Chapter - 6
Triangles

Exercise

In each of the questions 1 to 49, four options are given, out of which only one is correct. Choose the correct one.

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

Solution:
Given: The sides of a triangle have lengths (in cm) 10, 6.5 and a.
As we know that sum of lengths of any two sides of a triangle is greater than length of third side.
So, $a + 6.5 > 10$
$a > 10 – 6.5$
$a > 3.5$
According to the question, a is whole number.
So, the minimum value a can take is 4.
Hence, the correct option is (d).

2. Triangle DEF of Fig. 6.6 is a right triangle with ∠E = 90°. What type of angles are ∠D and ∠F?
(a) They are equal angles (b) They form a pair of adjacent angles
(c) They are complementary angles (d) They are supplementary angles

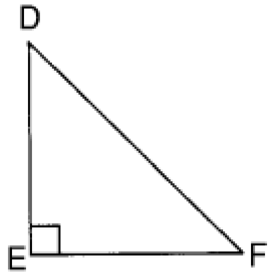


Fig. 6.6

Solution:
$\angle D + \angle E + \angle F = 180°$ [Angle sum property of a triangle]
$\angle D + \angle F = 180° - 90°$ [$\angle E = 90°$ (given)]
$= 90°$
So, ∠D and ∠F are complementary angles.
Hence, the correct option is (c).

3. In Fig. 6.7, PQ = PS. The value of x is
(a) 35° (b) 45° (c) 55° (d) 70°

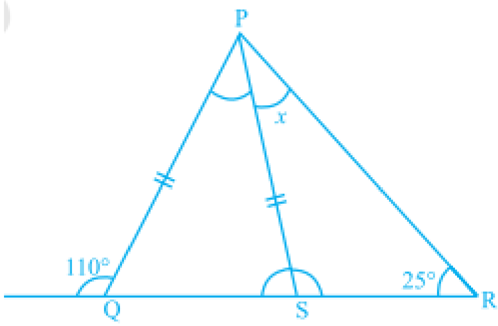
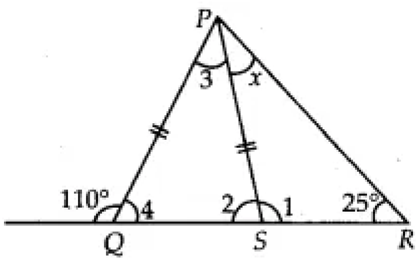


Fig. 6.7

Solution:



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

$\angle 2 + \angle 3 + \angle 4 = 180°$ [Angle sum property of a triangle]

$\angle 4 = 180° = 110°$ [Using equation (i)]

So, $\angle 4 = 70°$

Now, PQ = PS [Given]

$\angle 2 = \angle 4 = 70°$ …(ii)

Now, in ΔPRS:

$\angle 2 = x + 25°$ [Exterior angle property of a triangle]

$x = 70° – 25°$

$x = 45°$ [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

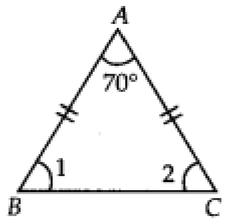
In the given option(s) which of the above statement(s) are true?

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

Solution:

Case I: Let ΔABC is an isosceles triangle in which AB = AC and vertex angle is 70°.

∠1 = ∠2 …(i) [AB = AC]



Now, ∠1 + ∠2 + ∠A = 180° [Angle sum property]

2(∠1) = 180° – 70° [Using equation (i)]

2(∠1) = 110°

$\angle 1 = \frac{110°}{2}$

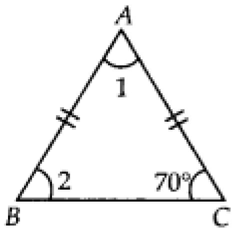
$\angle 1 = 55°$

So, ∠1 = ∠2 = 55°

Therefore, (i) is true.

Case II: Let ΔABC is an isosceles triangle in which AB = AC and base angle is 70°.

∠2 = 70° [AB = AC]



Now, ∠1 + ∠2 + ∠C = 180°

∠1 = 180°- ∠2 - ∠C

∠1 = 180° – 70° – 70°

∠1 = 40°

So, ∠1= 40° and ∠2 = 70°

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°

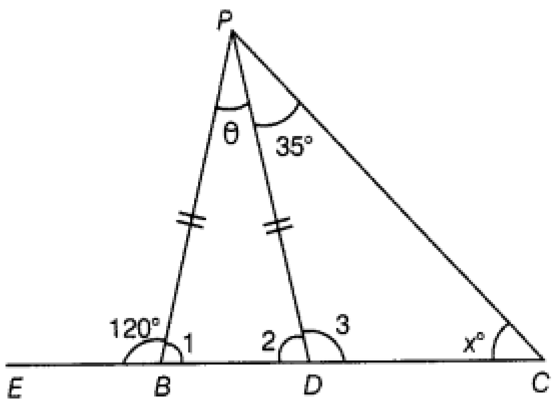


Fig. 6.8

Solution:
See the given figure in the question,
∠PBE = ∠PDB + ∠BPD [Exterior angle property]
120° = ∠PDB + θ …(i)

Now, in triangle PBD,
∠PBD + ∠BPD + ∠PDB = 180° [Angle sum property]
∠PBD + θ + ∠PDB = 180°
∠PBD = 180° – 120° = 60° [Using equation (i)]
And PB = PD [Given]
So, ∠PDB = ∠PBD = 60° …(ii)

Now, in ∆PDC,
∠PDB = ∠DCP + ∠DPC [Exterior angle property]
60° = x + 35° [Using equation (ii)] [Given: ∠DCP = x, ∠DPC = 35°]
x = 60° – 35°
x = 25°
Hence, the correct option is (c).

9. In ∆PQR,
(a) PQ – QR > PR (b) PQ + QR < PR (c) PQ – QR< PR (d) PQ + PR< QR

Solution:
In a triangle POR,
PQ +OR >PR: QR + PR > PO; PR + PQ > QR [Sum of any two sides of a triangle is greater than the third side]

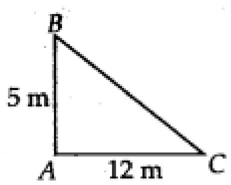
And: PQ – QR < PR; QR – PR < PQ
PR – PQ < QR [Difference of any two sides of a triangle is less than the third side].
Hence, the correct option is (c).

10. In ∆ ABC,
(a) AB + BC > AC (b) AB + BC < AC (c) AB + AC < BC (d) AC + BC < AB

Solution:
In a ∆ABC,
AB + BC > AC: BC + AC > AB; AC + AB > BC [∵ 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.



c is right angled triangle. So,
$(BC)^2 = (AB)^2 + (AC)^2$

$(BC)^2 = (5)^2 + (12)^2$
$(BC)^2 = 25 + 144 = 169$
$(BC)^2 = 13^2$
BC = 13 m

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

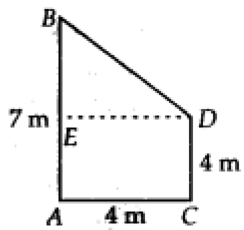
12. The triangle ABC formed by AB = 5 cm, BC = 8 cm, AC = 4 cm is
(a) an isosceles triangle only (b) a scalene triangle only
(c) an isosceles right triangle (d) scalene as well as a right triangle

Solution:
Let in ΔABC, AB = 5 cm, BC = 8 cm, AC = 4 cm
Now, $5^2 + 4^2 = 25 + 16 = 41 \neq 8^2$
And all sides of triangle are unequal.

So, ΔABC 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 m
BE = AB – AE = (7 – 4) m = 3 m [AE = CD = 4 m]

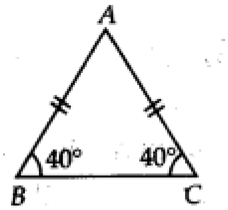


Now, ΔBED is a right angled triangle
$(BD)^2 = (BE)^2 + (DE)^2$
$(BD)^2 = (3)^2 + (4)^2 = 9 + 16$
$(BD)^2 = 25$
$(BD)^2 = 5^2$
BD = 5 m
Therefore, the distance between the tops of trees is 5 m.

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

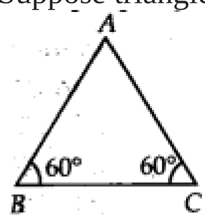
Solution:
Suppose triangle ABC be the given isosceles triangle in which AB = AC and each base angle is 40°.



Now, $\angle A + \angle B + \angle C = 180°$ [Angle sum property]
$\angle A = 180° - \angle B - \angle C$
$\angle A = 180° – 40° – 40°$ [$\angle B = \angle C = 40°$]
$\angle A = 100°$
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.



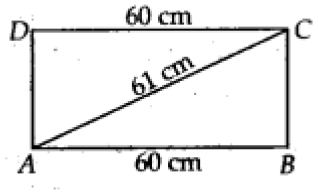
Now, $\angle A + \angle B + \angle C = 180°$ [Angle sum property]
$\angle A = 180° – 60° – 60°$
So, $\angle A = 60°$
Thus, all angles are of 60°

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 cm

So, perimeter of rectangle ABCD = 2(AB + BC)

= 2 (60 + 11)

= 2(71)

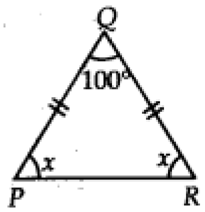
= 142 cm

Hence, the correct option is (d).

17. In ∆PQR, if PQ = QR and ∠Q = 100°, then ∠R is equal to
(a) 40° (b) 80° (c) 120° (d) 50°

Solution:

According to the question:



Let ∠R = x

PQ = QR [given]

SO, ∠R =∠P = x

Now, in triangle POR

∠P + ∠Q + ∠R = 180° [Angle sum property]

x + 100° + x = 180°

2x = 180° – 100°

2x = 80°

$$x = \frac{80°}{2}$$

$x = 40°$

Thus, ∠R = 40°

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 ∠A = 40. Then, ∠ACD is equal to
(a) 40°   (b) 80°   (c) 120°   (d) 60°

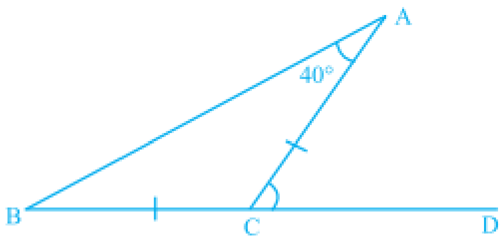


Fig. 6.9

Solution:
BC = CA [given]
∠A = ∠B = 40° [Angles opposite to equal sides are equal]
Now, ∠ACD = ∠A + ∠B [Exterior angle property]
∠ACD = 40° + 40°
∠ACD = 80°

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.
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°

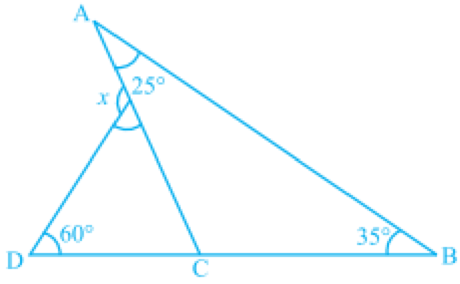


Fig. 6.10

Solution:
In ΔABC,
∠ACD =∠CAB + ∠ABC [Exterior angle property]
∠ACD = 25° + 35°
∠ACD = 60° …(i)

Now, x = ∠D +∠ACD, [Exterior angle property]
x = 60° + 60° [Using equation (i)] .
x = 120°
Hence, the correct option is (c).

