CBSE NCERT Solutions for Class 7 Mathematics Chapter 6

Back of Chapter Questions

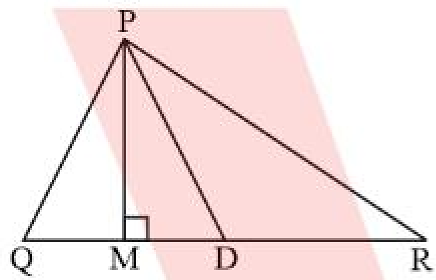
EXERCISE 6.1

1. In ΔPQR, D is the mid-point of $\overline{QR}$

$\overline{PM}$ is ______

PD is _______

Is $QM = MR$?



Solution:

(i) Since, PM is perpendicular to QR. Hence, $\overline{PM}$ is altitude.

(ii) Since, $QD = DR$. Hence, PD is median.

(iii) Since, $QD = DR$. Hence, $QM \neq MR$.

2. Draw rough sketches for the following:

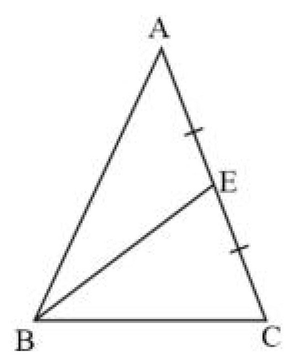
(A) In ΔABC, BE is a median.

(B) In ΔPQR, PQ and PR are altitudes of the triangle.

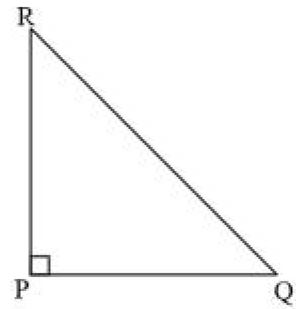
(C) In ΔXYZ, YL is an altitude in the exterior of the triangle.

Solution:

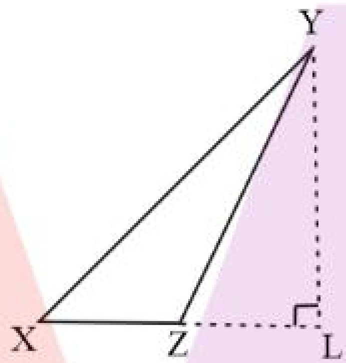
(A)



(B) Since PQ and PR are altitude. Hence ΔPQR is a right-angle triangle.



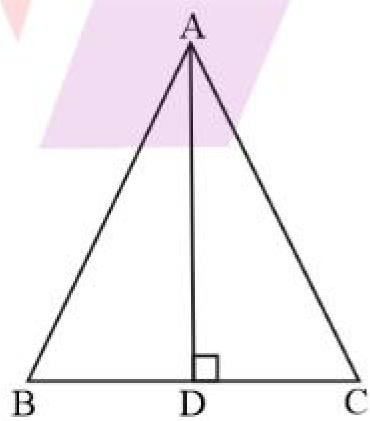
(C)



It can be observed that for ΔXYZ, YL is an altitude drawn exterior to side XZ which is extended up to point L.

3. Verify by drawing a diagram if the median and altitude of an isosceles triangle can be same.

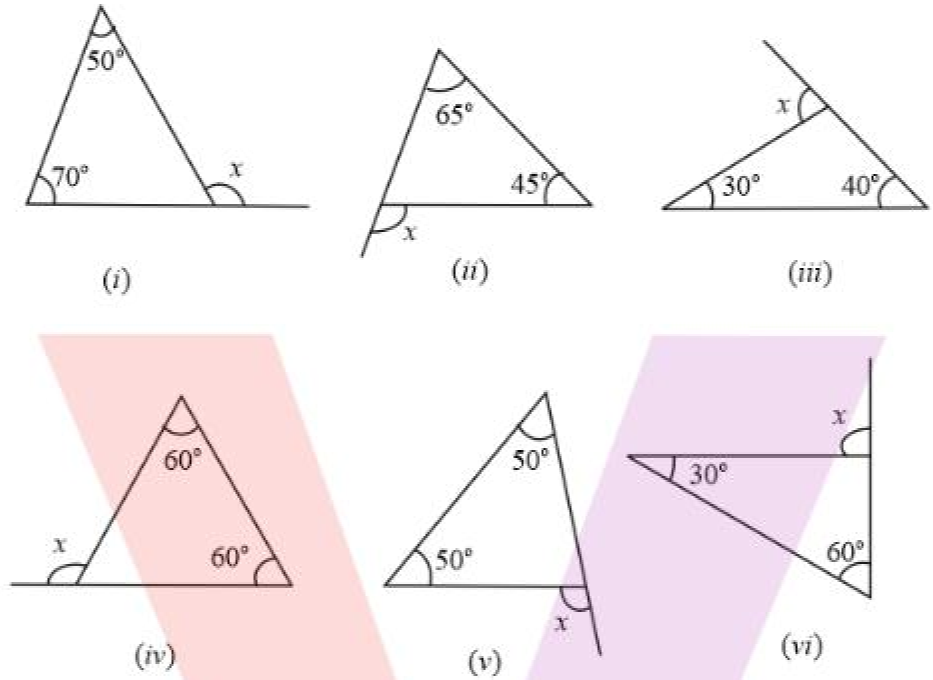
Solution:



