NCERT Exercises (Questions-Solutions)

Exercise 6.1

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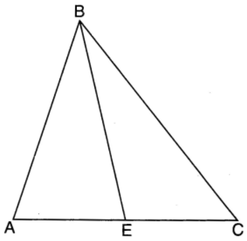
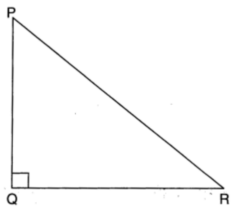
1. **In ΔPQR, D is the mid-point of QR.**
PM is ………………
PD is ……………….
Is $QM = MR$?

Sol. $\overline{PM}$ is the altitude.
PD is the median.
No! $QM \neq MR$.

2. **Draw rough sketches for the following :**
(a) In ΔABC, BE is a median.
(b) In $\Delta PQR, PQ$ and PR are altitudes of the triangle.
(c) In $\Delta XYZ, YL$ is an altitude in the exterior of the triangle.

Sol. (a)


(b)


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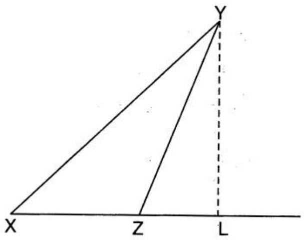
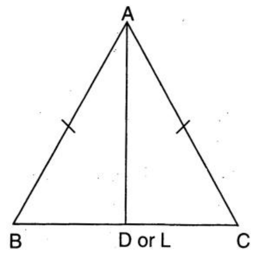


3. **Verify by drawing a diagram if the median and altitude of an isosceles triangle can be same.**

Sol.



AD is the median.
AL is the altitude.

Exercise 6.2

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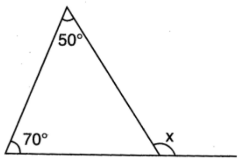
1. Find the value of the unknown exterior angle x in the following diagrams:

(i)


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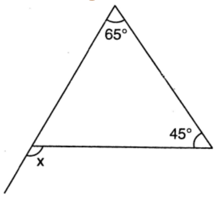
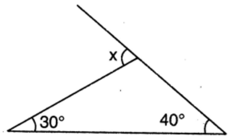


(iii)


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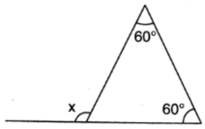
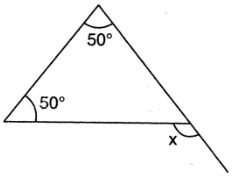
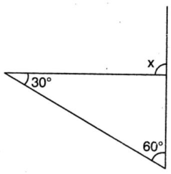


(v)


(vi)


Sol. $x = 50^o + 70^o$

The exterior angle of a triangle i equal
to the um of it two interior oppoite angle

$\Rightarrow$ $x = 120^o$

(ii) $x = 45^o + 65^o$

The exterior angle of a triangle i equal
to the um of it two interior angle

$\Rightarrow$ $x = 110^o$

(iii) $x = 30^o + 40^o$

The exterior angle of a triangle i equal to
the um of it two interior oppoite angle

$\Rightarrow$ $x = 70^o$

(iv) $x = 60^o + 60^o$

The exterior angle of a triangle i equal to
the um of it two interior oppoite angle

$\Rightarrow$ $x = 120^o$

(v) $x = 50^o + 50^o$

The exterior angle of a triangle i equal to
the um of it two interior oppoite angle

$\Rightarrow \quad x = 100^o$

(vi) $\quad x = 30^o + 60^o$

The exterior angle of a triangle i equal to
the um of it two interior oppoite angle

$\Rightarrow \quad x = 90^o$

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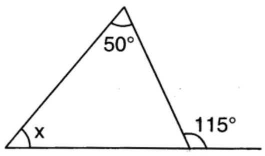
2. Find the value of the unknown interior angle x in the following figures:

(i)


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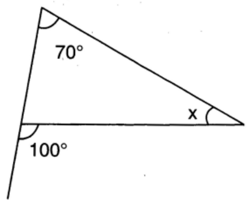

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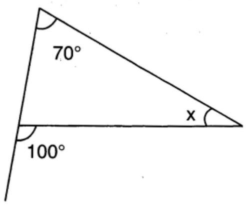

