = 0^\circ$$

which is not possible.

Hence, the given statement is false.

79. It is possible to have a triangle in which two of the angles are obtuse.

Solution:

Suppose two angles x and y of a triangle are obtuse.

Then $x > 90^\circ \dots (i)$

and $y > 90^\circ \dots (ii)$

From equation (i) and (ii):

$$x + y > 180^\circ$$

But in a triangle sum of all angles can't be greater than 180° .

So, triangle is not possible.

Hence, the given statement is false.

80. It is possible to have a triangle in which two angles are acute.

Solution:

In a triangle, at least two angles must be acute angle.

Hence, the given statement is true.

81. It is possible to have a triangle in which each angle is less than 60° .

Solution:

The sum of all angles in a triangle is equal to 180° . So, all three angles can never be less than 60° .

So, triangle is not possible.

Hence, the given statement is false.

82. It is possible to have a triangle in which each angle is greater than 60° .

Solution:

If all angles of a triangle are greater than 60° , then their sum will be greater than 180° . But in a triangle sum of all angles is 180°

So, triangle is not possible.

Hence, the given statement is false.

83. It is possible to have a triangle in which each angle is equal to 60° .

Solution:

As we know, in equilateral triangle each angle is equal to 60° .

Hence, the given statement is true.

84. A right-angled triangle may have all sides equal.

Solution:

As we know, a right-angled triangle may have two sides equal.
Hence, the given statement is false.

85. If two angles of a triangle are equal, the third angle is also equal to each of the other two angles.

Solution:

As we know that, in an isosceles triangle, always two angles are equal and not the third one.
Hence, the given statement is false.

86. In Fig. 6.28, two triangles are congruent by RHS.

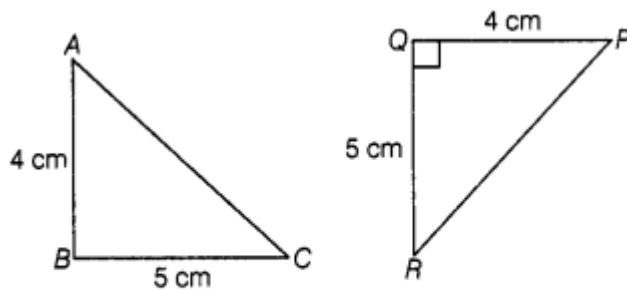


Fig. 6.28

Solution:

As we know that, given triangles are congruent by SAS.
Hence, the given statement is false.

87. The congruent figures super impose each other completely.

Solution:

As, congruent figures have same shape and same size.
Hence, the given statement is true.

88. A one rupee coin is congruent to a five rupee coin.

Solution:

As, they don't have same shape and same size.
Hence, the given statement is false.

89. The top and bottom faces of a kaleidoscope are congruent.

Solution:

As, they superimpose to each other.

Hence, the given statement is true.

90. Two acute angles are congruent.

Solution:

As, the measure of two acute angles may be different.
Hence, the given statement is false.

91. Two right angles are congruent.

Solution:

As, the measure of right angles is always same.
Hence, the given statement is true.

92. Two figures are congruent, if they have the same shape.

Solution:

Two figures are congruent, if they have the same shape and same size.
Hence, the given statement is false.

93. If the areas of two squares is same, they are congruent.

Solution:

As, two squares will have same areas only if their sides are equal and squares with same sides will superimpose to each other.
Hence, the given statement is true.

94. If the areas of two rectangles are same, they are congruent.

Solution:

As, rectangles with the different length and breadth may have equal areas. But, they will not superimpose to each other.
Hence, the given statement is false.

95. If the areas of two circles are the same, they are congruent.

Solution:

As, areas of two circles will be equal only if their radii are equal and circle with same radii will superimpose to each other.
Hence, the given statement is true.

96. Two squares having same perimeter are congruent.

Solution:

If two squares have same perimeter, then their sides will be equal. Therefore, the squares will superimpose to each other.

Hence, the given statement is true.

97. Two circles having same circumference are congruent.

Solution:

If two circles have same circumference, then their radii will be equal. Therefore, the circles will superimpose to each other.

Hence, the given statement is true.

98. If three angles of two triangles are equal, triangles are congruent.

Solution:

As, there is no congruency criterion of three angles.

Hence, the given statement is false.

99. If two legs of a right triangle are equal to two legs of another right triangle, then the right triangles are congruent.

Solution:

If two legs of a right angled triangle are equal to two legs of another right angled triangle, then their third leg will also be equal. Therefore, they will have same shape and same size.

Hence, the given statement is true.

100. If two sides and one angle of a triangle are equal to the two sides and angle of another triangle, then the two triangles are congruent.

Solution:

Two triangles are congruent if two sides and included angle of one triangle are equal to the two sides and included angle of another triangle.

Hence, the given statement is false.

101. If two triangles are congruent, then the corresponding angles are equal.

Solution:

If two triangles are congruent, then their sides and angles are equal.

Hence, the given statement is true.

102. If two angles and a side of a triangle are equal to two angles and a side of another triangle, then the triangles are congruent.

Solution:

If two angles and a side of a triangle are equal to two corresponding angles and the included side of the another triangle, then the triangles are congruent.

Hence, the given statement is false.

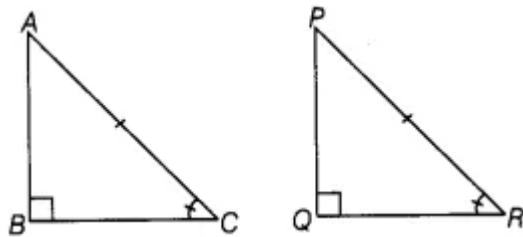
103. If the hypotenuse of one right triangle is equal to the hypotenuse of another right triangle, then the triangles are congruent.

Solution:

Two right triangles are congruent, if hypotenuse and one side of a triangle are equal to hypotenuse and one side of another triangle.
Hence, the given statement is false.

104. If hypotenuse and an acute angle of one right triangle are equal to the hypotenuse and an acute angle of another right triangle, then the triangles are congruent.

Solution:



In triangle ABC and PQR,

$$\angle B = \angle Q = 90^\circ$$

$$\angle C = \angle R$$

$$\angle A = \angle P$$

Also, in triangle ABC and PQR,

$$\angle A = \angle P$$

$$AC = PR$$

$$\angle C = \angle R$$

By ASA congruence criterion, $\triangle ABC \cong \triangle PQR$.

Hence, the given statement is true.

105. AAS congruence criterion is same as ASA congruence criterion.

Solution:

In ASA congruence criterion, the side 'S' included between the two angles of the triangle. In AAS congruence criterion, side 'S' is not included between two angles.
Hence, the given statement is false.

106. In Fig. 6.29, $AD \perp BC$ and AD is the bisector of angle BAC. Then, $\triangle ABD \cong \triangle ACD$ by RHS.

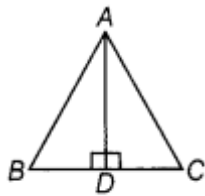


Fig. 6.29

Solution:

In triangle ABD and ACD,

$AD = AD$ [Common side]

$\angle BAD = \angle CAD$ [AD is the bisector of $\angle BAC$]

By ASA congruence criterion, $\triangle ABD \cong \triangle ACD$

Hence, the given statement is false.

107. The measure of three angles of a triangle are in the ratio 5 : 3 : 1. Find the measures of these angles.

Solution:

Let the angle of triangle be $5x$, $3x$ and x .

As we know, sum of all the triangles in a triangle = 180° .

So,

$$5x + 3x + x = 180^\circ$$

$$9x = 180^\circ$$

$$x = 20^\circ$$

So, the angles are $5x = 5 \times 20^\circ = 100^\circ$, $3x = 3 \times 20^\circ = 60^\circ$ and $x = 20^\circ$ that is $100^\circ, 60^\circ$ and 20° .

108. In Fig. 6.30, find the value of x .

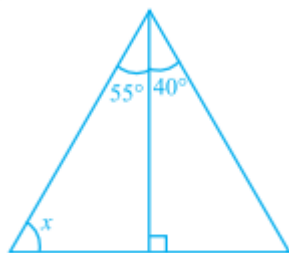


Fig. 6.30

Solution:

As we know that, the sum of all three angles in a triangle is equal to 180° .

So,

$$x + 55^\circ + 90^\circ = 180^\circ$$

$$x + 145^\circ = 180^\circ$$

$$x = 180^\circ - 145^\circ$$

$$x = 35^\circ$$

Hence, the value of x is 35° .

