Unit 6(Triangles)

Multiple Choice Questions (MCQs)

Question 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 :

(d) As we know, sum of any two sides in a triangle is always greater than the third side.

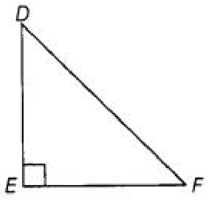
So, only 4 is the minimum value that satisfies as a side in triangle.

$$\begin{Bmatrix} 10 < 6.5 + 4 \\ 6.5 < 10 + 4 \\ 4 < 10 + 6.5 \end{Bmatrix}$$

Question 2:

ΔDEF of following figure is a right angled 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

Solution :

(c) Since, ∠D and ∠F are complementary angles.

In ΔDEF,

$\angle D + \angle E + \angle F = 180^\circ$ [angle sum property of a triangle]

$\Rightarrow \angle D + 90^\circ + \angle F = 180^\circ$ [$\because \angle E = 90^\circ$, given]

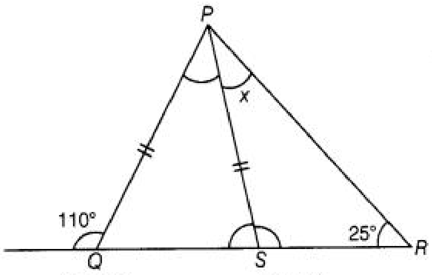
$\Rightarrow \angle D + \angle F = 180^\circ - 90^\circ$

$\Rightarrow \angle D + \angle F = 90^\circ$

Note *Two angles whose measures add to 180° are known as* ***supplementary angles*** *and two angles whose measures add to 90° are known as* ***complementary angles****.*

Question 3:

In the given figure, PQ = PS. The value of x is



(a) 35° (b) 45° (c) 55° (d) 70°

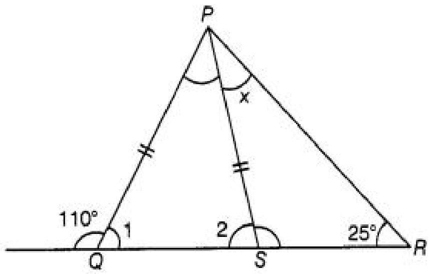
Solution :

(b) In ΔPQS,

$110° + \angle 1 = 180°$ [linear pair of angles]

$\Rightarrow \angle 1 = 180° - 110°$

$\Rightarrow \angle 1 = 70°$



Also, $\angle 1 = \angle 2 = 70°$ $[\because PQ = PS]$

As we know, the measure of any exterior angle of a triangle is equal to the sum of the measures of its two interior opposite angles.

$\therefore \angle 2 = x + 25°$

$\Rightarrow 70° = x + 25°$ $[\because \angle 2 = 70°]$

$\Rightarrow x = 70° - 25°$

$\Rightarrow x = 45°$

Question 4:

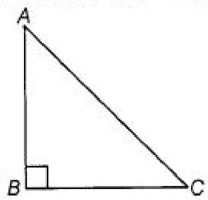
In a right angled triangle, the angles other than the right angle are

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

Solution :

(c) In right angled ΔABC, $\angle B = 90°$

$\therefore \angle A + \angle B + \angle C = 180°$ [angle sum property of a triangle]



$\Rightarrow \angle A + 90° + \angle C = 180°$

$\Rightarrow \angle A + \angle C = 180° - 90° = 90°$

Hence, in a right angled triangle, the angles other than the right angle are acute.

Question 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

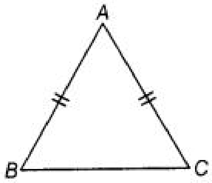
(c) (iii) only (d) (i) and (ii)

Solution :

(d) As we know, the sum of the interior angles of a triangle is 180°.

(i) According to the question,

$$70° + 55° + 55° = 180°$$



(ii) According to the question,

$$70° + 70° + 40° = 180°$$

(iii) Not possible, because two angles must be equal in an isosceles triangle.

So, (i) and (ii) can be possible.

Question 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.

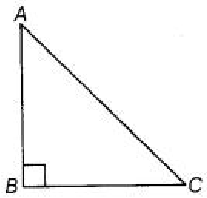
In the given option(s) which is true?

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

Solution :

(c) In a right angled ΔABC,

$$\angle B = 90°$$



As we know,

$$\angle A + \angle B + \angle C = 180° \quad \text{[angle sum property of a triangle]}$$

$$\Rightarrow \angle A + 90° + \angle C = 180°$$

$$\Rightarrow \angle A + \angle C = 180° - 90° = 90°$$

Hence, remaining two angles are complementary.

Question 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 :

(c) Since, these sides satisfy the Pythagoras theorem, therefore it is right angled triangle.

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

According to Pythagoras theorem,

$$3^2 + 4^2 = 5^2$$

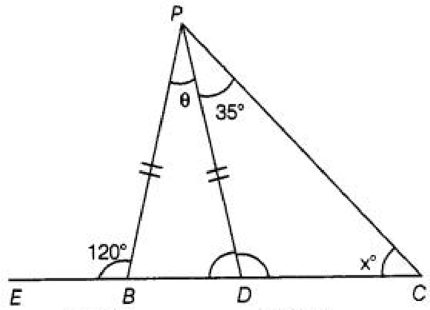
$$\Rightarrow 9 + 16 = 25$$

$$\Rightarrow 25 = 25 \quad \text{(satisfied)}$$

Note: The area of the square built upon the hypotenuse of a right angled triangle is equal to the sum of the areas of the squares upon the remaining sides is known as Pythagoras theorem.

Question 8:

In the given figure, PB = PD. The value of x is



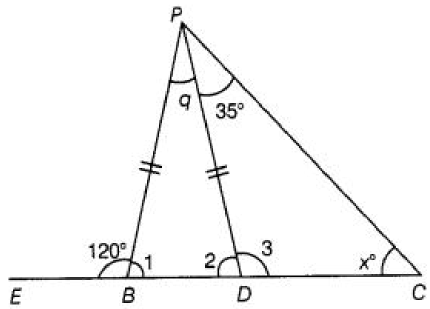
(a) 85° (b) 90° (c) 25° (d) 35°

Solution :

(c) In ΔPBD, $\angle 1 + 120° = 180°$ [linear pair]

$\angle 1 = 180° - 120° = 60°$

Also, $\angle 1 = \angle 2 = 60°$ [$\because PB = PD$]



Also, $\angle 2 + \angle 3 = 180°$ [linear pair]

$\Rightarrow$ $60° + \angle 3 = 180° \Rightarrow \angle 3 = 180° - 60°$

$\Rightarrow$ $\angle 3 = 120°$

In ΔPDC, $35° + \angle 3 + x° = 180°$ [angle sum property of a triangle]

$\Rightarrow$ $35° + 120° + x° = 180°$

$\Rightarrow$ $155° + x° = 180° \Rightarrow x° = 180° - 155°$

$\Rightarrow$ $x = 25°$

Question 9:

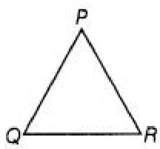
In A PQR,

(a) PQ – QR > PR (b) PQ +QR<PR

(c) PQ-QR< PR (d) PQ +<PR<QR

Solution :

(c) As we know, sum of the lengths of any two sides of a triangle is always greater than the length of the third side.



In ΔPQR, $PR + QR > PQ$

$\Rightarrow$ $PR > PQ - QR$

$\Rightarrow$ $PQ - QR < PR$

Question 10:

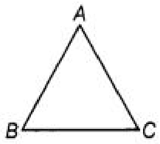
In Δ ABC,

(a) AB+BC> AC (b) AB + BC< AC

(c) AB+AC < BC (d) AC + BC < AB

Solution :

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



In ΔABC,

$$AB + BC > AC$$

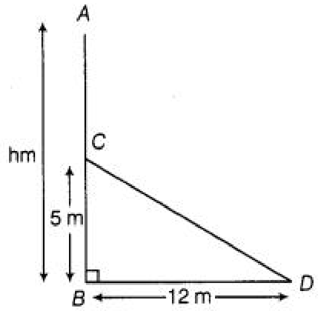
Question 11:

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 :

(c) Let AB be the given that tree of height h m, which is broken at D which is 12 m away from its base and the height of remaining part, i.e. CS is 5 m.



Now, $AB = AC + BC$

$\Rightarrow$ $AC = AB - BC = h - 5$

$\Rightarrow$ $AC = CD = h - 5$ ...(i)

In right angled ΔBDC, $CD^2 = CB^2 + BD^2$ [by Pythagoras theorem]

$\Rightarrow$ $(h-5)^2 = (5)^2 + (12)^2$ [from Eq. (i)]

$\Rightarrow$ $(h-5)^2 = 25 + 144$

$\Rightarrow$ $(h-5)^2 = 169$

$\Rightarrow$ $h - 5 = \sqrt{169} = 13$

$\Rightarrow$ $h = 13 + 5$

$\Rightarrow$ $h = 18\,\text{m}$

Hence, the height of the tree is 18 m.

Question 12:

The ΔABC formed by AB = 5 cm, BC = 8 cm and AC = 4 cm is

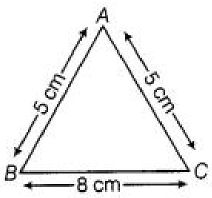
(a) an isosceles triangle only (b) a scalene triangle only

(c) an isosceles right triangle (d) scalene as well as a right triangle

Solution :

(b) (i) It's not isosceles triangle as all the sides are of different measure.

(ii) It's not right triangle, since it does not follow Pythagoras theorem.



$$4^2 + 5^2 = 8^2$$

$\Rightarrow$ $16 + 25 = 64$

$\Rightarrow$ $41 \neq 64$ (not satisfied)

Hence, it is a scalene triangle as all the sides are of different measure.

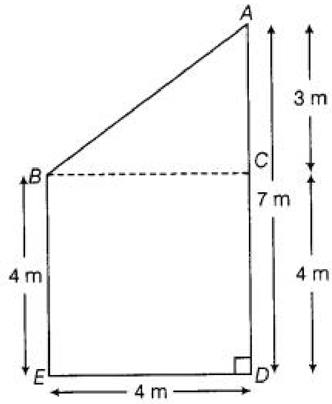
Question 13:

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 :

(b) Let BE be the smaller tree and AD be the bigger tree. Now, we have to find AB (i.e. the distance between their tops).



By observing,

$$ED = BC = 4\text{m and } BE = CD = 4\text{ m}$$

In ΔABC, $BC = 4\text{m}$

and $AC = AD - CD = (7-4)\text{m} = 3\text{m}$

In right angled ΔABC,

$$AB^2 = AC^2 + BC^2 = 4^2 + 3^2 \text{ [by Pythagoras theorem]}$$

$$= 16 + 9$$

$\Rightarrow$ $AB^2 = 25$

$\Rightarrow$ $AB = \sqrt{25}$

$\Rightarrow$ $AB = 5\text{m}$

Therefore, the distance between their tops is 5 m.

Question 14:

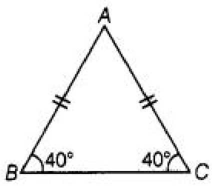
If in an isosceles triangle, each of the base angle is 40°, then the triangle is

(a) right angled triangle (b) acute angled triangle

(c) obtuse angled triangle (d) isosceles right angled triangle

Solution :

(c) As we know, the sum of the interior angles of a triangle is 180°.



In ΔABC,

$$\angle A + \angle B + \angle C = 180° \quad \text{[angle sum property of a triangle]}$$

$\Rightarrow$ $\angle A + 40° + 40° = 180°$

$\Rightarrow$ $\angle A = 180° - 80°$

$\Rightarrow$ $\angle A = 100°$ [obtuse angle]

Therefore, it is an obtuse angled triangle. Since, it has one angle which is greater than 90°.

Question 15:

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

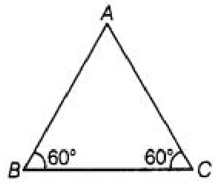
(a) isosceles but not equilateral (b) scalene

(c) equilateral (d) right angled

Solution :

(c) In ΔABC,

$$\angle A + \angle B + \angle C = 180^\circ \quad \text{[angle sum property of a triangle]}$$
$$\Rightarrow \angle A + 60^\circ + 60^\circ = 180^\circ \quad [\because \angle B = \angle C = 60^\circ, \text{ given}]$$
$$\Rightarrow \angle A + 120^\circ = 180^\circ$$
$$\Rightarrow \angle A = 60^\circ$$



Since, all the angles are of 60°. So, it is an equilateral triangle.

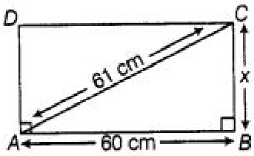
Question 16:

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 :

(d) Given, length of rectangle = 60 cm and its diagonal = 61 cm,



Let the breadth of a rectangle be x cm.