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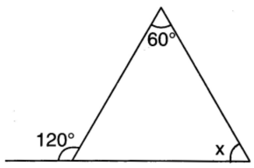
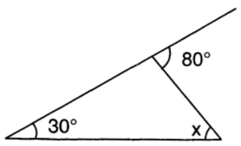


(v)


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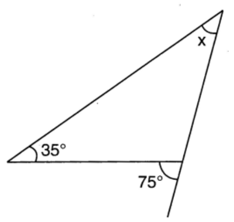

Sol. (i) $\quad 115^o = x + 50^o$

The exterior angle of a triangle i equal to
the um of it two interior oppoite angle

$\Rightarrow \quad x = 115^o - 50^o$

$\Rightarrow \quad x = 65^o$

(ii) $\quad 100^o = x + 70^o$

The exterior angle of a triangle is equal to
the sum of its two interior opposite angles

$\Rightarrow \quad x = 100^o - 70^o$

$x = 30^o$

(iii) $\quad 125^o = x + 90°$

The exterior angle of a triangle is equal to
the sum of its two interior opposite angles

$\Rightarrow \quad x = 125^o - 90^o$

$\Rightarrow \quad x = 35^o$

(iv) $120^o = x + 60^o$

|The exterior angle of a triangle is equal to the sum of its two interior opposite angles

$\Rightarrow$ $x = 120^o - 60^o$

$\Rightarrow$ $x = 60^o$

(v) $80^o = x + 30^o$

|The exterior angle of a triangle is equal to the sum of its two interior opposite angles

$\Rightarrow$ $x = 80^o - 30^o$

$\Rightarrow$ $x = 50^o$

(vi) $75^o = x + 35^o$

|The exterior angle of a triangle is equal to the sum of its two interior opposite angles

$\Rightarrow$ $x = 75^o - 35^o$

$\Rightarrow$ $x = 40^o$

Exercise 6.3

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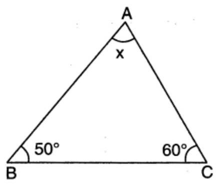
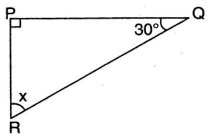
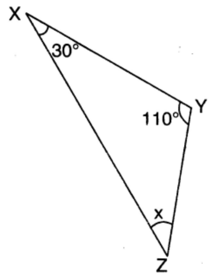
1. Find the value of the unknown x in the following diagrams:



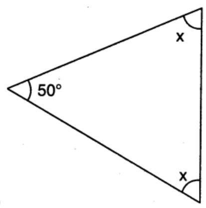
(i)



(ii)



(iii)



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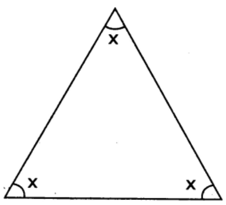
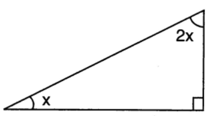


(v)



(vi)