109. In Fig. 6.31(i) and (ii), find the values of a , b and c .

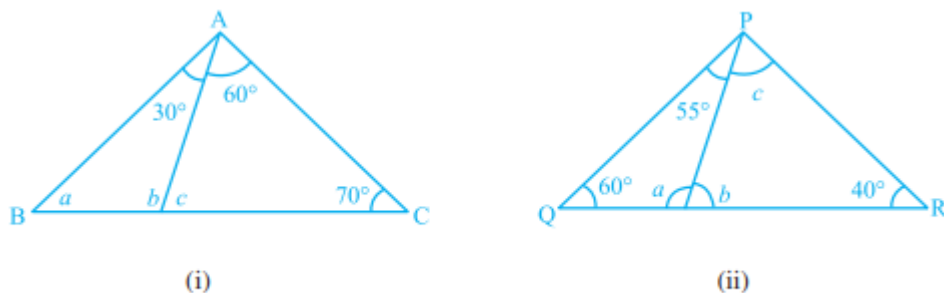
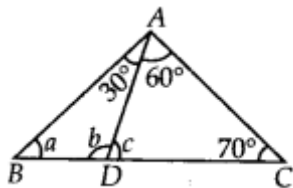


Fig. 6.31

Solution:

- (i) In $\triangle ADC$, $\angle ADB = \angle DAC + \angle ACD$ [Exterior angle property]
 $b = 60^\circ + 70^\circ = 130^\circ \dots (i)$



Now, in $\triangle ABD$, $\angle ABD + \angle ADB + \angle BAD = 180^\circ$ [Angle sum property]

$$a + b + 30^\circ = 180^\circ$$

$$a = 180^\circ - 30^\circ - 130^\circ \text{ [using equation (I)]}$$

$$a = 20^\circ \dots (II)$$

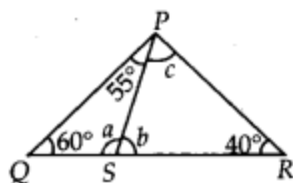
Also, $\angle ADC = \angle BAD + \angle ABD$ [Exterior angle property]

$$c = 30^\circ + a$$

$$c = 30^\circ + 20^\circ = 50^\circ \text{ [using equation (II)]}$$

Thus, $a = 20^\circ$, $b = 130^\circ$, $c = 50^\circ$

- (ii) In $\triangle POS$, $\angle PSR = \angle SPQ + \angle PQS$ [Exterior angle property]



$$b = 55^\circ + 60^\circ$$

$$b = 115^\circ \dots (I)$$

Now, in $\triangle PRS$, $\angle PSR + \angle PRS + \angle SPR = 180^\circ$ [Angle sum property]

$$b + 40^\circ + c = 180^\circ$$

$$c = 180^\circ - 40^\circ - 115^\circ \text{ [using equation (I)]}$$

$$c = 25^\circ \dots \text{(II)}$$

Also, $\angle PSQ = \angle SPR + \angle SRP$ [Exterior angle property]

$$a = c + 40^\circ$$

$$a = 25^\circ + 40^\circ = 65^\circ \text{ [using equation (II)]}$$

$$\text{Hence, } a = 65^\circ, b = 115^\circ, c = 25^\circ$$

110. In triangle XYZ, the measure of angle X is 30° greater than the measure of angle Y and angle Z is a right angle. Find the measure of $\angle Y$.

Solution:

$$\angle X = \angle Y + 40^\circ \dots \text{(i)}$$

$$\angle Z = 90^\circ \dots \text{(ii)}$$

In $\triangle XYZ$

$$\angle X + \angle Y + \angle Z = 180^\circ \quad [\text{Angle sum property}]$$

$$\angle Y + 30^\circ + \angle Y + 90^\circ = 180^\circ \quad [\text{Using equation (i) and (ii)}]$$

$$2\angle Y = 180^\circ - 90^\circ - 30^\circ = 60^\circ$$

$$\angle Y = \frac{60^\circ}{2}$$

$$\angle Y = 30^\circ$$

111. In a triangle ABC, the measure of angle A is 40° less than the measure of angle B and 50° less than that of angle C. Find the measure of $\angle A$.

Solution:

$$\text{Given: } \angle A = \angle B - 40^\circ \dots \text{(i)}$$

$$\text{and } \angle A = \angle C - 50^\circ \dots \text{(ii)}$$

Now, in $\triangle ABC$

$$\angle A + \angle B + \angle C = 180^\circ \quad [\text{Angle sum property}]$$

$$\angle A + \angle A + 40^\circ + \angle A + 50^\circ = 180^\circ \quad [\text{Using equation (i) and (ii)}]$$

$$3\angle A + 90^\circ = 180^\circ$$

$$3\angle A = 180^\circ - 90^\circ = 90^\circ$$

$$\angle A = \frac{90^\circ}{3}$$

$$\angle A = 30^\circ$$

112. I have three sides. One of my angle measures 15° . Another has a measure of 60° . What kind of a polygon am I? If I am a triangle, then what kind of triangle am I?

Solution:

As we know, a polygon having three sides is a triangle.

Given: the two angles are of measure 15° and 60°

Suppose third angle of triangle be x .

$$\text{So, } 15^\circ + 60^\circ + x = 180^\circ \quad [\text{Angle sum property of a triangle}]$$

$$x = 180^\circ - 60^\circ - 15^\circ$$

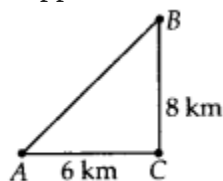
$$x = 105^\circ$$

Hence, one angle of triangle is obtuse angle. So, triangle is obtuse-angled triangle.

113. Jiya walks 6 km due east and then 8 km due north. How far is she from her starting place?

Solution:

Suppose A be the starting point and B be the ending point of Jiya.



As, $\triangle ABC$ is right angled.

$$\text{So, } (AB)^2 = (AC)^2 + (BC)^2$$

$$(AB)^2 = 6^2 + 8^2 = 36 + 64 = 100$$

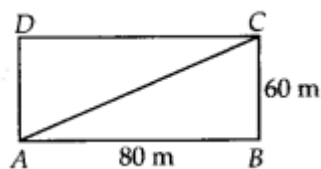
$$AB = 10$$

Hence, Jiya is 10 km away from her starting place.

114. Jayanti takes shortest route to her home by walking diagonally across a rectangular park. The park measures 60 metres $\times$ 80 metres. How much shorter is the route across the park than the route around its edges?

Solution:

Suppose ABCD be the given rectangular park.



As, $\triangle ABC$ is right angled.

$$\text{So, } (AC)^2 = (AB)^2 + (BC)^2$$

$$(AC)^2 = (80)^2 + (60)^2 = 6400 + 3600 = 10000$$

$$AC = 100$$

So, length of route across the park = 100 m and length of route around the edges = $(80 + 60)$ m = 140 m

Hence, the route across the park is shorter than the route around edges of park by

$$140 \text{ m} - 100 \text{ m} = 40 \text{ m}.$$

115. In $\triangle PQR$ of Fig. 6.32, $PQ = PR$. Find the measures of $\angle Q$ and $\angle R$.

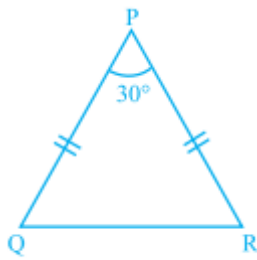


Fig. 6.32

Solution:

Given: $PQ = PR$

So, $\angle PRQ = \angle PQR \dots (I)$

Now, in $\triangle PQR$

$\angle PQR + \angle PRQ + \angle QPR = 180^\circ$ [Angle sum property]

$2\angle PQR + 30^\circ = 180^\circ$ [using equation (I)]

$2\angle PQR = 180^\circ - 30^\circ = 150^\circ$

$$\angle PQR = \frac{150^\circ}{2}$$

$$\angle PQR = 75^\circ$$

Hence, $\angle Q = \angle R = 75^\circ$

116. In Fig. 6.33, find the measures of $\angle x$ and $\angle y$.

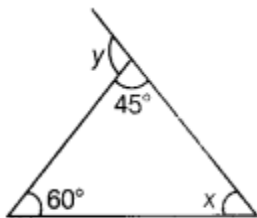
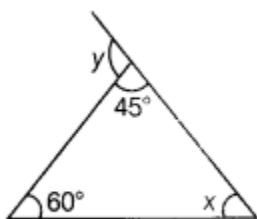


Fig. 6.23

Solution:



In $\triangle ABC$,

$\angle BAC + \angle ABC + \angle ACB = 180^\circ$ [Angle sum property]

$$45^\circ + 60^\circ + x = 180^\circ$$

$$x = 180^\circ - 45^\circ - 60^\circ = 75^\circ \dots (I)$$

Now, $\angle BAD = \angle ABC + \angle ACB$ [Exterior angle property]

$$y = 60^\circ + x$$

$$y = 60^\circ + 75^\circ = 135^\circ \text{ [using equation (I)]}$$

$$\text{Hence, } x = 75^\circ \text{ and } y = 135^\circ$$

117. In Fig. 6.34, find the measures of $\angle PON$ and $\angle NPO$.

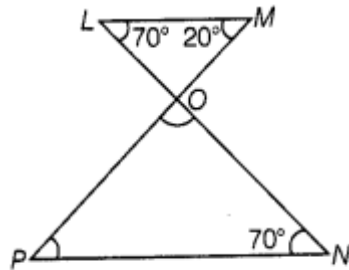


Fig. 6.34

Solution:

In $\triangle LOM$,

$$\angle LOM + \angle OLM + \angle OML = 180^\circ \text{ [Angle sum property]}$$

$$\angle LOM + 70^\circ + 20^\circ = 180^\circ$$

$$\angle LOM = 180^\circ - 70^\circ - 20^\circ = 90^\circ$$

$$\angle LOM = \angle PON \text{ [Vertically opposite angles]}$$

$$\text{So, } \angle PON = 90^\circ$$

Now, in $\triangle PON$,

$$\angle PON + \angle ONP + \angle NPO = 180^\circ \text{ [Angle sum property]}$$

$$90^\circ + 70^\circ + \angle NPO = 180^\circ$$

$$\angle NPO = 180^\circ - 90^\circ - 70^\circ = 20^\circ$$

$$\text{Hence, } \angle PON = 90^\circ \text{ and } \angle NPO = 20^\circ$$

118. In Fig. 6.35, $QP \parallel RT$. Find the values of x and y .

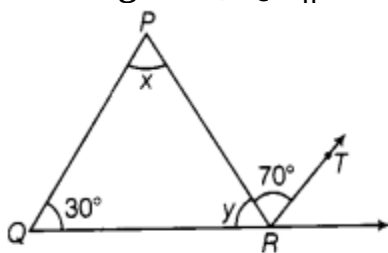


Fig. 6.35

Solution:

Given: $QP \parallel RT$ and PR is a transversal.

$$\text{So, } \angle QPR = \angle PRT \text{ [Alternate interior angles]}$$

$$x = 70^\circ$$

Now, $QP \parallel RT$ and QR is a transversal.