Let us draw a line segment AD perpendicular to BC. It is an altitude for this triangle. It can be observed that the length of BD and DC is also same. Therefore, AD is also a median of this triangle.

EXERCISE 6.2

1. Find the value of the unknown exterior angle x in the following diagrams:



Solution:

(i) As per Exterior angle theorem,

Exterior angle = Sum of interior opposite angles

Hence, $x = 50° + 70°$

$\Rightarrow x = 120°$

(ii) As per Exterior angle theorem,

Exterior angle = Sum of interior opposite angles

Hence, $x = 65° + 45°$

$\Rightarrow x = 110°$

(iii) As per Exterior angle theorem,

Exterior angle = Sum of interior opposite angles

Hence, $x = 40° + 30°$

$\Rightarrow x = 70°$

(iv) As per Exterior angle theorem,

Exterior angle = Sum of interior opposite angles

Hence, $x = 60° + 60°$

$\Rightarrow x = 120°$

(v) As per Exterior angle theorem,

Exterior angle = Sum of interior opposite angles

Hence, $x = 50° + 50°$

$\Rightarrow x = 100°$

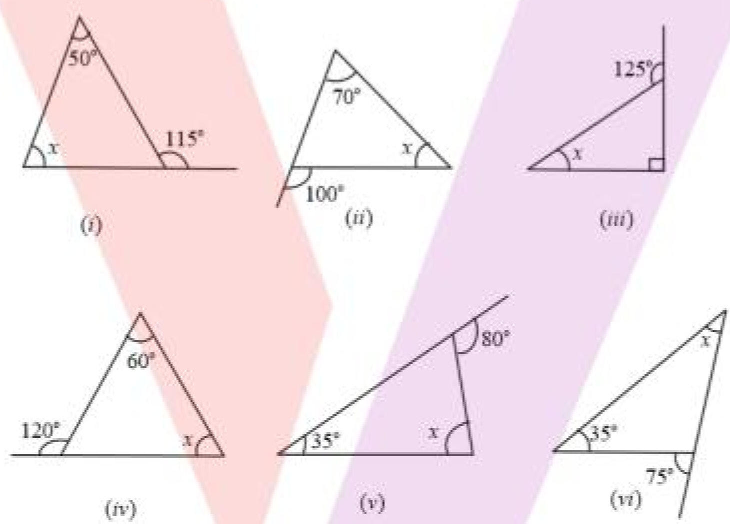
(vi) As per Exterior angle theorem,

Exterior angle = Sum of interior opposite angles

Hence, $x = 30° + 60°$

$\Rightarrow x = 90°$

2. Find the value of the unknown interior angle x in the following figures:



Solution:

