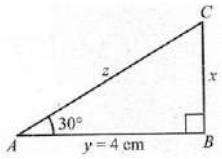
EXERCISE 6.5

Find the values of and from the following right angled triangles.

(i)



Ans:

$$\cos\theta = \frac{\text{base}}{\text{Hyp}}$$

$$\cos 30 = \frac{y}{z}$$

$$\frac{\sqrt{3}}{2} = \frac{4}{z}$$

$$z = \frac{4 \times 2}{\sqrt{3}}$$

$$z = \frac{8}{\sqrt{3}}$$

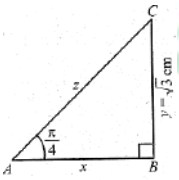
$$\tan\theta = \frac{\text{Prep}}{\text{base}}$$

$$\tan 30 \frac{x}{4}$$

$$4 \times \frac{1}{\sqrt{3}} = x$$

$$x = \frac{4}{\sqrt{3}}$$

(ii)



Ans:

$$\sin\theta = \frac{\text{Prep}}{\text{Hyp}}$$

$$\sin\frac{\pi}{4} = \frac{\sqrt{3}}{z}$$

$$\frac{1}{\sqrt{2}} = \frac{\sqrt{3}}{z}$$

$$z = \sqrt{2} \times \sqrt{3}$$

$$z = \sqrt{2 \times 3}$$

$$z = \sqrt{6}$$

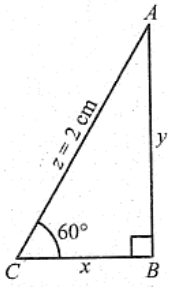
$$\tan\theta = \frac{\text{Prep}}{\text{base}}$$

$$\tan\frac{\pi}{4}=\frac{\sqrt{3}}{x}$$

$$1=\frac{\sqrt{3}}{x}$$

$$x=\sqrt{3}$$

(iii)



Ans:

$$\sin\theta=\frac{\text{Prep}}{\text{Hyp}}$$

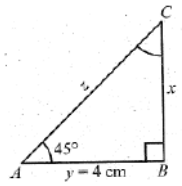
$$\sin 60=\frac{y}{2}$$

$$\frac{\sqrt{3}}{2}=\frac{y}{2}$$

$$\frac{2\times\sqrt{3}}{2}=y$$

$$y=\sqrt{3}$$

(iv)



Ans:

$$\tan\theta=\frac{\text{Prep}}{\text{base}}$$

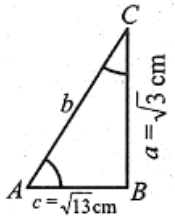
$$\tan 45=\frac{y}{4}$$

$$1=\frac{y}{4}$$

$$y=4\text{cm}$$

Q.1 **F**

ind the unknown side and angles of the following triangles.



(i)

Ans:

$$\tan\theta = \frac{\text{Prep}}{\text{base}}$$

$$\tan\theta = \frac{\sqrt{3}}{1}$$

$$\tan\theta = \sqrt{3}$$

$$\theta = \tan^{-1}\sqrt{3}$$

$$\theta = 60°$$

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

$$60 + 90 + \angle C = 180°$$

$$150 + \angle C = 180°$$

$$\angle C = 180° - 150°$$

$$\angle C = 30°$$

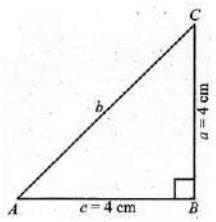
$$\tan 30 = \frac{\sqrt{3}}{b}$$

$$\frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{b}$$

$$b = \sqrt{3} \times \sqrt{3}$$

$$b = \left(\sqrt{3}\right)^2$$

$$b = 3 \text{ cm}$$



(ii)

Ans:

$$\tan\theta = \frac{\text{Prep}}{\text{base}}$$

$$\tan\theta = \frac{4}{4}$$

$$\tan\theta = 1$$

$$\theta = \tan^{-1}1$$

$$\theta = 45°$$

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

$$45° + 90° + \angle C = 180°$$

$135° + \angle C = 180°$

$\angle C = 180° - 135°$

$\angle C = 45°$

$\sin\theta = \frac{\text{Prep}}{\text{Hyp}}$

$\sin 45 = \frac{a}{b}$

$\frac{1}{\sqrt{2}} = \frac{4}{b}$

$b = 4\sqrt{2}$

Q.2 **E**

ach side of a square field is 60 m long. Find the lengths of the diagonals of the field.