So, $\angle PQR + \angle QRT = 180^\circ$ [Co-interior angles]

$$30^\circ + y + 70^\circ = 180^\circ$$

$$y = 180^\circ - 30^\circ - 70^\circ = 80^\circ$$

Hence, $a = 70^\circ$ and $y = 80^\circ$,

119. Find the measure of $\angle A$ in Fig. 6.36.

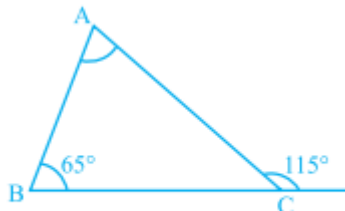
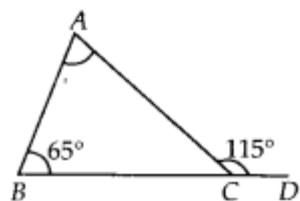


Fig. 6.36

Solution:



$\angle ACD = \angle ABC + \angle CAB$ [Exterior angle property]

$$115^\circ = 65^\circ + \angle CAB$$

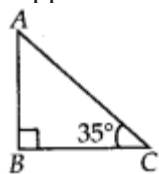
$$\angle CAB = 115^\circ - 65^\circ = 50^\circ$$

Hence, $\angle A = 50^\circ$

120. In a right-angled triangle if an angle measures 35° , then find the measure of the third angle.

Solution:

Suppose $\triangle ABC$ be the given triangle such that $\angle B = 90^\circ$ and $\angle C = 35^\circ$



Now, $\angle A + \angle B + \angle C = 180^\circ$ [Angle sum property]

$$\Rightarrow \angle A = 180^\circ - 90^\circ - 35^\circ$$

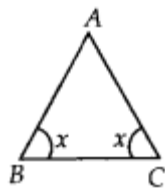
$$\Rightarrow \angle A = 55^\circ$$

Hence, third angle of triangle is 55° .

121. Each of the two equal angles of an isosceles triangle is four times the third angle. Find the angles of the triangle.

Solution:

Suppose $\triangle ABC$ be the given isosceles triangle, such that $AB = AC$ and $\angle B = \angle C = x$.



Now, $\angle B = \angle C = 4\angle A \dots (I)$ [given]

$\angle A + \angle B + \angle C = 180^\circ$ [Angle sum property]

$\angle A + 4\angle A + 4\angle A = 180^\circ$ [Using equation (I)]

$9\angle A = 180^\circ$

$$\angle A = \frac{180^\circ}{9}$$

$$\angle A = 20^\circ$$

So, $\angle B = \angle C = 4 \times 20^\circ = 80^\circ$

Hence, $20^\circ, 80^\circ$ and 80° are the angles of the triangle.

122. The angles of a triangle are in the ratio 2: 3: 5. Find the angles.

Solution:

Suppose the angles of the triangle be $2x, 3x$ and $5x$.

So, $2x + 3x + 5x = 180^\circ$ [Angle sum property of a triangle]

$10x = 180^\circ$

$$x = \frac{180^\circ}{10}$$

$$x = 18^\circ$$

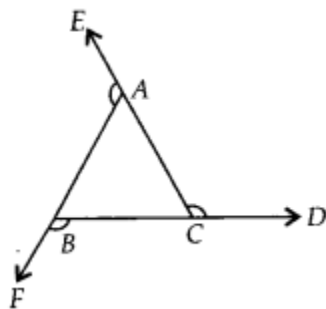
So, $2x = 2 \times 18^\circ = 36^\circ, 3x = 3 \times 18^\circ = 54^\circ, 5x = 5 \times 18^\circ = 90^\circ$

Hence, $36^\circ, 54^\circ$ and 90° are the angles of the triangle.

123. If the sides of a triangle are produced in an order, show that the sum of the exterior angles so formed is 360° .

Solution:

Suppose triangle ABC be the given triangle and BD, CE, AF are the produced side in order.



$$\angle ACD = \angle CAB + \angle CBA$$

$$\angle BAE = \angle ABC + \angle ACB$$

$$\angle CBF = \angle BAC + \angle BCA$$

$\dots (i)$ [Exterior angle property]

$\dots (ii)$ [Exterior angle property]

$\dots (iii)$ [Exterior angle property]

Adding equation (i), (ii) and (iii), get

$$\angle ACD + \angle BAE + \angle CBF = \angle CAB + \angle CBA + \angle ABC + \angle ACB + \angle BAC + \angle BCA$$

$$\begin{aligned}\angle ACD + \angle BAE + \angle CBF &= 2[\angle ABC + \angle ACB + \angle BAC] \\ &= 2(180^\circ) \text{ [Angle sum property]} \\ &= 360^\circ\end{aligned}$$

124. In $\triangle ABC$, if $\angle A = \angle C$, and exterior angle $ABX = 140^\circ$, then find the angles of the triangle.

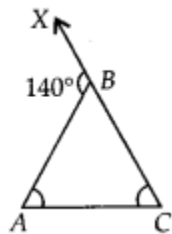
Solution:

$$\angle ABX = \angle BAC + \angle BCA \text{ [Exterior angle property]}$$

$$140^\circ = 2\angle BAC \text{ [}\because \angle A = \angle C\text{]}$$

$$\angle BAC = \frac{140^\circ}{2}$$

$$\angle BAC = 70^\circ$$



$$\text{So, } \angle BAC = \angle BCA = 70^\circ \dots (I)$$

Now, in $\triangle ABC$

$$\angle A + \angle B + \angle C = 180^\circ \text{ [Angle sum property]}$$

$$\angle B = 180^\circ - 70^\circ - 70^\circ \text{ [using equation (I)]}$$

$$\angle B = 40^\circ$$

Hence, $\angle A = 70^\circ$, $\angle B = 40^\circ$ and $\angle C = 70^\circ$ are the angles of triangle.

125. Find the values of x and y in Fig. 6.37.

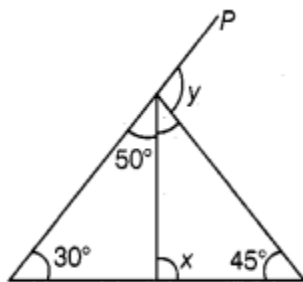
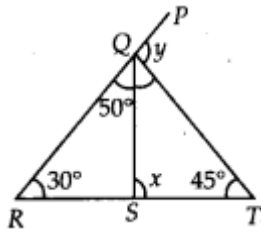


Fig. 6.37

Solution:

$$\text{In } \triangle QRS, \angle QST = \angle QRS + \angle SOR \text{ [Exterior angle property]}$$

$$x = 30^\circ + 50^\circ = 80^\circ$$



Also, in $\triangle QRT$, $\angle PQT = \angle QRT + \angle QTR$ [Exterior angle property]
 $y = 30^\circ + 45^\circ = 75^\circ$
Hence, $x = 80^\circ$ and $y = 75^\circ$

126. Find the value of x in Fig. 6.38.

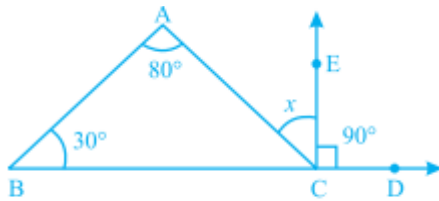


Fig. 6.38

Solution:

In $\triangle ABC$, $\angle ACD = \angle CAB + \angle CBA$ [Exterior angle property]
 $x + 90^\circ = 80^\circ + 30^\circ$
 $x = 110^\circ - 90^\circ = 20^\circ$
Hence, the value of x is 20° .

127. The angles of a triangle are arranged in descending order of their magnitudes. If the difference between two consecutive angles is 10° , find the three angles.

Solution:

Suppose $\triangle ABC$ be the given triangle and descending order of angles of the triangle is $\angle A$, $\angle B$, $\angle C$

Now, $\angle A - \angle B = 10^\circ \dots (I)$

$\angle B - \angle C = 10^\circ \dots (II)$

Also, $\angle A + \angle B + \angle C = 180^\circ$ [Angle sum property]

$\angle B + 10^\circ + \angle B + \angle B - 10^\circ = 180^\circ$ [Using equation (I) and (II)]

$3\angle B = 180^\circ$

$$\angle B = \frac{180^\circ}{3}$$

$$\angle B = 60^\circ$$

So, $\angle A = \angle B + 10^\circ = 60^\circ + 10^\circ = 70^\circ$

and $\angle C = \angle B - 10^\circ = 60^\circ - 10^\circ = 50^\circ$

Hence, 70° , 60° and 50° are the angles of the triangle.

128. In $\triangle ABC$, $DE \parallel BC$ (Fig. 6.39). Find the values of x , y and z .

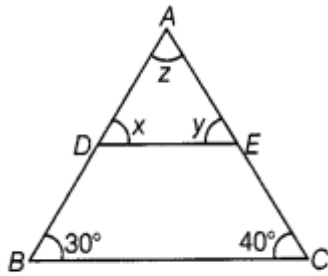


Fig. 6.39

Solution:

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

So, $\angle ADE = \angle DBC$ [Corresponding angles]

$$x = 30^\circ$$

Now, $DE \parallel BC$ and AC is a transversal.

So, $\angle AED = \angle ECB$ [Corresponding angles]

$$y = 40^\circ$$

In $\triangle ABC$,

$$\angle A + \angle B + \angle C = 180^\circ \text{ [Angle sum property]}$$

$$z + 30^\circ + 40^\circ = 180^\circ$$

$$z = 180^\circ - 40^\circ - 30^\circ = 110^\circ$$

Hence, $x = 30^\circ$, $y = 40^\circ$ and $z = 110^\circ$.