Sol. (i) $x + 50^o + 60^o = 180^o$

|By the angle – sum property of a triangle

$\Rightarrow$ $x + 110^o = 180^o$

$\Rightarrow$ $x = 180^o - 110^o$

$\Rightarrow$ $x = 70^o$

(ii) $x + 90^o + 30^o = 180^o$

|By the angle – sum property of a triangle

$\Rightarrow$ $x + 120^o = 180^o$

$\Rightarrow \quad x = 180^o - 120^o$

$\Rightarrow \quad x = 60^o$

(iii) $\quad x + 30^o + 110^o = 180^o$

|By the angle – sum property of a triangle

$\Rightarrow \quad x + 140^o = 180^o$

$\Rightarrow \quad x = 180^o - 140^o$

$\Rightarrow \quad x = 40^o$

(iv) $\quad x + x + 50^o = 180^o$

|By the angle – sum property of a triangle

$\Rightarrow \quad 2x + 50^o = 180^o$

$\Rightarrow \quad 2x = 180^o - 50^o$

$\Rightarrow \quad 2x = 130^o$

$\Rightarrow \quad x = \dfrac{130^o}{2}$

$\Rightarrow \quad x = 65^o$

(v) $\quad x + x + x = 180^o$

|By the angle - sum property of a triangle

$\Rightarrow \quad 3x = 180^o$

$\Rightarrow \quad x = \dfrac{180^o}{3}$

$\Rightarrow \quad x = 60^o$

(vi) $\quad x + 2x + 90^o = 180^o$

|By the angle - sum property of a triangle

$\Rightarrow \quad 3x + 90^o = 180^o$

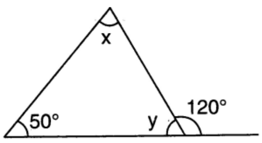
$\Rightarrow \quad 3x = 180^o - 90^o$

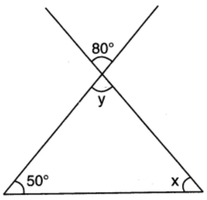
$\Rightarrow \quad 3x = 90^o$

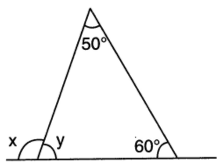
$\Rightarrow \quad x = \dfrac{90^o}{3}$

$\Rightarrow \quad x = 30^o$

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

(i)


(ii)


(iii)


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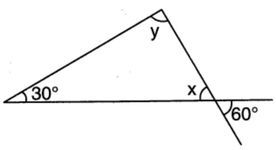
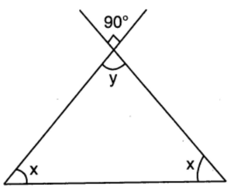
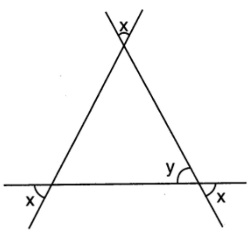


(v)


(vi)


Sol. (i) $\quad 50^o + x = 120^o$

$|$By exterior – angle property of a triangle ...(1)

$\Rightarrow \quad x = 120^o - 50^o$

$\Rightarrow \quad x = 70^o$ ... (2)

Again, $x + y + 50^o = 180^o$

$\Rightarrow \quad x + y + 50^o = 180^o$

$|$By angle – sum property of a triangle ...(4)

$\Rightarrow \quad x + y = 180^o - 50^o$

$\Rightarrow \quad x + y = 130^o$

$\Rightarrow \quad 70^o + y = 130^o$ $|$Using (2)

$\Rightarrow \quad y = 130^o - 70^o$

$\Rightarrow \quad y = 60^o$ ... (5)

(ii) $y = 80^o$

$|$Vertically opposite angles are equal ...(1)

$\Rightarrow \quad x + 50^o + y = 180^o$

$|$By angle – sum property of a triangle

$\Rightarrow \quad x + y = 180^o - 50^o$

$\Rightarrow \quad x + y = 130^o$

$\Rightarrow \quad x + 80^o = 130^o$ $|$Using(1)

$\Rightarrow \quad x = 130^o - 80^o$

$\Rightarrow \quad x = 50^o$

(iii) $x = 50^o + 60^o$

$|$By exterior-angle property of atriangle

$\Rightarrow \quad x = 110^o$

$\Rightarrow \quad x = 110$

$y + 50^o + 60^o = 180^o$

$|$By angle-sum property of a triangle

$\Rightarrow \quad y + 110^o = 180^o$

$\Rightarrow \quad y = 180^o - 110^o$

$\Rightarrow \quad y = 70^o$

(iv) $x = 60^o$ ....(1)

$|$Vertically opposite angles are equal

$x + 30^o + y = 180^o$

$|$By angles-sum property of triangle

$x + y = 180^o - 30^o$

$\Rightarrow \quad x + y = 150^o$

$\Rightarrow \quad 60^o + y = 150^o$ $|$Using (1)

$\Rightarrow \quad y = 150^o - 60^o$

$\Rightarrow \quad y = 90^o$

(v) $\quad y = 90^o \quad$ ... (1)

$|$Vertically oppostie angles are equal

$x + x + y = 180^o$ $|$By angle-sum property of a triangle

$\Rightarrow \quad 2x + y = 180^o$

$\Rightarrow \quad 2x + 90^o = 180^o \quad |$Using (1)

$\Rightarrow \quad 2x = 180^o - 90^o$

$\Rightarrow \quad 2x = 90^o$

$\Rightarrow \quad x = \frac{90^o}{2}$

$\Rightarrow \quad x = 45^o$

(vi) $\quad x = y \quad$ ... (1)