(i) As per Exterior angle theorem,

Exterior angle = Sum of interior opposite angles

Hence, $x + 50° = 115°$

$\Rightarrow x = 115° - 50° = 65°$

(ii) As per Exterior angle theorem,

Exterior angle = Sum of interior opposite angles

Hence, $70° + x = 100°$

$\Rightarrow x = 100° - 70° = 30°$

(iii) As per Exterior angle theorem,

Exterior angle = Sum of interior opposite angles

Hence, x + 90° = 125°

⇒ x = 125° − 90° = 35°

(iv) As per Exterior angle theorem,

Exterior angle = Sum of interior opposite angles

Hence, x + 60° = 120°

⇒ x = 120° − 60° = 60°

(v) As per Exterior angle theorem,

Exterior angle = Sum of interior opposite angles

Hence, x + 30° = 80°

⇒ x = 80° − 30° = 50°

(vi) As per Exterior angle theorem,

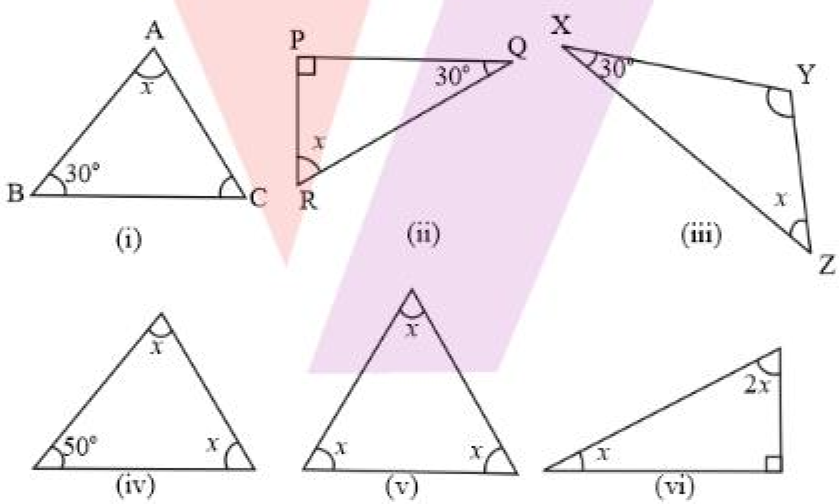
Exterior angle = Sum of interior opposite angles

Hence, x + 35° = 75°

⇒ x = 75° − 35° = 40°

EXERCISE 6.3

1. Find the value of the unknown x in the following diagrams:



Solution:

(i) As per angle sum property of a triangle,

The total measure of the three angles of a triangle is 180°.

Hence, x + 50° + 60° = 180°

⇒ x + 110° = 180°

$\Rightarrow x = 180° - 110° = 70°$

(ii) As per angle sum property of a triangle,

The total measure of the three angles of a triangle is 180°.

Hence, $x + 90° + 30° = 180°$

$\Rightarrow x + 120° = 180°$

$\Rightarrow x = 180° - 120° = 60°$

(iii) As per angle sum property of a triangle,

The total measure of the three angles of a triangle is 180°.

Hence, $x + 30° + 110° = 180°$

$\Rightarrow x + 140° = 180°$

$\Rightarrow x = 180° - 140° = 40°$

(iv) As per angle sum property of a triangle,

The total measure of the three angles of a triangle is 180°.

Hence, $50° + x + x = 180°$

$\Rightarrow 50° + 2x = 180°$

$\Rightarrow 2x = 180° - 50° = 130°$

$\Rightarrow x = \frac{130°}{2} = 65°$

(v) As per angle sum property of a triangle,

The total measure of the three angles of a triangle is 180°.

Hence, $x + x + x = 180°$

$\Rightarrow 3x = 180°$

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

(vi) As per angle sum property of a triangle,

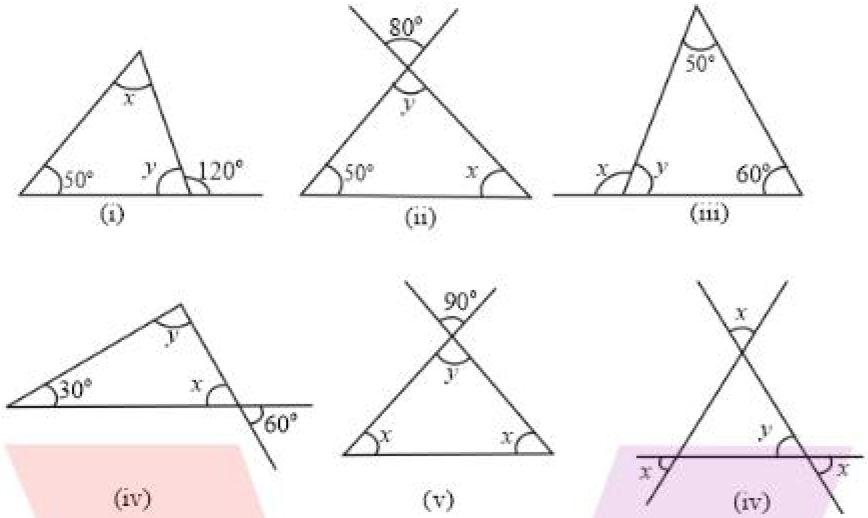
The total measure of the three angles of a triangle is 180°.