In right angled ΔABC,

$$\Rightarrow (AC)^2 = (AB)^2 + (BC)^2$$
$$\Rightarrow (BC)^2 = (AC)^2 + (AB)^2 \quad \text{[by Pythagoras theorem]}$$
$$\Rightarrow x^2 = (61)^2 - (60)^2 = 3721 - 3600 = 121$$
$$\Rightarrow x = \sqrt{121} = 11 \text{ cm}$$

$\therefore$ Breadth of rectangle = 11 cm and length of rectangle = 60 cm

Now, perimeter of rectangle $= 2(l + b)$

$= 2(60 + 11) = 2 \times 71$

$= 142$ cm

Question 17:

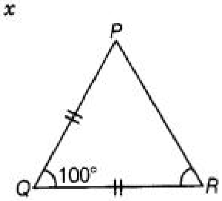
In ΔPQR, if PQ = QR and ∠Q = 100°, then ∠R is equal to

(a) 40° (b) 80° (c) 120° (d) 50°

Solution :

(a) In ΔPQR, $PQ = QR$ [given]

Let $\angle P = \angle R = x$



As we know,

$$\therefore \angle P + \angle Q + \angle R = 180^\circ \quad \text{[angle sum property of a triangle]}$$
$$\Rightarrow x + 100^\circ + x = 180^\circ \quad [\because \angle Q = 100^\circ, \text{ given}]$$
$$\Rightarrow 2x + 100^\circ = 180^\circ$$
$$\Rightarrow 2x = 80^\circ$$
$$\Rightarrow x = 40^\circ$$

Hence, $\angle P = \angle R = 40^\circ$

Question 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

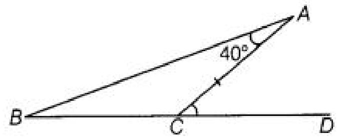
(d) Difference of any two sides of a triangle is greater than the third side

Solution :

(d) The difference of the length of any two sides of a triangle is always smaller than the length of the third side.

Question 19:

In the given figure, BC = CA and ∠A = 40°. Then, ∠ACD is equal to



(a) 40° (b) 80° (c) 120° (d) 60°

Solution :

(b) Given, $BC = CA$,

$\therefore \quad \angle B = \angle A = 40^\circ$ [∵ opposite angles of two equal sides are equal]

As we know, the measure of any exterior angle of a triangle is equal to the sum of the measure of its two interior opposite angles.

So, $\angle ACD = \angle A + \angle B = 40^\circ + 40^\circ$

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

Question 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) 2 cm and 16 cm (d) 1 cm and 16 cm

Solution :

(c) The third side must be greater than the difference between two sides and less than the sum of two sides.

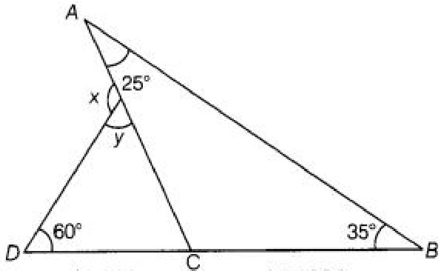
Sum of two sides = 7 + 9 = 16 cm

Difference of two sides = 9 – 7 = 2 cm

So, length of the third side must lie between 2 cm and 16 cm.

Question 21:

From the following figure, the value of x is



(a) 75° (b) 90° (c) 120° (d) 60°

Solution :

(c) In ΔABC, $\angle CAB + \angle ABC + \angle BCA = 180^\circ$ [angle sum property of a triangle]

$\Rightarrow \quad 25^\circ + 35^\circ + \angle BCA = 180^\circ$

$\Rightarrow \quad \angle BCA = 180^\circ - 60^\circ$

$\Rightarrow \quad \angle BCA = 120^\circ$

Also, $\angle BCA$ is an exterior angle.

$\therefore \quad \angle BCA = \angle D + y$

$\Rightarrow \quad y = \angle BCA - \angle D = 120^\circ - 60^\circ$ [∵ $\angle D = 60^\circ$, given]

$\Rightarrow \quad y = 60^\circ$

Now, $\angle x$ and $\angle y$ form a linear pair

$\therefore \quad x + y = 180^\circ$

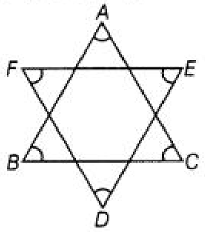
$\Rightarrow \quad x + 60^\circ = 180^\circ$

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

Question 22:

In the given figure, the value of

$\angle A + \angle B + \angle C + \angle D + \angle E + \angle F$ is



(a) 190° (b) 540° (c) 360° (d) 180°

Solution :

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

In ΔABC, $\angle A + \angle B + \angle C = 180°$ [interior angles of ΔABC] ...(i)

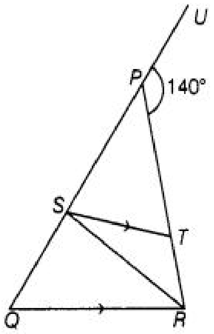
In ΔDEF, $\angle D + \angle E + \angle F = 180°$ [interior angles of ΔDEF] ...(ii)

On adding Eqs.(i) and (ii), we get

$$\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 180° + 180°$$
$$= 360°$$

Question 23:

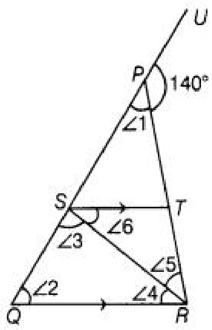
In the given figure, PQ = PR, RS = RQ and ST || QR. If the exterior ∠RPU is 140°, then the measure of ∠TSR is



(a) 55° (b) 40° (c) 50° (d) 45°

Solution :

(b) Here,



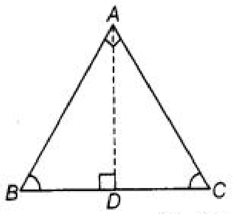
$\angle 1 + \angle P = 180°$ [linear pair]

$\Rightarrow$ $\angle 1 + 140° = 180°$

$\Rightarrow$	$\angle 1 = 180° - 140°$	
$\Rightarrow$	$\angle 1 = 40°$	
Since,	$PQ = PR$	
$\therefore$	$\angle Q = \angle R = x$	[say]
In ΔPQR,	$\angle P + \angle Q + \angle R = 180°$	[angle sum property of a triangle]
$\Rightarrow$	$40° + x + x = 180°$	
$\Rightarrow$	$2x = 180° - 40° \Rightarrow 2x = 140°$	
$\Rightarrow$	$x = 70°$	
So,	$\angle Q = \angle R = 70°$	
Given that,	$RS = RQ$	
$\therefore$	$\angle 2 = \angle 3 = 70°$	
In ΔSQR,	$\angle 2 + \angle 3 + \angle 4 = 180°$	[angle sum property of a triangle]
$\Rightarrow$	$70° + 70° + \angle 4 = 180°$	
$\Rightarrow$	$\angle 4 = 180° - 140°$	
$\Rightarrow$	$\angle 4 = 40°$	
Also,	$ST \parallel QR$	[given]
Now,	$\angle 4 = \angle 6 = 40°$	[alternate interior angles]
$\therefore$	$\angle TSR = 40°$	

Question 24:

In the given figure ∠BAC = 90°, AD ⊥ BC and ∠BAD = 50°, then ∠ACD is



(a) 50° (b) 40°
(c) 70° (d) 60°

Solution :

(a) Given, $\angle BAC = 90°$, $AD \perp BC$ and $\angle BAD = 50°$

In ΔABD,	$\angle ABD + \angle DAB + \angle ADB = 180°$	[angle sum property of a triangle]
$\Rightarrow$	$\angle ABD + 50° + 90° = 180°$	
$\Rightarrow$	$\angle ABD + 40° = 180° \Rightarrow \angle ABD = 180° - 40°$	
$\Rightarrow$	$\angle ABD = 40°$	
Now, in ΔABC,	$\angle A + \angle B + \angle C = 180°$	[angle sum property of a triangle]
$\Rightarrow$	$90° + 40° + \angle C = 180°$	
$\Rightarrow$	$\angle C = 180° - 130°$	
$\Rightarrow$	$\angle C = 50°$	
$\therefore$	$\angle ACD = 50°$	

Question 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 :

Let A, B and C be the angles of the triangle. Then, one angle of a triangle is equal to the sum of the other two angles,

i.e. $\angle A = \angle B + \angle C$ …(i)

As we know,	$\angle A + \angle B + \angle C = 180°$	[angle sum property of a triangle]
$\Rightarrow$	$\angle A + \angle A = 180°$	[from Eq. (i)]
$\Rightarrow$	$2\angle A = 180° \Rightarrow \angle A = \frac{180°}{2}$	
$\Rightarrow$	$\angle A = 90°$	

Hence, the triangle is right angled.

Question 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 :

(b) As we know, the measure of any exterior angle is equal to the sum of two opposite interior angles.

Let the interior angle be x.

Given that, interior opposite angles are equal.

$\therefore \quad 130° = x + x$

$\Rightarrow \quad 130° = 2x \quad \Rightarrow \quad x = \frac{130°}{2}$

$\Rightarrow \quad x = 65°$

Hence, the interior angle is = 65°.

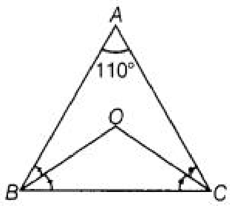
Question 27:

If one of the angle 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 :

(d) In ΔABC, $\angle A = 110°$ [given]



We know, that $\angle A + \angle B + \angle C = 180°$ [angle sum property of a triangle]

$\Rightarrow \quad \angle B + \angle C = 180° - \angle A$

$\Rightarrow \quad \angle B + \angle C = 180° - 110°$

$\Rightarrow \quad \angle B + \angle C = 70° \quad \ldots(i)$

$\Rightarrow \quad \frac{1}{2}\angle B + \frac{1}{2}\angle C = \frac{70}{2} = 35°$ [$\because$ Eq. (i) is divided by 2]

$\Rightarrow \quad \frac{1}{2}(\angle B + \angle C) = 35°$

Now, in ΔBOC,

$\angle BOC + \angle OBC + \angle OCB = 180°$ [angle sum property of a triangle] ...(ii)

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

[$\because$ OB and OC are the bisectors of $\angle B$ and $\angle C$, then $\angle OBC = \frac{1}{2}\angle B$ and $\angle OCB = \frac{1}{2}\angle C$]

$\Rightarrow \quad \angle BOC + 35° = 180°$

$\Rightarrow \quad \angle BOC = 180° - 35°$

$\Rightarrow \quad \angle BOC = 145°$

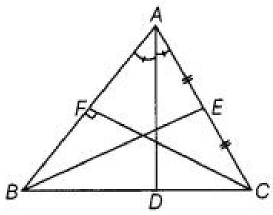
Question 28:

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 :

(b) As we know, median of a triangle bisects the opposite sides.



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

Question 29:

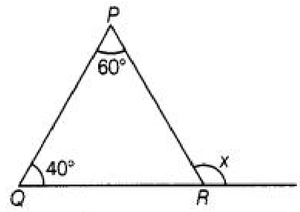
In ΔPQR, if ∠P = 60° and ∠Q = 40°, then the exterior angle formed by producing QR is equal to

(a) 60° (b) 120°

(c) 100° (d) 80°

Solution :

(c) As we know, the measure of exterior angle is equal to the sum of opposite two interior angles.



In ΔPQR, $\angle x$ is the exterior angle.

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

$= 60° + 40° = 100°$

Question 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 :

(d) We know that, the sum of the interior angles of a triangle is 180°.

Now, we will verify the given triplets :

(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.

Question 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 m

Solution :

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

Hence, option (c) satisfies the given condition.

Verification

18+14 >5

18 + 5 > 14

5+ 14> 18

Question 32:

How many altitudes does a triangle have?

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

Solution :

(b) A triangle has 3 altitudes

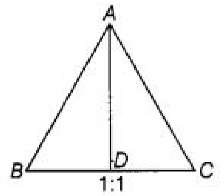
Question 33:

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 :

(a) Consider ΔABC in which AD divides BC in the ratio 1:1.



Now, $BD : DC = 1:1$

$\Rightarrow \frac{BD}{DC} = \frac{1}{1}$

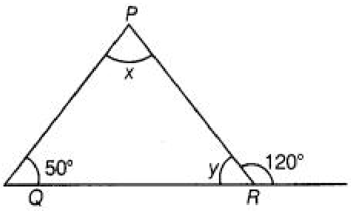
$\therefore BD = DC$

Since, AD divides BC into two equal parts. Hence, AD is the median.

Note: The line segment joining a vertex of a triangle to the mid-point of its opposite side is called a median.

Question 34:

The measures of $\angle x$ and $\angle y$ in the given figure are respectively



(a) 30°, 60° (b) 40°, 40° (c) 70°, 70° (d) 70°, 60°

Solution :

(d) As we know,

Measure of exterior angle = Sum of the opposite interior angles

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

$\Rightarrow 120° = x + 50°$ $[\because \angle R = 120°]$

$\Rightarrow x = 120° - 50°$

$\Rightarrow x = 70°$

Now, the sum of the interior angles of a triangle is 180°.

$\therefore x + y + 50° = 180°$

$\Rightarrow 70° + y + 50° = 180°$

$\Rightarrow 120° + y = 180°$

$\Rightarrow y = 180° - 120°$

$\Rightarrow y = 60°$

Question 35:

If 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 :

(d) As we know, sum of any two sides of a triangle is always greater than the third side. So, option (d) satisfy this rule.