$x + x + y = 180^o$ $|$Vertically oppostie angles are equal

$\Rightarrow \quad 2x + y = 180^o$

$|$By angle-sum property of a triangle

$\Rightarrow \quad 2x + x = 180^o \quad |$Using (1)

$\Rightarrow \quad 3x = 180^o$

$\Rightarrow \quad 3x = \frac{180^o}{3}$

$\Rightarrow \quad x = 60^o \quad$ ... (2)

$\Rightarrow \quad y = 60^o \quad |$Using (1)

Exercise 6.4

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

(i) $2\text{ cm},\ 3\text{ cm},\ 5\text{ cm}$

(ii) $3\text{ cm},\ 6\text{ cm},\ 7\text{ cm}$

(iii) $6\text{ cm},\ 3\text{ cm},\ 2\text{ cm}.$

Sol. (i) $\mathbf{2\,cm, 3\,cm, 5\,cm}$

We have $\quad 2 + 3 = 5$

$\Rightarrow$ Sum of the lengths of two sides = Length of the third side

This is impossible since the sum of the lengths of any two sides of a triangle is greater than the length of the third side.

(ii) $\mathbf{3\,cm, 6\,cm, 7\,cm}$

We see that $\quad 3 + 6 > 7$

$6 + 7 > 3$

$7 + 3 > 6$

Therefore, it is possible to have a triangle with side lengths $3\text{ cm},\ 6\text{ cm},\ 7\text{ cm}$.

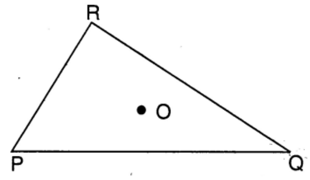
(iii) $\mathbf{6\,cm, 3\,cm, 2\,cm}$

We see that $\quad 6 + 3 = 9 > 2$

$$3+2=5 \ngtr 6$$
$$2+6=8>3$$

Therefore, it is not possible to have a triangle with side lengths $6\text{ cm},\ 3\text{ cm},\ 2\text{ cm}$.

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



(i) $OP+OQ>PQ$?

(ii) $OQ+OR>QR$?

(iii) $OR+OP>RP$?

Sol. (i) Yes! $\mathrm{OP}+\mathrm{OQ}>\mathrm{PQ}$ ... (1)

Sum of the lengths of any two sides of a triangle is greater than the length of the third side ... (2)

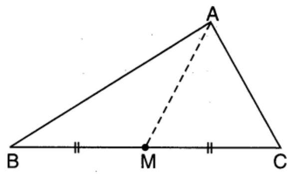
(ii) Yes! $OQ+OR>QR$

Sum of the length of any two side of a triangle is greater than the length of the third side ... (3)

(iii) Yes! $OR+OP>RP$

Sum of the lengths of any two sides of a triangle is greater than the length of the third side

3. AM is a median of a triangle ABC.



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

(Consider the sides of triangles ΔABM **and** ΔAMC**.)**

Sol. In ΔABM,

$AB+BM>AM$

Sum of the length of any two side of a triangle is greater than the lenth of the third side

In ΔACM,

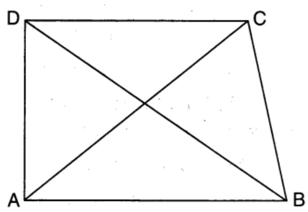
$CA+CM>AM$ ... (2)

Sum of the lenths of any two sides of a triangle is greater than the lenth of the third side

Sum (1) and (2),

$$(AB+BM)+(CA+CM)>AM+AM$$
$$\Rightarrow \quad AB+(BM+CM)+CA>2AM$$
$$\Rightarrow \quad AB+BC+CA>2AM$$

4. $ABCD$ **is a quadrilateral, Is** $AB+BC+CD+DA>AC+BD$ **?**



Sol. In ΔABC,

$AB + BC > AC$ ... (1)

Sum of the length of any two sides of a triangle
is greater than the lengthof the third side

In $\Delta ACD,$

$CD + DA > AC$ ... (2)

Sum of the lengths of any two sides of a triangle
is greater than the length of the third side

Adding (1) and (2),

$AB + BC + CD + DA > 2AC$ ... (3)

In $\Delta ABD,$

$AB + DA > BD$ ... (4)

Sum of the lenths of any two sides of a triangle
is greater than the lenth of the third side

In $\Delta ABCD$,

$BC + CD > BD$ ... (5)