22. In Fig. 6.11, the value of ∠A + ∠B + ∠C + ∠D + ∠E + ∠F is
(a) 190° (b) 540° (c) 360° (d) 180°

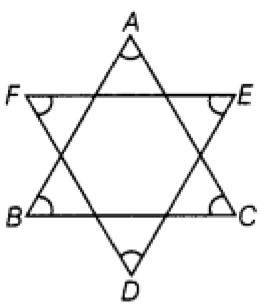


Fig. 6.11

Solution:
See the given figure in the question, in ΔABC:
∠A + ∠B + ∠C = 180° …(i) [Angle sum property]

In ΔDEF:
∠D+ ∠E + ∠F = 180° …(ii) [Angle sum property]

Adding equation (i) and (ii), get:
∠A+∠B+ ∠C + ∠D+ ∠E+∠F = 180° + 180°
∠A+∠B+ ∠C + ∠D+ ∠E+∠F = 360°
Hence, the correct option is (c).

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

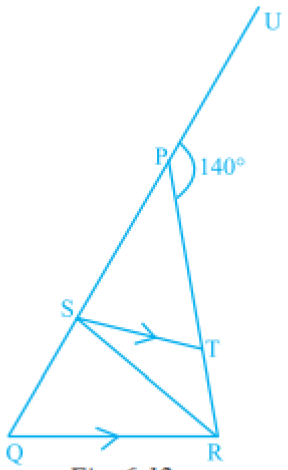


Fig. 6.12

Solution:
Given: PQ = PR
So, ∠PRQ = ∠PQR

See the given figure in the question, in ΔPQR:
∠RPU = ∠PRQ + ∠PQR [Exterior angle property]
140° = 2∠POR [∠PRQ = ∠PQR]
$$\angle POR = \frac{140°}{2}$$
$$\angle POR = 70°$$

ST || QR and QS is a transversal.
So, ∠PST = ∠PQR = 70° … (ii) [Corresponding angles]
Now, in ΔQSR RS = RQ (given) .
So, ∠SQR – ∠RSQ = 70°

Now, PQ is a straight line.
So, ∠PST + ∠TSR + ∠RSQ = 180°
70° + ∠TSR + 70° = 180° [Using (ii) and (iii)]
∠TSR = 180° – 70° – 70°
∠TSR = 180° – 140°
∠TSR = 40°
Hence, the correct option is (b).

24. In Fig. 6.13, ∠BAC = 90°, AD ⊥ BC and ∠BAD = 50°, then ∠ACD is
(a) 50° (b) 40° (c) 70° (d) 60°

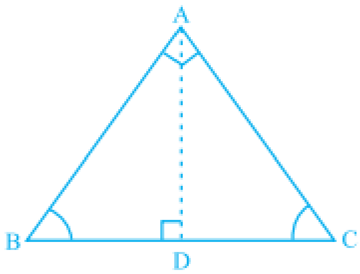


Fig. 6.13

Solution:
Given: ∠BAC = 90° and ∠BAD = 50°
So, ∠DAC = ∠BAC – ∠BAD
∠DAC = 90° – 50°
∠DAC = 40°

Now, in triangle ADC:
∠ADB = ∠DAC + ∠ACD [Exterior angle property]
90° = 40° + ∠ACD [AD ⊥ BC]
∠ACD = 90° – 40°
∠ACD = 50°

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)

Now, x + y + z = 180° [Angle sum property]
x + x = 180° [Using equation (i)]
2x = 180°

$$x = \frac{180°}{2}$$

$x = 90°$
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° = x + x [Exterior angle property]

2x = 130°

$x = \frac{130°}{2}$

$x = 65°$

Therefore, each interior opposite angle is of 65°

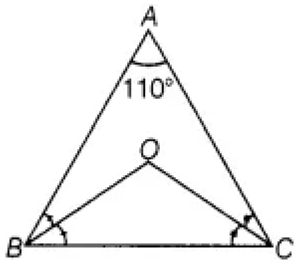
Hence, the correct option is (b).

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 ∠A = 110° and OB, OC are the angle bisectors of ∠B, C respectively.



In triangle ABC,

$\angle A + \angle B + \angle c = 180°$ [Angle sum property]

$\angle B + \angle C = 180° - 110°$

$\angle B + \angle C = 70°$

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

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

Now, in triangle BOC:

$\angle BOC + \angle OBC + \angle OCB = 180°$ [Angle sum property of a triangle]

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

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,

$\angle BOC + 35° = 180°$

$\angle BOC = 180° - 35°$

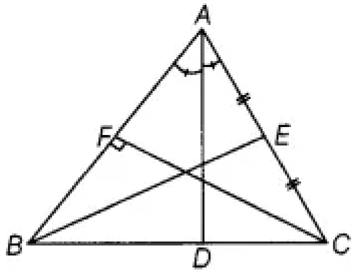
$\angle BOC = 145°$

Hence, the correct option is (d).

28. In ΔABC, AD is the bisector of ∠A meeting BC at D, CF ⊥ 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.

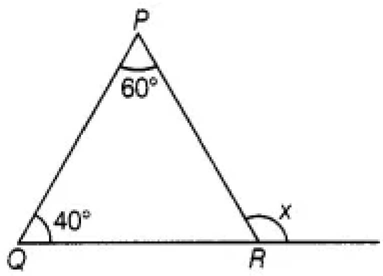


So, the median is BE as AE = EC.
Hence, the correct option is (b).

29. In ΔPQR, if ∠ P = 60°, and ∠ Q = 40°, 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.

So, $\angle x = \angle p + \angle Q$

$\angle x = 60° + 40°$

$\angle x = 100°$

Hence, the correct option is (c).

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

(a) 67°, 51°, 62° (b) 70°, 83°, 27° (c) 90°, 70°, 20° (d) 40°, 132°, 18°

Solution:

As we know that, the sum of the interior angles of a triangle is 180°.
So, verifying the given triplets as:
(a) 67°+ 51°+ 62° = 180°

(b) 70° + 83° + 27° = 180°

(c) 90° + 70° + 20° = 180°

(d) 40° + 132°+ 18° = 190°

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 ∠x and ∠y in Fig. 6.14 are respectively
(a) 30°, 60°   (b) 40°, 40°   (c) 70°, 70°   (d) 70°, 60°

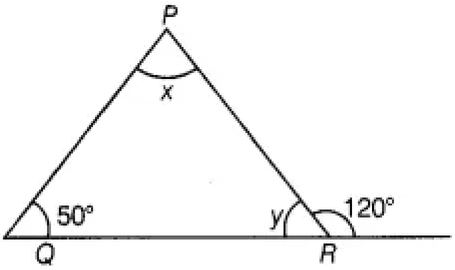
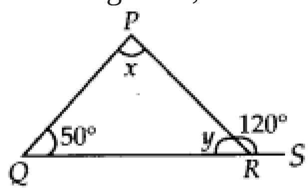


Fig. 6.14

Solution:
Given figure is,



In ΔPQR,
∠PRS = ∠RPQ + ∠POR [Exterior angle property]
120° = x + 50°
x = 120°- 50° = 70°

Now, x + y + 50° = 180° [Angle sum property]
70° + y + 50° = 180°
y = 180° – 70°- 50°
y = 180° – 120°
y = 60°

Therefore, x = 70°, y = 60°
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.

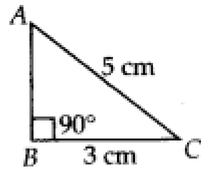
So, 6 + x > 10; 10 + x > 6; 10 + 6 > x
x > 4; x > -4; x < 16

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,

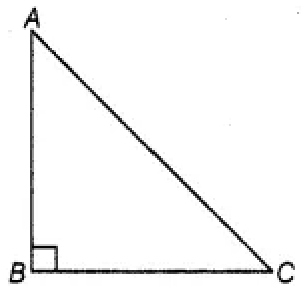


$(AC)^2 = (AB)^2 + (BC)^2$
$5^2 = (AB)^2 + 3^2$
$(AB)^2 = 25 - 9 = 16 = 4^2$
AB = 4 cm

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 it's altitude outside the triangle?

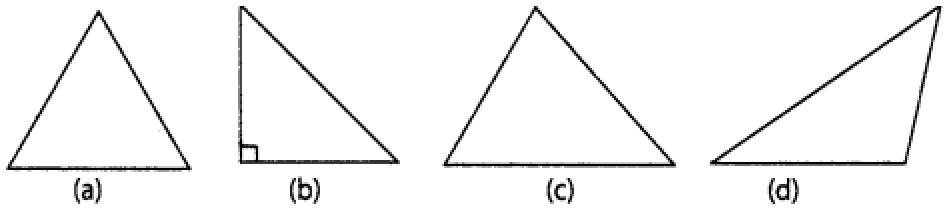
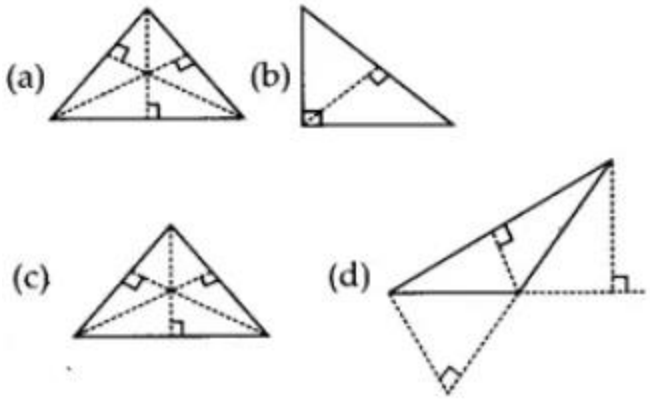


Fig. 6.15

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 || CD, then

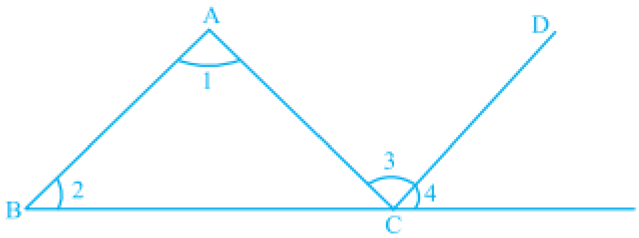


Fig. 6.16

(a) ∠ 2 = ∠ 3 (b) ∠ 1 = ∠ 4 (c) ∠ 4 = ∠ 1 + ∠ 2 (d) ∠ 1 + ∠ 2 = ∠ 3 + ∠ 4

Solution:
Given, AB || CD
So, ∠2 = ∠4 …(i) (Corresponding angles)
And ∠1 = ∠3 …(ii) [Alternate interior angles]

Adding equation (i) and (ii), get
∠1 + ∠2 = ∠3 + ∠4
Hence, the correct option is (d).

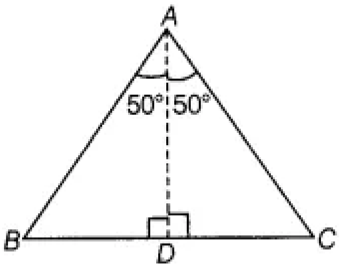
40. In ΔABC, ∠A = 100°, AD bisects ∠A and AD⊥BC. Then, ∠B is equal to
(a) 80° (b) 20° (c) 40° (d) 30°

Solution:
Given: AD bisects, ∠A.

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

$$\angle BAD = \frac{110°}{2}$$

$$\angle BAD = 50°$$



Now, AD ⊥ BC
So, ∠ADC = 90°

Now, in ΔABD,
∠ADC = ∠ABD + ∠BAD [Exterior angle property]
90° = ∠ABD + 50°
∠ABD = 90°- 50° = 40°
Therefore, ∠B = 40°
Hence, the correct option is (c).

41. In ΔABC, ∠A = 50°, ∠B = 70° and bisector of ∠C meets AB in D (Fig. 6.17). Measure of ∠ADC is.

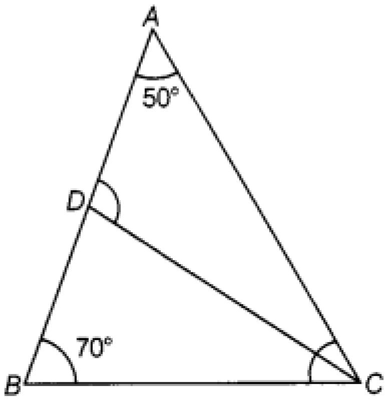


Fig. 6.17

(a) 50° (b) 100° (c) 30° (d) 70°

Solution:

In ΔABC, ∠A +∠B + ∠C = 180° [Angle sum property]
∠C = 180° – 70° – 50°
∠C = 60 °

Since, CD bisects ∠C.