Verification

6+6>10

6+ 10> 6

10+ 6> 6

Question 36:

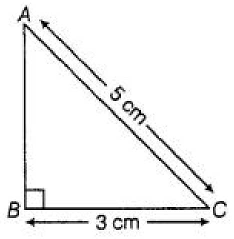
In a right angled ΔABC, if ∠B = 90°, BC = 3 cm and AC = 5 cm, then the length of side AB is

(a) 3 cm (b) 4 cm

(c) 5 cm (d) 6 cm

Solution :

(b) Since, Δ ABC is a right angled triangle.



In right angled ΔABC,

$$AC^2 = AB^2 + BC^2 \quad \text{[by Pythagoras theorem]}$$

$\Rightarrow$ $5^2 = AB^2 + 3^2$ [$\because AC = 5$ cm and $BC = 3$ cm, given]

$\Rightarrow$ $AB^2 = 25 - 9$

$\Rightarrow$ $AB^2 = 16 \Rightarrow AB = \sqrt{16}$

$\Rightarrow$ $AB = 4$ cm

Question 37:

In a right angled Δ ABC, if ∠B = 90°, then which of the following is true?

(a) $AS^2 = BC^2 + AC^2$

(b) $A C^2 = AB^2 + BC^2$

(c) AB = BC + AC

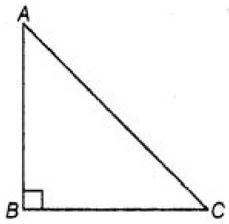
(d) AC = AB + BC

Solution :

(b) According to Pythagoras theorem,

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

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

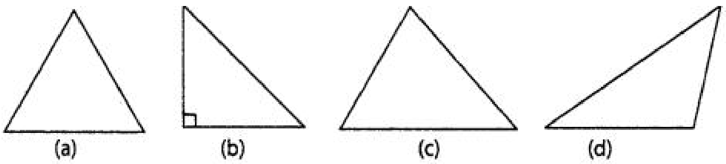


Question 38:

Which of the following figures will have it's altitude outside triangle?

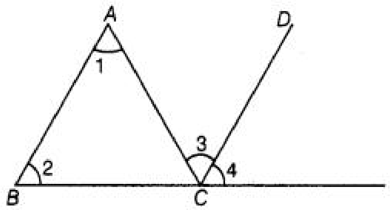
Solution :

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



Question 39:

In the given figure, if AB || CD, then



(a) ∠2 = ∠3

(b) ∠1 = ∠4

(c) ∠4 = ∠1 + ∠2

(d) ∠1 + ∠2 = ∠3 + ∠4

Solution :

(d) Given, AB || CD and AC is the transversal.

So, $\angle 1 = \angle 3$ [alternate interior angles]

Also, in ΔABC, $\angle 3 + \angle 4 = \angle 1 + \angle 2$

[∵ exterior angle = sum of two opposite interior angles]

Question 40:

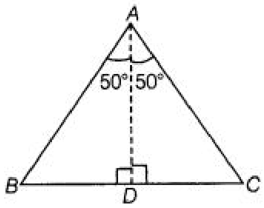
In ΔABC, ∠A = 100°, AD bisects ∠A and AD ⊥ BC. Then, ∠B is equal to

(a) 80° (b) 20° (c) 40° (d) 30°

Solution :

(c) Given, $\angle BAD = \angle DAC = 50°$ [∵ AD bisects ∠A and ∠A = 100°]

and $\angle BDA = \angle ADC = 90°$ [∵ AD ⊥ BC]



Now, in ΔABD,

$\angle ABD + \angle BAD + \angle BDA = 180°$ [angle sum property of a triangle]

$\Rightarrow \angle ABD + 50° + 90° = 180°$

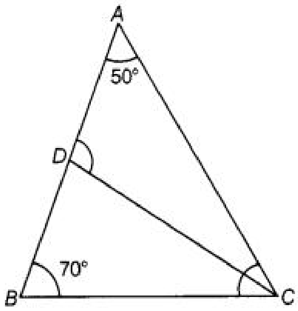
$\Rightarrow \angle ABD + 140° = 180°$

$\Rightarrow \angle ABD = 180° - 140°$

$\Rightarrow \angle ABD = 40°$

Question 41:

In ΔABC, ∠A = 50°, ∠B = 70° and bisector of ∠C meets AB in D as shown in the given figure. Measure of ∠ADC is



(a) 50° (b) 100° (c) 30° (d) 70°

Solution :

(b) In ΔADC,

$\angle ADC + \angle DAC + \angle ACD = 180°$ [angle sum property of a triangle]

$\Rightarrow \angle ADC + 50° + \angle ACD = 180°$ [∵ ∠DAC = 50°]

$\Rightarrow \angle ACD = 130° - \angle ADC$ ... (i)

In ΔDBC, $\angle ADC = \angle DBC + \angle BCD$

[∵ exterior angle is equal to sum of opposite interior angles]

$\Rightarrow \angle ADC = 70° + \angle ACD$ [∵ ∠ACD = ∠BCD]

$\Rightarrow \angle ADC = 70° + 130° - \angle ADC$ [from Eq. (i)]

$\Rightarrow \angle ADC = 200° - \angle ADC$

$\Rightarrow 2\angle ADC = 200°$

$\Rightarrow \angle ADC = \frac{200°}{2}$

$\Rightarrow \angle ADC = 100°$

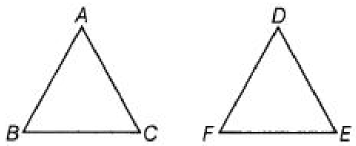
Question 42:

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 :

(b) Two figures are said to be congruent, if the trace copy of figure 1 fits exactly on that of figure 2.



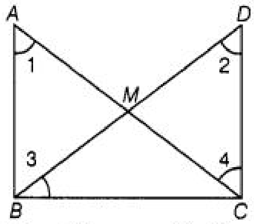
Now, if ΔABC and ΔDEF are congruent, then

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

Hence, option (b) is not true.

Question 43:

In the given figure, 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) $\angle 1 = \angle 3$

Solution :

(b) In ΔAMB and ΔCMD,

$AM = CM$ [M is the mid-point]

$BM = DM$ [M is the mid-point]

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

By SAS congruence criterion,

$\Delta AMB \cong \Delta CMD$

$\therefore$ $\angle 1 = \angle 4$ [by CPCT]

Question 44:

If D is the mid-point of side BC in ΔABC, where AB = AC, then ∠ADC is

(a) 60° (b) 45° (c) 120° (d) 90°

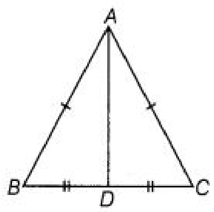
Solution :

(d) In ΔADB and ΔADC,

$BD = DC$ [D is the mid-point]

$AB = AC$ [given]

$AD = AD$ [common side]



By SSS congruence criterion, $\Delta ABD \cong \Delta ACD$

$\therefore$ $\angle ADB = \angle ADC$ [by CPCT]

We know that, $\angle ADB + \angle ADC = 180°$ [linear pair]

$\Rightarrow$ $2\angle ADC = 180°$ [$\because \angle ADB = \angle ADC$]

$\Rightarrow$ $\angle ADC = 90°$

Question 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

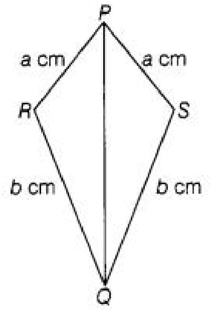
(c) SAS congruence criterion (d) AAA congruence criterion

Solution :

(b) 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.

Question 46:

By which congruency criterion, the two triangles in the given figure are congruent?



(a) RHS (b) ASA

(c) SSS (d) SAS

Solution :

(c) In ΔPQR and ΔPQS,

$$PR = PS = a\text{ cm}$$
$$RQ = SQ = b\text{ cm}$$
$$PQ = PQ = \text{Common line segment}$$

By SSS congruence criterion,

$$\Delta PQR \cong \Delta PQS$$

Question 47:

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

(a) AAA (b) SSS

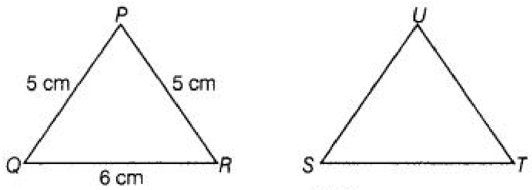
(c) SAS (d) ASA

Solution :

(a) AAA is not a congruency criterion, because if all the three angles of two triangles are equal; this does not imply that both the triangles fit exactly on each other.

Question 48:

If ΔPQR is congruent to ΔSTU as shown in the given figure, then what is the length of TU?



(a) 5 cm (b) 6 cm

(c) 7 cm (d) Cannot be determined

Solution :

(b) Given that, $\Delta PQR \cong \Delta STU$

$\Rightarrow$ $PQ = ST$

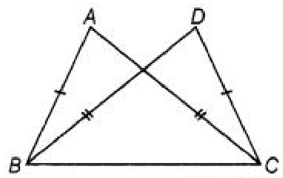
$\Rightarrow$ $QR = TU$

$\Rightarrow$ $PR = SU$

Hence, $TU = QR = 6\text{cm}$

Question 49:

If ΔABC and ΔDBC are on the same base BC, AB = DC and AC = DB as shown in the given figure, then which of the following gives a congruence relationship?



(a) $\Delta ABC \cong \Delta DBC$ (b) $\Delta ABC \cong \Delta CBD$

(c) $\Delta ABC \cong \Delta DCB$ (d) $\Delta ABC \cong \Delta BCD$

Solution :

(c) Since, $AB = DC$ [given]

and $AC = DB$

$BC = BC$ [common base]

By SSS congruence criterion,

$$\Delta ABC \cong \Delta DCB$$

Fill in the Blanks

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

Question 50:

The_______triangle always has altitude outside itself.

Solution :

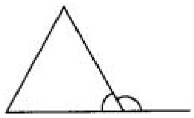
The **obtuse** angled triangle always has altitude outside itself,

Question 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°**, because they form a linear pair.



Question 52:

The longest side of a right angled triangle is called its______.

Solution :

Hypotenuse is the longest side of a right angled triangle.

Question 53:

Median is also called______in an equilateral triangle.

Solution :

Median is also called **an altitude** in an equilateral triangle.

Question 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°** as all the angles in an equilateral triangle are equal.

Let x be the angle of equilateral.

According to the angle sum property of a triangle, [∵ measure of each angle = x (say)]

$$x + x + x = 180°$$

$$\Rightarrow 3x = 180°$$

$$\Rightarrow x = \frac{180°}{3}$$

$$\Rightarrow x = 60°$$

Question 55:

In an isosceles triangle, two angles are always______.

Solution :

In an isosceles triangle, two angles are always **equal.** Since, if two sides are equal, then the angles opposite them are equal.

Question 56:

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

Solution :

In an isosceles triangle, angles opposite to equal sides are**equal.** Since, if two angles are equal then the sides opposite to them are also equal.

Question 57:

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

Solution :

Let the angles of a triangle be a, band c. It is given that,

$$a = b + c$$

We also know that, $a + b + c = 180^\circ$ [angle sum property of a triangle]

$\Rightarrow$ $a + a = 180^\circ$ [$\because b + c = a$]

$\Rightarrow$ $2a = 180^\circ$

$\Rightarrow$ $a = \frac{180^\circ}{2}$

$\Rightarrow$ $a = 90^\circ$

Hence, the measure of that angle is **90°**.

Question 58:

Every triangle has atleast______acute angle (s).

Solution :

Every triangle has atleast **two** acute angles.

Question 59:

Two line segments are congruent, if they are of______lengths.

Solution :

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

Question 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.

Question 61:

Two rectangles are congruent, if they have same______and______.

Solution :

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

Question 62:

Two squares are congruent, if they have same………………. .

Solution :

Two squares are congruent, if they have same **side**.

Question 63:

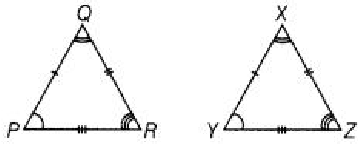
If ΔPQR and ΔXYZ are congruent under the correspondence QPR ↔ XYZ, then

(i) ∠R =______ (ii) QR =______

(iii) ∠P =______ (iv) QP = ______

(v) ∠Q =______ (vi) RP =______

Solution :



Given, $\Delta QPR \cong \Delta XYZ$

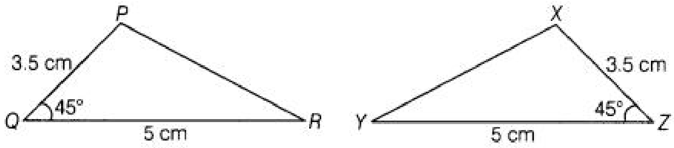
(i) $\angle R = \angle Z$ (ii) $QR = XZ$

(iii) $\angle P = \angle Y$ (iv) $QP = XY$

(v) $\angle Q = \angle X$ (vi) $RP = ZY$

Question 64:

In the given figure, ΔPQR ≅ Δ ……….. .