Sum of the lenths of any two sides of a triangle is
greater than the length of the third side

Adding (4) and (5),

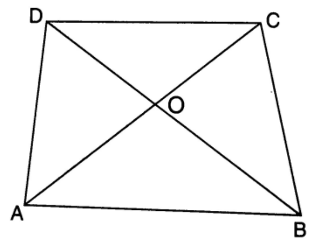
$AB + BC + CD + DA > 2BD$ ... (6)

Adding (3) and (6),

$2[AB + BC + CD + DA] > 2(AC + BD)$

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

5. **$ABCD$ is a quadrilateral. Is**
$AB + BC + CD + DA < 2(AC + BD)$?



Sol. In $\Delta OAB,$

$OA + OB > AB$ ... (1)

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

In $\Delta OBC, OB + OC > BC$ ... (2)

|Sum of the lengths of any two sides of a triangle
|is greater than the length of the third side

In $\Delta OCA, OC + OA > CA$ ... (3)

|Sum of the lengths of any two sides of a triangle is
|greater than the length of the third side

In $\Delta OAD, OA + OD > AD$ ... (4)

|Sum of the lengths of any two sides of a triangle is
|greater than the length of the third side

Adding (1), (2), (3) and (4),

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

$\Rightarrow \quad AB+BC+CD+DA < 2$
$(OA+OB+OC+OD)$

$\Rightarrow \quad AB+BC+CD+DA < 2 \ (OA+OC+OB+OD)$

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

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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?

Sol. Let $x\ cm$ be the length of the third side.

$\because$ Sum of the lengths of any two sides of a triangle is greater than the length of the third side.

$\therefore$ We should have

$12+15 > x \Rightarrow 27 > x \Rightarrow x < 27$

$15 + x > 12 \Rightarrow x > 12 - 15 \Rightarrow x > -3$

$x + 12 > 15 \Rightarrow x > 15 - 12 \Rightarrow x > 3$

$x > -3$ and $x > 3 \Rightarrow x > 3$

$\therefore$ The length of the third side should be any length between 3 cm and 27 cm.

Exercise 6.5

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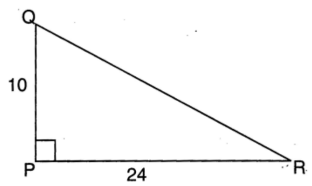
1. PQR is a triangle right-angled at P. If $PQ = 10$ cm and $PR = 24$ cm, find QR.

Sol.



$QR^2 = 10^2 + 24^2$

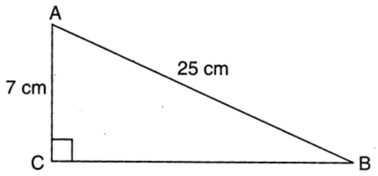
|By Pythagoras Property

$\Rightarrow \quad = 100 + 576 = 676$

$\Rightarrow \quad QR = 26$ cm

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

Sol.



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

| By Pythagoras Property

$\Rightarrow \quad 7^2+BC^2=25^2$

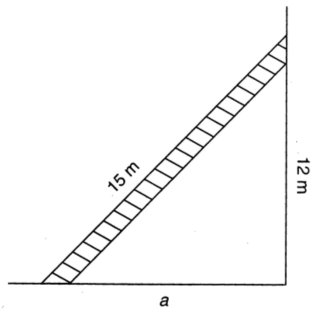
$\Rightarrow \quad 49+BC^2=625$

$\Rightarrow \quad BC^2=625-49$

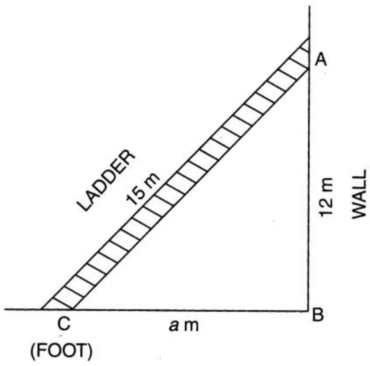
$\Rightarrow \quad BC^2=576$

$\Rightarrow \quad BC=24\ \mathrm{cm}$.

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.



Sol.



Let the distance of the foot of the ladder from the wall be a m. Then,

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

| By Pythagoras Property

$\Rightarrow \quad a^2+144=225$

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

$\Rightarrow \quad a=81$

$\Rightarrow \quad a=9$

Hence, 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.