129. In Fig. 6.40, find the values of x , y and z .

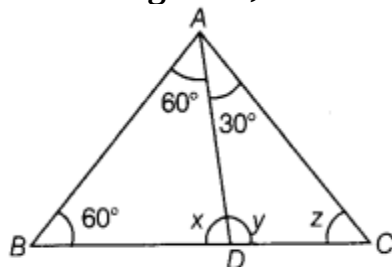
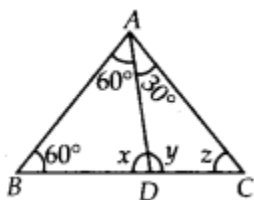


Fig. 6.40

Solution:

In $\triangle ABD$,

$$\angle BAD + \angle BDA + \angle ABD = 180^\circ \text{ [Angle sum property]}$$



$$60^\circ + x + 60^\circ = 180^\circ$$

$$x = 180^\circ - 120^\circ = 60^\circ$$

Now, $\angle ADC = \angle BAD + \angle ABD$ [Exterior angle property]
 $y = 60^\circ + 60^\circ = 120^\circ$

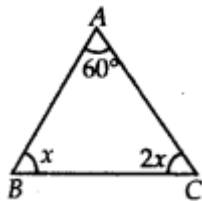
Also, in $\triangle ADC$,
 $\angle ADB - \angle DAC + \angle DCA$ [Exterior angle property]
 $x = 30^\circ + z$
 $z = 60^\circ - 30^\circ = 30^\circ$ [$x = 60^\circ$]
Hence, $x = 60^\circ$, $y = 120^\circ$ and $z = 30^\circ$

130. If one angle of a triangle is 60° and the other two angles are in the ratio 1 : 2, find the angles.

Solution:

Suppose $\triangle ABC$ be the given triangle such that $\angle A = 60^\circ$ and let angle B and C are x and 2x respectively.

$\angle A + \angle B + \angle C = 180^\circ$ [Angle sum property]



$$60^\circ + x + 2x = 180^\circ$$

$$3x = 180^\circ - 60^\circ = 120^\circ$$

$$x = \frac{120^\circ}{3}$$

$$x = 40^\circ$$

Hence, $\angle B = 40^\circ$ and $\angle C = 2 \times 40^\circ = 80^\circ$

131. In $\triangle PQR$, if $3\angle P = 4\angle Q = 6\angle R$, calculate the angles of the triangle.

Solution:

In $\triangle PQR$,

$\angle P + \angle Q + \angle R = 180^\circ$ [Angle sum property]

$$\frac{6}{3}\angle R + \frac{6}{4}\angle R + \angle R = 180^\circ \quad [3\angle P = 4\angle Q = 6\angle R]$$

$$2\angle R + \frac{3}{2}\angle R + \angle R = 180^\circ$$

$$\frac{(4+3+2)}{2}\angle R = 180^\circ$$

$$\frac{9}{2} \angle R = 180^\circ$$

$$\angle R = \frac{180^\circ \times 2}{9}$$

$$\angle R = 40^\circ$$

So,

$$\angle P = \frac{6}{3} \times 40^\circ = 80^\circ$$

$$\text{And } \angle Q = \frac{6}{4} \times 40^\circ = 60^\circ$$

Hence, $\angle P = 80^\circ$, $\angle Q = 60^\circ$ and $\angle R = 40^\circ$

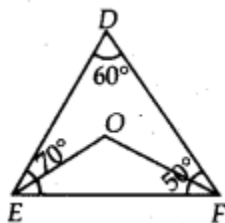
132. In $\triangle DEF$, $\angle D = 60^\circ$, $\angle E = 70^\circ$ and the bisectors of $\angle E$ and $\angle F$ meet at O. Find (i) $\angle F$ (ii) $\angle EOF$.

Solution:

- (i) In $\triangle DEF$,
 $\angle D + \angle E + \angle F = 180^\circ$ [Angle sum property]
 $60^\circ + 70^\circ + \angle F = 180^\circ$
 $\angle F = 180^\circ - 60^\circ - 70^\circ = 50^\circ$

- (ii) Given: EO and FO are the bisectors of $\angle E$ and $\angle F$ respectively.

$$\angle OEF = \angle OED = \frac{70^\circ}{2} = 35^\circ$$



$$\text{And } \angle OFE = \angle OFD = \frac{50^\circ}{2} = 25^\circ$$

Now, in $\triangle OEF$,

$$\angle OEF + \angle OFE + \angle EOF = 180^\circ \text{ [Angle sum property]}$$

$$35^\circ + 25^\circ + \angle EOF = 180^\circ$$

$$\angle EOF = 180^\circ - 35^\circ - 25^\circ = 120^\circ$$

133. In Fig. 6.41, $\triangle PQR$ is right-angled at P. U and T are the points on line QRF. If $QP \parallel ST$ and $US \parallel RP$, find $\angle S$.

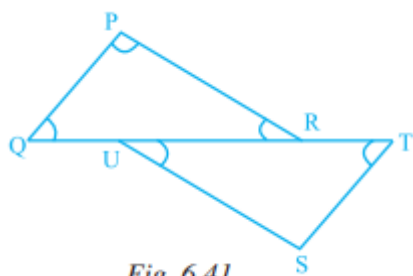


Fig. 6.41

Solution:

$QP \parallel ST$ and QT is a transversal.

So, $\angle PQT = \angle STO$ [Alternate interior angles]

$US \parallel PR$ and UR is a transversal.

So, $\angle PRU = \angle SUR$ [Alternate interior angles]

Two angles of $\triangle PQR$ equal to two angles of $\triangle STU$. Therefore, third angle also will be equal.

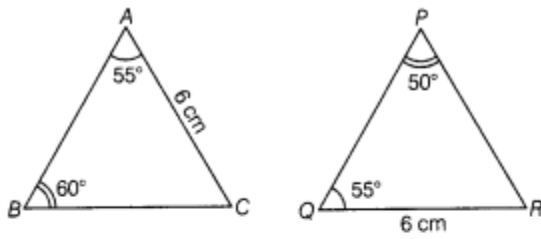
So, $\angle QPR = \angle TSU$

Now, given that $\angle P = 90^\circ$

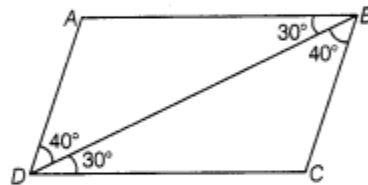
Hence, $\angle S = 90^\circ$.

134. In each of the given pairs of triangles of Fig. 6.42, applying only ASA congruence criterion, determine which triangles are congruent. Also, write the congruent triangles in symbolic form.

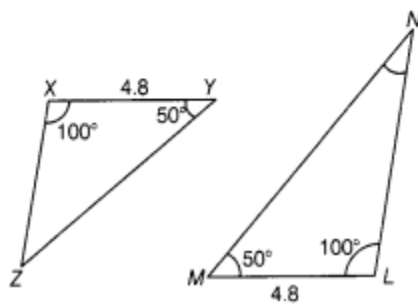
(a)



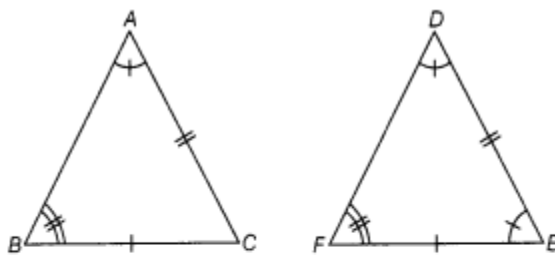
(b)



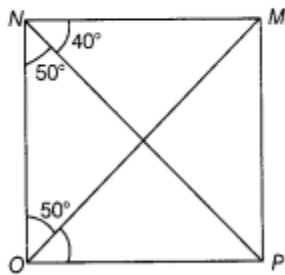
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(d)



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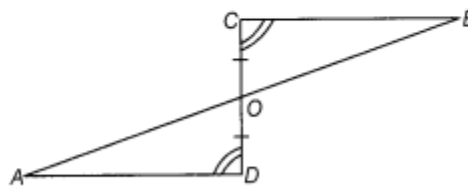


Fig. 6.42

Solution:

(a) In the given figure, ΔABC and ΔPOR are not congruent.