Solution :

In ΔPQR and ΔXZY,

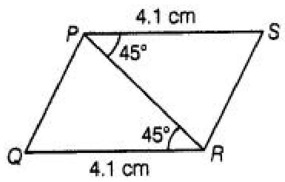
$$PQ = XZ = 3.5\text{ cm}$$
$$QR = ZY = 5\text{ cm}$$
$$\angle PQR = \angle XZY = 45^\circ$$

By SAS congruence criterion,

$$\Delta PQR \cong \Delta XZY$$

Question 65:

In the given figure, ΔPQR ≅ Δ ……….. .



Solution :

In ΔPQR and ΔRSP, $QR = SP = 4.1\text{ cm}$

$PR = PR$ [common side]

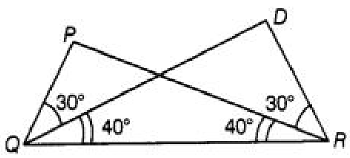
$\angle SPR = \angle QRP = 45^\circ$

By SAS congruence criterion,

$$\Delta PQR \cong \Delta \mathbf{RSP}$$

Question 66:

In the given figure, Δ ……….. ≅ΔPQR.



Solution :

From the given figure, in ΔDRQ and ΔPQR,

$QR = QR$ [common side]

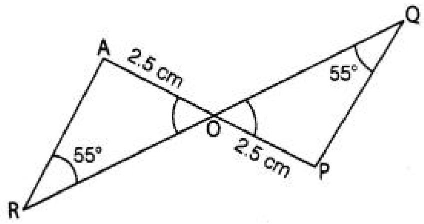
$\angle DRQ = \angle PQR = 70^\circ$

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

By ASA congruence criterion, $\Delta \mathbf{DRQ} \cong \Delta PQR$

Question 67:

In the given figure, ΔARO ≅ Δ ……….. .



Solution :

In ΔARO and ΔPQO, $\angle AOR = \angle POQ$ [vertically opposite angles]

$\angle ARO = \angle PQO = 55°$ [given]

$\Rightarrow$ $\angle RAO = \angle QPO$

Now, in ΔARO and ΔPQO, $\angle AOR = \angle POQ$ [vertically opposite angles]

$AO = PO = 2.5\,cm$

$\angle RAO = \angle QPO$ [proved above]

By ASS congruence criterion, $\Delta ARO \cong \Delta \mathbf{PQO}$

Question 68:

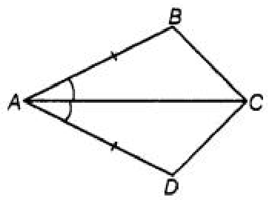
In the given figure, AB = AD and ∠BAC = ∠DAC. Then,

(i) A____ ≅ABC

(ii) BC =___ .

(iii) ∠BCA=______ .

(iv) Line segment AC bisects___ and_____ .



Solution :

(i) In ΔABC and ΔADC,

$AB = AD$ [given]

$AC = AC$ [common side]

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

By SAS congruence criterion,

$\mathbf{\Delta ADC} \cong \Delta ABC$

(ii) Now, $BC = \mathbf{DC}$ [by CPCT]

(iii) Also, $\angle BCA = \mathbf{\angle DCA}$ [by CPCT]

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

Since, $\angle BAC = \angle DAC$

and $\angle BCA = \angle DCA$

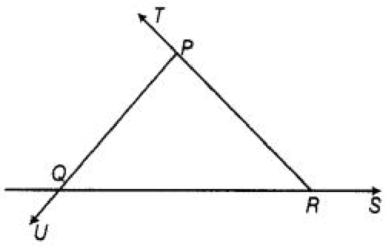
Question 69:

In the given figure,

(i) ∠TPQ = ∠______+ ∠______

(ii) ∠UQR = ∠______+ ∠______

(iii) ∠PRS = ∠______+ ∠______



Solution :

Exterior angle property

The measure of an exterior angle is equal to the sum of the two opposite interior angles.

(i) ∠TPQ= ∠PQR + ∠PRQ

(ii) ∠UQR= ∠QRP + ∠QPR

(iii) ∠PRS **=** ∠RPQ + ∠RQP

True/False

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

Question 70:

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

Solution :

False

Only in a right angled triangle, the sum of two shorter sides is equal to the square of the third side.

Question 71:

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

Solution :

False

Sum of two sides of a triangle is greater than the third side.

Question 72:

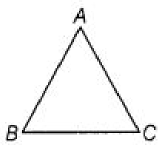
The difference between the lengths of any two sides of a triangle is smaller than the length of third side.

Solution :

True

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

e.g. $AB - BC < AC$

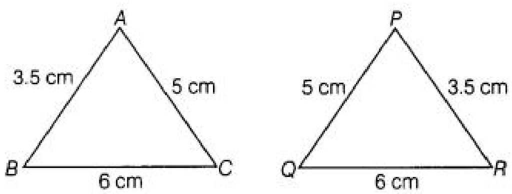


Question 73:

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 :

False



In ΔABC and ΔPRQ, $AB = PR = 3.5$ cm, $BC = RQ = 6$ cm and $AC = PQ = 5$ cm

By SSS congruence criterion, $\Delta ABC \cong \Delta PRQ$

Question 74:

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

Solution :

False

It is not necessary that sum of any two angles of a triangle is always greater than the third angle, e.g. Let the angles of a triangle be 20°, 50° and 110°, respectively.

Hence, 20° + 50° = 70°, which is less than 110°.

Question 75:

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

Solution :

False

The sum of the measures of three angles of a triangle is always equal to 180°.

Question 76:

It is possible to have a right angled equilateral triangle.

Solution :

False

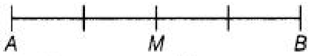
In a right angled triangle, one angle is equal to 90° and in equilateral triangle, all angles are equal to 60°.

Question 77:

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

Solution :

True



Given that, *m* is mid-point of a line segment *AB*,

i.e. $AM = MB$

We know that, two line segments are congruent that's why they are of same lengths.

Question 78:

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

Solution :

False

If in a triangle two angles are right angles, then third angle = 180° – (90° + 90°) = 0°, which is not possible.

Question 79:

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

Solution :

False

Obtuse angles are those angles which are greater than 90°. So, sum of two obtuse angles will be greater than 180°, which is not possible as the sum of all the angles of a triangle is 180°.

Question 80:

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

Solution :

True

In a triangle, atleast two angles must be acute angle.

Question 81:

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

Solution :

False

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

Question 82:

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

Solution :

False

If all the angles are greater than 60° in a triangle, then the sum of all the three angles with exceed 180°, which cannot be possible in case of triangle

Question 83:

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

Solution :

True

The triangle in which each angle is equal to 60° is called an equilateral triangle.

Question 84:

A right angled triangle may have all sides equal.

Solution :

False

Hypotenuse is always the greater than the other two sides of the right angled triangle.

Question 85:

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

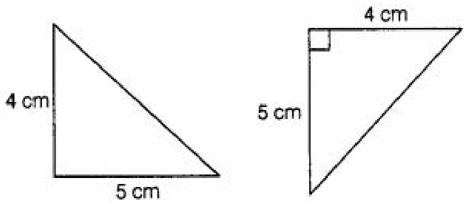
Solution :

False

In an isosceles triangle, always two angles are equal and not the third one.

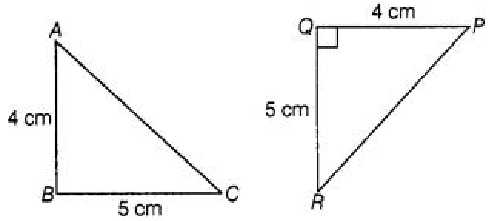
Question 86:

In the given figures, two triangles are congruent by RHS.



Solution :

True



In ΔABC, $AC = \sqrt{AB^2 + BC^2} = \sqrt{4^2 + 5^2} = \sqrt{41}$ cm [by Pythagoras theorem]

In ΔPQR, $PR = \sqrt{PQ^2 + QR^2} = \sqrt{4^2 + 5^2} = \sqrt{41}$ cm [by Pythagoras theorem]

Now, in ΔABC and ΔPQR,

$$AB = PQ = 4 \text{ cm}$$
$$AC = PR = \sqrt{41} \text{ cm}$$
$$\angle ABC = \angle PQR = 90°$$

By RHS congruence criterian, $\Delta ABC \cong \Delta PQR$

Question 87:

The congruent figures superimpose to each other completely.

Solution :

True

Because congruent figures have same shape and same size.

Question 88:

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

Solution :

False

Because they don't have same shape and same size.

Question 89:

The top and bottom faces of a kaleidoscope are congruent.

Solution :

True

Because they superimpose to each other.

Question 90:

Two acute angles are congruent.

Solution :

False

Because the measure of two acute angles may be different.

Question 91:

Two right angles are congruent.

Solution :

True

Since, the measure of right angles is always same.

Question 92:

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

Solution :

False

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

Question 93:

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

Solution :

True

Because two squares will have same areas only if their sides are equal and squares with same sides will superimpose to each other.

Question 94:

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

Solution :

False

Because rectangles with the different length and breadth may have equal areas. But, they will not superimpose to each other.

Question 95:

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

Solution :

True

Because areas of two circles will be equal only if their radii are equal and circle with same radii will superimpose to each other.

Question 96:

Two squares having same perimeter are congruent.

Solution :

True

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

Question 97:

Two circles having same circumference are congruent.

Solution :

True

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

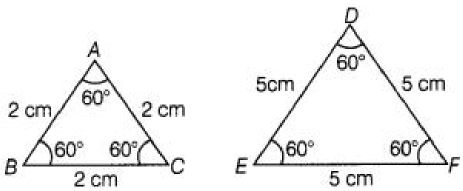
Question 98:

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

Solution :

False

Consider two equilateral triangles with different sides.



Both ΔABC and ΔDEF have same angles but their size is different. So, they are not congruent

Question 99:

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

Solution :

True

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. Hence, they will have same shape and same size.

Question 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 :

False

Because if two sides and the angle included between them of the other triangle, then the two triangles will be congruent.

Question 101:

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

Solution :

True

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

Question 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 :

False

if two angles and the side included between them of a triangle are equal to two angles and included a side between them of the other triangle, then triangles are congruent.

Question 103:

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

Solution :

False

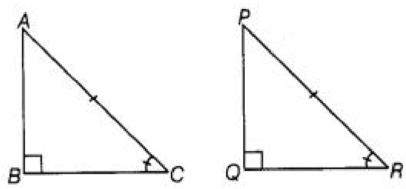
Two right angled triangles are congruent, if the hypotenuse and a side of one of the triangle are equal to the hypotenuse and one of the side of the other triangle.

Question 104:

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

Solution :

True



In ΔABC and ΔPQR, $\angle B = \angle Q = 90^\circ$

$\angle C = \angle R$ [given]

$\Rightarrow$ $\angle A = \angle P$

Now, in ΔABC and ΔPQR, $\angle A = \angle P$

$AC = PR$

$\angle C = \angle R$

By ASA congruence criterian, $\Delta ABC \cong \Delta PQR$

Question 105:

AAS congruence criterion is same as ASA congruence criterion.

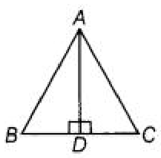
Solution :

False

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.

Question 106:

In the given figure, AD⊥BC and AD is the bisector of angle BAC. Then, ΔABD ≅ ΔACD by RHS.



Solution :

False

In ΔABD and ΔACD,

$AD = AD$ [common side]

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

$\angle ADB = \angle ADC = 90^\circ$

By ASA congruence criterion,

$\Delta ABD \cong \Delta ACD$

Question 107:

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

Solution :

Let measures of the given angles of a triangle be $5x$, $3x$ and x.

$\because$ Sum of all the angles in a triangle = 180°

$\therefore \quad 5x + 3x + x = 180°$

$\Rightarrow \quad 9x = 180°$

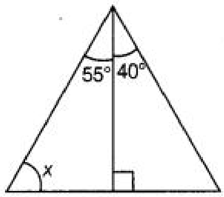
$\Rightarrow \quad x = \frac{180°}{9}$

$\Rightarrow \quad x = 20°$

So, the angles are $5x = 5 \times 20° = 100°$, $3x = 3 \times 20° = 60°$ and $x = 20°$ i.e. 100°, 60° and 20°.

Question 108:

In the given figure, find the value of x.



Solution :

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

So, $\quad x + 55° + 90° = 180°$

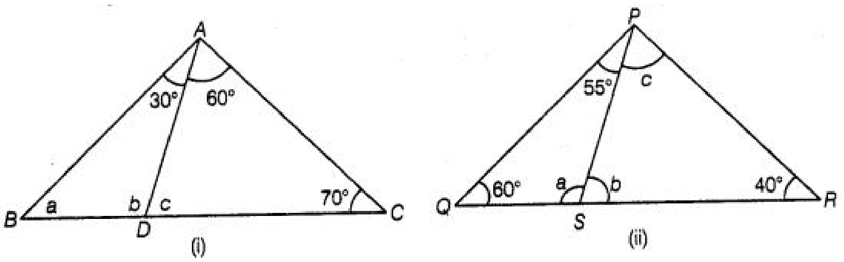
$\Rightarrow \quad x + 145° = 180°$

$\Rightarrow \quad x = 180° - 145°$

$\Rightarrow \quad x = 35°$

Question 109:

In the given figures (i) and (ii), find the values of a, b and c.