Sol. (i) **2.5 cm, 6.5 cm, 6 cm**

We see that

$(2.5)2+6^2=6.25+36=42.25=(6.5)^2$ Therefore, the given lengths can be the sides of a right triangle. Also, the angle between the lengths, 2.5 cm and 6 cm is a right angle.

(ii) **2 cm, 2 cm, 5 cm**

$\because$ $2+2=4\not>5$

$\therefore$ The given lengths cannot be the sides of a triangle

|The sum of the lengths of any two sides of a triangle is greater than the third side

(iii) **1.5 cm, 2 cm, 2.5 cm**

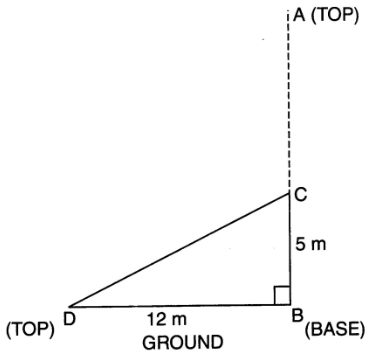
We find that

$$1.5^2+2^2=2.25+4=6.25=2.5^2$$

Therefore, the given lengths can be the sides of a right triangle. Also, the angle between the lengths 1.5 cm and 2 cm is a right angle.

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.**

Sol.



$AC=CD$

|Given

In right angled triangle DBC,

$DC^2=BC^2+BD^2$

|by Pythagoras Property

$=5^2+12^2$

$=25+144$

$=169$

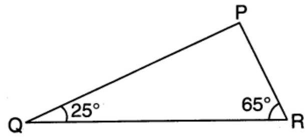
$\Rightarrow$ $DC=13$

$\Rightarrow$ $AC=13$

$\Rightarrow$ $AB=AC+BC=13+5=18$

Therefore, the original height of the tree $=18$ m.

6. Angles Q and R of a ΔPQR are 25^o and 65^o. Write which of the following is true:



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

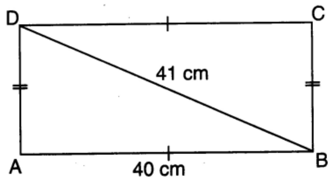
(ii) $PQ^2+RP^2=QR^2$

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

Sol. (ii) $\mathrm{PQ}^2+\mathrm{RP}^2=\mathrm{QR}^2$ is true.

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

Sol.



In right-angled triangle DAB,

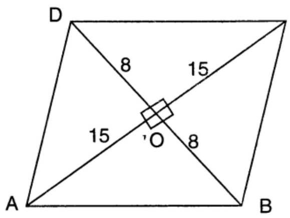
$$AB^2+AD^2=BD^2$$
$$\Rightarrow \quad 40^2+AD^2=41^2$$
$$\Rightarrow \quad AD^2=41^2-40^2$$
$$\Rightarrow \quad AD^2=1681-1600$$
$$\Rightarrow \quad AD^2=81$$
$$\Rightarrow \quad AD=9$$

$\therefore$ Perimeter of the rectangle

$$=2(AB+AD)$$
$$=2(40+9)$$
$$=2(49)=98\text{ cm}$$

Hence, the perimeter of the rectangle is 98 cm.

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



Sol. Let ABCD be a rhombus whose diagonals BD and AC are of lengths 16 cm and 30 cm respectively. Let the diagonals BD and AC intersect each other at O.

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

$$\mathrm{BO}=\mathrm{OD}=8\text{ cm},$$
$$\mathrm{AO}=\mathrm{OC}=15\text{ cm},$$

$\angle AOB=\angle BOC=\angle COD=\angle DOA=90^o$ In right-angled triangle AOB.

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

|By Pythagoras Property

$\Rightarrow \quad AB^2 = OA^2 + OB^2$

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

$\Rightarrow \quad AB^2 = 225 + 64$

$\Rightarrow \quad AB^2 = 289$

$\Rightarrow \quad AB = 17 \text{ cm}$

Therefore, perimeter of the rhombus ABCD

$= 4$ side

$= 4$ AB

$= 4 \times 17 \text{ cm}$

$= 68 \text{ cm}$

Hence, the perimeter of the rhombus is 68 cm.