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

Now, in ΔBDC, ∠ADC = ∠DBC + ∠DCB [Exterior angle property]
∠ADC = 70° + 30 = 100°
Hence, the correct option is (b).

42. If for ΔABC and ΔDEF, the correspondence CAB ↔ EDF gives a congruence, then which of the following is not true?
(a) AC = DE (b) AB = EF (c) ∠A = ∠D (d) ∠C = ∠E

Solution:
Given: ΔCAB ≅ ΔEDF
So, AC = DE, AB = DF, BC = FE, ∠A =∠D, ∠C = ∠E, ∠B = ∠F
Hence, the correct option is (b).

43. In Fig. 6.18, M is the mid-point of both AC and BD. Then
(a) ∠1 = ∠2 (b) ∠1 = ∠4 (c) ∠2 = ∠4 (d) ∠1 = ∠3

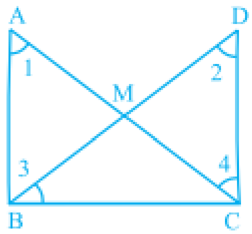


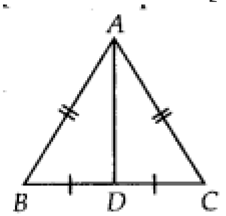
Fig. 6.18

Solution:
In ΔAMB and ΔCMD,
AM = CM [M is mid-point of AC]
BM = DM [M is mid-point of BD]
∠AMB = ∠CMD [Vertically opposite angles]
So, ∠AMB ≅ ∠CMD [SAS criterion]
So, ∠1 = ∠4 [By C.P.C.T]
Hence, the correct option is (b).

44. If D is the mid-point of the side BC in ΔABC where AB = AC, then ∠ADC is
(a) 60° (b) 45° (c) 120s° (d) 90°

Solution:

In ΔABD and ΔACD,
AD = AD [common]
AB = AC [given]
BD = CD [D is mid-point of BC]



So, ΔABD = ΔACD [SSS criterion]
As, ∠ADB = ∠ADC [By C.P.C.T]…(i)
But ∠ADB + ∠ADC = 180° [BC is a straight line]
∠ADC + ∠ADC = 180° [By using equation (i)]
2 ∠ADC = 180°
∠ADC = 90°
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

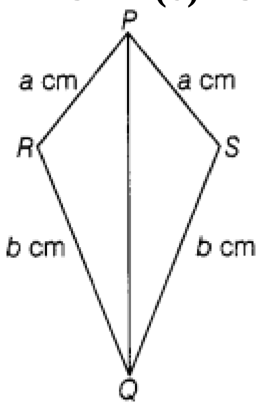


Fig. 6.19

Solution:
In ΔPRQ and ΔPSQ,
PQ =PQ [common]
PR = PS = a cm [given]
QR = QS = b = cm [given]
So, ΔPRQ = ΔPSQ [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 ΔPQR is congruent to ΔSTU (Fig. 6.20), then what is the length of TU?
(a) 5 cm (b) 6 cm (c) 7 cm (d) cannot be determined

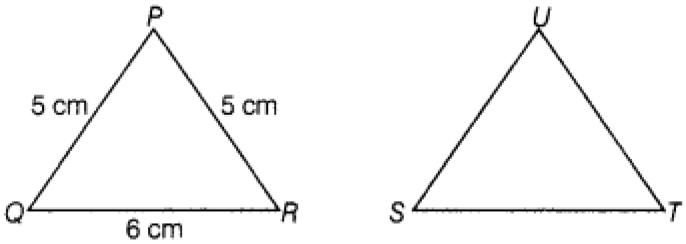


Fig. 6.20

Solution:
Given that
ΔPOR ≅ ΔSTU
So, TU = OR = 6 cm
Hence, the correct option is (b).

49. If ΔABC and ΔDBC are on the same base BC, AB = DC and AC = DB (Fig. 6.21), then which of the following gives a congruence relationship?
(a) Δ ABC ≅ Δ DBC (b) Δ ABC ≅ ΔCBD (c) Δ ABC ≅ Δ DCB (d) Δ ABC ≅ ΔBCD

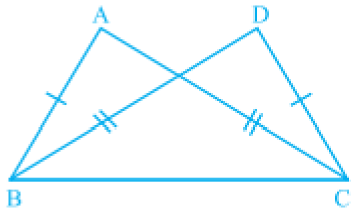


Fig. 6.21

Solution:
In ΔABC and ΔDCB,
AB = DC (given)
AC = DB (given)
BC = CB (common)
So, ΔABC ≅ ΔDCB (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 …(i)

Now, x + y + z-180° [Angle sum property]
x + x = 180° [Using equation (i)]
2x = 180°
x = 90°
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 ΔPQR and ΔXYZ are congruent under the correspondence QPR ↔ XYZ, then
(i) ∠R = ________________
(ii) QR = ________________
(iii) ∠P = ________________
(iv) QP = ________________
(v) ∠ Q = ________________
(vi) RP =________________

Solution:
Given: ΔQPR = ΔXYZ
(i) ∠R = Z
(ii) QR = XZ
(iii) ∠P = ∠Y
(iv) OP = XY
(v) ∠Q = ∠X
(vi) RP =ZY

64. In Fig. 6.22, ΔPQR ≅ Δ ____________

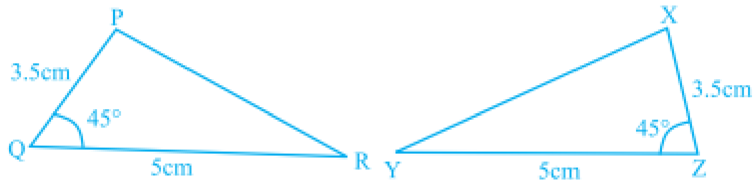


Fig. 6.22

Solution:
XZY: In ΔPQR and ΔXZY,
PQ = XZ = 3.5 cm
∠PQR = ∠XZY = 45°
QR = ZY = 5 cm
So, ΔPQR ≅ ΔXZY [SAS criterion]

65. In Fig. 6.23, ΔPQR ≅ Δ ____________

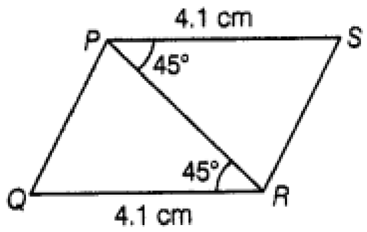


Fig. 6.23

Solution:

RSP: In ΔPQR and ΔRSP,
QR = SP = 4.1 cm
∠PRQ = ∠RPS = 45°
PR = RP [common]
So, ΔPQR ≅ ΔRSP [SAS criterion]

66. In Fig. 6.24, Δ ________ ≅ Δ PQR

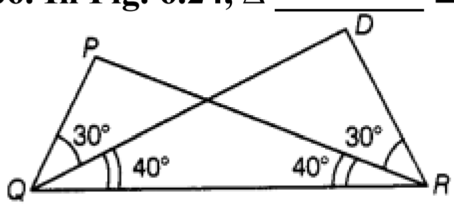


Fig. 6.24

Solution:

DRQ: In ΔPQR and ΔDRQ,
∠PRQ = ∠DQR = 40°
∠PQR = ∠DRQ = 30° + 40° = 70°
QR = RQ [common]
So, ΔPQR ≅ ΔDRQ [ASA criterion]

67. In Fig. 6.25, Δ ARO ≅ Δ _________

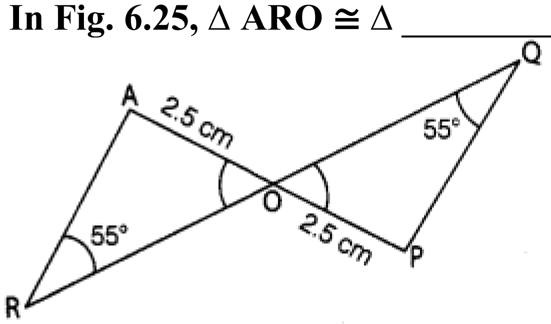


Fig. 6.25

Solution:

PQO: In ΔARO and ΔPQO,
∠ARO = ∠PQO = 55°

∠AOR = ∠POQ [Vertically opposite angles]
So, ∠RAQ = ∠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, ΔARO ≅ Δ<u>PQO</u> [ASA criterion]

68. In Fig. 6.26, AB = AD and ∠BAC = ∠ DAC. Then
(i) Δ ___________ ≅ Δ ABC.
(ii) BC = ___________.
(iii) ∠BCA = ___________.
(iv) Line segment AC bisects __________ and ___________.

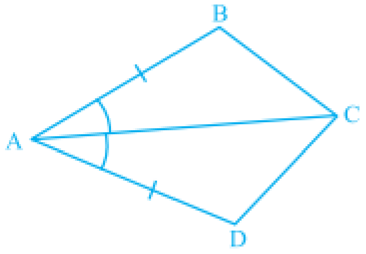


Fig. 6.26

Solution:
In ΔABC and ΔADC,
AC = AC [common]
∠BAC = ∠DAC [given]
AB = AD [given]
So, ΔABC ≅ ΔADC [SAS criterion]
So, BC = DC [By C.P.C.T.]
and ∠BCA = ∠DCA [By C.P.C.T.]

(i) Δ<u>ADC</u> ≅ ΔABC
(ii) BC = <u>DC</u>
(iii) ∠BCA = ∠<u>DCA</u>
(iv) Line segment AC bisects <u>∠BAD</u> and <u>∠BCD</u>.

69. In Fig. 6.27,
(i) ∠ TPQ = ∠ _____ + ∠ _____
(ii) ∠ UQR = ∠ _____ + ∠ _____
(iii) ∠ PRS = ∠ _____ + ∠ _____

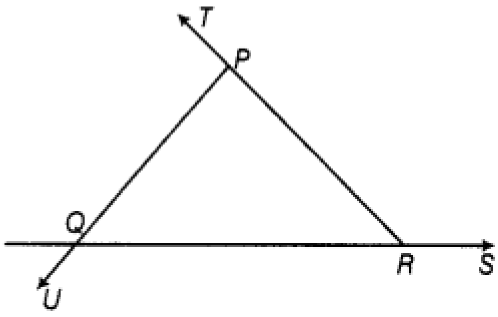


Fig. 6.27

Solution:

(i) PQR, PRQ: ∠TPQ = ∠PQR + ∠PRQ [Exterior angle property]
(ii) QPR, QRP: ∠UQR = ∠QPR + ∠QRP [Exterior angle property]
(iii) RPQ, ROP: ∠PRS = ∠RPQ + ∠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 ΔABC, AB = 3.5 cm, AC = 5 cm, BC = 6 cm and in ΔPQR, PR= 3.5 cm, PQ = 5 cm, RQ = 6 cm. Then ΔABC ≅ ΔPQR.

Solution:

In ΔABC and ΔPOR,
AB = PR = 3.5 cm
AC = PQ = 5 cm
BC = RO = 6 cm
So, ΔABC ⟷ ΔPRQ [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° + 90° + x = 180° [Angle sum property]

$x = 180° – 180° = 0°$
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 $x > 90°$ …(i)
and $y > 90°$ …(ii)
From equation (i) and (ii):
$x + y > 180°$
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.

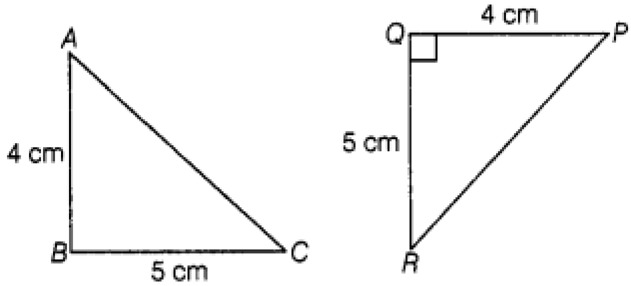


Fig. 6.28

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.

