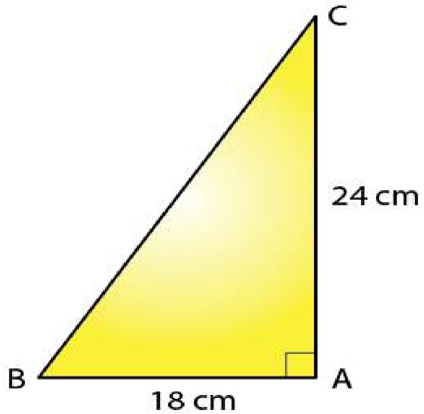
EXERCISE 16 PAGE: 189

1. Triangle ABC is right-angled at vertex A. Calculate the length of BC, if AB = 18 cm and AC = 24 cm.
Solution:

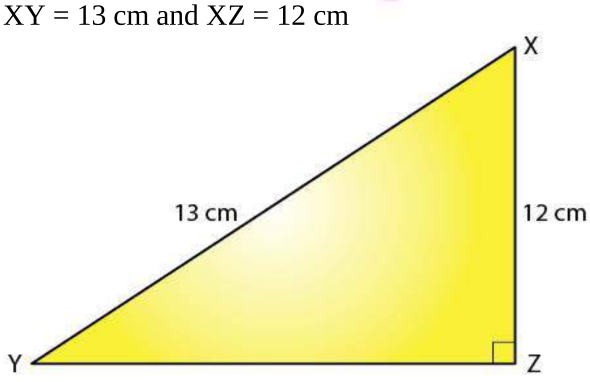
It is given that
Triangle ABC is right-angled at vertex A
AB = 18 cm and AC = 24 cm



Using Pythagoras Theorem
$BC^2 = AB^2 + AC^2$
Substituting the values
$BC^2 = 18^2 + 24^2$
By further calculation
$BC^2 = 324 + 576 = 900$
$BC = \sqrt{900} = \sqrt{(30 \times 30)}$
So we get
BC = 30 cm

2. Triangle XYZ is right-angled at vertex Z. Calculate the length of YZ, if XY = 13 cm and XZ = 12 cm.
Solution:

It is given that
Triangle XYZ is right-angled at vertex Z
XY = 13 cm and XZ = 12 cm

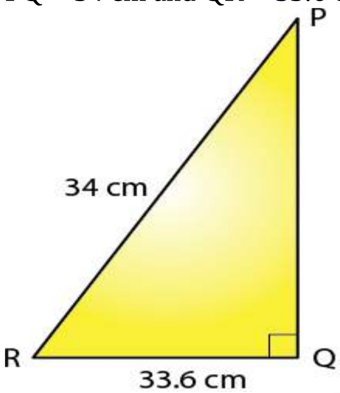


Using Pythagoras Theorem
$XY^2 = XZ^2 + YZ^2$

Substituting the values
$13^2 = 12^2 + YZ^2$
By further calculation
$YZ^2 = 13^2 - 12^2$
$YZ^2 = 169 – 144 = 25$
$YZ = \sqrt{25} = \sqrt{(5 \times 5)}$
So we get
YZ = 5 cm

3. Triangle PQR is right-angled at vertex R. Calculate the length of PR, if:
PQ = 34 cm and QR = 33.6 cm.
Solution:

It is given that
Triangle PQR is right-angled at vertex R
PQ = 34 cm and QR = 33.6 cm



Using Pythagoras Theorem
$PQ^2 = PR^2 + QR^2$
Substituting the values
$34^2 = PR^2 + 33.6^2$
By further calculation
$1156 = PR^2 + 1128.96$
$PR^2 = 1156 – 1128.96$
$PR = \sqrt{27.04}$
So we get
PR = 5.2 cm

4. The sides of a certain triangle are given below. Find, which of them is right-triangle
(i) 16 cm, 20 cm and 12 cm
(ii) 6 m, 9 m and 13 m
Solution:

(i) 16 cm, 20 cm and 12 cm
The triangle will be right angled if square of the largest side is equal to the sum of the squares of the other two sides.
Here $20^2 = 16^2 = 12^2$
We can write it as
$20^2 = 16^2 + 12^2$

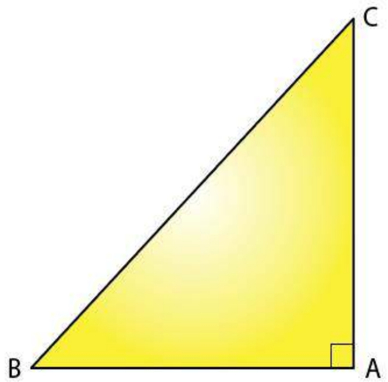
By further calculation
400 = 256 + 144
So we get
400 = 400

Hence, the given triangle is right angled.