Hence, $x + 2x + 90° = 180°$

$\Rightarrow 3x = 180° - 90° = 90°$

$\Rightarrow x = \frac{90°}{3} = 30°$

2. Find the values of the unknowns x and y in the following diagrams:



Solution:

(i) $y + 120° = 180°$ (Linear pair)

$\Rightarrow y = 180° - 120° = 60°$

Again, as per angle sum property of a triangle,

The total measure of the three angles of a triangle is 180°.

Hence, $x + y + 50° = 180°$

$\Rightarrow x + 60° + 50° = 180°$

$\Rightarrow x + 110° = 180°$

$\Rightarrow x = 180° - 110° = 70°$

Hence, the value of x and y are 70° and 60° respectively.

(ii) $y = 80°$ (Vertically opposite angles)

Again, as per angle sum property of a triangle,

The total measure of the three angles of a triangle is 180°.

Hence, $y + x + 50° = 180°$

$\Rightarrow 80° + x + 50° = 180°$

$\Rightarrow x + 130° = 180°$

$\Rightarrow x = 180° - 130° = 50°$

Hence, the value of x and y are 50° and 80° respectively.

(iii) As per angle sum property of a triangle,

The total measure of the three angles of a triangle is 180°.

Hence, $y + 50° + 60° = 180°$ (Angle sum property)

$\Rightarrow y = 180° - 60° - 50° = 70°$

$x + y = 180°$ (Linear pair)

$\Rightarrow x = 180° - y = 180° - 70° = 110°$

Hence, the value of x and y are 110° and 70° respectively.

(iv) $x = 60°$ (Vertically opposite angles)

Again, as per angle sum property of a triangle,

The total measure of the three angles of a triangle is 180°.

Hence, $30° + x + y = 180°$

$\Rightarrow 30° + 60° + y = 180°$

$\Rightarrow y = 180° - 30° - 60° = 90°$

Hence, the value of x and y are 60° and 90° respectively.

(v) $y = 90°$ (Vertically opposite angles)

Again, as per angle sum property of a triangle,

The total measure of the three angles of a triangle is 180°.

Hence, $x + x + y = 180°$

$\Rightarrow 2x + y = 180°$

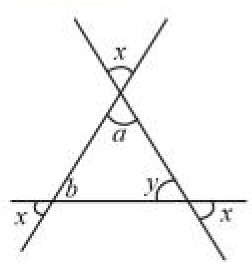
$\Rightarrow 2x + 90° = 180°$

$\Rightarrow 2x = 180° - 90° = 90°$

$\Rightarrow x = \frac{90°}{2} = 45°$

Hence, the value of x and y are 45° and 90° respectively.

(vi)



$y = x$ (Vertically opposite angles)

$a = x$ (Vertically opposite angles)

$b = x$ (Vertically opposite angles)

Again, as per angle sum property of a triangle,

The total measure of the three angles of a triangle is 180°.

Hence, $a + b + y = 180°$

$\Rightarrow x + x + x = 180°$

$\Rightarrow 3x = 180°$

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

Hence, the value of $y = x = 60°$

EXERCISE 6.4

1. Is it possible to have a triangle with the following sides?

(i) 2 cm, 3 cm, 5 cm

(ii) 3 cm, 6 cm, 7cm

(iii) 6 cm, 3 cm, 2 cm

Solution:

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

(i) Given that, the sides of the triangle are 2 cm, 3 cm, 5 cm.

It can be observed that,

$2 + 3 = 5$ cm

However, 5 cm $=$ 5 cm

Hence, this triangle is not possible.

(ii) Given that, the sides of the triangle are 3 cm, 6 cm, 7 cm.

Here, $3 + 6 = 9$ cm $>$ 7 cm

$6 + 7 = 13$ cm $>$ 3 cm

$3 + 7 = 10$ cm $>$ 6 cm

Hence, this triangle is possible.

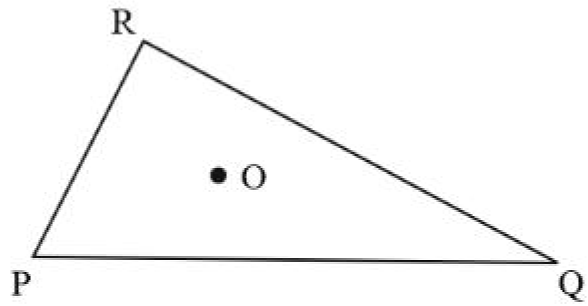
(iii) Given that, the sides of the triangle are 6 cm, 3 cm, 2 cm.