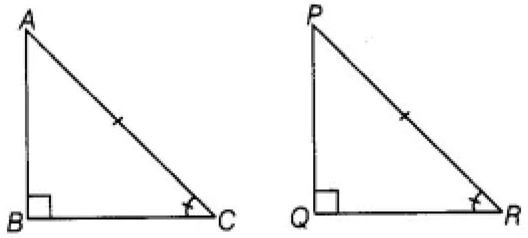
Solution:
If two angles and a side of a triangle are equal to two corresponding angles and the included side of the another triangle, then the triangles are congruent.
Hence, the given statement is false.

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,
$\angle B = \angle Q = 90°$
$\angle C = \angle R$
$\angle A = \angle P$
Also, in triangle ABC and PQR,
$\angle A = \angle P$
AC = PR
$\angle C = \angle R$
By ASA congruence criterion, $\Delta ABC \cong \Delta PQR$.
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 ⊥ BC and AD is the bisector of angle BAC. Then, ΔABD ≅ ΔACD by RHS.

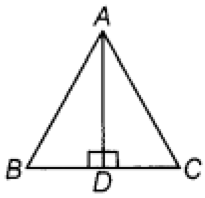


Fig. 6.29

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, $\Delta ABC \cong \Delta ACD$
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,
$5x + 3x + x = 180°$
$9x = 180°$
$x = 20°$
So, the angles are 5x = $5 \times 20° = 100°$, 3x = $3 \times 20° = 60°$ and $x = 20°$ that is $100°, 60°$ and $20°$.

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

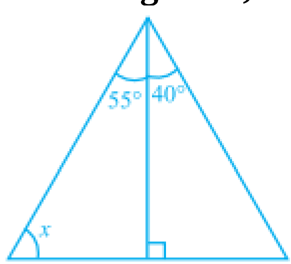


Fig. 6.30

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

$x + 55° + 90° = 180°$

$x + 145° = 180°$

$x = 180° - 145°$

$x = 35°$

Hence, the value of x is $35°$.

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

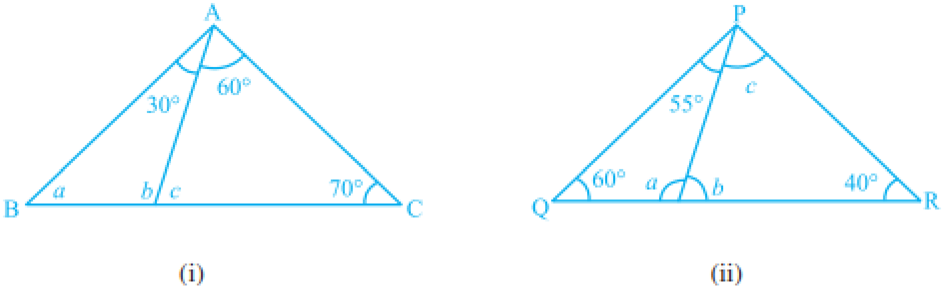
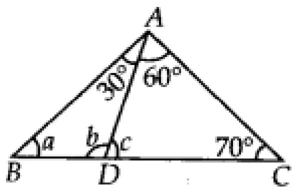


Fig. 6.31

Solution:

(i) In ΔADC, ∠ADB = ∠DAC+ ∠ACD [Exterior angle property]

b = 60° +70° = 130° …(i)



Now, in ΔABD, ∠ABD + ∠ADB + ∠BAD = 180° [Angle sum property]

a + b + 30° = 180°

a = 180° – 30° – 130° [using equation (I)]

a = 20° …(II)

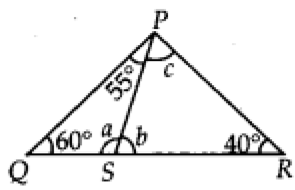
Also, ∠ADC = ∠BAD + ∠ABD [Exterior angle property]

c = 30° + a

c = 30° + 20° = 50° [using equation (II)]

Thus, a = 20°, b = 130°,c = 50°

(ii) In ΔPOS, ∠PSR = ∠SPQ+ ∠PQS [Exterior angle property]



b = 55° + 60°

b = 115° …(I)

Now, in ΔPRS, ∠PSR + ∠PRS + ∠SPR = 180° [Angle sum property]

b + 40° + c = 180°

c = 180° – 40° – 115° [using equation (I)]

c = 25° …(II)
Also, ∠PSQ = ∠SPR + ∠SRP [Exterior angle property]
a = c + 40°
a = 25° + 40° = 65° [using equation (II)]
Hence, a = 65°, b = 115°, c = 25°

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 ∠Y.

Solution:
∠X = ∠Y + 40° …(i)
∠Z = 90° …(ii)
In ΔXYZ
∠X + ∠Y+∠Z = 180° [Angle sum property]
∠Y + 30° + ∠Y + 90° = 180° [Using equation (i) and (ii)]
2∠Y = 180°- 90° – 30° = 60°

$$\angle Y = \frac{60°}{2}$$

$$\angle Y = 30°$$

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 ∠ A.

Solution:
Given: ∠A = ∠B – 40° …(i)
and ∠A = ∠C – 50° …(ii)

Now, in ΔABC
∠A + ∠B + ∠C = 180° [Angle sum property]
∠A + ∠A + 40° + ∠A + 50° = 180° [Using equation (i) and (ii)]
3∠A + 90° = 180°
3∠A = 180° – 90° = 90°

$$\angle A = \frac{90°}{3}$$

$$\angle A = 30°$$

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?

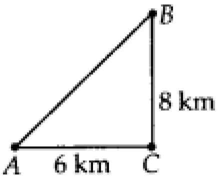
Solution:
As we know, a polygon having three sides is a triangle.
Given: the two angles are of measure 15° and 60°
Suppose third angle of triangle be x.
So, 15° + 60° + x = 180° [Angle sum property of a triangle]
x = 180° – 60° – 15°

x = 105°
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.

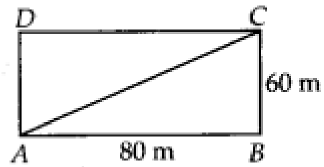


As, ΔABC is right angled.
So, $(AB)^2 = (AC)^2 + (BC)^2$
$(AB)^2 = 6^2 + 8^2 = 36 + 64 = 100$
AB = 10
Hence, Jiya is 10 km away from her starting place.

114. Jayanti takes shortest route to her home by walking diagonally across a rectangular park. The park measures 60 metres × 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, ΔABC is right angled.
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 m – 100 m = 40 m.

115. In ΔPQR of Fig. 6.32, PQ = PR. Find the measures of ∠Q and ∠R.

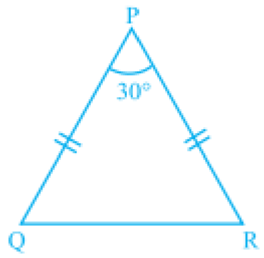


Fig. 6.32

Solution:

Given: PQ = PR

So, ∠PRQ = ∠PQR …(I)

Now, in ΔPOR

∠PQR + ∠PRQ+ ∠QPR = 180° [Angle sum property]

2∠POR + 30° = 180° [using equation (II)]

2∠PQR = 180° – 30° = 150°

$$\angle PQR = \frac{150°}{2}$$

$$\angle PQR = 75°$$

Hence, ∠Q = ∠R = 75°

116. In Fig. 6.33, find the measures of ∠ x and ∠ y.

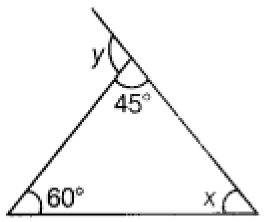
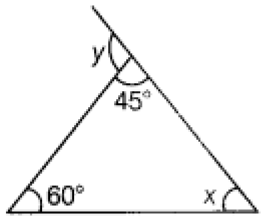


Fig. 6.23

Solution:



In ΔABC,

∠BAC + ∠ABC + ∠ACB = 180° [Angle sum property]

45° + 60° + x = 180°

x = 180°- 45° – 60° = 75° …(I)

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

y = 60° + x
y = 60° +75° = 135° [using equation (I)]
Hence, x = 75° and y = 135°

117. In Fig. 6.34, find the measures of ∠ PON and ∠ NPO.

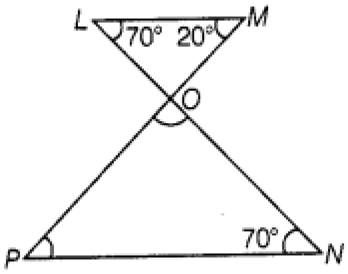


Fig. 6.34

Solution:

In ΔLOM,
∠LOM + ∠OLM+∠OML = 180° [Angle sum property]
∠LOM + 70° + 20° = 180°
∠LOM = 180° – 70° – 20° = 90°
∠LOM = ∠PON [Vertically opposite angles]

So, ∠PON = 90°
Now, in ΔPON,
∠PON + ∠ONP + ∠NPO = 180° [Angle sum property]
90° + 70° + ∠NPO = 180°
∠NPO = 180°- 90° – 70° = 20°
Hence, ∠PON = 90° and ∠NPO = 20°

118. In Fig. 6.35, QP || RT. Find the values of x and y.

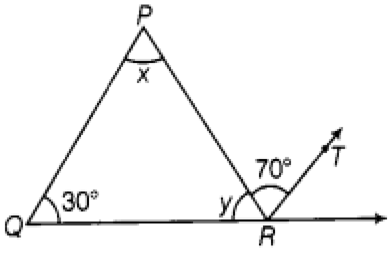


Fig. 6.35

Solution:

Given: QP || RT and PR is a transversal.
So, ∠QPR = ∠PRT [Alternate interior angles]
x = 70°
Now, QP || RT and QR is a transversal.

So, ∠PQR + ∠QRT = 180° [Co-interior angles]
30° + y + 70° = 180°
y = 180° – 30° – 70° = 80°
Hence, a = 70° and y = 80°,

119. Find the measure of ∠ A in Fig. 6.36.

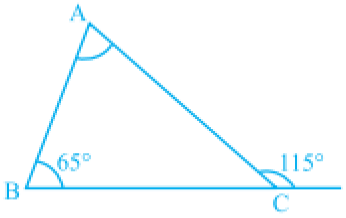
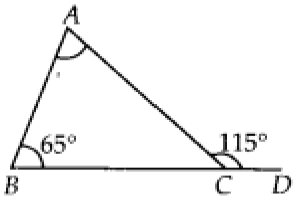


Fig. 6.36

Solution:

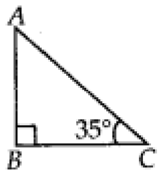


∠ACD = ∠ABC + ∠CAB [Exterior angle property]
115° = 65° + ∠CAB
∠CAB = 115° – 65°= 50°
Hence, ∠A = 50°

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

Solution:

Suppose ΔABC be the given triangle such that ∠B = 90° and ∠C = 35°

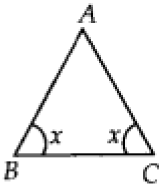


Now, ∠A +∠B + ∠C = 180° [Angle sum property]
⇒ ∠A = 180°- 90° – 35°
⇒ ∠A = 55°
Hence, third angle of triangle is 55°.

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



Now, $\angle B = \angle C = 4\angle A$ …(I) [given]
$\angle A + \angle B + \angle C = 180°$ [Angle sum property]
$\angle A + 4\angle A + 4\angle A = 180°$ [Using equation (I)]
$9\angle A = 180°$

$$\angle A = \frac{180°}{9}$$

$$\angle A = 80°$$

So, $\angle B = \angle C = 4 \times 20° = 80°$
Hence, 80, 809 and 20° 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, $2x + 3x + 5x = 180°$ [Angle sum property of a triangle]
$10x = 180°$

$$x = \frac{180°}{10}$$

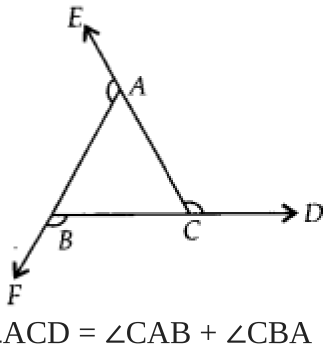
$$x = 18°$$

So, $2x = 2 \times 18° = 36°$, $3x = 3 \times 18° = 54$, $5x = 5 \times 18° = 90°$
Hence, 36°, 54° 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.