Solution :

In figure (i), $\quad \angle A + \angle B + \angle C = 180°$ [sum of all angles of a triangle is 180°]

$\Rightarrow \quad 90° + a + 70° = 180°$ [$\because \angle A = 90°$ and $\angle C = 70°$, from the figure]

$\Rightarrow \quad a + 160° = 180°$

$\Rightarrow \quad a = 180° - 160° = 20°$

Since, c is an exterior angle of ΔABD.

$\therefore \quad \angle c = a + 30° = 20° + 30° = 50°$

[$\because$ exterior angle = the sum of opposite interior angles]

Also, b is an exterior angle of ΔADC.

$\therefore \quad \angle b = 60° + 70° = 130°$

[$\because$ exterior angles = sum of opposite interior angles]

In figure (ii),

In ΔPQS, $\quad \angle QPS + \angle PQS + \angle PSQ = 180°$ [sum of all the angles of a triangle is 180°]

$\Rightarrow \quad 55° + 60° + a = 180°$

$\Rightarrow \quad 115° + a = 180°$

$\Rightarrow \quad a = 180° - 115° = 65°$

Now, $\quad a + b = 180°$ [linear pair has sum of 180°]

$\Rightarrow \quad 65° + b = 180°$

$\Rightarrow \quad b = 180° - 65° = 115°$

In ΔPSR, $\quad \angle PSR + \angle SPR + \angle PRS = 180°$

[sum of all angles of a triangle is 180°]

$\Rightarrow \quad 115° + c + 40° = 180°$

$\Rightarrow \quad 155° + c = 180°$

$\Rightarrow \quad c = 180° - 155° = 25°$

Question 110:

In ΔXYZ, the measure of ∠X is 30° greater than the measure of ∠Y and ∠Z is a right angle. Find measure of ∠Y.

Solution :

According to the question,

Measure of $\angle X = \angle Y + 30°$

Measure of $\angle Z = 90°$

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

i.e. $\angle X + \angle Y + \angle Z = 180°$

$\Rightarrow \angle Y + (\angle Y + 30°) + 90° = 180°$

$\Rightarrow 2\angle Y + 120° = 180°$

$\Rightarrow 2\angle Y = 180° - 120° = 60°$

$\therefore \angle Y = \frac{60°}{2} = 30°$

Question 111:

In a ΔABC, the measure of an ∠A is 40° less than the measure of other ∠B is 50° less than that of ∠C. Find the measure of ∠A.

Solution :

According to the question,

Measure of $\angle A = \angle B - 40°$

Measure of $\angle C = \angle B - 40° + 50°$

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

i.e. $\angle A + \angle B + \angle C = 180°$

$\Rightarrow (\angle B - 40°) + \angle B + (\angle B - 40° + 50°) = 180°$

$\Rightarrow 3\angle B - 30° = 180° \Rightarrow 3\angle B = 210°$

$\therefore \angle B = \frac{210°}{3} = 70°$

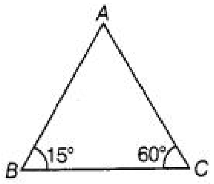
So, the measure of $\angle A = 70° - 40° = 30°$.

Question 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 :

The polygon with three sides is called triangle.



According to the angle sum property of a triangle,

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

$\Rightarrow \angle A + 15° + 60° = 180° \Rightarrow \angle A = 180° - 75°$

$\angle A = 105°$

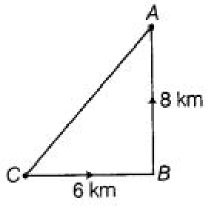
As one angle in this triangle is greater than 90°, so it is an obtuse angled triangle.

Question 113:

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

Solution :

As per the given information, we can draw the following figure, which is a right angled triangle at B.



Distance from starting point to the final position is the hypotenuse of right angled ΔABC,

i.e. $AC^2 = AB^2 + BC^2$ [by Pythagoras theorem]

$\Rightarrow$ $(6)^2 + (8)^2 = (\text{Distance})^2$ [$\because AC =$ distance]

$\Rightarrow$ $36 + 64 = (\text{Distance})^2$

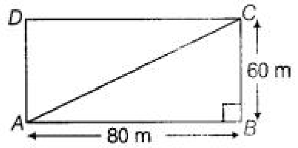
$\therefore$ $\text{Distance} = \sqrt{100} = 10\,\text{km}$

Question 114:

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

Solution :

As the park is rectangular, ail the angles are of 90°.



In right angled ΔABC, $AC^2 = AB^2 + BC^2$ [by Pythagoras theorem]

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

$\Rightarrow$ $AC^2 = 10000$

$\Rightarrow$ $AC = \sqrt{10000}$

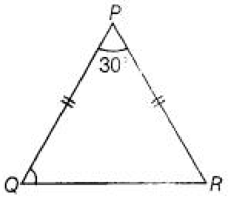
$\Rightarrow$ $AC = 100\,\text{m}$

If she goes through AB and AC, then total distance covered $= (60 + 80)\,\text{m} = 140\,\text{m}$

$\therefore$ Difference between two paths $= (140 - 100)\,\text{m} = 40\,\text{m}$

Question 115:

In ΔPQR of the given figure, PQ = PR. Find measures of ∠Q and ∠R.



Solution :

Since, $PQ = PR$ [given]

$\therefore$ $\angle Q = \angle R = x$ [say]

As we know, $\angle P + \angle Q + \angle R = 180°$ [angle sum property of a triangle]

$\Rightarrow$ $30° + x + x = 180°$

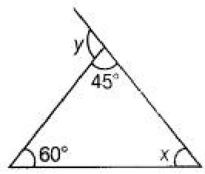
$\Rightarrow$ $2x = 150°$

$\Rightarrow$ $x = 75°$

Hence, $\angle Q = \angle R = 75°$

Question 116:

In the given figure, find the measures of ∠x and ∠y.



Solution :

Since, $\angle y$ and 45° form a linear pair.

So, $\angle y + 45° = 180°$ [∵ linear pair has sum of 180°]

$\Rightarrow \angle y = 180° - 45°$

$\Rightarrow \angle y = 135°$

∵ The sum of all angles in a triangle is equal to 180°.

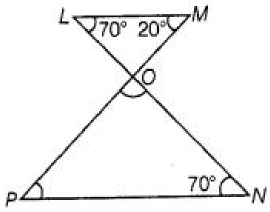
So, $45° + 60° + \angle x = 180°$

$\Rightarrow 105° + \angle x = 180°$

$\Rightarrow \angle x = 180° - 105° = 75°$

Question 117:

In the given figure, find the measures of ∠PON and ∠NPO.



Solution :

In ΔLOM,

$\angle OLM + \angle OML + \angle LOM = 180°$ [angle sum property of a triangle]

$\Rightarrow 70° + 20° + \angle LOM = 180°$

$\Rightarrow 90° + \angle LOM = 180°$

$\Rightarrow \angle LOM = 180° - 90° = 90°$

Also $\angle PON = 90°$

[since, vertically opposite angles are equal]

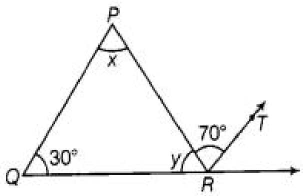
In ΔPON, $\angle PON + \angle NPO + \angle ONP = 180°$ [angle sum property of a triangle]

$\Rightarrow 90° + \angle NPO + 70° = 180°$

$\Rightarrow \angle NPO = 180° - 160° = 20°$

Question 118:

In the given figure, QP || RT. Find the values of x and y.



Solution :

In the given figure, QP|| RT, where PR is a transversal line.

So, ∠x and ∠TRPare alternate interior angles,

$\therefore \angle x = 70°$

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

$\therefore \angle x + 30° + \angle y = 180°$

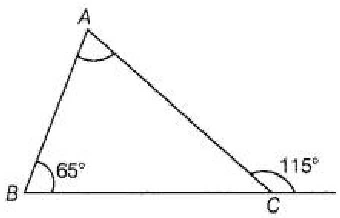
$\Rightarrow 70° + 30° + \angle y = 180°$

$\Rightarrow \angle y = 180° - 100°$

$\Rightarrow \angle y = 80°$

Question 119:

Find the measure of ∠A in the given figure.



Solution :

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

$\therefore \quad 115° = 65° + \angle A$

$\Rightarrow \quad \angle A = 115° - 65° = 50°$

Question 120:

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

Solution :

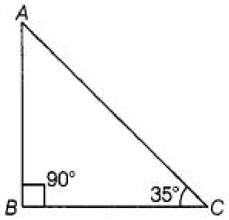
In a right angled ΔABC,

$\angle A + \angle B + \angle C = 180°$ [angle sum property of a triangle]

$\Rightarrow \quad \angle A + 90° + 35° = 180°$ [$\because \angle B = 90°$ and $\angle C = 35°$, given]

$\Rightarrow \quad \angle A + 125° = 180°$

$\Rightarrow \quad \angle A = 180° - 125° = 55°$

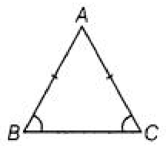


Question 121:

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

Solution :

Let the third angle be x. Then, the other two angles are 4x and 4x, respectively.



We know that, the sum of all three angles in a triangle is 180°.

i.e. $\angle A + \angle B + \angle C = 180°$

$\Rightarrow \quad x + 4x + 4x = 180°$

$\Rightarrow \quad 9x = 180°$

$\Rightarrow \quad x = \frac{180°}{9} = 20°$

Hence, the three angles are $4x = 4 \times 20° = 80°$, $4x = 4 \times 20° = 80°$ and $x = 20°$.

Question 122:

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

Solution :

Let measures of the given angles of a triangle be 2x, 3x and 5x.

$\because$ Sum of all the angles in a triangle = 180°

$\therefore \quad 2x + 3x + 5x = 180° \Rightarrow 10x = 180°$

$\Rightarrow \quad x = \frac{180°}{10} = 18°$

So, the angles are $2x = 2 \times 18° = 36°$, $3x = 3 \times 18° = 54°$ and $5x = 5 \times 18° = 90°$.

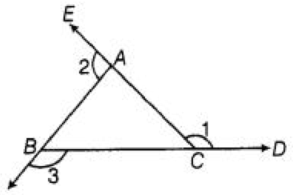
Question 123:

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

Solution :

In ΔABC, by exterior angle property,

$$\text{Exterior } \angle 1 = \text{Interior } \angle A + \text{Interior } \angle B \quad \text{... (i)}$$
$$\text{Exterior } \angle 2 = \text{Interior } \angle B + \text{Interior } \angle C \quad \text{... (ii)}$$
$$\text{Exterior } \angle 3 = \text{Interior } \angle A + \text{Interior } \angle C \quad \text{... (iii)}$$



On adding Eqs. (i), (ii) and (iii), we get

$$\angle 1 + \angle 2 + \angle 3 = 2(\angle A + \angle B + \angle C)$$

[by angle sum property of a triangle, $\angle A + \angle B + \angle C = 180°$]

$\Rightarrow$ $\angle 1 + \angle 2 + \angle 3 = 2 \times 180°$

$\Rightarrow$ $\angle 1 + \angle 2 + \angle 3 = 360°$

Hence, the sum of exterior angles is 360°.

Question 124:

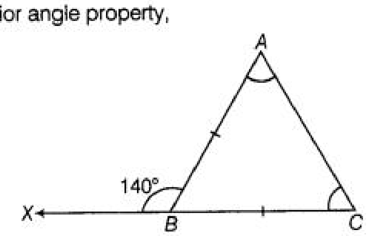
In ΔABC, if $\angle A = \angle C$ and exterior $\angle ABX = 140°$, then find the angles of the triangle.

Solution :

Given, $\angle A = \angle C$ and exterior $\angle ABX = 140°$

Let $\angle A = \angle C = x$

According to the exterior angle property,



$$\text{Exterior } \angle B = \text{Interior } \angle A + \text{Interior } \angle C$$

$\Rightarrow$ $140° = x + x \Rightarrow 140° = 2x$

$\Rightarrow$ $x = \frac{140°}{2} = 70°$

So, $\angle A = \angle C = 70°$

Now, $\angle A + \angle B + \angle C = 180°$ [angle sum property of a triangle]

$\Rightarrow$ $70° + \angle B + 70° = 180°$

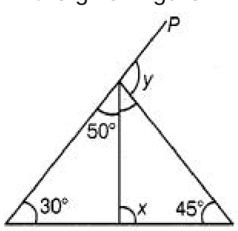
$\Rightarrow$ $\angle B + 140° = 180° \Rightarrow \angle B = 180° - 140°$

$\Rightarrow$ $\angle B = 40°$

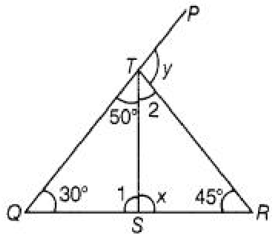
Hence, all the angles of the triangle are 70°, 40° and 70°.