Here, $6 + 3 = 9$ cm $>$ 2 cm

However, $3 + 2 = 5$ cm $<$ 6 cm

Hence, this triangle is not possible.

2. Take any point O in the interior of a triangle PQR. Is



(i) $OP + OQ > PQ$?

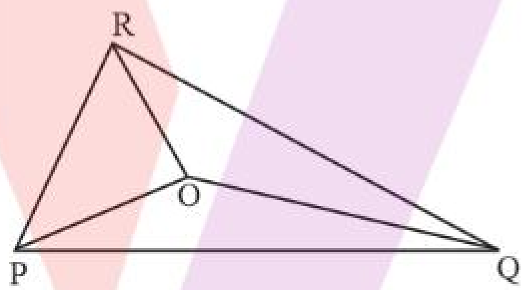
(ii) $OQ + OR > QR$?

(iii) $OR + OP > RP$?

Solution:

Given that, if O is a point in the interior of a given triangle, then three triangles $\Delta OPQ, \Delta OQR,$ and ΔORP can be constructed. In a triangle, the sum of the lengths of either two sides is always greater than the third side.

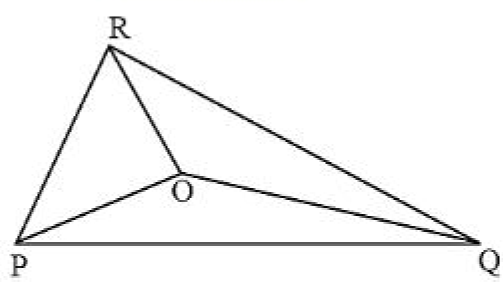
(i)



Yes, as ΔOPQ is a triangle with sides $OP, OQ,$ and PQ.

$\therefore OP + OQ > PQ$

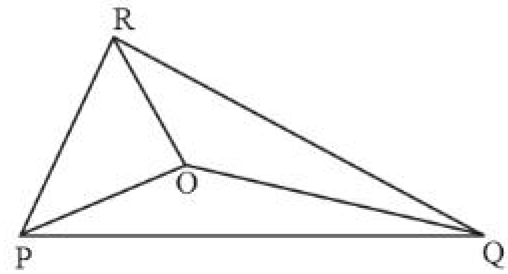
(ii)



Yes, as ΔOQR is a triangle with sides $OR, OQ,$ and QR.

$\therefore OQ + OR > QR$

(iii)



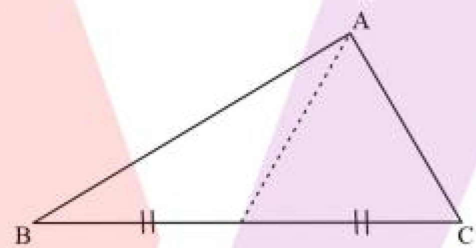
Yes, as ΔORP is a triangle with sides OR, OP, and PR.

$$\therefore OR + OP > RP$$

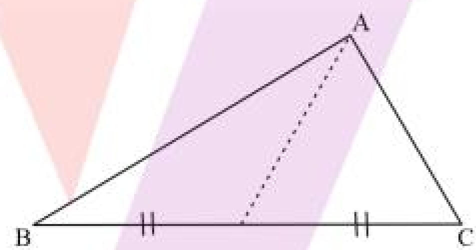
3. AM is a median of a triangle ABC.

Is $AB + BC + CA > 2AM$?

(Consider the sides of triangles ΔABM and ΔAMC.)



Solution:



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

In ΔABM,

$AB + BM > AM$ ....(i)

Similarly, in ΔACM,

$AC + CM > AM$ ....(ii)

Adding equation (i) and (ii),

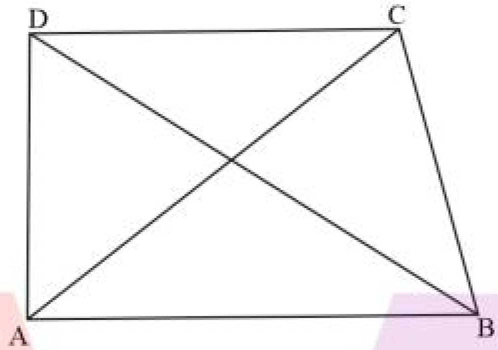
$AB + BM + MC + AC > AM + AM$

$\Rightarrow AB + BC + AC > 2AM$

Therefore, the given expression is true.

4. ABCD is a quadrilateral

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



Solution:

In a triangle, the sum of the lengths of either two sides is always greater than the third side.