(b) In ΔABD and ΔCDB ,

$BD = DB$ (common)

$\angle ABD = \angle CDB = 30^\circ$ (given)

$\angle ADB = \angle CBD = 40^\circ$ (given)
So, $\triangle ABD \cong \triangle CDB$ (ASA criterion)

(c) In $\triangle XYZ$ and $\triangle LMN$,
 $XY = LM = 4.8$ (given)
 $\angle YXZ = \angle MLN = 100^\circ$ (given)
 $\angle XYZ = \angle LMN = 50^\circ$ (given)
So, $\triangle XYZ \cong \triangle LMN$ (ASA criterion)

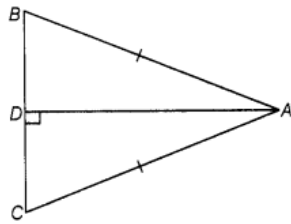
(d) In $\triangle ABC$ and $\triangle DFE$,
 $\angle A = \angle D$ (given)
 $\angle B = \angle F$ (given)
So, $\angle C = \angle E$ (since two angles are equal)
 $BC = FE$ (given)
So, $\triangle ABC \cong \triangle DFE$ (ASA criterion)

(e) In $\triangle PON$ and $\triangle MNO$,
 $NO = ON$ (common)
 $\angle NOP = \angle ONM = 50^\circ + 40^\circ = 90^\circ$ (given)
 $\angle ONP = \angle NOM = 50^\circ$ (given)
So, $\triangle PON \cong \triangle MNO$ (ASA criterion)

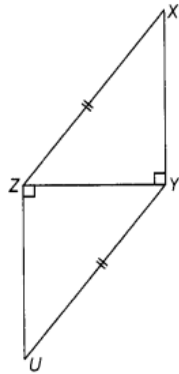
(f) In $\triangle AOD$ and $\triangle BOC$,
 $\angle AOD = \angle BOC$ (Vertically opposite angles)
 $OD = OC$ (given)
 $\angle ADO = \angle BCO$ (given)
So, $\triangle AOD \cong \triangle BOC$ (ASA criterion)

135. In each of the given pairs of triangles of Fig. 6.43, using only RHS congruence criterion, determine which pairs of triangles are congruent. In case of congruence, write the result in symbolic form:

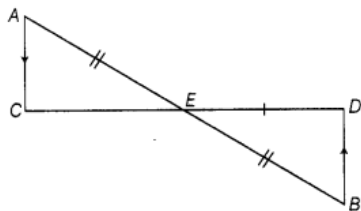
(a)



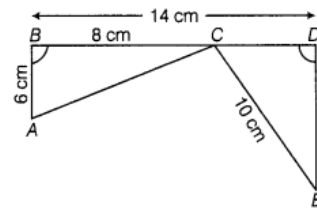
(b)



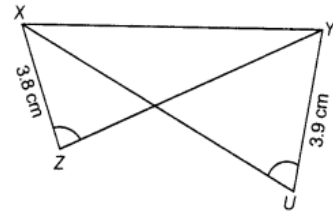
(c)



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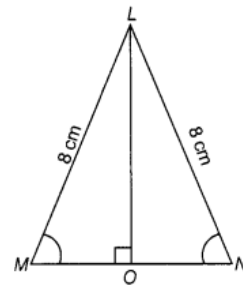


Fig. 6.43

Solution:

(a) In $\triangle ADB$ and $\triangle ADC$,

$AD = AD$ (common)

$\angle ADB = \angle ADC$ (Each 90°)

$AB = AC$ (given hypotenuse)

So, $\triangle ADB \cong \triangle ADC$ (RHS criterion)

(b) In $\triangle XYZ$ and $\triangle UZY$,

$\angle Y = \angle Z$ (Each 90°)

$XZ = UY$ (given hypotenuse)

$YZ = ZY$ (common)

So, $\triangle XYZ \cong \triangle UZY$ (RHS criterion)

(c) In $\triangle ACE$ and $\triangle BDE$,

$\angle ACE = \angle BDE$ ($AC \parallel BD$, alternate interior angles)

$CE = DE$ (given)

$\angle AEC = \angle BED$ (Vertically opposite angles)

So, $\triangle ACE \cong \triangle BDE$ (ASA criterion)

So, triangles are congruent but not by RHS congruence criterion

(d) In $\triangle ABC$, by Pythagoras theorem

$$\begin{aligned}(AC)^2 &= (AB)^2 + (BC)^2 \\ &= 6^2 + 8^2 = 36 + 64 = 100 = 10^2 \\ \text{So, } AC &= 10 \text{ cm}\end{aligned}$$

In $\triangle EDC$,

$$DC = BD - BC = (14 - 8) \text{ cm} = 6 \text{ cm}, CE = 10 \text{ cm}$$

Now, in $\triangle ABC$ and $\triangle CDE$,

$$\angle B = \angle D \quad (\text{each } 90^\circ)$$

$$AB = CD = 6 \text{ cm}$$

$$AC = CE = 10 \text{ cm} \quad (\text{hypotenuse})$$

So, $\triangle ABC \cong \triangle CDE$ (RHS criterion)

(e) In the given figure, $\triangle XYZ$ and $\triangle YXU$ are not congruent by any criterion.

(f) In $\triangle LMO$ and $\triangle LNO$,

$$LO = LO \quad (\text{common})$$

$$LM = LN = 8 \text{ cm} \quad (\text{hypotenuse})$$

$$\angle LOM = \angle LON \quad (\text{each } 90^\circ)$$

So, $\triangle LOM \cong \triangle LON$ (RHS criterion)

136. In Fig. 6.44, if $RP = RQ$, find the value of x .

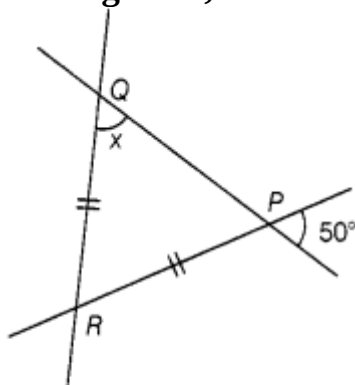


Fig. 6.44

Solution:

$$RP = RQ$$

So, $\angle RQP = \angle RPQ = x$ [angles opposite to equal sides are equal]

Now, $\angle RPQ = 50^\circ$ [vertically opposite angles]

Hence, $x = 50^\circ$.

137. In Fig. 6.45, if $ST = SU$, then find the values of x and y .

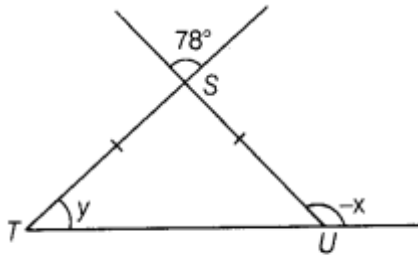


Fig. 6.45

Solution:

$\angle TSU = 78^\circ$ [vertically opposite angles]

$\angle SUT = \angle STU = y$ [$\because ST = SU$]

Now, in $\triangle STU$,

$\angle STU + \angle SUT + \angle TSU = 180^\circ$ [Angle sum property]

$$y + y + 78^\circ = 180^\circ$$

$$2y = 180^\circ - 78^\circ = 102^\circ$$

$$y = \frac{102^\circ}{2}$$

$$y = 51^\circ$$

Now, $x = \angle TSU + \angle UTS$ [Exterior angle property]

$$x = 78^\circ + 51^\circ$$

$$x = 129^\circ$$

Hence, $x = 129^\circ$ and $y = 51^\circ$,

138. Check whether the following measures (in cm) can be the sides of a right-angled triangle or not. 1.5, 3.6, 3.9

Solution:

As we know that, in a right angled triangle, the sum of square of two shorter sides must be equal to the square of the third.

$$(1.5)^2 + (3.6)^2 = 2.25 + 12.96 = 15.21 \text{ and } (3.9)^2 = 15.21$$

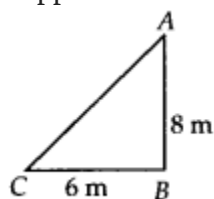
$$\text{So, } (1.5)^2 + (3.6)^2 = (3.9)^2$$

Hence, given sides are sides of a right angled triangle.

139. Height of a pole is 8 m. Find the length of rope tied with its top from a point on the ground at a distance of 6 m from its bottom.

Solution:

Suppose AB be the given pole of height 8m and rope be AC



As, $\triangle ABC$ is a right angled triangle.

$$\text{So, } (AC)^2 = (AB)^2 + (BC)^2$$

$$(AC)^2 = 8^2 + 6^2 = 64 + 36$$

$$(AC)^2 = 100 = 10^2$$

$$\text{So, } AC = 10 \text{ m}$$

Hence, the required length of rope is 10 m.

140. In Fig. 6.46, if y is five times x , find the value of z .

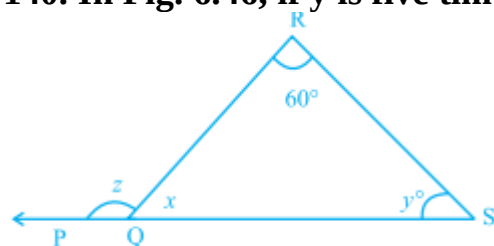


Fig. 6.46

Solution:

In $\triangle QRS$,

$$\angle RQS + \angle RSQ + \angle QRS = 180^\circ \text{ [Angle sum property]}$$

$$x + y + 60^\circ = 180^\circ$$

$$x + 5x = 180^\circ - 60^\circ [\because y = 5x \text{ (given)}]$$

$$6x = 120^\circ$$

$$x = \frac{120^\circ}{6}$$

$$x = 20^\circ$$

$$\text{So, } y = 5x = 5 \times 20^\circ = 100^\circ$$

$$\text{Now, } \angle RQP = \angle QRS + \angle QSR \text{ [Exterior angle property]}$$

$$z = 60^\circ + 100^\circ = 160^\circ$$

Hence, the angle of z is 160° .

141. The lengths of two sides of an isosceles triangle are 9 cm and 20 cm. What is the perimeter of the triangle? Give reason.

Solution:

Sides of isosceles triangle are 9 cm and 20 cm.

As, sum of any two sides of a triangle is greater than third side.

$$\text{If third side will be 9 cm then } 9 + 9 = 18 < 20$$

So, the triangle will not form.

So, third side of triangle must be 20 cm.

Perimeter = $(9 + 20 + 20)$ cm = 49 cm.

142. Without drawing the triangles write all six pairs of equal measures in each of the following pairs of congruent triangles.