Ans:

$\tan\theta = \frac{\text{Prep}}{\text{base}}$

$\tan\theta = \frac{60}{60}$

$\tan\theta = 1$

$\theta = \tan^{-1}1$

$\theta = 45°$

$\sin\theta = \frac{\text{Prep}}{\text{Hyp}}$

$\sin 45 = \frac{60}{AC}$

$AC = \frac{60}{\sin 45}$

$AC = 60 \div \frac{1}{\sqrt{2}}$

$AC = 60 \times \frac{\sqrt{2}}{1}$

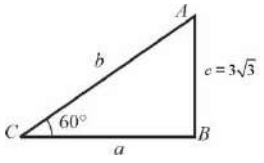
$AC = 60\sqrt{2}$

Q.3 **S**

olve the following triangles when $m\angle B = 90°$:

(i) $m\angle C = 60°, c =$

Ans:



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

$\angle A + 90° + 60° = 180°$

$\angle A + 150° = 180°$

$\angle A = 180° - 150°$

$\angle A = 30°$

$$\sin\theta = \frac{\text{Prep}}{\text{Hyp}}$$

$$\sin 60 = \frac{3\sqrt{3}}{b}$$

$$b = \frac{3\sqrt{3}}{\sin 60} = 3\sqrt{3} \div \frac{\sqrt{3}}{2}$$

$$b = 3\sqrt{3} \times \frac{2}{\sqrt{3}} = 6$$

$$\cos\theta = \frac{\text{base}}{\text{Hyp}}$$

$$\cos 60 = \frac{a}{b}$$

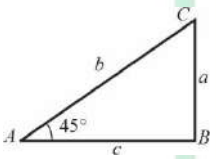
$$6\cos 60 = a$$

$$a^3 = 6 \times \frac{1}{2}$$

$$a = 3 \text{ cm}$$

(ii) $m\angle C = 45°, a =$

Ans:



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

$$\angle A + 90° + 45° = 180°$$

$$\angle A + 135° = 180°$$

$$\angle A = 180° - 135°$$

$$\angle A = 45°$$

$$\tan\theta = \frac{\text{Prep}}{\text{base}}$$

$$\tan 45 = \frac{8}{C}$$

$$C\tan 45 = 8$$

$$C(1) = 8$$

$$C = 8$$

$$\sin\theta = \frac{\text{Prep}}{\text{base}}$$

$$\sin 45 = \frac{8}{b}$$

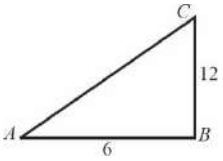
$$b = \frac{8}{\sin 45} = 8 \div \sin 45$$

$$b = 8 \div \frac{1}{\sqrt{2}}$$

$$b = 8\sqrt{2} \text{ cm}$$

(iii) $a = 12cm, c = 6c$

Ans:



$\tan\theta = \frac{\text{Prep}}{\text{base}}$

$\tan\theta = \frac{12}{6}$

$\theta = \tan^{-1} 2$

$\theta = 63$

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

$63° + 90° + \angle C = 180°$

$153° + \angle C = 180°$

$\angle C = 180° - 153°$

$\angle C = 27°$

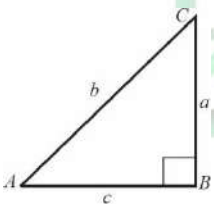
$\sin 63 = \frac{12}{b}$

$b = \frac{12}{\sin 63}$

$b = 13.46$ cm

(iv) $m\angle A = 60°, c = 4$

Ans:



$\cos\theta = \frac{\text{base}}{\text{Hyp}}$

$\cos 60 = \frac{4}{b}$

$b = \frac{4}{\cos 60}$

$b = 4 \div \cos 60$

$b = 4 \div \frac{1}{2}$

$b = 4 \times \frac{2}{1} = 8$

$\sin\theta = \frac{\text{Prep}}{\text{Hyp}}$

$\sin 60 = \frac{a}{8}$

$\frac{\sqrt{3}}{2} = \frac{a}{8}$

$\frac{8\sqrt{3}}{2} = 9$

$a = 4\sqrt{3}$

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

$60° + 90° + \angle C = 180°$

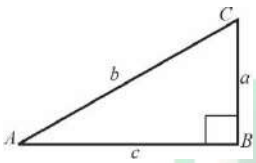
$150° + \angle C = 180°$

$\angle C = 180° - 150°$

$\angle C = 30°$

(v) $m\angle A = 30°, c = 4$

Ans:



$\cos\theta = \frac{\text{base}}{\text{Hyp}}$

$\cos 60 = \frac{4}{b}$

$b = \frac{4}{\cos 60} \Rightarrow b = 4 \div \cos 60$

$b = 4 \div \frac{1}{2} \Rightarrow b = 4 \times \frac{2}{1} = 8$

$\sin\theta = \frac{\text{Prep}}{\text{Hyp}}$

$\sin 60 = \frac{a}{8}$

$\frac{\sqrt{3}}{2} = \frac{a}{8}$

$\frac{8\sqrt{3}}{2} = 9$

$a = 4\sqrt{3}$ cm

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

$60° + 90° + \angle C = 180°$

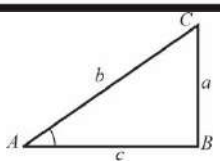
$150° + \angle C = 180°$

$\angle C = 180° - 150°$

$\angle C = 30°$

(vi) $b = 10cm, a = 6c$

Ans:



$$\sin\theta = \frac{\text{Prep}}{\text{Hyp}}$$

$$\theta = \sin^{-1}\frac{6}{10}$$

$$\theta = 37°$$

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

$$37° + 90° + \angle C = 180°$$

$$127° + \angle C = 180°$$

$$\angle C = 180° - 127°$$

$$\angle C = 53°$$

$$\cos\theta = \frac{\text{base}}{\text{Hyp}}$$

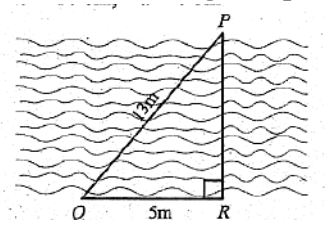
$$\cos 53° = \frac{C}{10}$$

$$C = 10\cos 53°$$

$$C = 6\,\text{cm}$$

Q.4 **L**

et Q and R be the two points on the same bank of a canal. The point P is placed on the other bank straight to point R. Find the width of the canal and the angle PQR in radians.



Ans:

$$\cos\theta = \frac{\text{base}}{\text{Hyp}}$$

$$\cos\theta = \frac{5}{13}$$

$$\theta = \cos^{-1}\frac{5}{13}$$

$$\theta = 67.38$$

$$\sin\theta = \frac{\text{Prep}}{\text{Hyp}}$$

$$\sin 67.38 = \frac{PR}{13}$$

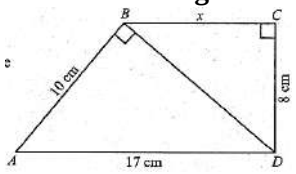
$$13\sin 67.38 = \overline{PR}$$

$\overline{PR} = 11.99$

$\overline{PR} = 12$

Q.5 **C**

alculate the length x in the adjoining figure.



Ans:

ΔABD

By Pathagorous theorem

$(\text{Hyp})^2 = (\text{Prep})^2 + (\text{Base})^2$

$(17)^2 = (BD)^2 + (10)^2$

$289 = (BD)^2 + 100$

$289 - 100 = (BD)^2$

Taking square root

$\sqrt{(BD)^2} = \sqrt{189}$

$BD = 3\sqrt{21}$

Again by Pathagorous theorem

$(\text{Hyp})^2 = (\text{Prep})^2 + (\text{Base})^2$

$\left(3\sqrt{21}\right)^2 = (x)^2 + (8)^2$

$189 = x^2 + 64$

$189 - 64 = x^2$

$125 = x^2$

Taking square root

$\sqrt{x^2} = \sqrt{125}$

$x = 5\sqrt{5}$

Q.6 **I**

f the ladder is placed along the wall such that the foot of the ladder is 2 m away from the wall. If the length of the ladder is 8 m, find the height of the wall.