(ii) 6 m, 9 m and 13 m
The triangle will be right angled if square of the largest side is equal to the sum of the squares of the other two sides.
Here $13^2 = 9^2 + 6^2$
By further calculation
169 = 81 + 36
So we get
$169 \neq 117$

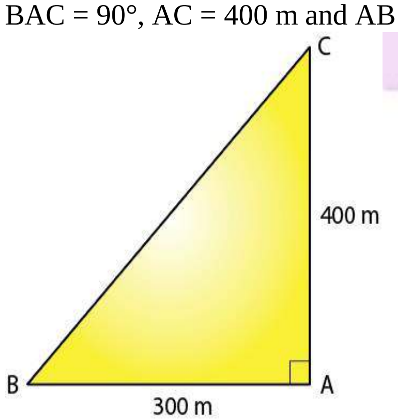
Hence, the given triangle is not right angled.

5. In the given figure, angle BAC = 90°, AC = 400 m and AB = 300 m. Find the length of BC.



Solution:

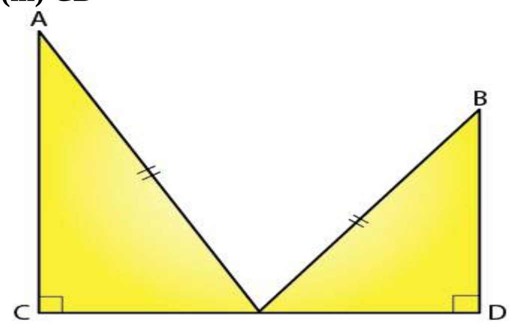
It is given that
BAC = 90°, AC = 400 m and AB = 300 m



Using Pythagoras Theorem
$BC^2 = AB^2 + AC^2$
Substituting the values

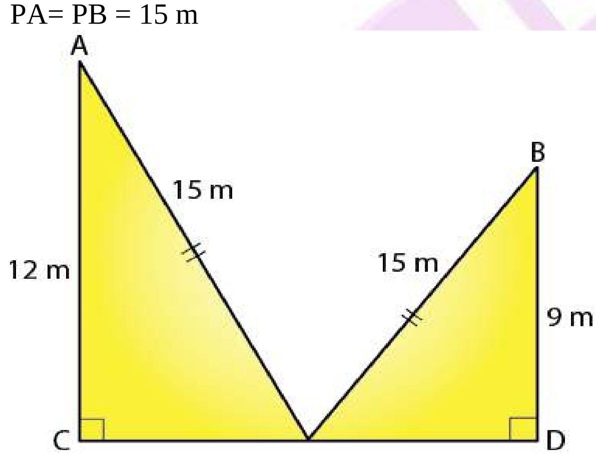
$BC^2 = 300^2 + 400^2$
By further calculation
$BC^2 = 90000 + 160000 = 250000$
$BC = \sqrt{250000}$
So we get
BC = 500 m

6. In the given figure, angle ACP = ∠BDP = 90°, AC = 12 m, BD = 9 m and PA= PB = 15 m. Find:
(i) CP
(ii) PD
(iii) CD



Solution:

It is given that
ACP = ∠BDP = 90°
AC = 12 m
BD = 9 m
PA= PB = 15 m



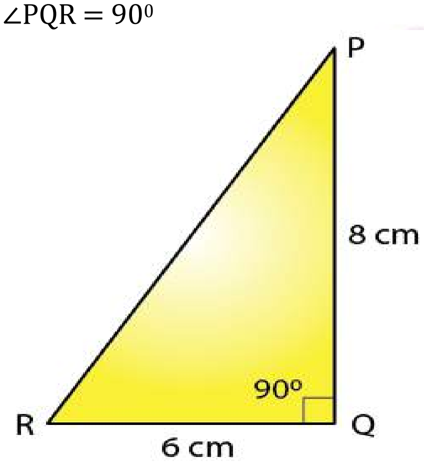
(i) In the right angled triangle ACP
$AP^2 = AC^2 + CP^2$
Substituting the values
$15^2 = 12^2 + CP^2$
By further calculation
$225 = 144 + CP^2$
$CP^2 = 225 - 144 = 81$
So we get
$CP = \sqrt{81} = 9$ m

(ii) In the right angled triangle BPD
$PB^2 = BD^2 + PD^2$
Substituting the values
$15^2 = 9^2 + PD^2$
By further calculation
$225 = 81 + PD^2$
$PD^2 = 225 - 81 = 144$
So we get
$PD = \sqrt{144} = 12$ m