Question 125:

Find the values of x and y in the given figure.



Solution :



In ΔTQS, $\angle T + \angle Q + \angle S = 180°$ [angle sum property of a triangle]

$\Rightarrow 50° + 30° + \angle 1 = 180°$

$\Rightarrow 80° + \angle 1 = 180°$

$\Rightarrow \angle 1 = 180° - 80° = 100°$

Now, $\angle 1 + x = 180°$ [linear pair]

$\Rightarrow 100° + x = 180° = 180° - 100°$

$\Rightarrow x = 80°$

In ΔTSR, $x + 45° + \angle 2 = 180°$ [angle sum property of a triangle]

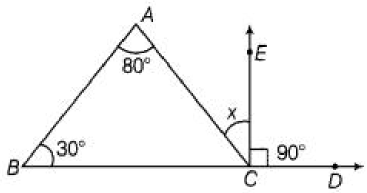
$\Rightarrow \angle 2 = 180° - 80° - 45° = 55°$

Now, $50° + \angle 2 + y = 180°$ [linear pair]

$\Rightarrow y = 180° - 50° - 55° = 75°$

Question 126:

Find the value of x in the given figure.



Solution :

In the given figure, $\angle BAC = 80°$, $\angle ABC = 30°$, $\angle ACE = x$ and $\angle ECD = 90°$

In ΔABC, we know that, exterior angle is equal to the sum of interior opposite angles.

$\therefore \angle ACD = \angle CAB + \angle ABC$

$\Rightarrow \angle ACE + \angle ECD = 80° + 30°$ $[\because \angle ACD = \angle ACE + \angle ECD]$

$\Rightarrow \angle ACE + 90° = 110°$ $[\because \angle ECD = 90°]$

$\Rightarrow \angle ACE = 110° - 90° = 20°$

Question 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 :

Let one of the angles of a triangle be x. If angles are arranged in descending order.

Then, angles will be x, (x -10°) and (x – 20°).

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

So, $x + (x - 10°) + (x - 20°) = 180°$

$\Rightarrow x + x + x - 30° = 180°$

$\Rightarrow 3x = 180° + 30°$

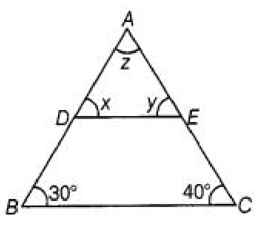
$\Rightarrow 3x = 210°$

$\Rightarrow x = \frac{210°}{3} = 70°$

Hence, angles will be 70°, 70° – 10° and 70° – 20° i.e. 70°, 60° and 50°

Question 128:

In ΔABC, DE || BC (see the figure). Find the values of x, y and z.

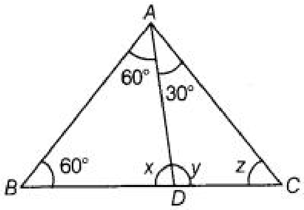


Solution :

In ΔABC,	$\angle A + \angle B + \angle C = 180°$	[sum of all angles of a triangle is 180°]
$\Rightarrow$	$z + 30° + 40° = 180°$	
$\Rightarrow$	$z + 70° = 180°$	
$\Rightarrow$	$z = 180° - 70° = 110°$	
$\because$	$DE \parallel BC$	
Now,	$\angle ADE = \angle ABC$	[$\because$ corresponding angles are equal]
$\Rightarrow$	$\angle x = 30°$ and $\angle AED = \angle ACB$	
		[$\because$ corresponding angles are equal]
$\Rightarrow$	$\angle y = 40°$	

Question 129:

In the given figure, find the values of x, y and z.



Solution :

In the given figure, $\angle BAD = 60°$, $\angle ABD = 60°$, $\angle ADB = x$, $\angle DAC = 30°$, $\angle ADC = y$ and $\angle ACD = z$

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

In ΔABD, $\angle BAD + \angle ABD + \angle ADB = 180°$

$\Rightarrow$ $60° + 60° + x = 180°$

$\Rightarrow$ $120° + x = 180°$

$\Rightarrow$ $x = 180° - 120°$

$\Rightarrow$ $x = 60°$

Now, $y = \angle BAD + \angle ABD$

[$\because$ exterior angle is equal to the sum of interior opposite angles]

$\Rightarrow$ $y = 60° + 60°$

$\therefore$ $y = 120°$

In ΔADC, $\angle DAC + \angle ADC + \angle ACD = 180°$ [angle sum property of a triangle]

$\Rightarrow$ $30° + 120° + z = 180°$

$\Rightarrow$ $150° + z = 180°$

$\Rightarrow$ $z = 180° - 150°$

$\Rightarrow$ $z = 30°$

Hence, $x = 60°$, $y = 120°$ and $z = 30°$

Question 130:

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

Solution :

Given, one angle of a triangle is 60°.

Let the other two angles be x and $2x$.

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

So, $x + 2x + 60° = 180°$

$\Rightarrow$ $3x = 180° - 60°$

$\Rightarrow$ $3x = 120°$

$\Rightarrow$ $x = 40°$

So, the other two angles will be $x = 40°$ and $2x = 2 \times 40° = 80°$.

Question 131:

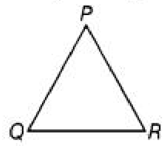
In ΔPQR, if 3∠P = 4∠Q = 6∠R, calculate the angles of the triangle.

Solution :

Given, $3\angle P = 4\angle Q = 6\angle R$

Then, $\angle P = \frac{6}{3}\angle R = 2\angle R$

$\angle Q = \frac{6}{4}\angle R = \frac{3}{2}\angle R$



In ΔPQR,

$\angle P + \angle Q + \angle R = 180°$ [angle sum property of a triangle]

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

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

$\Rightarrow 6\angle R + 3\angle R = 180° \times 2$ [on taking LCM in LHS]

$\Rightarrow 9\angle R = 360°$

$\Rightarrow \angle R = \frac{360°}{9} = 40°$

$\therefore \angle P = 2\angle R = 2 \times 40° = 80°$

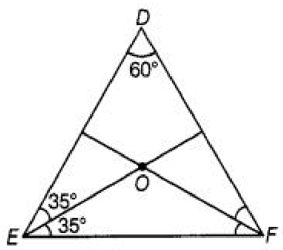
and $\angle Q = \frac{3}{2}\angle R = \frac{3}{2} \times 40° = 60°$

Hence, all the angles of the triangle are 80°, 60° and 40°.

Question 132:

In ΔDEF, ∠D = 60°, ∠E = 70° and the bisectors of ∠E and ∠E meet at 0. Find (i) ∠F (ii) ∠EOF.

Solution :



(i) As we know,

$\angle D + \angle E + \angle F = 180°$ [angle sum property of a triangle]

$\Rightarrow 60° + 70° + \angle F = 180°$ [$\because \angle D = 60°$ and $\angle E = 70°$]

$\Rightarrow \angle F = 180° - 130°$

$\Rightarrow \angle F = 50°$

(ii) Now, as *FO* is the bisector of $\angle F$.

So, $\angle EFO = \frac{\angle F}{2} = \frac{50°}{2} = 25°$

and $\angle OEF = \frac{\angle E}{2} = \frac{70°}{2} = 35°$ [$\because \angle D = 60°$ and $\angle E = 70°$]

In ΔEOF, $\angle EOF + \angle OEF + \angle OFE = 180°$ [angle sum property of a triangle]

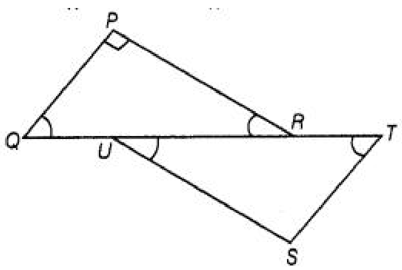
$\Rightarrow \angle EOF + 35° + 25° = 180°$

$\Rightarrow \angle EOF = 180° - 60°$

$\Rightarrow \angle EOF = 120°$

Question 133:

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



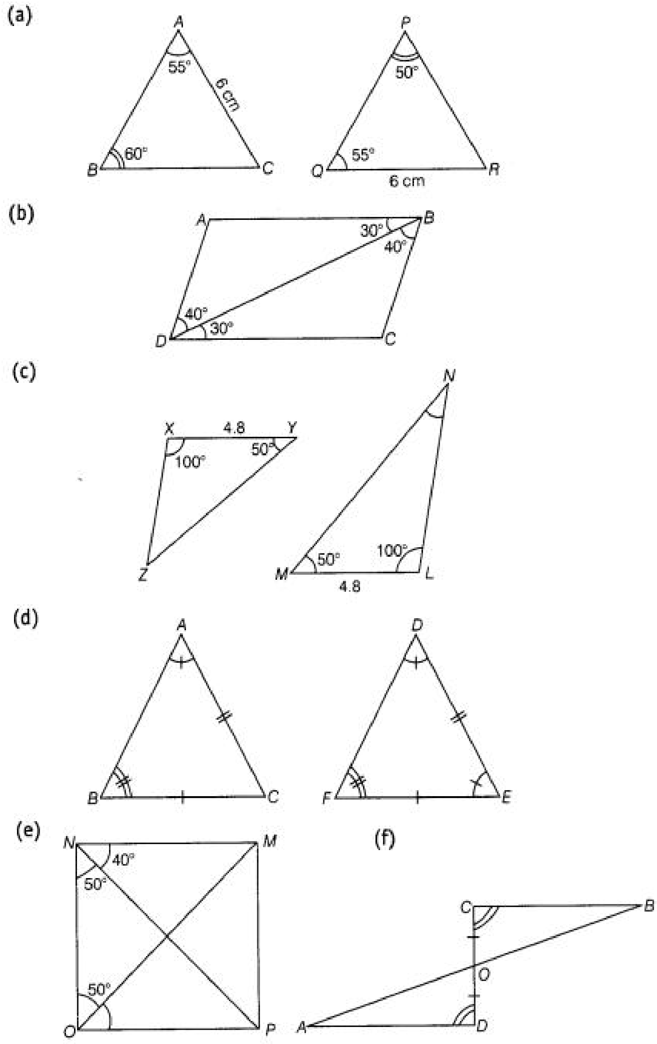
Solution :

If QP || ST and QT is a transversal, then ∠PQR = ∠STU [alternate interior

angles]
and if DS || RP and QT is a transversal, then ∠PRQ = ∠SUT [alternate interior angles]
Hence, ∠S must be equal to ∠P i.e. 90°.

Question 134:

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



Solution :

(a) Not possible, because the side is not included between two angles.

(b) ΔABD ≅ ΔCDB

(c) ΔXYZ ≅ ΔLMN

(d) Not possible, because there is not any included side equal.

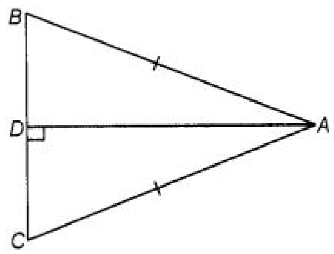
(e) ΔMNO ≅ ΔPON

(f) ΔAOD ≅ ΔBOC

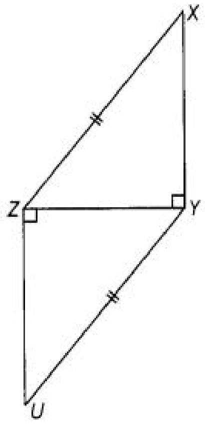
Question 135:

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

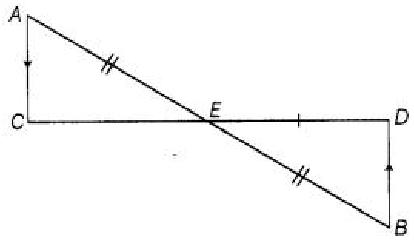
(a)



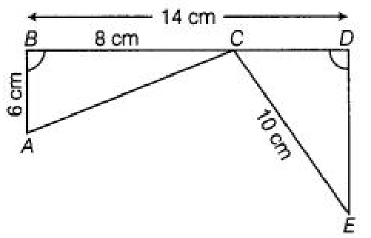
(b)



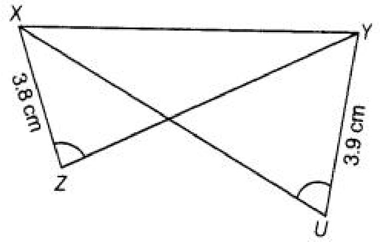
(c)



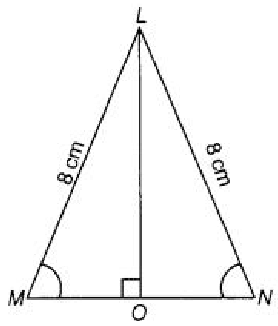
(d)



(e)



(f)



Solution :

(a) In ΔABD and ΔACD, $AB = AC$ [given]

$AD = AD$ [common side]

$\angle ADB = \angle ADC = 90°$

By RHS congruence criterion, $\Delta ABD \cong \Delta ACD$

(b) In ΔXYZ and ΔUZY, $\angle XYZ = \angle UZY = 90°$

$XZ = YU$ [given]

$ZY = ZY$ [common side]

By RHS congruence criterion, $\Delta XYZ \cong \Delta UZY$

(c) In ΔAEC and ΔBED, $CE = DE$ [given]

$AE = BE$ [given]

$\angle ACE = \angle BDE = 90°$

By RHS congruence criterion, $\Delta AEC \cong \Delta BED$

(d) Here, $CD = BD - BC = 14 - 8 = 6$ cm

In right angled ΔABC,

$AC = \sqrt{AB^2 + BC^2} = \sqrt{6^2 + 8^2} = \sqrt{36 + 64}$ [by Pythagoras theorem]

$= \sqrt{100} = 10$ cm

In right angled ΔCDE,

$DE = \sqrt{CE^2 - CD^2} = \sqrt{10^2 - 6^2} = \sqrt{100 - 36} = \sqrt{64} = 8$ cm

In ΔABC and ΔCDE, $AC = CE = 10$ cm

$BC = DE = 8$ cm

$\angle ABC = \angle CDE = 90°$

By RHS congruence criterion, $\Delta ABC \cong \Delta CDE$

(e) Not possible, because there is not any right angle.