$\angle ACD = \angle CAB + \angle CBA$ …(i) [Exterior angle property]
$\angle BAE = \angle ABC + \angle ACB$ …(ii) [Exterior angle property]
$\angle CBF = \angle BAC + \angle BCA$ …(iii) [Exterior angle property]

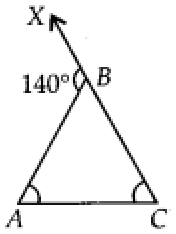
Adding equation (i), (ii) and (iii), get
∠ACD + ∠BAE +∠CBF = ∠CAB +∠CBA + ∠ABC + ∠ACB + ∠BAC + ∠BCA
∠ACD + ∠BAE + ∠CBF = 2[∠ABC + ∠ACB + ∠BAC]
= 2(180°) [Angle sum property]
= 360°

124. In ΔABC, if ∠A = ∠C, and exterior angle ABX = 140°, then find the angles of the triangle.

Solution:
∠ABX=∠BAC + ∠BCA [Exterior angle property]
140° =2∠BAC [∵ ∠A = ∠C]

$$\angle BAC = \frac{140°}{2}$$

$$\angle BAC = 70°$$



So, BAC =∠BCA = 70° …(I)

Now, in ΔABC
∠A +∠B + ∠C = 180° [Angle sum property]
∠B = 180° – 70° -70 [using equation (I)]
∠B = 40°
Hence, ∠A = 70°, ∠B = 40° and ∠C = 70° are the angles of triangle.

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

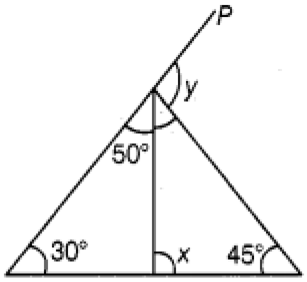
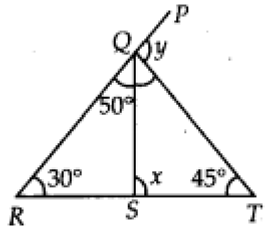


Fig. 6.37

Solution:
In ΔQRS, ∠QST = ∠QRS + ∠SOR [Exterior angle property]
x = 30° + 50° = 80°



Also, in ΔQRT, ∠PQT = ∠QRT + ∠QTR [Exterior angle property]
y = 30° + 45° = 75°
Hence, x = 80° and y = 75°

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

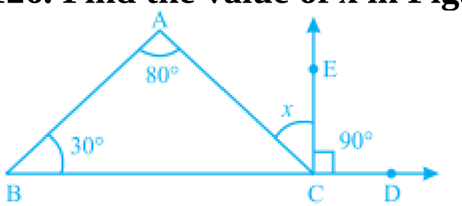


Fig. 6.38

Solution:

In ΔABC, ∠ACD= ∠CAB + ∠CBA [Exterior angle property]
x + 90° = 80° + 30°
x = 110°- 90° = 20°
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 ΔABC be the given triangle and descending order of angles of the triangle is ∠A, ∠B, ∠C
Now, ∠A – ∠B = 10° …(I)
∠B – ∠C = 10° …(II)

Also, ∠A +∠B + ∠C = 180° [Angle sum property]
∠B + 10° + ∠B + ∠B – 10° = 180° [Using equation (I) and (II)]
3∠B = 180°

$$\angle B = \frac{180°}{3}$$

$$\angle B = 60°$$

So, ∠A = ∠B + 10° = 60° + 10° = 70°
and ∠C = ∠B – 10° = 60° – 10° = 50°
Hence, 70°, 60° and 50° are the angles of the triangle.

128. In Δ ABC, DE || BC (Fig. 6.39). Find the values of x, y and z.

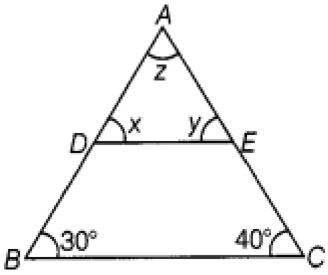


Fig. 6.39

Solution:

DE || BC and AB is a transversal.
So, ∠ADE = ∠DBC [Corresponding angles]
$x = 30°$

Now, DE || BC and AC is a transversal.
So, ∠AED = ∠ECB [Corresponding angles]
$y = 40°$

In ΔABC,
∠A + ∠B + ∠C = 180° [Angle sum property]
$z + 30° + 40° = 180°$
$z = 180° – 40° – 30° = 110°$
Hence, x = 30°, y = 40° and z = 110°.

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

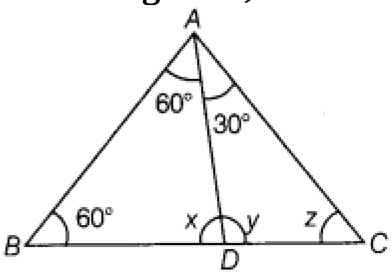
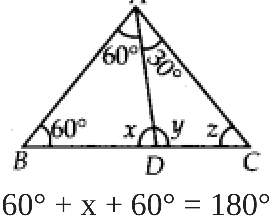


Fig. 6.40

Solution:

In ΔABD,
∠BAD + ∠BDA + ∠ABD = 180° [Angle sum property]



$60° + x + 60° = 180°$

x = 180° – 120° = 60°

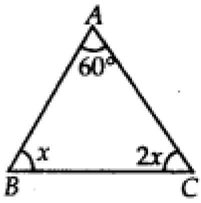
Now, ∠ADC = ∠BAD + ∠ABD [Exterior angle property]
y = 60° + 60° = 120°

Also, in ΔADC,
∠ADB – ∠DAC + ∠DCA [Exterior angle property]
x = 30° + z
z = 60° – 30° = 30° [x = 60°]
Hence, x = 60°, y = 120° and z = 30°

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 ΔABC be the given triangle such that ∠A = 60° and let angle B and C are x and 2x respectively.
∠A + ∠B + ∠C = 180° [Angle sum property]



60° + x + 2x = 180°
3x = 180° – 60° = 120°

$$x = \frac{120°}{3}$$

$$x = 40°$$

Hence, ∠B = 40° and ∠C = 2 × 40° = 80°

131. In ΔPQR, if 3∠P = 4∠Q = 6∠R, calculate the angles of the triangle.

Solution:

In ΔPOR,
∠P + ∠Q+ ∠R = 180° [Angle sum property]

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

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

$$\frac{(4+3+2)}{2}\angle R = 180°$$

$$\frac{9}{2}\angle R = 180°$$

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

$$\angle R = 40°$$

So,

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

And $\angle Q = \frac{6}{4} \times 40° = 60°$

Hence, ∠P = 80°, ∠Q = 60° and ∠R = 40°

132. In ΔDEF, ∠D = 60°, ∠E = 70° and the bisectors of ∠E and ∠F meet at O. Find (i) ∠F (ii) ∠EOF.

Solution:

(i) In ΔDEF,

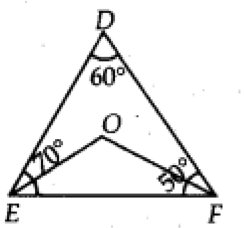
∠D + ∠E +∠F = 180° [Angle sum property]

60° +70° + ∠F = 180°

∠F = 180° – 60° – 70°= 50°

(ii) Given: EO and FO are the bisectors of ∠E and ∠F respectively.

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



And $\angle OFE = \angle OFD = \frac{50°}{2} = 25°$

Now, in ΔOEF,

∠OEF + ∠OFE+ ∠EOF = 180° [Angle sum property]

35° + 25° + ∠EOF = 180°

∠EOF = 180° – 35° – 25° = 120°

133. In Fig. 6.41, ΔPQR is right-angled at P. U and T are the points on line QRF. If QP || ST and US || RP, find ∠S.

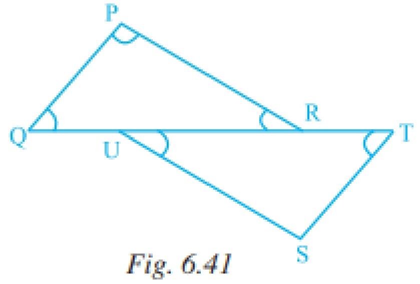


Fig. 6.41

Solution:

QP || ST and QT is a transversal.
So, ∠PQT = ∠STO [Alternate interior angles]
US || PR and UR is a transversal.

So, ∠PRU = ∠SUR [Alternate interior angles]
Two angles of ΔPQR equal to two angles of ΔSTU. Therefore, third angle also will be equal.
So, ∠QPR = ∠TSU

Now, given that ∠P = 90°
Hence, ∠S = 90°.

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.

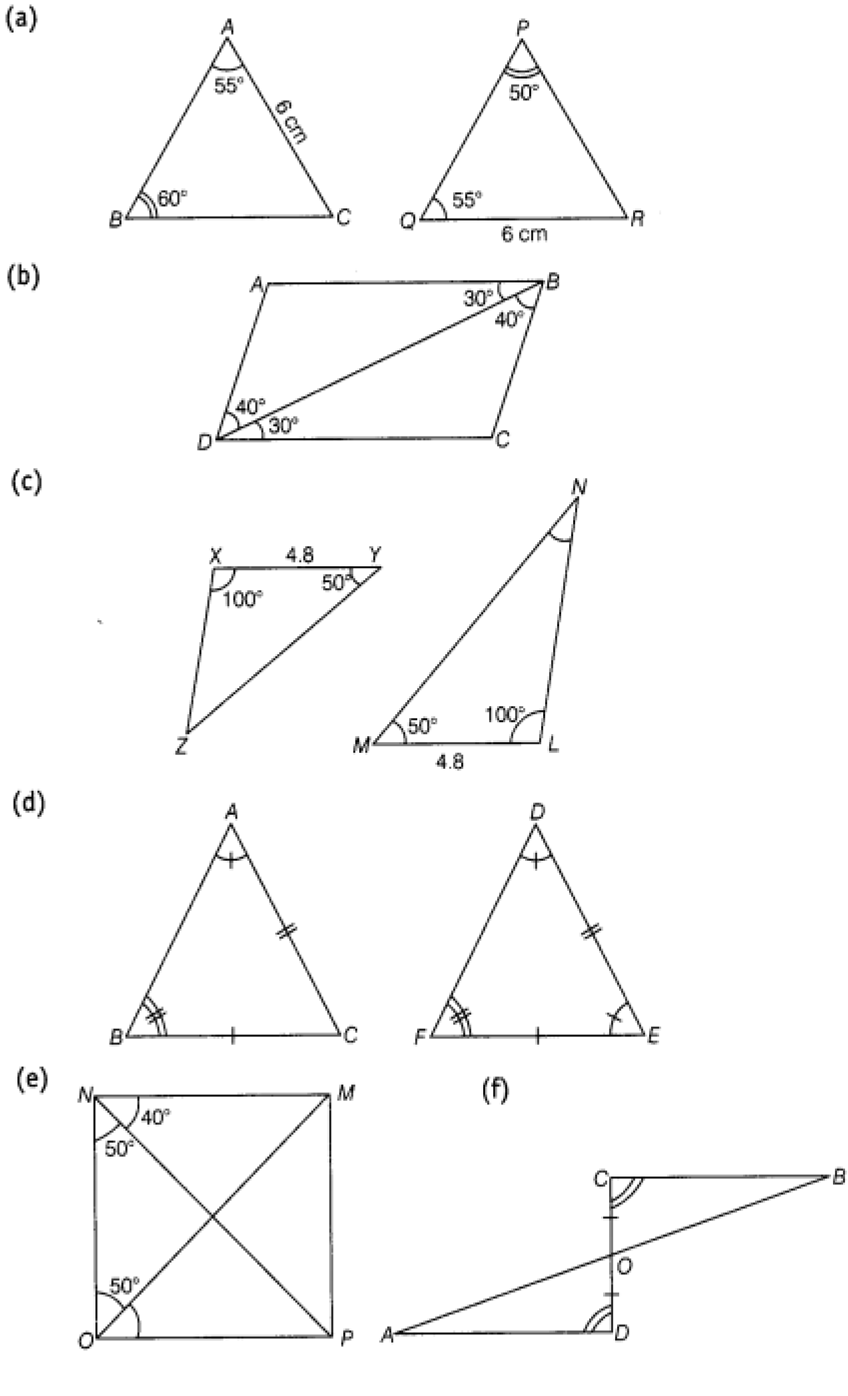


Fig. 6.42

Solution:

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

(b) In ΔABD and ΔCDB,

BD = DB (common)

∠ABD =∠CDB = 30° (given)

∠ADB = ∠CBD = 40° (given)
So, ΔABD ≅ ΔCDB (ASA criterion)

(c) In ΔXYZ and ΔLMN,
XY = LM = 4.8 (given)
∠YXZ = ∠MLN – 100° (given)
∠XYZ = LMN = 50° (given)
So, ΔXYZ ≅ ΔLMN (ASA criterion)

(d) In ΔABC and ΔDFE,
∠A =∠D (given)
∠B = ∠F (given)
So, ∠C = ∠E (since two angles are equal)
BC = FE (given)
So, ΔABC ≅ ΔDFE (ASA criterion)

(e) In ΔPON and ΔMNO,
NO = ON (common)
∠NOP = ∠ONM = 50° + 40 = 90° (given)
∠ONP = ∠NOM = 50° (given)
So, ΔPON ≅ ΔMNO (ASA criterion)

(f) In ΔAOD and ΔBOC,
∠AOD = ∠BOC (Vertically opposite angles)
OD = OC (given)
∠ADO = ∠BCO (given)
So, ΔAOD ≅ ΔBOC (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:

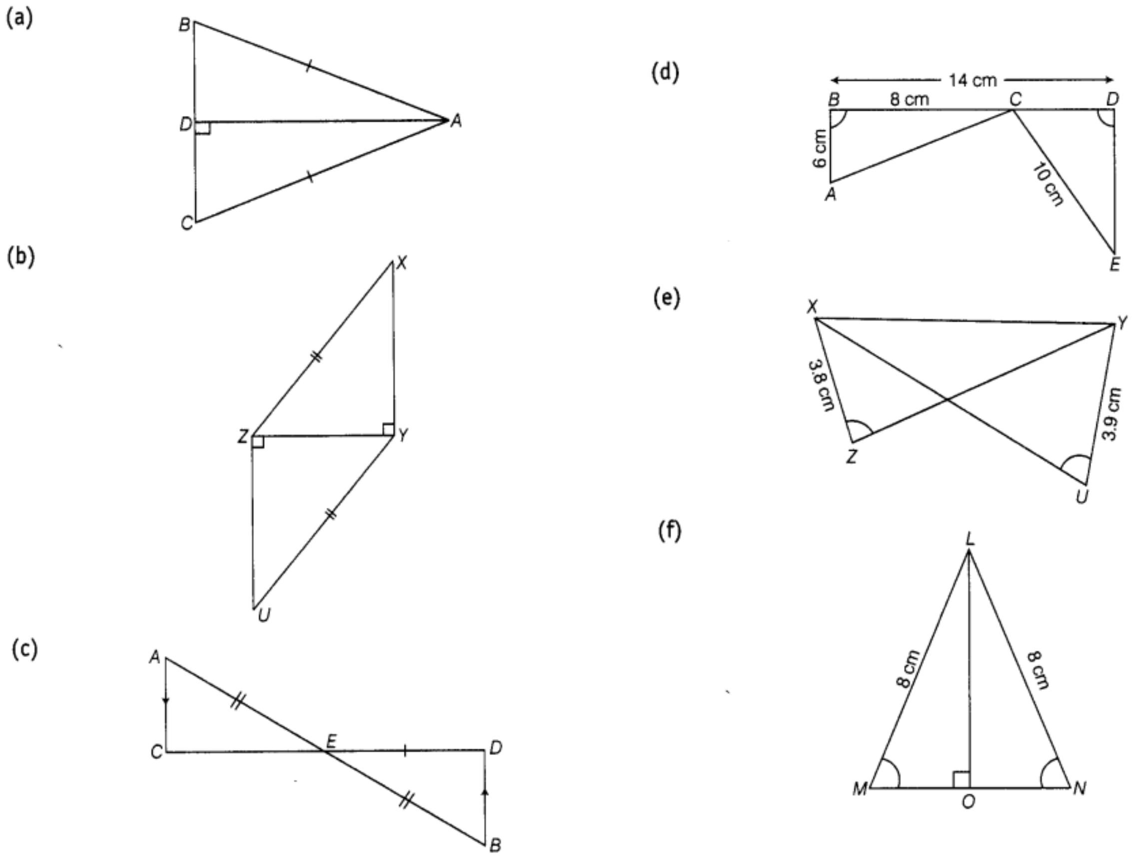


Fig. 6.43

Solution:

(a) In ΔADB and ΔADC,
AD = AD (common)
∠ADB = ∠ADC (Each 90°)
AB = AC (given hypotenuse)
So, ΔADB ≅ ΔADC (RHS criterion)

(b) In ΔXYZ and ΔUZY,
∠Y = ∠Z (Each 90°)
XZ = UY (given hypotenuse)
YZ = ZY (common)
So, ΔXYZ ≅ ΔUZY (RHS criterion)

(c) In ΔACE and ΔBDE,
∠ACE = ∠BDE (AC || BD, alternate interior angles)
CE = DE (given)
∠AEC = ∠BED (Vertically opposite angles)
So, ΔACE ≅ ΔBDE (ASA criterion)
So, triangles are congruent but not by RHS congruence criterion

(d) In ΔABC, by Pythagoras theorem
$(AC)^2 = (AB)^2 + (BC)^2$
$= 6^2 + 8^2 = 36 + 64 = 100 = 10^2$
So, AC – 10 cm

In ΔEDC,
DC = BD – BC = (14 – 8) cm = 6cm, CE = 10 cm
Now, in ΔABC and ΔCDE,
∠B =∠D (each 90°)
AB = CD = 6 cm
AC = CE = 10 cm (hypotenuse)
So, ΔABC ≅ ΔCDE (RHS criterion)

(e) In the given figure, ΔXYZ and ΔYXU are not congruent by any criterion.

(f) In ΔLMO and ΔLNO,
LO = LO (common)
LM = LN = 8 cm (hypotenuse)
∠LOM = ∠LON (each 90°)
So, ΔLOM ≅ ΔLON (RHS criterion)

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

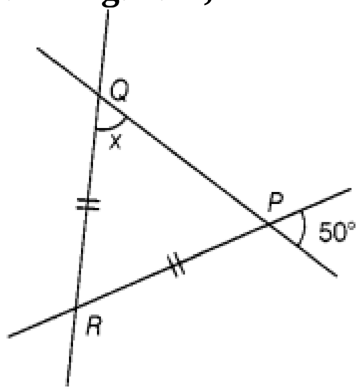


Fig. 6.44

Solution:

RP = RQ
So, ∠RQP = ∠RPQ = x [angles opposite to equal sides are equal]
Now, ∠RPQ = 50° [vertically opposite angles]
Hence, x = 50°.

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

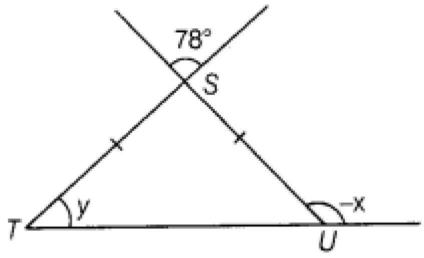


Fig. 6.45

Solution:
∠TSU = 78° [vertically opposite angles]
∠SUT = ∠STU = y [∵ ST = SU]

Now, in ΔSTU,
∠STU + ∠SUT + ∠TSU = 180° [Angle sum property]
y + y + 78° = 180°
2y = 180° – 78° = 102°

$$y = \frac{102°}{2}$$

$$y = 51°$$

Now, x = ∠TSU + ∠UTS [Exterior angle property]
x = 78° + 51°
x = 129°
Hence, x = 129° and y = 51°,

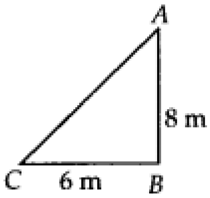
138. Check whether the following measures (in cm) can be the sides of a right-angled triangle or not. 1.5, 3.6, 3.9

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.
$(1.5)^2 + (3.6)^2 = 2.25 + 12.96 = 15.21$ and $(3.9)^2 = 15.21$
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, ΔABC is a right angled triangle.
So, $(AC)^2 = (AB)^2 + (BC)^2$
$(AC)^2 = 8^2 + 6^2 = 64 + 36$
$(AC)^2 = 100 = 10^2$
So, AC = 10 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.

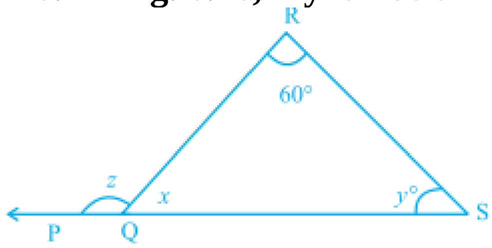


Fig. 6.46

Solution:

In ΔQRS,
∠ROS + ∠RSQ + ∠QRS = 180° [Angle sum property]
x + y + 60° = 180°
x + 5x = 180° – 60° [∵ y = 5x (given)]
6x = 120°

$$x = \frac{120°}{6}$$

$x = 20°$
So, y = 5x = 5 × 20° – 100°
Now, ∠RQP = ∠QRS + ∠QSR [Exterior angle property]
z = 60° + 100° = 160°
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.
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) ΔSTU ≅ ΔDEF (b) ΔABC ≅ ΔLMN (c) ΔYZX ≅ PQR (d) ΔXYZ ≅ ΔMLN

Solution:
(a) ΔSTU ≅ ΔDEF
ST = DE, TU= LF, SU = DF
∠STU = ∠DEF, ∠SUT = ∠DFE, ∠TSU = ∠EDF

(b) ΔABC ≅ ΔLMN
AB = LM, BC = MN, AC = LN
∠ABC = ∠LMN, ∠ACB = ANM, ∠BAC =∠MLN

(c) ΔYZX ≅ ΔPOR
YZ = PQ, ZX = OR, YX = PR
∠YZX=∠POR, ∠YXZ = ∠PRO, ∠XYZ = ∠RPQ
(d) ΔXYZ ≅ ΔMLN
XY = ML, YZ = LN, XZ = MN
∠XYZ = ∠MLN, ∠XZY = ∠MNL, ∠ZXY = ∠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:

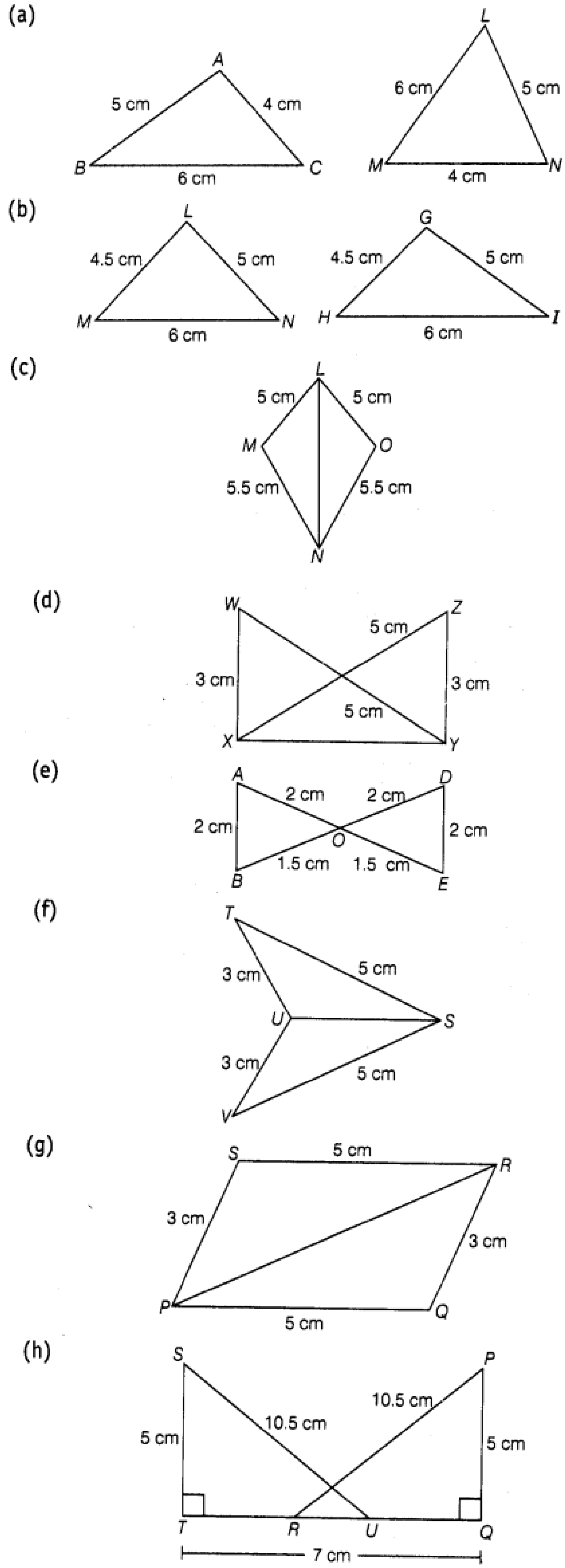

(a)
A
5 cm
4 cm
B
6 cm
C
L
6 cm
5 cm
M
4 cm
N
(b)
L
4.5 cm
5 cm
M
6 cm
N
G
4.5 cm
5 cm
H
6 cm
I
(c)
L
5 cm
5 cm
M
O
5.5 cm
5.5 cm
N
(d)
W
Z
5 cm
3 cm
3 cm
5 cm
X
Y
(e)
A
2 cm
2 cm
D
2 cm
O
2 cm
1.5 cm
1.5 cm
B
E
(f)
T
3 cm
5 cm
U
S
3 cm
5 cm
V
(g)
S
5 cm
R
3 cm
3 cm
P
5 cm
Q
(h)
S
P
10.5 cm
10.5 cm
5 cm
5 cm
T
R
U
Q
7 cm

Fig. 6.47

Solution:

(a) In ΔABC and ΔNLM,
AB = NL = 5 cm (given)
BC = LM = 6 cm (given)
AC = NM = 4 cm (given)
So, $\Delta ABC \cong \Delta NLM$ (SSS criterion)

(b) In ΔLMN and ΔGHI,
LM = GH = 4.5 cm (given)
LN = GI = 5 cm (given)
MN = HI = 6 cm (given)
So, $\Delta LMN \cong \Delta GHI$ (SSS criterion)

(c) In ΔLMN and ΔLON,
LM = LO = 5 cm (given)
MN = ON = 5.5 cm (given)
LN = LN (common)
So, $\Delta LMN \cong \Delta LON$ (SSS criterion)

(d) In ΔXYZ and ΔYXW,
XY = YX (common)
ZY = WX = 3 cm (given)
ZX = WY = 5 cm (given)
So, $\Delta YXW \cong \Delta XYZ$ (SSS criterion)

(e) In ΔAOB and ΔDOE,
AO = DO = 2 cm (given)
AB = DE = 2 cm (given)
BO = EO = 1.5 cm (given)
So, $\Delta AOB \cong \Delta DOE$ (SSS criterion)

(f) In ΔSTU and ΔSVU,
SU = SU (common)
ST = SV = 5 cm (given)
UT = UV = 3 cm (given)
So, $\Delta STU \cong \Delta SVU$ (SSS criterion)

(g) In ΔPQR and ΔRSP,
PR = RP (common)
PQ = RS = 5 cm (given)
OR = SP = 3 cm (given)
So, $\Delta PQR \cong \Delta RSP$ (SSS criterion)

(h) In ΔSTU, by Pythagoras theorem,

$TU^2 = (10.5)^2 - 5^2 = 135.25$

and in ΔPQR, $QR^2 = (10.5)^2 - 5^2 = 135.25$

(i) So, $TU^2 = QR^2$

TU = QR …(I)

In ΔSTU and ΔPOR,

ST = PQ = 5 cm (given)

SU = PR = 10.5 cm (given)

TU = QR [From equation (I)].

ΔSTU ≅ ΔPQR (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 ΔABD ≅ ΔACD. If so why?

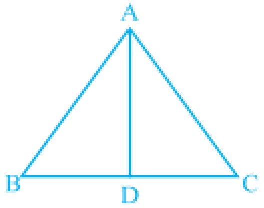


Fig. 6.48

Solution:

(a) In ΔABD and ΔACD,

AD = AD (common)

AB = AC (given)

BD = CD (D is mid-point of BC)

(b) Yes, by using part (a), get

ΔABD ≅ ΔACD (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 ΔNOM ≅ ΔMLN. Give reason?

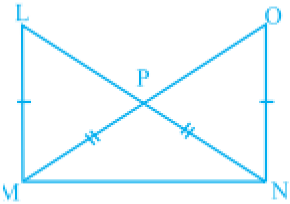


Fig. 6.49

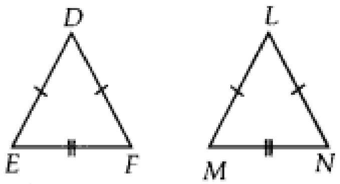
Solution:

(a) In ΔNOM and ΔMLN,
NM = MN (common)
OM = LN (given)
ON = LM (given)

(b) Yes, by using part (a), we get
ΔNOM ≅ ΔMLN (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 ∠ E = 40°, what is the measure of ∠ N?

Solution:



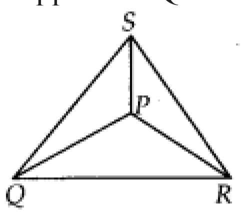
In ΔDEF and ΔLMN,
EF = MN (given)
DE = LM given
DF = LN [∵ DE = DF and LM = LN]

So, ΔDEF ≅ ΔLMN (SSS criterion)
So, ∠E = ∠M [By C.P.C.T.)
Now, ∠E = 40° ⇒ ∠M = 40°
Since, ∠M = ∠N [∵ LN = LM]
Hence, ∠N = 40°.

147. If ΔPQR and ΔSQR 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:

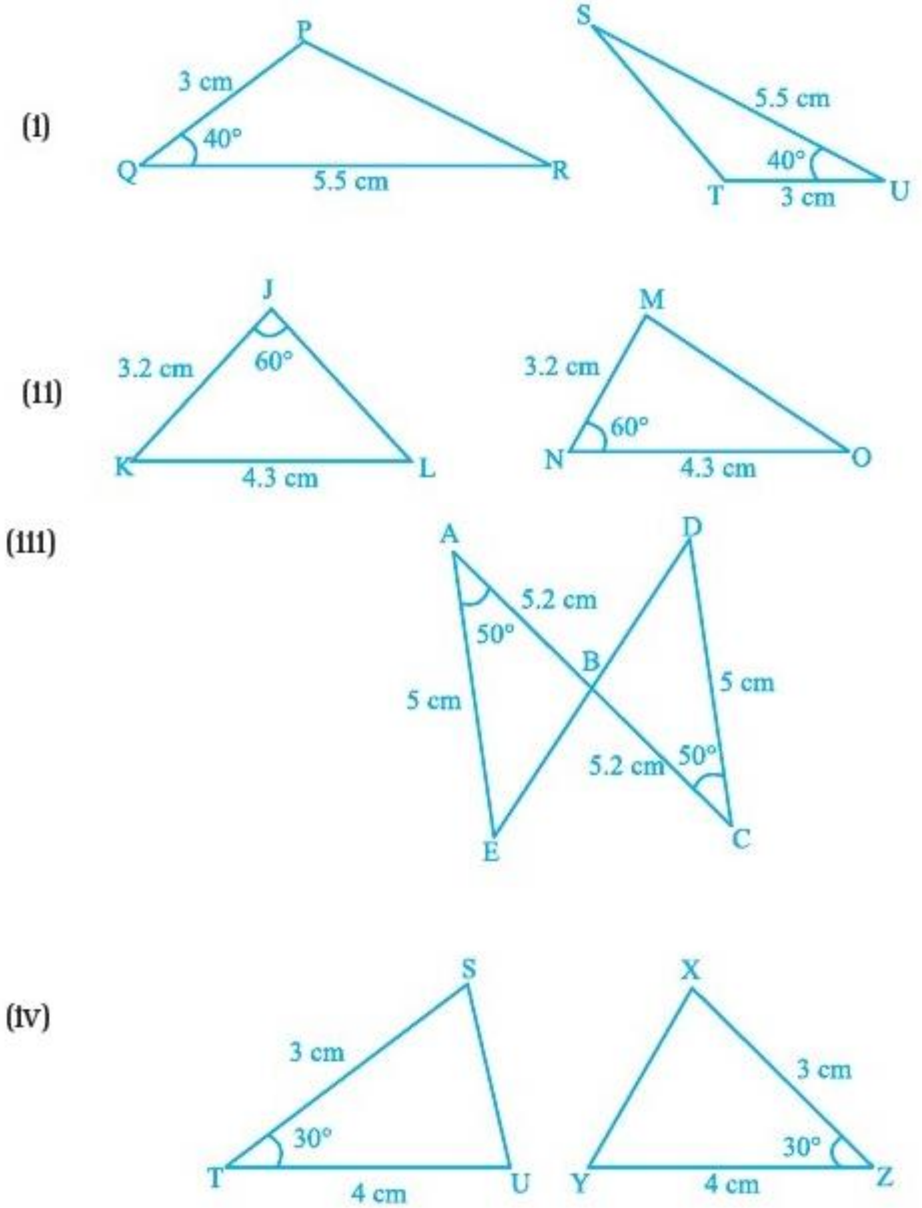
Suppose ΔPQR and ΔSOR are the given triangles such that PQ = PR and SQ = SR.



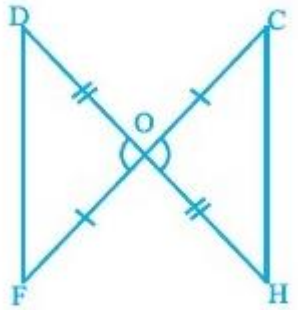
Now, in ΔPSQ and ΔPSR,
PQ = PR (given)
SQ = SR (given)
PS = PS (common)

So, ΔPSQ ≅ ΔPSR (SSS criterion)
Yes, the ΔPSQ and ΔPSR are congruent by using SSS criterion

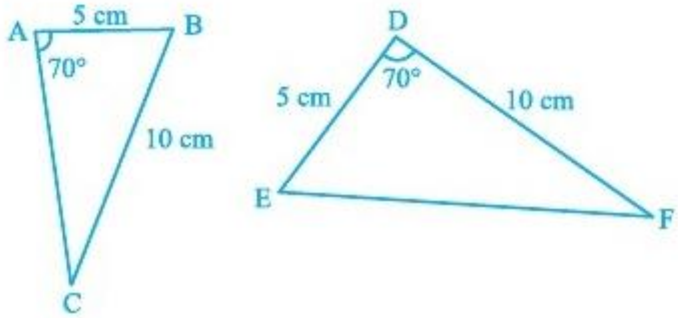
148. In Fig. 6.50, which pairs of triangles are congruent by SAS congruence criterion (condition)? If congruent, write the congruence of the two triangles in symbolic form.