(a) $\triangle STU \cong \triangle DEF$ (b) $\triangle ABC \cong \triangle LMN$ (c) $\triangle YZX \cong \triangle PQR$ (d) $\triangle XYZ \cong \triangle MLN$

Solution:

(a) $\triangle STU \cong \triangle DEF$

$ST = DE$, $TU = LF$, $SU = DF$

$\angle STU = \angle DEF$, $\angle SUT = \angle DFE$, $\angle TSU = \angle EDF$

(b) $\triangle ABC \cong \triangle LMN$

$AB = LM$, $BC = MN$, $AC = LN$

$\angle ABC = \angle LMN$, $\angle ACB = \angle ANM$, $\angle BAC = \angle MLN$

(c) $\triangle YZX \cong \triangle POR$

$YZ = PQ$, $ZX = OR$, $YX = PR$

$\angle YZX = \angle POR$, $\angle YXZ = \angle PRO$, $\angle XYZ = \angle RPQ$

(d) $\triangle XYZ \cong \triangle MLN$

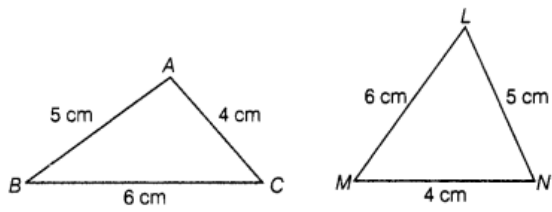
$XY = ML$, $YZ = LN$, $XZ = MN$

$\angle XYZ = \angle MLN$, $\angle XZY = \angle MNL$, $\angle ZXY = \angle NML$.

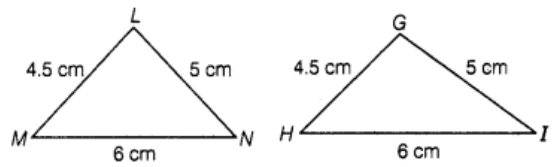
143. In the following pairs of triangles of Fig. 6.47, the lengths of the sides are indicated along the sides. By applying SSS congruence criterion, determine which triangles are congruent. If congruent, write the results in symbolic form.

Solution:

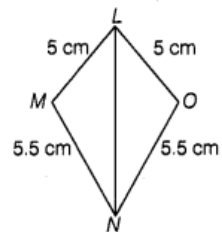
(a)



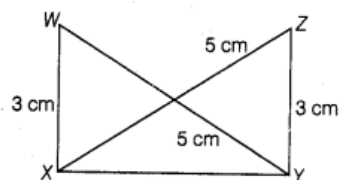
(b)



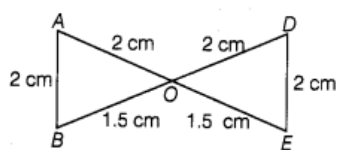
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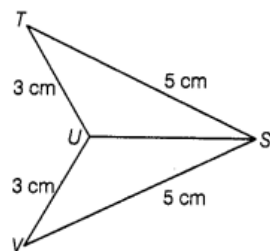
(d)



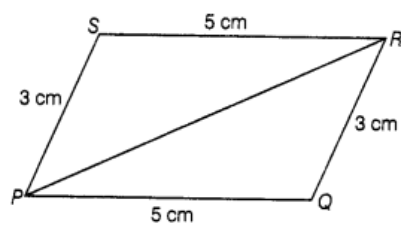
(e)



(f)



(g)



(h)

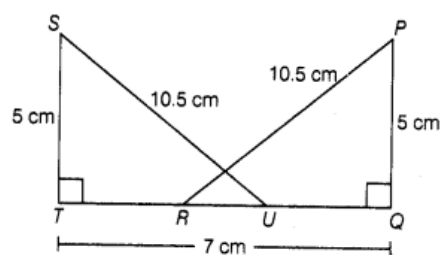


Fig. 6.47

Solution:

(a) In $\triangle ABC$ and $\triangle NLM$,

$$\begin{aligned} AB &= NL = 5 \text{ cm} && \text{(given)} \\ BC &= LM = 6 \text{ cm} && \text{(given)} \\ AC &= NM = 4 \text{ cm} && \text{(given)} \\ \text{So, } \triangle ABC &\cong \triangle NLM && \text{(SSS criterion)} \end{aligned}$$

(b) In $\triangle LMN$ and $\triangle GHI$,

$$\begin{aligned} LM &= GH = 4.5 \text{ cm} && \text{(given)} \\ LN &= GI = 5 \text{ cm} && \text{(given)} \\ MN &= HI = 6 \text{ cm} && \text{(given)} \\ \text{So, } \triangle LMN &\cong \triangle GHI && \text{(SSS criterion)} \end{aligned}$$

(c) In $\triangle LMN$ and $\triangle LON$,

$$\begin{aligned} LM &= LO = 5 \text{ cm} && \text{(given)} \\ MN &= ON = 5.5 \text{ cm} && \text{(given)} \\ LN &= LN && \text{(common)} \\ \text{So, } \triangle LMN &\cong \triangle LON && \text{(SSS criterion)} \end{aligned}$$

(d) In $\triangle XYZ$ and $\triangle YXW$,

$$\begin{aligned} XY &= YX && \text{(common)} \\ ZY &= WX = 3 \text{ cm} && \text{(given)} \\ ZX &= WY = 5 \text{ cm} && \text{(given)} \\ \text{So, } \triangle YXW &\cong \triangle XYZ && \text{(SSS criterion)} \end{aligned}$$

(e) In $\triangle AOB$ and $\triangle DOE$,

$$\begin{aligned} AO &= DO = 2 \text{ cm} && \text{(given)} \\ AB &= DE = 2 \text{ cm} && \text{(given)} \\ BO &= EO = 1.5 \text{ cm} && \text{(given)} \\ \text{So, } \triangle AOB &\cong \triangle DOE && \text{(SSS criterion)} \end{aligned}$$

(f) In $\triangle STU$ and $\triangle SVU$,

$$\begin{aligned} SU &= SU && \text{(common)} \\ ST &= SV = 5 \text{ cm} && \text{(given)} \\ UT &= UV = 3 \text{ cm} && \text{(given)} \\ \text{So, } \triangle STU &\cong \triangle SVU && \text{(SSS criterion)} \end{aligned}$$

(g) In $\triangle PQR$ and $\triangle RSP$,

$$\begin{aligned} PR &= RP && \text{(common)} \\ PQ &= RS = 5 \text{ cm} && \text{(given)} \\ OR &= SP = 3 \text{ cm} && \text{(given)} \\ \text{So, } \triangle PQR &\cong \triangle RSP && \text{(SSS criterion)} \end{aligned}$$

(h) In $\triangle STU$, by Pythagoras theorem,
 $TU^2 = (10.5)^2 - 5^2 = 135.25$
 and in $\triangle PQR$, $QR^2 = (10.5)^2 - 5^2 = 135.25$

(i) So, $TU^2 = QR^2$
 $TU = QR \dots (I)$
 In $\triangle STU$ and $\triangle PQR$,
 $ST = PQ = 5 \text{ cm}$ (given)
 $SU = PR = 10.5 \text{ cm}$ (given)
 $TU = QR$ [From equation (I)].
 $\triangle STU \cong \triangle PQR$ (SSS criterion)

144. ABC is an isosceles triangle with $AB = AC$ and D is the mid-point of base BC (Fig. 6.48). (a) State three pairs of equal parts in the triangles ABD and ACD.

(b) Is $\triangle ABD \cong \triangle ACD$. If so why?

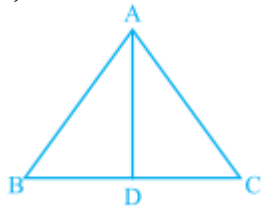


Fig. 6.48

Solution:

(a) In $\triangle ABD$ and $\triangle ACD$,
 $AD = AD$ (common)
 $AB = AC$ (given)
 $BD = CD$ (D is mid-point of BC)

(b) Yes, by using part (a), get
 $\triangle ABD \cong \triangle ACD$ (SSS criterion)

145. In Fig. 6.49, it is given that $LM = ON$ and $NL = MO$

(a) State the three pairs of equal parts in the triangles NOM and MLN.

(b) Is $\triangle NOM \cong \triangle MLN$. Give reason?

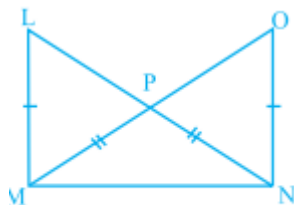


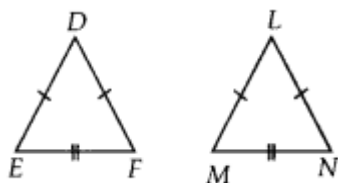
Fig. 6.49

Solution:

- (a) In $\triangle NOM$ and $\triangle MLN$,
 $NM = MN$ (common)
 $OM = LN$ (given)
 $ON = LM$ (given)
- (b) Yes, by using part (a), we get
 $\triangle NOM \cong \triangle MLN$ (SSS criterion)

146. Triangles DEF and LMN are both isosceles with $DE = DF$ and $LM = LN$, respectively. If $DE = LM$ and $EF = MN$, then, are the two triangles congruent? Which condition do you use? If $\angle E = 40^\circ$, what is the measure of $\angle N$?

Solution:



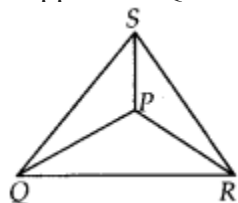
In $\triangle DEF$ and $\triangle LMN$,
 $EF = MN$ (given)
 $DE = LM$ given
 $DF = LN$ [$\because DE = DF$ and $LM = LN$]

So, $\triangle DEF \cong \triangle LMN$ (SSS criterion)
 So, $\angle E = \angle M$ [By C.P.C.T.]
 Now, $\angle E = 40^\circ \Rightarrow \angle M = 40^\circ$
 Since, $\angle M = \angle N$ [$\because LN = LM$]
 Hence, $\angle N = 40^\circ$.

147. If $\triangle PQR$ and $\triangle SQR$ are both isosceles triangle on a common base QR such that P and S lie on the same side of QR. Are triangles PSQ and PSR congruent? Which condition do you use?