(f) In ΔLOM and ΔLON, $LM = LN = 8$ cm

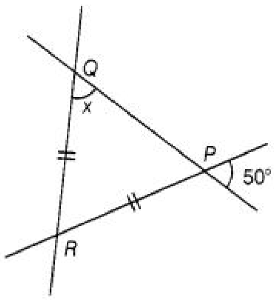
$LO = LO$ [common side]

$\angle LOM = \angle LON = 90°$

By RHS congruence criterion, $\Delta LOM \cong \Delta LON$

Question 136:

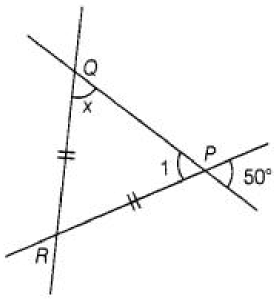
In the given figure, if RP = RQ, find the value of x.



Solution :

Given, $RP = RQ$

Since, $\angle 1 = 50°$ [vertically opposite angles]

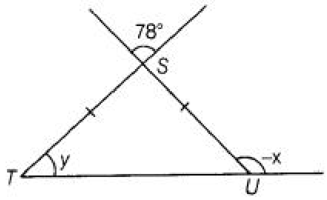


Also, $\angle 1 = x$ [$\because RP = RQ$]

So, $x = 50°$

Question 137:

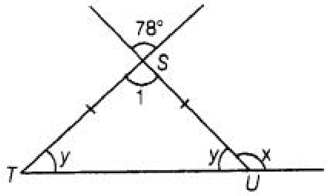
In the given figure, if ST = SU, then find the values of x and y.



Solution :

Given, $ST = SU$

$\therefore$ $\angle SUT = \angle STU = y$ [$\because$ angles opposite to equal sides are equal]



Also, $\angle 1 = 78°$ [vertically opposite angles]

In ΔSUT, $78° + y + y = 180°$ [angle sum property of a triangle]

$\Rightarrow$ $78° + 2y = 180°$

$\Rightarrow$ $2y = 180° - 78° = 102°$

$\Rightarrow$ $y = \dfrac{102°}{2} = 51°$

Also, $x + y = 180°$ [linear pair]

$\Rightarrow$ $x + 51° = 180°$

$\Rightarrow$ $x = 180° - 51°$

$\Rightarrow$ $x = 129°$

Question 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 :

For a right angled triangle, the sum of square of two shorter sides must be equal to the square of the third side.

Now, $1.5^2 + 3.6^2 = 2.25 + 12.96$

$= 15.21$

Also, $(3.9)^2 = 15.21$

$\Rightarrow$ $(1.5)^2 + (3.6)^2 = (3.9)^2$

Hence, the given sides form right angled triangle.

Question 139:

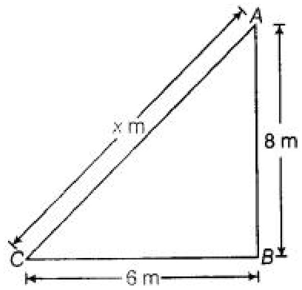
Height of a pole is 8 m. Find the length of rope tied with its top from a point on the ground at a distance of 6 m from its bottom.

Solution :

Given, height of a pole is 8 m.

Distance between the bottom of the pole and a point on the ground is 6 m.

On the basis of given information, we can draw the following figure:



Let the length of the rope be x m.

$\because AB =$ Height of the pole

BC = Distance between the bottom of the pole and a point on ground, where rope was tied

To find the length of the rope, we will use Pythagoras theorem, in right angled ΔABC.

$\therefore \quad (AC)^2 = (AB)^2 + (BC)^2$

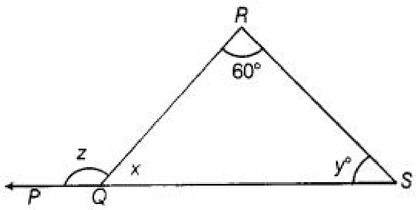
$\Rightarrow \quad (x)^2 = (8)^2 + (6)^2 \Rightarrow x^2 = 64 + 36$

$\Rightarrow \quad x^2 = 100 \Rightarrow x = \sqrt{100} = 10\text{ m}$

Hence, the length of the rope is 10 m.

Question 140:

In the given figure, if y is five times x, find the value of z.



Solution :

Given, $\quad y = 5x$

According to the angle sum property of a triangle,

$60° + x + y = 180°$

$\Rightarrow \quad 60° + x + 5x = 180° \quad [\because y = 5x]$

$\Rightarrow \quad 60° + 6x = 180° \Rightarrow 6x = 180° - 60° = 120°$

$\Rightarrow \quad x = \frac{120°}{6} = 20°$

$\therefore \quad y = 5x = 5 \times 20 = 100°$

According to the exterior angle property,

$z = 60° + y$

$= 60° + 100° \quad [\because y = 100°]$

$= 160°$

Question 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 :

Third side must be 20 cm, because sum of two sides should be greater than the third side.

∴ Perimeter of the triangle

= Sum of all sides

= (9 + 20 + 20) cm

= 49 cm

Question 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 ≅ APQR

(d) ΔXYZ ≅ ΔMLN

Solution :

We know that, corresponding parts of congruent triangles are equal.

(a) ΔSTU ≅ ΔDEF

∠S = ∠D, ∠T = ∠E and ∠U = ∠F ST = DE, TU = EF and SU = DF

(b) ΔABC ≅ ΔLMN

∠A = ∠L, ∠B = ∠M and ∠C = ∠N AB = LM, BC = MN and AC = LN

(c) ΔYZX ≅ APQR

∠T = ∠P, ∠Z = ∠Q and ∠X = ∠R YZ = PQ, ZX = QR and YX = PR

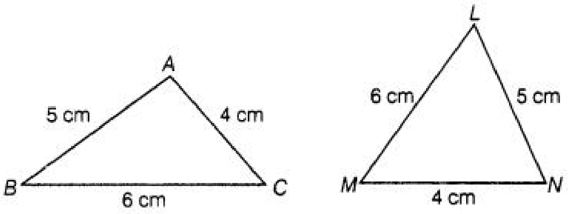
(d) ΔXYZ ≅ ΔMLN

∠X = ∠M, ∠Y = ∠L and ∠Z = ∠N XY = ML,YZ = LN and XZ = MN

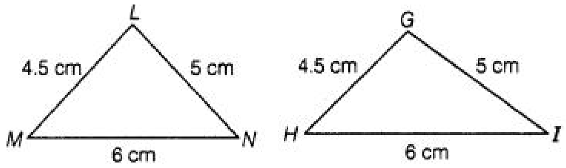
Question 143:

In the following pairs of triangles in below figures, 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.

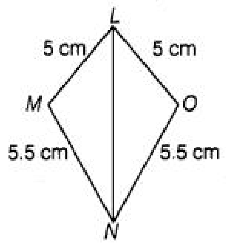
(a)



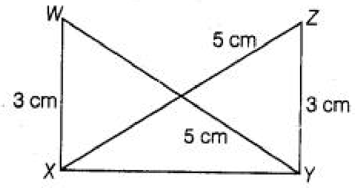
(b)



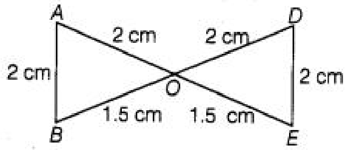
(c)



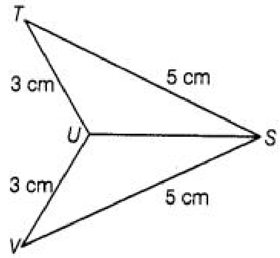
(d)



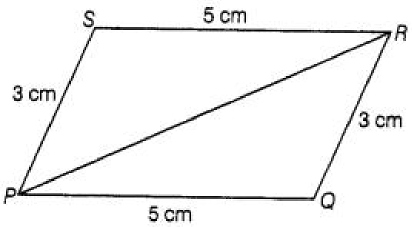
(e)



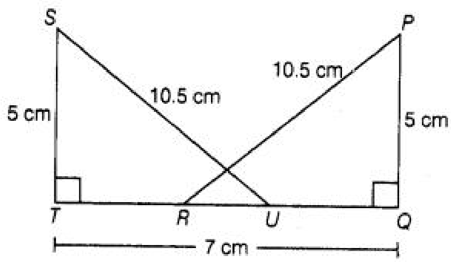
(f)



(g)



(h)



Solution :

(a) ΔABC ≅ ΔNLM

(b) ΔLMN ≅ ΔGHI

(c) ΔLMN ≅ ΔLON

(d) ΔZYX ≅ ΔWXY

(e) ΔOAB ≅ ΔDOE

(f) ΔSTU ≅ ΔSVU

(g) ΔPSR ≅ ARQP

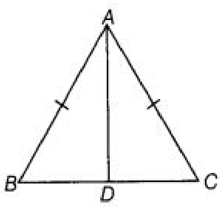
(h) ΔSTU ≅ ΔPQR

Question 144:

ABC is an isosceles triangle with AB = AC and D is the mid-point of base BC (see the figure).

(a) State three pairs of equal parts in the ΔABD and ΔACD.

(b) Is ΔABD ≅ ΔACD? If so why?



Solution :

Given,	$AB = AC$	
and	$BD = CD$	

(a) In ΔABD and ΔACD,

	$AB = AC$	[given]
	$BD = CD$	[given]
	$AD = AD$	[common side]

(b) Yes, by SSS congruence criterion,

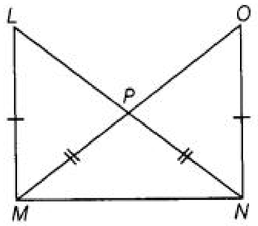
$$\Delta ABD \cong \Delta ACD$$

Question 145:

In the given figure, it is given that LM = ON and NL = MO.

(a) State the three pairs of equal parts in the ΔNOM and ΔMLN.

(b) Is ΔNOM ≅ ΔMLN? Give reason.



Solution :

(a) In ΔNOM and ΔMLN,	$LM = ON$	[given]
	$MN = MN$	[common side]
	$LN = OM$	[given]

(b) Yes, by SSS congruence criterion,

$$\Delta NOM \cong \Delta MLN$$

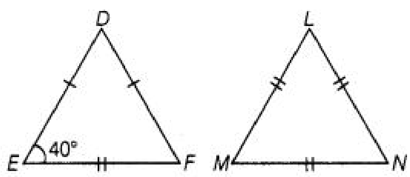
Question 146:

ΔDEF and ΔLMN 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 :

Here,	$DE = DF$	...(i)
	$LM = LN$	...(ii)
and	$DE = LM$	...(iii)



From Eqs. (i), (ii) and (iii), we get $DE = DF = LM = LN$

In ΔDEF and ΔLMN,	$DE = LM$	[given]
	$EF = MN$	[given]
	$DF = LN$	[proved above]

By SSS congruence criterion, $\Delta DEF \cong \Delta LMN$

$\therefore$	$\angle E = \angle M$	[by CPCT]
	$\angle M = 40°$	
Also,	$\angle M = \angle N$	
	[$\because \angle M = \angle N$ and angles opposite to equal sides are equal]	
$\Rightarrow$	$\angle N = 40°$	

Question 147:

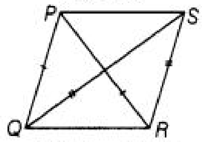
If ΔPQR and ΔSQR are both isosceles triangle on a common base QR such that P and S lie on the same side of QR. Are ΔPSQ and ΔPSR congruent? Which condition do you use?