(iii) We know that
CP = 9 m
PD = 12 m
So we get
CD = CP + PD
Substituting the values
CD = 9 + 12 = 21 m

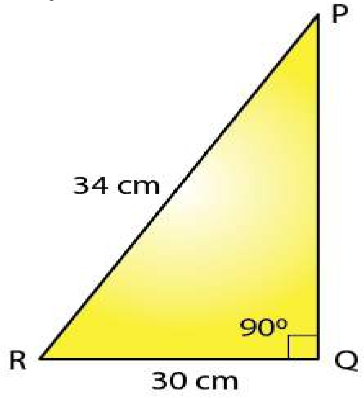
7. In triangle PQR, angle Q = 90°, find:
(i) PR, if PQ = 8 cm and QR = 6 cm
(ii) PQ, if PR = 34 cm and QR = 30 cm
Solution:

(i) It is given that
PQ = 8 cm and QR = 6 cm
$\angle PQR = 90^0$



Using Pythagoras Theorem
$PR^2 = PQ^2 + QR^2$
Substituting the values
$PR^2 = 8^2 + 6^2$
By further calculation
$PR^2 = 64 + 36 = 100$
$PR = \sqrt{100}$
So we get
PR = 10 cm

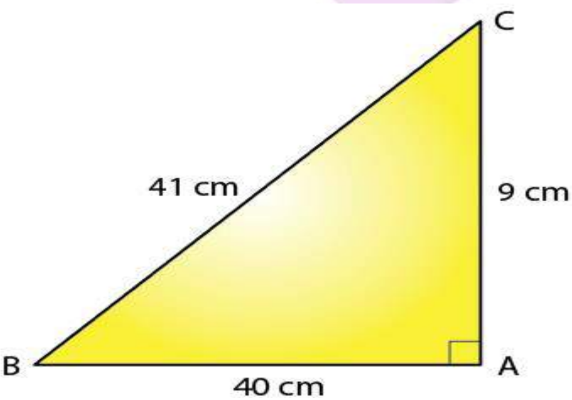
(ii) It is given that
PR = 34 cm and QR = 30 cm
$\angle PQR = 90^0$



Using Pythagoras Theorem
$PR^2 = PQ^2 + QR^2$
Substituting the values
$34^2 = PQ^2 + 30^2$
By further calculation
$1156 = PQ^2 + 900$
$PQ^2 = 1156 – 900 = 256$
$PQ = \sqrt{256}$
So we get
PQ = 16 cm

8. Show that the triangle ABC is a right-angled triangle; if:
AB = 9 cm, BC = 40 cm and AC = 41 cm
Solution:

It is given that
AB = 9 cm
BC = 40 cm
AC = 41 cm

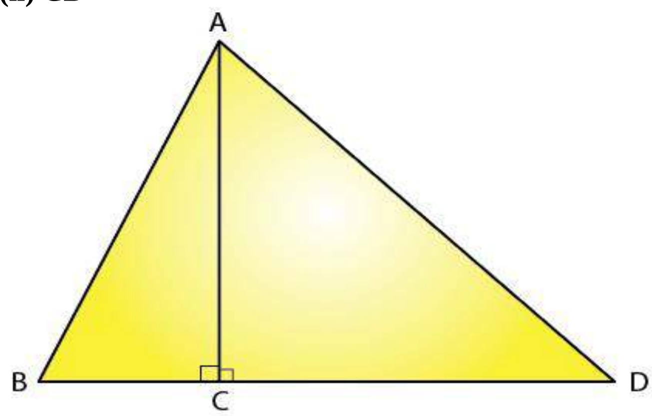


The triangle will be right angled if square of the largest side is equal to the sum of the squares of the other two sides.
Using Pythagoras Theorem

$AC^2 = BC^2 + AB^2$
Substituting the values
$41^2 = 40^2 + 9^2$
By further calculation
$1681 = 1600 + 81$
So we get
$1681 = 1681$

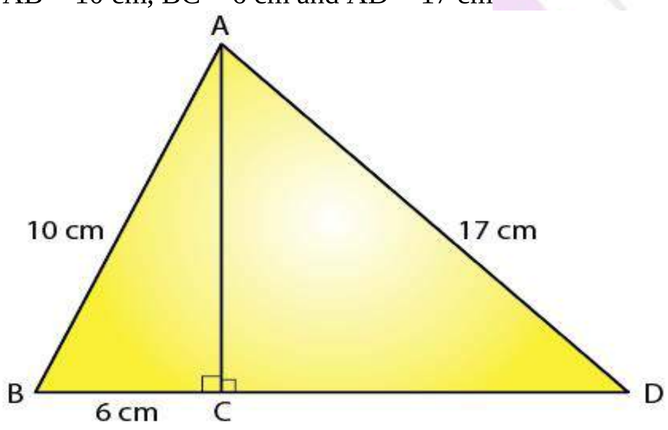
Therefore, ABC is a right-angled triangle.