Solution:

Suppose $\triangle PQR$ and $\triangle SQR$ are the given triangles such that $PQ = PR$ and $SQ = SR$.

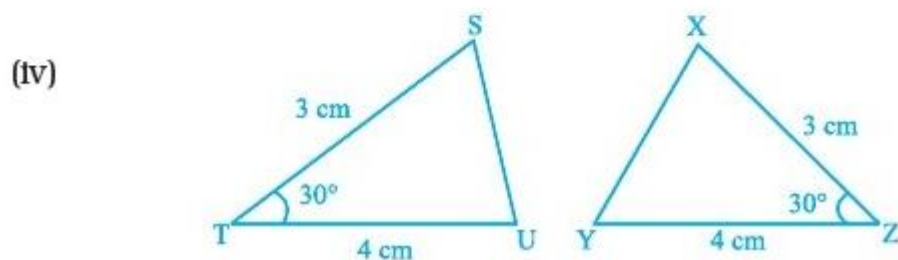
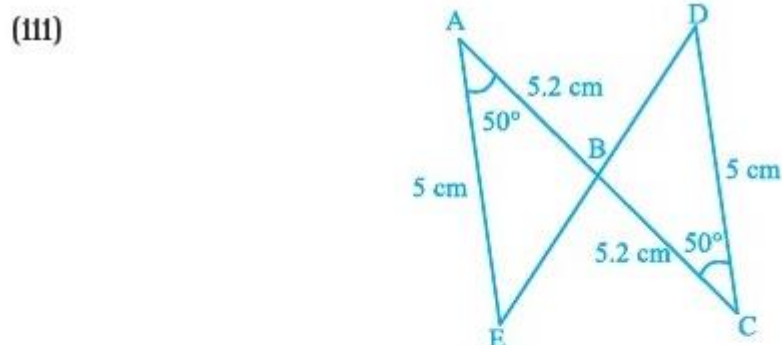
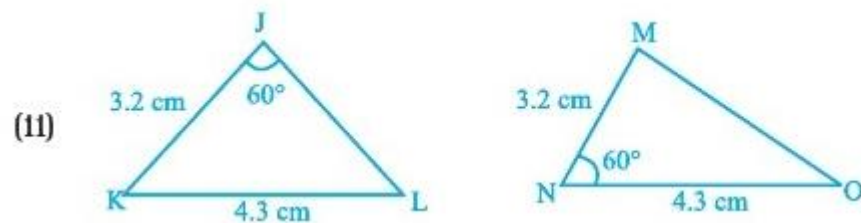
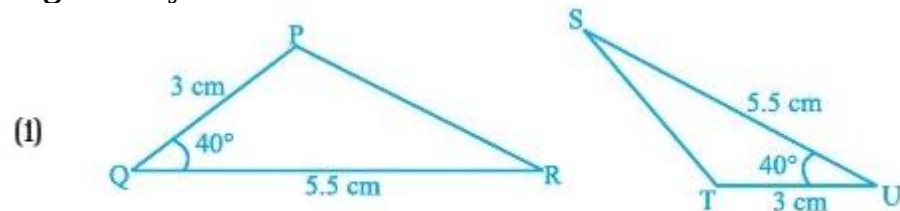


Now, in $\triangle PSQ$ and $\triangle PSR$,
 $PQ = PR$ (given)
 $SQ = SR$ (given)
 $PS = PS$ (common)

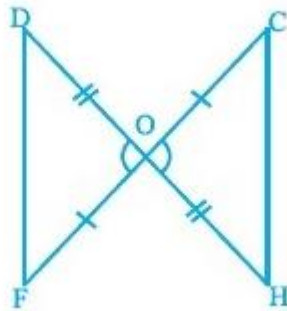
So, $\triangle PSQ \cong \triangle PSR$ (SSS criterion)

Yes, the $\triangle PSQ$ and $\triangle PSR$ are congruent by using SSS criterion

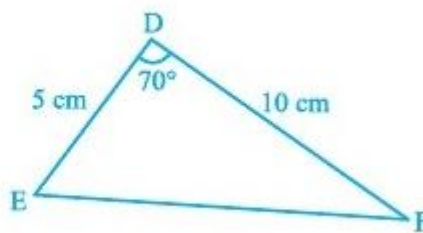
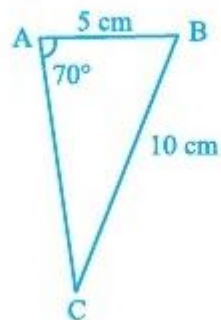
148. In Fig. 6.50, which pairs of triangles are congruent by SAS congruence criterion (condition)? If congruent, write the congruence of the two triangles in symbolic form.



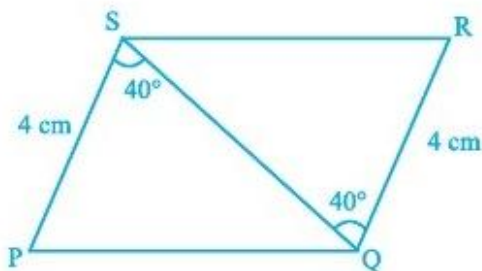
(v)



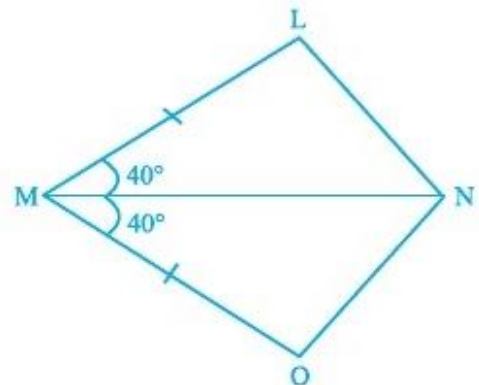
(vi)



(vii)



(viii)



Solution:

(i) In $\triangle POR$ and $\triangle TUS$,

$PQ = TU = 3 \text{ cm}$ (given)

$OR = US = 5.5 \text{ cm}$ (given)

$\angle POR = \angle TUS = 40^\circ$ (given)

So, $\triangle POR \cong \triangle TUS$ (SAS criterion)

(ii) In the given figure, $\triangle JKL$ and $\triangle MNO$ are not congruent by any criterion.

(iii) In $\triangle ABE$ and $\triangle CBD$,

$\angle EAB = \angle DCB = 50^\circ$ (given)

$AE = CD = 5 \text{ cm}$ (given)

$AB = CB = 5.2 \text{ cm}$ (given)

So, $\triangle ABE \cong \triangle CBD$ (SAS criterion)

(iv) In $\triangle SUT$ and $\triangle XYZ$

$ST = XZ = 3 \text{ cm}$ (given)
 $UT = YZ = 4 \text{ cm}$ (given)
 $\angle STU = \angle XZY = 30^\circ$ (given)
 So, $\triangle SUT \cong \triangle XYZ$ (SAS criterion)

(v) In $\triangle DOF$ and $\triangle HOC$,
 $DO = HO$ (given)
 $FO = CO$ (given)
 $\angle DOF = \angle HOC$ (Vertically opposite angles)
 So, $\triangle DOF \cong \triangle HOC$ (SAS criterion)

(vi) In the given figure, $\triangle ABC$ and $\triangle DEF$ are not congruent by any criterion.

(vii) In $\triangle PSQ$ and $\triangle RQS$.
 $SQ = QS$ (common)
 $PS = RQ = 4 \text{ cm}$ (given)
 $\angle PSQ = \angle RQS = 40^\circ$ (given)
 So, $\triangle PSQ \cong \triangle ROS$ (SAS criterion)

(viii) In $\triangle LMN$ and $\triangle OMN$,
 $MN = MN$ (common)
 $LM = OM$ (given)
 $\angle LMN = \angle OMN = 40^\circ$ (given)
 So, $\triangle LMN \cong \triangle OMN$ (SAS criterion)

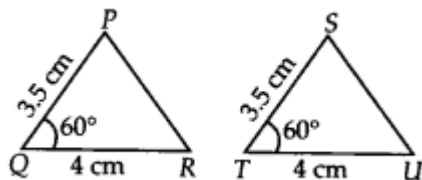
149. State which of the following pairs of triangles are congruent. If yes, write them in symbolic form (you may draw a rough figure).

(a) $\triangle PQR : PQ = 3.5 \text{ cm}, QR = 4.0 \text{ cm}, \angle Q = 60^\circ$ $\triangle STU : ST = 3.5 \text{ cm}, TU = 4 \text{ cm}, \angle T = 60^\circ$

(b) $\triangle ABC : AB = 4.8 \text{ cm}, \angle A = 90^\circ, AC = 6.8 \text{ cm}$ $\triangle XYZ : YZ = 6.8 \text{ cm}, \angle X = 90^\circ, ZX = 4.8 \text{ cm}$

Solution:

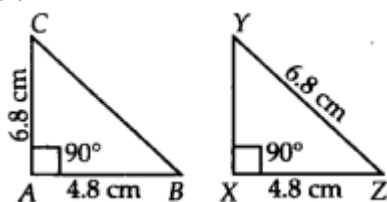
(a)



In $\triangle PQR$ and $\triangle STU$,
 $PQ = ST = 3.5 \text{ cm}$ (given)
 $\angle PQR = \angle STU = 60^\circ$ (given)

$QR = TU = 4 \text{ cm}$ (given)
 So, $\triangle PQR \cong \triangle STU$ (SAS criterion)

(b) Here, $\triangle ABC$ and $\triangle XYZ$ are not congruent by any criterion.



150. In Fig. 6.51, $PQ = PS$ and $\angle 1 = \angle 2$.

(i) Is $\triangle PQR \cong \triangle PSR$? Give reasons.

(ii) Is $QR = SR$? Give reasons.