Solution :

In ΔPSQ and ΔPSR, $PQ = PR$ [given]

$SQ = SR$ [given]

$PS = PS$ [common side]

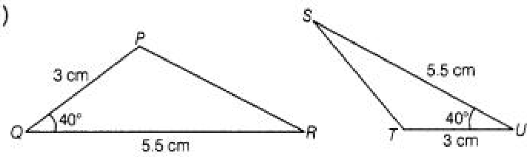


By SSS congruence criterion, $\Delta PSQ \cong \Delta PSR$

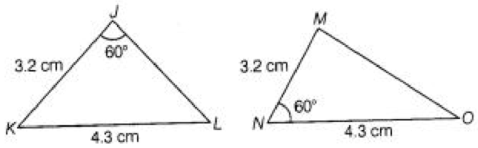
Question 148:

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

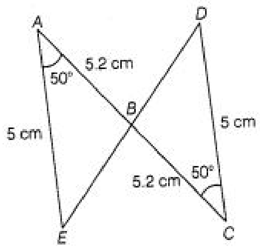
(i)



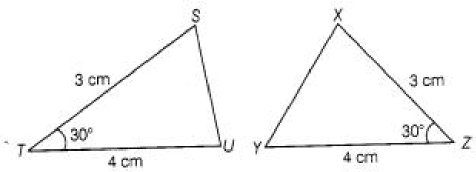
(ii)



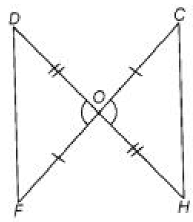
(iii)



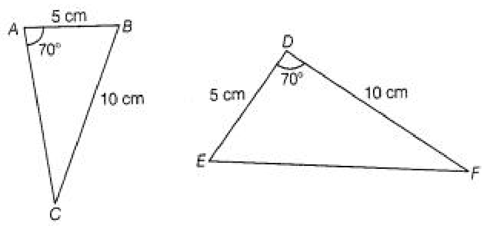
(iv)



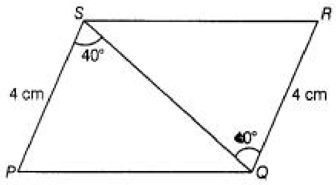
(v)



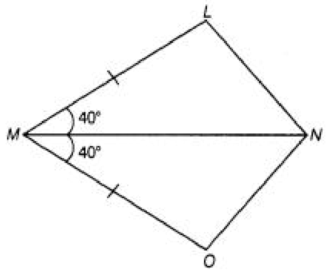
(vi)



(vii)



(viii)



Solution :

(i) In ΔPQR and ΔTUS,

$$PQ = TU = 3\text{ cm}$$
$$QR = US = 5.5\text{ cm}$$
$$\angle PQR = \angle TUS = 40^\circ$$

By SAS congruence criterion, $\Delta PQR \cong \Delta TUS$

(ii) Not congruent, because angle in not included between two sides.

(iii) In ΔBCD and ΔBAE,

$$AB = CB = 5.2\text{ cm}$$
$$DC = EA = 5\text{ cm}$$
$$\angle EAB = \angle DCB = 50^\circ$$

By SAS congruence criterion, $\Delta BCD \cong \Delta BAE$

(iv) In ΔSTU and ΔXZY,

$$TU = ZY = 4\text{ cm}$$
$$TS = ZX = 3\text{ cm}$$
$$\angle STU = \angle XZY = 30^\circ$$

By SAS congruence criterion, $\Delta STU \cong \Delta XZY$

(v) In ΔDOF and ΔHOC,

$DO = HO$ [given]

$CO = FO$ [given]

$\angle DOF = \angle HOC$ [vertically opposite angles]

By SAS congruence criterion, $\Delta DOF \cong \Delta HOC$

(vi) Not congruent, because angle is not included between two sides.

(vii) In ΔPSQ and ΔRQS,

$PS = RQ = 4\text{ cm}$

$SQ = SQ$ [common side]

$\angle PSQ = \angle RQS = 40^\circ$

By SAS congruence criterion,

$$\Delta PSQ \cong \Delta RQS$$

(viii) In ΔLMN and ΔOMN,

$LM = OM$ [given]

$MN = MN$ [common side]

$\angle LMN = \angle OMN = 40^\circ$

By SAS congruence criterion,

$$\Delta LMN \cong \Delta OMN$$

Question 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) ΔPQR : PQ = 3.5 cm, QR 4.0 cm, ∠Q 60°

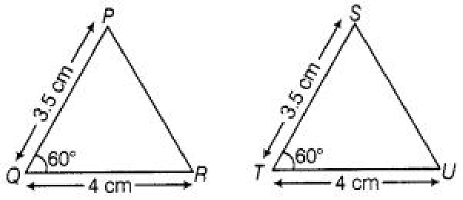
ΔSTU : ST = 3.5 cm, TU = 4 cm, ∠T = 60°

(b) ΔABC : AB = 4.8 cm, ∠A = 90°, AC = 6.8 cm

ΔXYZ : YZ = 6.8 cm, ∠X = 90°, ZX = 4.8 cm

Solution :

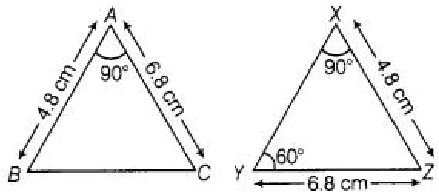
(a)



Both the triangles are congruent.

∴ $\Delta PQR \cong \Delta STU$ [by SAS congruence criterion]

(b)



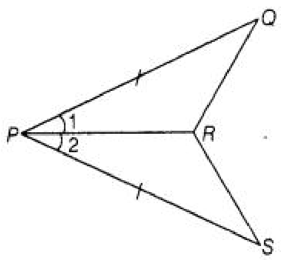
Both the triangles are not congruent.

Question 150:

In the given figure, PQ = PS and ∠1 = ∠2.

(i) Is ΔPQR ≅ ΔPSR? Give reason.

(ii) Is QR =SR? Give reason.



Solution :

Yes,

(i) In ΔPQR and ΔPSR, $PQ = PS$ [given]

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

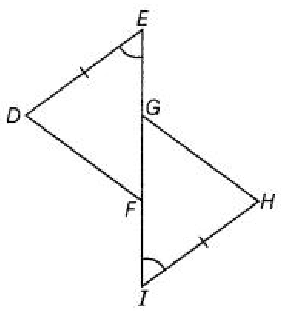
$PR = PR$ [common side]

By SAS congruence criterion, $\Delta PQR \cong \Delta PSR$

(ii) Yes, $QR = SR$ [by CPCT]

Question 151:

In the given figure, DE = IH, EG = FI and ∠E = ∠I. Is ΔDEF ≅ ΔHIG? If yes, by which congruence criterion?



Solution :

Given, $EG = FI$

$EG + GF = FI + GF$ [adding GF on both sides]

$EF = IG$

In ΔDEF and ΔHIG, $DE = IH$ [given]

$EF = IG$ [proved above]

$\angle E = \angle I$ [given]

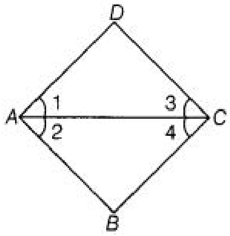
By SAS congruence criterion, $\Delta DEF \cong \Delta HIG$

Question 152:

In the given figure, ∠1 = ∠2 and ∠3 = ∠4.

(i) Is ΔADC ≅ ΔABC Why?

Show that AD = AB and CD = CB.



Solution :

(i) In ΔADC and ΔABC, ∠1 = ∠2 [given]

AC = AC [common side]

∠3 = ∠4 [given]

By ASA congruence criterion, ΔADC ≅ ΔABC

(ii) AD = AB [by CPCT]

CD = CB [by CPCT]

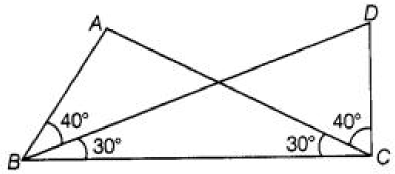
Question 153:

Observe the following figure and state the three pairs of equal parts in ΔABC and ΔDBC.

(i) Is ΔABC ≅ ΔDCB? Why?

(ii) Is AB = DC? Why?

(iii) Is AC = DB? Why?



Solution :

(i) In ΔABC and DCB,

BC = BC [common side]

∠ABC = ∠DCB = 70°

∠ACB = ∠DBC = 30°

By ASA congruence criterion,

ΔABC ≅ ΔDCB

(ii) AB = DC [by CPCT]

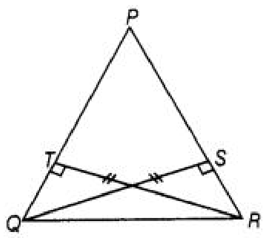
(iii) AC = DB [by CPCT]

Question 154:

In the given figure, QS⊥PR, RT⊥PQ and QS = RT.

(i) Is ΔQSR ≅ ΔRTS? Give reason.

(ii) Is ∠PQR = ∠PRQ? Give reason.



Solution :

(i) In ΔQSR and ΔRTQ QS = RT [given]

∠QSR = ∠QTR = 90°

QR = QR [common side]

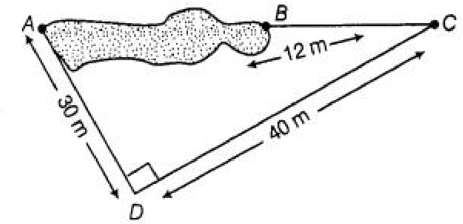
By RHS congruence criterion,

ΔQSR ≅ ΔRTQ

(ii) Yes, ∠PQR = ∠PRQ [by CPCT]

Question 155:

Points A and B are on the opposite edges of a pond as shown in the given figure. To find the distance between the two points, the surveyor makes a rightangled triangle as shown. Find the distance AB.



Solution :

Since, ΔACD is a right angled triangle.

In right angled ΔADC, by Pythagoras theorem,

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

$\Rightarrow$ $(AC)^2 = (30)^2 + (40)^2$ [$\because AD = 30$ cm and $CD = 40$ cm, given]

$\Rightarrow$ $(AC)^2 = 900 + 1600$

$\Rightarrow$ $(AC)^2 = 2500$

$\Rightarrow$ $AC = \sqrt{2500}$

$\therefore$ $AC = 50$ m

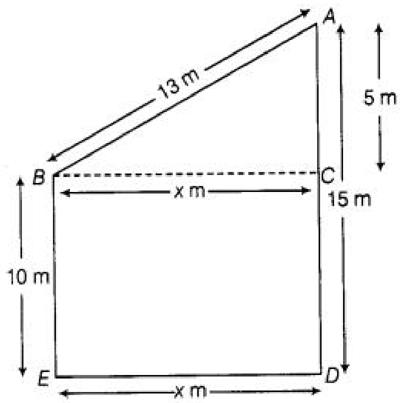
Now, $AB = AC - BC = 50 - 12 = 38$ m

Hence, the distance AB is 38 m.

Question 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 distance between their feet.

Solution :



Let $BC = x$ m

In right angled ΔACB,

$AB^2 = AC^2 + BC^2$ [by Pythagoras theorem]

$\Rightarrow$ $(13)^2 = (5)^2 + x^2$

$\Rightarrow$ $169 - 25 = x^2$

$\Rightarrow$ $144 = x^2$

$\Rightarrow$ $x = \sqrt{144}$

$\Rightarrow$ $x = 12$ m

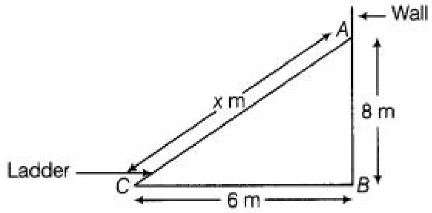
Hence, the distance between the feet of two poles is 12 m.

Question 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) Let the length of the ladder be x m.



In right angled ΔABC,

$$AC^2 = AB^2 + BC^2 \quad \text{[by Pythagoras theorem]}$$

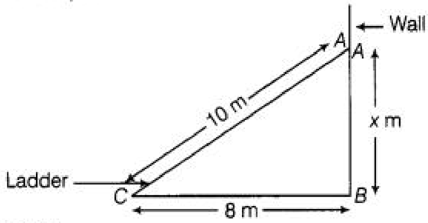
$$\Rightarrow \quad (x)^2 = (8)^2 + (6)^2$$

$$\Rightarrow \quad = \sqrt{(8)^2 + (6)^2} = \sqrt{64 + 36} = \sqrt{100}$$

$$\Rightarrow \quad x = 10\,\text{m}$$

Hence, the length of the ladder is 10 m.

(b) Let the height of the top be x m.



In right angled ΔACB,

$$AC^2 = AB^2 + BC^2 \quad \text{[by Pythagoras theorem]}$$

$$\Rightarrow \quad AB^2 = AC^2 - BC^2$$

$$\Rightarrow \quad x^2 = (10)^2 - (8)^2 = 100 - 64$$

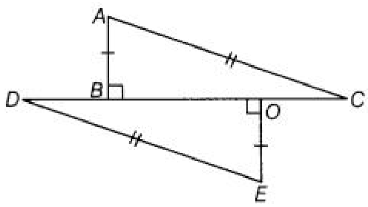
$$\Rightarrow \quad x = \sqrt{36}$$

$$\Rightarrow \quad x = 6\,\text{m}$$

Hence, the height of the top is 6 m.

Question 158:

In the given figure, state the three pairs of equal parts in ΔABC and ΔEOD. Is ΔABC ≅ ΔEOD? Why?



Solution :

In ΔABC and ΔEOD, $AB = EO$ [given]

$AC = ED$ [given]

$\angle ABC = \angle EOD = 90°$

By RHS congruence criterion, $\Delta ABC \cong \Delta EOD$

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