9. In the given figure, angle ACB = 90° = angle ACD. If AB = 10 cm, BC = 6 cm and AD = 17 cm, find:
(i) AC
(ii) CD



Solution:

It is given that
angle ACB = 90° = angle ACD
AB = 10 cm, BC = 6 cm and AD = 17 cm



(i) In the right angled triangle ABC
BC = 6 cm and AB = 10cm

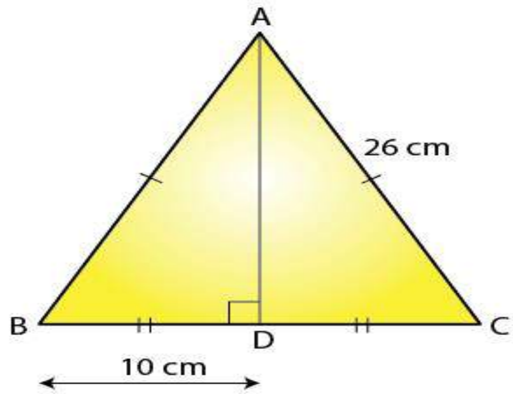
Using Pythagoras Theorem
$AB^2 = AC^2 + BC^2$
Substituting the values
$10^2 = AC^2 + 6^2$

By further calculation
$100 = AC^2 + 36$
$AC^2 = 100 – 36 = 64$
$AC = \sqrt{64} = \sqrt{(8 \times 8)}$
So we get
AC = 8 cm

(ii) In the right angled triangle ACD
AD = 17 cm and AC = 8cm

Using Pythagoras Theorem
$AD^2 = AC^2 + CD^2$
Substituting the values
$17^2 = 8^2 + CD^2$
By further calculation
$289 = 64 + CD^2$
$CD^2 = 289 – 64 = 225$
$CD = \sqrt{225} = \sqrt{(15 \times 15)}$
So we get
CD = 15 cm

10. In the given figure, angle ADB = 90°, AC = AB = 26 cm and BD = DC. If the length of AD = 24 cm; find the length of BC.



Solution:

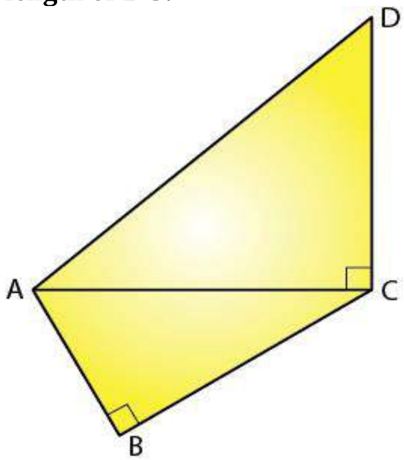
It is given that
angle ADB = 90°
AC = AB = 26 cm
BD = DC

Using Pythagoras Theorem
$AC^2 = AD^2 + DC^2$
Substituting the values
$26^2 = 24^2 + DC^2$
By further calculation
$676 = 576 + DC^2$
$DC^2 = 676 – 576 = 100$
$DC = \sqrt{100}$

So we get
DC = 10 cm

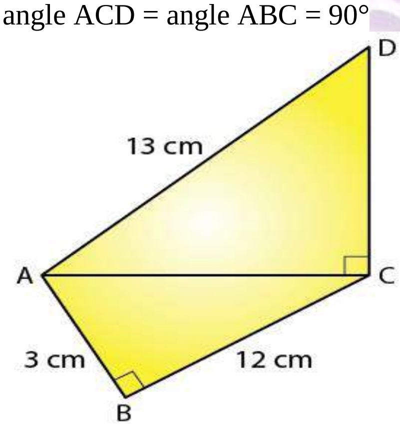
Here the length of BC = BD + DC
Substituting the values
Length of BC = 10 + 10 = 20 cm

11. In the given figure, AD = 13 cm, BC = 12 cm, AB = 3 cm and angle ACD = angle ABC = 90°. Find the length of DC.



Solution:

It is given that
AD = 13 cm
BC = 12 cm
AB = 3 cm
angle ACD = angle ABC = 90°



(i) In a right angled triangle ABC
AB = 3 cm and BC = 12 cm
Using Pythagoras Theorem
$AC^2 = AB^2 + BC^2$
Substituting the values
$AC^2 = 3^2 + 12^2$
By further calculation
$AC^2 = 9 + 144 = 153$