Consider ΔABC,

$AB + BC > CA$ ………… (i)

In ΔBCD,

$BC + CD > DB$ …………(ii)

In ΔCDA,

$CD + DA > AC$ ………… (iii)

In ΔDAB,

$DA + AB > DB$ ………… (iv)

Adding equations (i), (ii), (iii), and (iv), we obtain

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

$\Rightarrow 2AB + 2BC + 2CD + 2DA > 2AC + 2BD$

$\Rightarrow 2(AB + BC + CD + DA) > 2(AC + BD)$

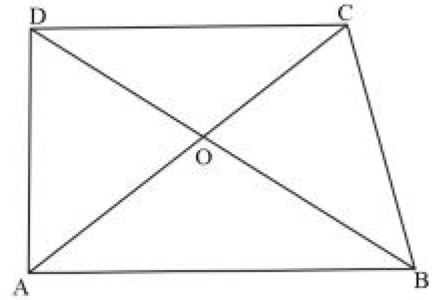
$\Rightarrow (AB + BC + CD + DA) > (AC + BD)$

Therefore, the given expression is true.

5. $ABCD$ is a quadrilateral.

Is $AB + BC + CD + DA < 2(AC + BD)$?

Solution:



In a triangle, the sum of the lengths of either two sides is always greater than the third side.

Consider ΔOAB,

$OA + OB > AB$ ……… (i)

In ΔOBC,

$OB + OC > BC$ ……… (ii)

In ΔOCD,

$OC + OD > CD$ ………… (iii)

In ΔODA,

$OD + OA > DA$ ……… (iv)

Adding equations $(i), (ii), (iii), and\ (iv)$, we obtain

$OA + OB + OB + OC + OC + OD + OD + OA > AB + BC + CD + DA$

$\Rightarrow 2OA + 2OB + 2OC + 2OD > AB + BC + CD + DA$

$\Rightarrow 2OA + 2OC + 2OB + 2OD > AB + BC + CD + DA$

$2(OA + OC) + 2(OB + OD) > AB + BC + CD + DA$

$\Rightarrow 2(AC) + 2(BD) > AB + BC + CD + DA$

$\Rightarrow 2(AC + BD) > AB + BC + CD + DA$

$\Rightarrow AB + BC + CD + DA < 2(AC + BD)$

Therefore, the given expression is true.

6. The lengths of two sides of a triangle are 12 cm and 15 cm.

Between what two measures should the length of the third side fall?

Solution:

In a triangle, the sum of the lengths of either two sides is always greater than the third side and also, the difference of the lengths of either two sides is always lesser than the third side.

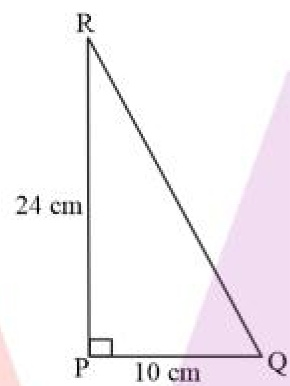
Therefore, the third side will be lesser than the sum of these two ($i.e.,12 + 15 = 27$) and also, it will be greater than the difference of these two ($i.e.,15 - 12 = 3$).

Therefore, the third side ranges between $3\ cm$ and $27\ cm$.

EXERCISE 6.5

1. PQR is a triangle right angled at P. If $PQ = 10\ cm$ and $PR = 24\ cm$, find QR.

Solution:



By applying Pythagoras theorem to ΔPQR,

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

$\Rightarrow (10)^2 + (24)^2 = (QR)^2$

$\Rightarrow 100 + 576 = (QR)^2$

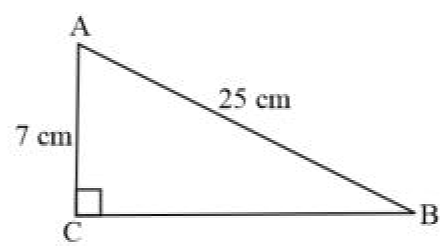
$\Rightarrow 676 = (QR)^2$

$\Rightarrow QR = \sqrt{676}\ cm = 26\ cm$

Therefore, $QR = 26\ cm$

2. ABC is a triangle right angled at C. If $AB = 25\ cm$ and $AC = 7\ cm$, find BC.

Solution:



By applying Pythagoras theorem to ΔABC,

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

$\Rightarrow (BC)^2 = (AB)^2 - (AC)^2$

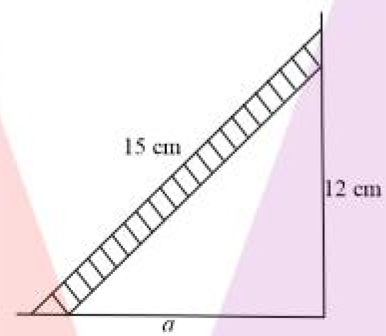
$\Rightarrow (BC)^2 = (25)^2 - (7)^2$

$\Rightarrow (BC)^2 = 625 - 49 = 576$

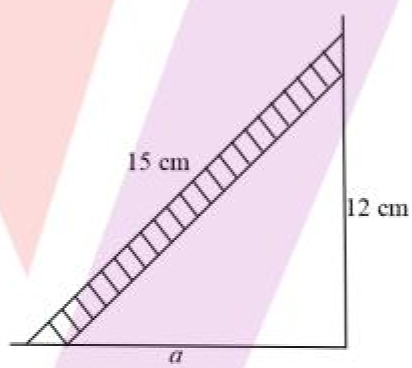
$\Rightarrow BC = \sqrt{576}\ cm = 24\ cm$

Therefore, $BC = 24\ cm$

3. A $15\ m$ long ladder reached a window $12\ m$ high from the ground on placing it against a wall at a distance a. Find the distance of the foot of the ladder from the wall.



Solution:



By applying Pythagoras theorem,

$15^2 = 12^2 + a^2$

$\Rightarrow 225 = 144 + a^2$

$\Rightarrow a^2 = 225 - 144 = 81$

$\Rightarrow a = 9\ m$

Therefore, the distance of the foot of the ladder from the wall is $9\ m$.

4. Which of the following can be the sides of a right triangle?

(i) $2.5\ cm, 6.5\ cm, 6\ cm$

(ii) $2\ cm, 2\ cm, 5\ cm$

(iii) $1.5\ cm, 2\ cm, 2.5\ cm$

In the case of right-angled triangles, identify the right angles.

Solution:

(i) $2.5\ cm, 6.5\ cm, 6\ cm$

$2.5^2 = 6.25$

$6.5^2 = 42.25$

$62 = 36$

It can be observed that,

$36 + 6.25 = 42.25$

$\Rightarrow 6^2 + 2.5^2 = 6.5^2$

The square of the length of one side is the sum of the squares of the lengths of the remaining two sides. Hence, these are the sides of a right-angled triangle with the side measuring $6.5\ cm$ as the hypotenuse.

(ii) $2\ cm, 2\ cm, 5\ cm$

$2^2 = 4$

$2^2 = 4$

$5^2 = 25$

Here, $2^2 + 2^2 \neq 5^2$

The square of the length of one side is not equal to the sum of the squares of the lengths of the remaining two sides. Hence, these sides are not of a right-angled triangle.

(iii) $1.5\ cm, 2\ cm, 2.5\ cm$

$1.5^2 = 2.25$

$2^2 = 4$

$2.5^2 = 6.25$

Here,

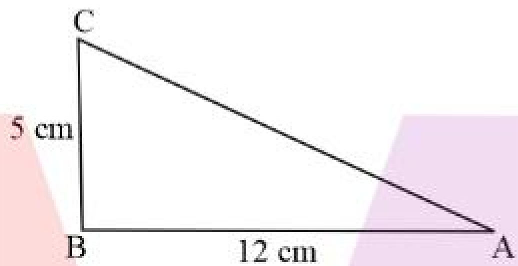
$2.25 + 4 = 6.25$

$1.5^2 + 2^2 = 2.5^2$

The square of the length of one side is the sum of the squares of the lengths of the remaining two sides. Hence, these are the sides of a right-angled triangle with the side measuring 2.5 cm as the hypotenuse.

5. A tree is broken at a height of 5 m from the ground and its top touches the ground at a distance of 12 m from the base of the tree. Find the original height of the tree.

Solution:



In the given figure, BC represents the unbroken part of the tree. Point C represents the point where the tree broke and CA represents the broken part of the tree. Triangle ABC, thus formed, is right-angled at B.

Applying Pythagoras theorem in ΔABC,

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

$\Rightarrow (AC)^2 = 12^2 + 5^2$

$\Rightarrow AC^2 = 25 + 144 = 169$

$\Rightarrow AC = 13\, m$

Thus, original height of the tree $= AC + CB = 13\, m + 5\, m = 18\, m$

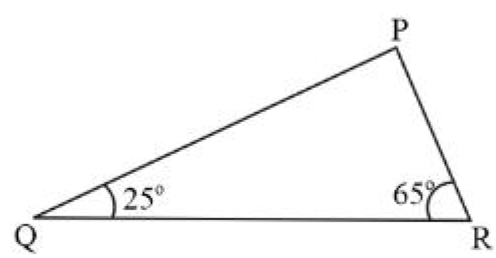
6. Angles Q and R of a ΔPQR are 25° and 65°.