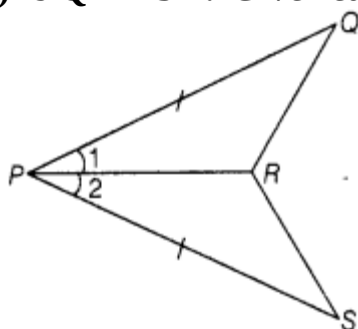


Fig. 6.51

Solution:

- (i) In $\triangle PQR$ and $\triangle PSR$,
 $PQ = PS$ (given)
 $\angle 1 = \angle 2$ (given)
 $PR = PR$ (common)
 So, $\triangle PQR \cong \triangle PSR$ (SAS criterion)

- (ii) Yes, $QR = SR$ (By C.P.C.T.)

151. In Fig. 6.52, $DE = IH$, $EG = FI$ and $\angle E = \angle I$. Is $\triangle DEF \cong \triangle HIG$? If yes, by which congruence criterion?

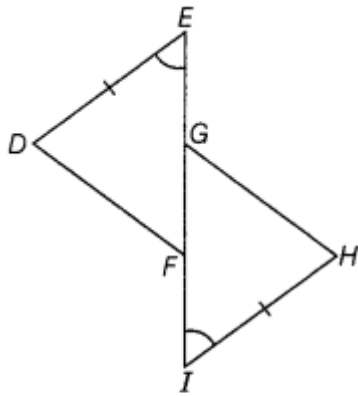


Fig. 6.52

Solution:

In $\triangle DEF$ and $\triangle HIG$,

$DE = HI$ (given)

$\angle E = \angle I$ (given)

$EF = IG$

$$\left[\begin{array}{l} EG = IF \text{ (Given)} \\ EG + GF = IF + GF \\ EF = IG \end{array} \right]$$

So, $\triangle DEF \cong \triangle HIG$ (SAS criterion)

152. In Fig. 6.53, $\angle 1 = \angle 2$ and $\angle 3 = \angle 4$.

(i) Is $\triangle ADC \cong \triangle ABC$? Why ?

(ii) Show that $AD = AB$ and $CD = CB$.

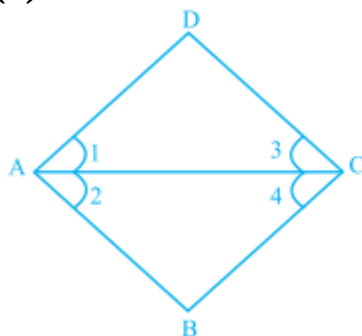


Fig. 6.53

Solution:

(i) In $\triangle ADC$ and $\triangle ABC$,

$\angle 1 = \angle 2$ [given]

$AC = AC$ [common]

$\angle 3 = \angle 4$ [given]

So, $\triangle ADC = \triangle ABC$ (ASA criterion)

(ii) By using equation (I) part, get

$AD = AB$ [By C.P.C.T.]

and $CD = CB$ [By C.P.C.T.]

153. Observe Fig. 6.54 and state the three pairs of equal parts in triangles ABC and DCB.

(i) Is $\triangle ABC \cong \triangle DCB$? Why?

(ii) Is $AB = DC$? Why?

(iii) Is $AC = DB$? Why?

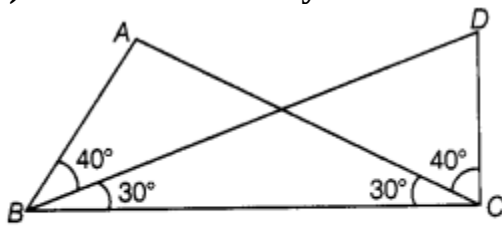


Fig. 6.54

Solution:

(i) In $\triangle ABC$ and $\triangle DCB$,

$\angle ABC = \angle DCB = 40^\circ + 30^\circ = 70^\circ$ (given)

$\angle ACB = \angle DBC = 30^\circ$ (given)

$BC = CB$ (common)

So, $\triangle ABC \cong \triangle DCB$ (ASA criterion)

(ii) Yes, by using (I) part, we get

$AB = DC$ (By C.P.C.T.)

(iii) Yes, by using (I) part, we get

$AC = DB$ (By C.P.C.T.)

154. In Fig. 6.55, $QS \perp PR$, $RT \perp PQ$ and $QS = RT$.

(i) Is $\triangle QSR \cong \triangle RTQ$? Give reasons.

(ii) Is $\angle PQR = \angle PRQ$? Give reasons.

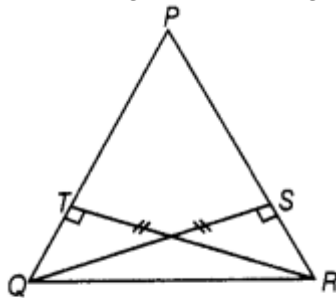


Fig. 6.55

Solution:

- (i) In $\triangle QSR$ and $\triangle RTO$,
 $\angle OSR = \angle RTO = 90^\circ$ [$QS \perp PR$ and $RT \perp PQ$ (given)]
 $QS = RT$ [given]
 $QR = RO$ [common hypotenuse]
So, $\triangle QSR \cong \triangle RTO$ [RHS criterion]
(ii) Yes, by using (1) part, we get
 $\angle TQR = \angle SRQ$ [By C.P.C.T]
Hence, $\angle PQR = \angle PRQ$

155. Points A and B are on the opposite edges of a pond as shown in Fig. 6.56. To find the distance between the two points, the surveyor makes a right-angled triangle as shown. Find the distance AB.

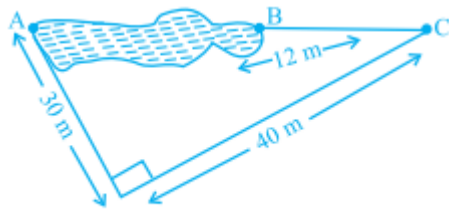
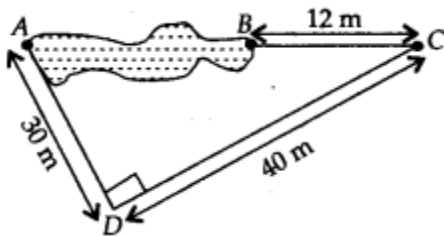


Fig. 6.56

Solution:

Since, $\triangle ADC$ is right-angled triangle

$$\begin{aligned}\text{So, } (AC)^2 &= (AD)^2 + (DC)^2 \\ &= (30)^2 + (40)^2 \\ &= 900 + 1600 \\ &= 2500 \\ &= (50)^2\end{aligned}$$

So, $AC = 50$ m

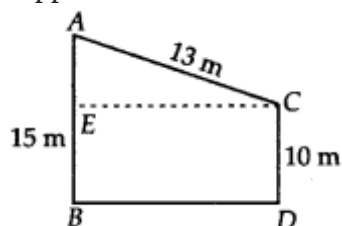
Now, $AB = AC - BC = 50 - 12 = 38$

Hence, the distance AB is 38 m.

156. Two poles of 10 m and 15 m stand upright on a plane ground. If the distance between the tops is 13 m, find the distance between their feet.

Solution:

Suppose AB and CD are the given poles of heights 15 m and 10 m such that AC = 13 m.



Now, $BD = CE$ and $BE = CD = 10$ m

So, $AE = AB - BE = (15 - 10)$ m = 5 m

Now, in $\triangle AEC$,

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

$$(13)^2 = 5^2 + (EC)^2$$

$$(EC)^2 = 169 - 25 = 144 = (12)^2$$

So, $EC = 12$ m

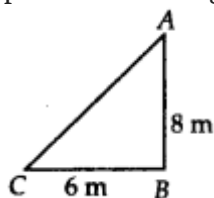
Also, $BD = 12$ m

Hence, distance between the feet of poles is 12 m.

157. The foot of a ladder is 6 m away from its wall and its top reaches a window 8 m above the ground, (a) Find the length of the ladder. (b) If the ladder is shifted in such a way that its foot is 8 m away from the wall, to what height does its top reach?

Solution:

(a) Suppose AC be the given ladder such that $BC = 6$ m and $AB = 8$ m.



Now, in $\triangle ABC$,

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

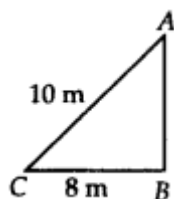
$$= 8^2 + 6^2$$

$$= 64 + 36 = 100 = (10)^2$$

So, $AC = 10$ m

Hence, length of the ladder is 10 m.

(b) Suppose AC be the ladder of length 10 m and $BC = 8$ m.



In $\triangle ABC$,

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

$$(10)^2 = (AB)^2 + (8)^2$$

$$(AB)^2 = 100 - 64 = 36 = (6)^2$$

So, $AB = 6$ m

Hence, the ladder top reaches 6 m above the ground.

158. In Fig. 6.57, state the three pairs of equal parts in $\triangle ABC$ and $\triangle EOD$. Is $\triangle ABC \cong \triangle EOD$? Why?

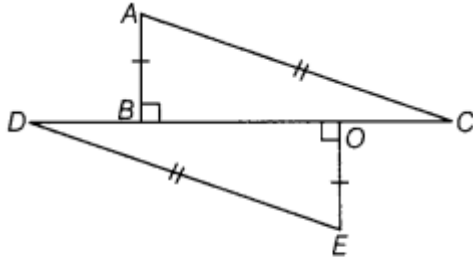


Fig. 6.57

Solution:

In $\triangle ABC$ and $\triangle EOD$,

$AB = EO$ (given)

$\angle ABC = \angle EOD = 90^\circ$ [Given]

$AC = ED$ [given hypotenuse]

Hence, $\triangle ABC \cong \triangle EOD$ (RHS criterion)