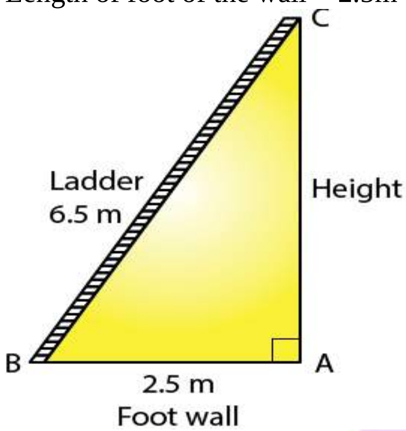
So we get
AC = √153 cm

(ii) In a right angled triangle ACD
AD = 13 cm and AC = √153 cm
Using Pythagoras Theorem
$DC^2 = AB^2 - AC^2$
Substituting the values
$DC^2 = 13^2 + \sqrt{153}^2$
By further calculation
$DC^2 = 169 - 153 = 16$
So we get
DC = √16 = 4 cm

Hence, the length of DC is 4 cm.

12. A ladder, 6.5 m long, rests against a vertical wall. If the foot of the ladder is 2.5 m from the foot of the wall, find upto how much height does the ladder reach?
Solution:

It is given that
Length of ladder = 6.5 m
Length of foot of the wall = 2.5m

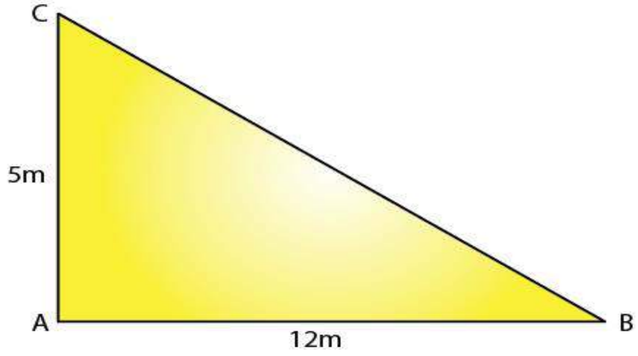


Using Pythagoras Theorem
$BC^2 = AB^2 + AC^2$
Substituting the values
$6.5^2 = 2.5^2 + AC^2$
By further calculation
$AC^2 = 42.25 – 6.25 = 36$
So we get
AC = √36 = 6 m

Hence, the ladder reaches upto 6 m.

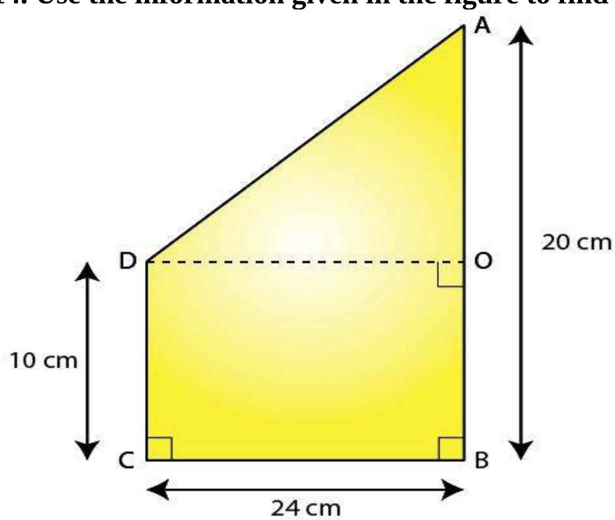
13. A boy first goes 5 m due north and then 12 m due east. Find the distance between the initial and the final position of the boy.
Solution:

It is given that
Direction of north AC = 5 m
Direction of east AB = 12 m



Using Pythagoras Theorem
$BC^2 = AC^2 + AB^2$
Substituting the values
$BC^2 = 5^2 + 12^2$
By further calculation
$BC^2 = 25 + 144 = 169$
$BC = \sqrt{169} = \sqrt{(13 \times 13)}$
So we get
BC = 13 m

14. Use the information given in the figure to find the length AD.



Solution:

It is given that
AB = 20 cm
AO = AB/2 = 20/2 = 10 cm
BC = OD = 24 cm

Using Pythagoras Theorem
$AD^2 = AO^2 + OD^2$

Substituting the values
$AD^2 = 10^2 + 24^2$
By further calculation
$AD^2 = 100 + 576 = 676$
$AD = \sqrt{676} = \sqrt{(26 \times 26)}$
So we get
AD = 26 cm