Write which of the following is true:

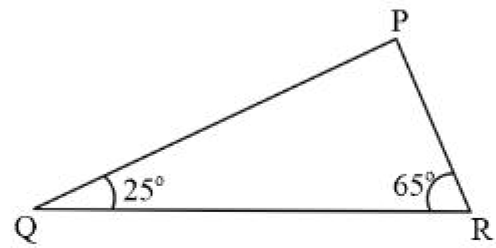
(i) $(PQ)^2 + (QR)^2 = (RP)^2$

(ii) $(PQ)^2 + (RP)^2 = (QR)^2$

(iii) $(RP)^2 + (QR)^2 = (PQ)^2$



Solution:



The sum of the measures of all interior angles of a triangle is 180^o.

Hence, $\angle PQR + \angle PRQ + \angle QPR = 180°$

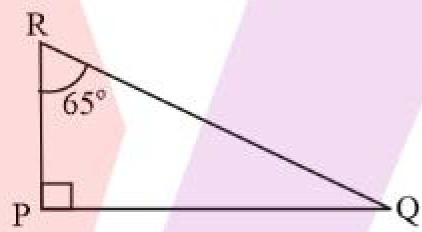
$\Rightarrow 25° + 65° + \angle QPR = 180°$

$\Rightarrow 90° + \angle QPR = 180°$

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

Therefore, $\Delta\ PQR$ is right-angled at point P.

Hence, $(PQ)^2 + (RP)^2 = (QR)^2$

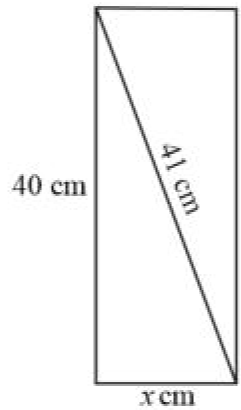


Hence, $(PQ)^2 + (RP)^2 = (QR)^2$

Thus, (ii) is true.

7. Find the perimeter of the rectangle whose length is $40\ cm$ and a diagonal is $41\ cm$.

Solution:



In a rectangle, all interior angles are of 90° measure. Therefore, Pythagoras theorem can be applied here.

$41^2 = 40^2 + x^2$

$\Rightarrow 1681 = 1600 + x^2$

$\Rightarrow x^2 = 1681 - 1600 = 81$

$\Rightarrow x = 9\ cm$

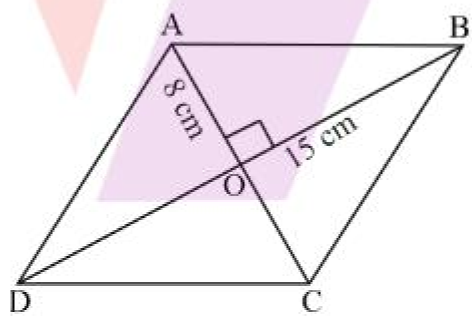
Perimeter = $2(Length + Breadth)$

$= 2(x + 40) = 2(9 + 40) = 98\ cm$

Therefore, the perimeter of the given rectangle is 98 cm.

8. The diagonals of a rhombus measure 16 cm and 30 cm. Find its perimeter.

Solution:



Let $ABCD$ be a rhombus (all sides are of equal length) and its diagonals, AC and BD, are intersecting each other at point O. Diagonals in a rhombus bisect each other at 90°. It can be observed that

$AO = \frac{AC}{2} = \frac{16}{2} = 8\ cm$

$BO = \frac{BD}{2} = \frac{30}{2} = 15$

By applying Pythagoras theorem in ΔAOB,

$OA^2 + OB^2 = AB^2 cm$

$\Rightarrow 8^2 + 15^2 = AB^2$

$\Rightarrow 64 + 225 = AB^2$

$\Rightarrow 289 = AB^2$

$\Rightarrow AB = 17$

Therefore, the length of the side of rhombus is 17 cm.

Perimeter of rhombus = $4 \times$ Side of the rhombus $= 4 \times 17 = 68$ cm

Hence, the perimeter of the rhombus = 68 cm.

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