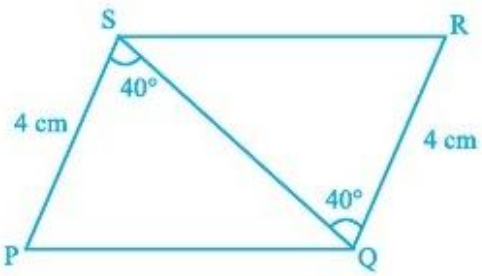
(v)



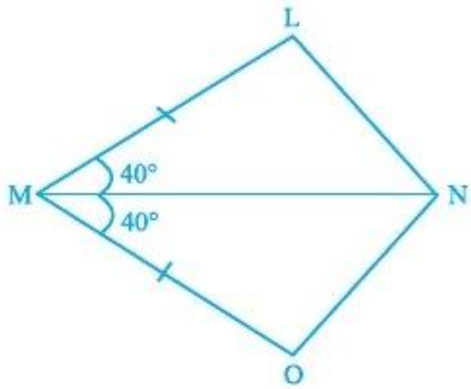
(vi)



(vii)



(viii)



Solution:

(j) In ΔPOR and ΔTUS,

PQ = TU = 3 cm (given)

OR = US = 5.5 cm (given)

∠POR = ∠TUS = 40° (given)

So, ΔPOR ≅ ΔTUS (SAS criterion)

(ii) In the given figure, ΔJKL and ΔMNO are not congruent by any criterion.

(iii) In ΔABE and ΔCBD,

∠EAB = ∠DCB = 50° (given)

AE = CD = 5 cm (given)

AB = CB = 5.2 cm (given)

So, ΔABE ≅ ΔCBD (SAS criterion)

(iv) In ΔSUT and ΔXYZ

ST = XZ = 3 cm (given)
UT = YZ = 4 cm (given)
∠STU = ∠XZY = 30° (given)
So, ΔSUT ≅ ΔXYZ (SAS criterion)

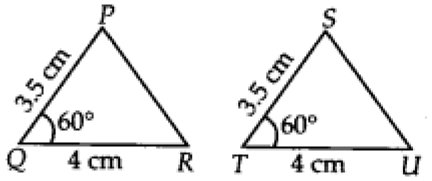
(v) In ΔDOF and ΔHOC,
DO = HO (given)
FO = CO (given)
∠DOF = ∠HOC (Vertically opposite angles)
So, ADOF ≅ AHOC (SAS criterion)

(vi) In the given figure, ΔABC and ΔDEF are not congruent by any criterion.

(vii) In ΔPSQ and ΔRQS.
SQ = QS (common)
PS = RQ = 4 cm (given)
∠PSQ = ∠RQS = 40° (given)
So, ΔPSQ ≅ ΔROS (SAS criterion)

(viii) In ΔLMN and ΔOMN,
MN = MN (common)
LM = OM (given)
∠LMN = ∠OMN = 40° (given)
So, ΔLMN ≅ ΔOMN (SAS criterion)

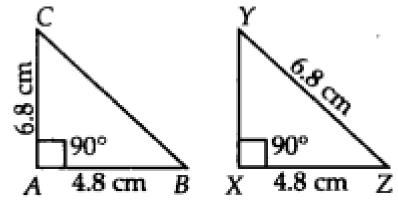
149. State which of the following pairs of triangles are congruent. If yes, write them in symbolic form (you may draw a rough figure).
(a) Δ PQR : PQ = 3.5 cm, QR = 4.0 cm, ∠ Q = 60° Δ STU : ST = 3.5 cm, TU = 4 cm, ∠ T = 60°
(b) ΔABC : AB = 4.8 cm, ∠ A = 90°, AC = 6.8 cm ΔXYZ : YZ = 6.8 cm, ∠ X = 90° , ZX = 4.8 cm

Solution:
(a)


In ΔPQR and ΔSTU,
PQ = ST = 3.5 cm (given)
∠PQR = ∠STU = 60° (given)

OR = TU = 4 cm (given)
So, ΔPQR ≅ ΔSTU (SAS criterion)

(b) Here, ΔABC and ΔXYZ are not congruent by any criterion.



150. In Fig. 6.51, PQ = PS and ∠ 1 = ∠ 2.
(i) Is ΔPQR ≅ ΔPSR? Give reasons.
(ii) Is QR = SR? Give reasons.

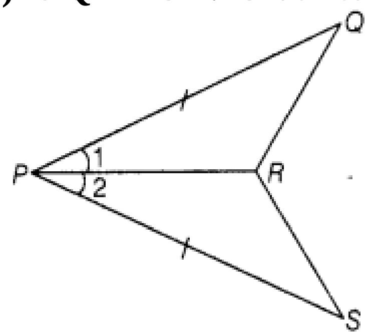


Fig. 6.51

Solution:

(i) In ΔPQR and ΔPSR,
PQ = PS (given)
∠1 = ∠2 (given)
PR = PR (common)
So, ΔPOR ≅ ΔPSR (SAS criterion)

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

151. In Fig. 6.52, DE = IH, EG = FI and ∠ E = ∠ I. Is ΔDEF ≅ ΔHIG? If yes, by which congruence criterion?

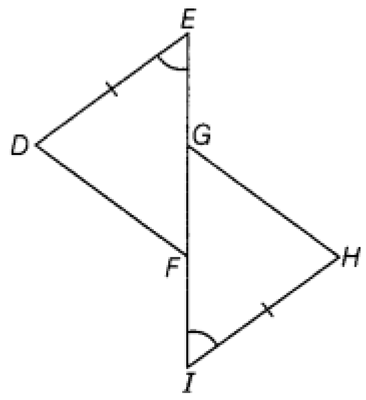


Fig. 6.52

Solution:

In ΔDEF and ΔHIG,

DE = HI (given)

∠E = ∠I (given)

EF = IG

$$\begin{bmatrix} EG = IF \ \ (\text{Given}) \\ EG + GF = IF + GF \\ EF = IG \end{bmatrix}$$

So, ΔDEF ≅ ΔHIG (SAS criterion)

152. In Fig. 6.53, ∠1 = ∠ 2 and ∠ 3 = ∠ 4.
(i) Is ΔADC ≅ Δ ABC? Why ?
(ii) Show that AD = AB and CD = CB.

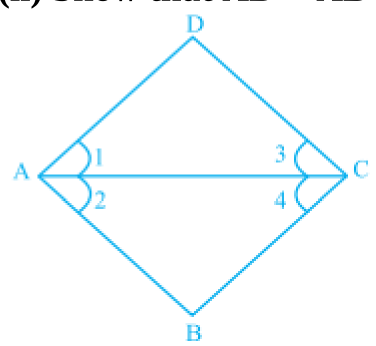


Fig. 6.53

Solution:

(i) In ΔADC and ΔABC,

∠1 = ∠2 [given]

AC = AC [common]

∠3 = ∠4 [given]

So, ΔADC = ΔABC (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 DBC.
(i) Is ΔABC ≅ ΔDCB? Why?
(ii) Is AB = DC? Why?
(iii) Is AC = DB? Why?

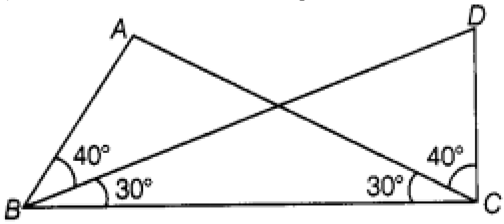


Fig. 6.54

Solution:
(i) In ΔABC and ΔDCB,
∠ABC = ∠DCB = 40° + 30 = 70° (given)
∠ACB = ∠DBC = 30° (given)
BC = CB (common)
So, ΔABC ≅ ΔDCB (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 ⊥ PR, RT ⊥ PQ and QS = RT.
(i) Is Δ QSR ≅ Δ RTQ? Give reasons.
(ii) Is ∠ PQR = ∠ PRQ? Give reasons.

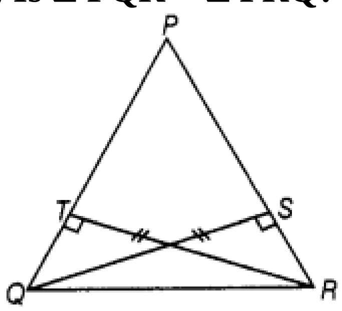


Fig. 6.55

Solution:

(i) In ΔQSR and ΔRTO,

∠OSR = ∠RTO = 90° [QS ⊥ PR and RT ⊥ PQ (given)]

QS = RT [given]

QR = RO [common hypotenuse]

So, ΔQSR ≅ ΔRTQ [RHS criterion]

(ii) Yes, by using (1) part, we get

∠TQR = ∠SRQ [By C.P.C.T]

Hence, ∠PQR = 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.

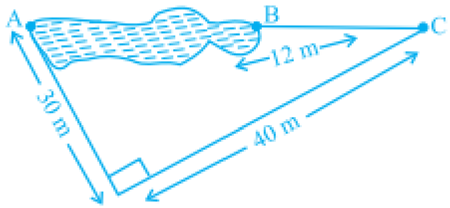
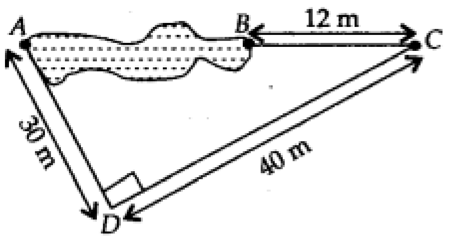


Fig. 6.56

Solution:



Since, ΔADC is right-angled triangle

So, $(AC)^2 = (AD)^2 + (CD)^2$

$= (30)^2 + (40)^2$

$= 900 + 1600$

$= 2500$

$= (50)^2$

So, AC = 50 m

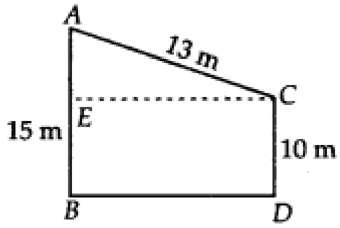
Now, AB = AC – BC = 50 – 12 = 38

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 ΔAEC,

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

$(13)^2 = 5^2 + (EC)^2$

$(EC)^2 = 169 – 25 = 144 – (12)^2$

sSo, EC = 12 m

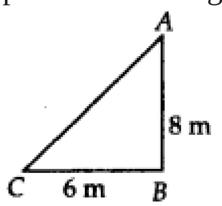
Also, BD – 12 m

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 ΔABC,

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

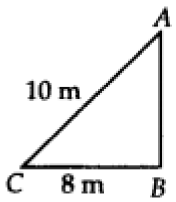
$= 8^2 + 6^2$

$= 64 + 36 = 100 = (10)^2$

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 ΔABC,

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

$(10)^2 = (AB)^2 + (8)^2$

$(AB)^2 = 100 – 64 = 36 = (6)^2$
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 ΔABC and ΔEOD. Is ΔABC ≅ Δ EOD? Why?

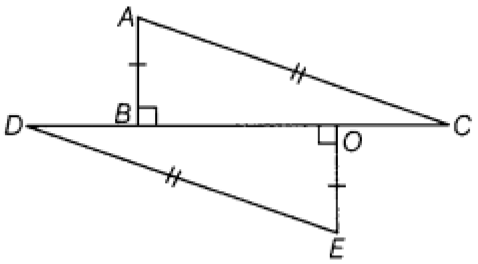


Fig. 6.57

Solution:

In ΔABC and ΔEOD,
AB = EO (given)
∠ABC = ∠EOD = 90° [Given]
AC = ED [given hypotenuse]
Hence, Δ ABC ≅ Δ EOD (RHS criterion)