Ans:

By Pathagorous theorem.

$(\text{Hyp})^2 = (\text{Prep})^2 + (\text{Base})^2$

$(8)^2 = (BC)^2 + (2)^2$

$64 = (BC)^2 + 4$

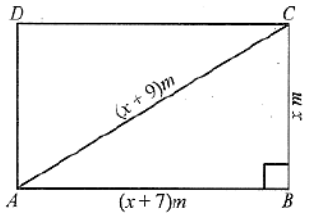
$64 - 4 = (BC)^2$

$\sqrt{(BC)^2} = \sqrt{60}$

$BC = 2\sqrt{15}\text{m}$

Q.7 **T**

he diagonal of a rectangular field *ABCD* **is** $(x+9)m$ **and the sides are** $(x+7)m$ **and** x **m. Find the value of** x**.**



Ans:

$(\text{Hyp})^2 = (\text{Prep})^2 + (\text{Base})^2$

$(x+9)^2 = x^2 + (x+7)^2$

$x^2 + 18x + 81 = x^2 + x^2 + 14x + 49$

$0 = 2x^2 + 14x + 49 - x^2 - 18x - 81$

$x^2 - 4x - 32 = 0$

$x(x-8) + 4(x-8) = 0$

$(x-8)(x+4) = 0$

$x - 8 = 0 \quad x + 4 = 0$

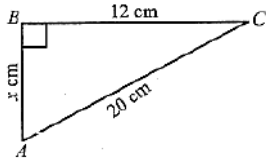
$x = 8 \qquad x = -4$

Distance can not be negative

So, $x = 8$

Q.8 **C**

alculate the value of 'x' in each case.



Ans:

$(\text{Hyp})^2 = (\text{Prep})^2 + (\text{Base})^2$

$(20)^2 = (12)^2 + (x)^2$

$400 = 144 + x^2$

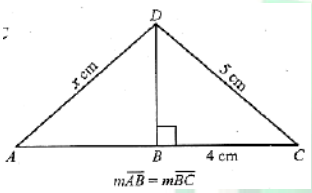
$400 - 144 = x^2$

$x^2 = 256$

Taking square root

$\sqrt{x^2} = \sqrt{256}$

$x = 16$ cm



Ans:

ΔCBD

$(\text{Hyp})^2 = (\text{Prep})^2 + (\text{Base})^2$

$(5)^2 = (BD)^2 + (4)^2$

$25 = (BD)^2 + 16$

$25 - 16 = (BD)^2$

$\sqrt{(BD)^2} = \sqrt{9}$

$BD = 3$

ΔABD

$(\text{Hyp})^2 = (\text{Prep})^2 + (\text{Base})^2$

$x^2 = (3)^2 + (4)^2$

$x^2 = 9 + 16$

$x^2 = 25$

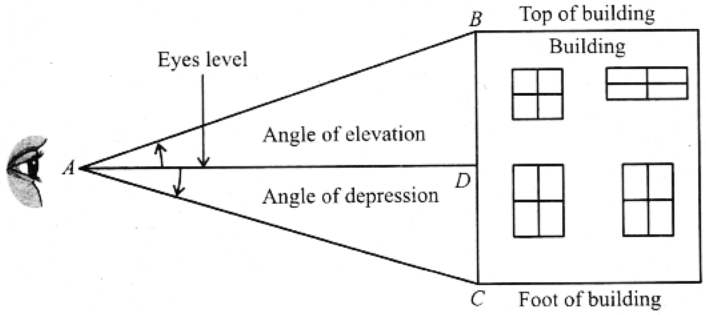
Taking square root

$\sqrt{x^2} = \sqrt{25}$

$x = 5$

The Angle of Elevation and the Angle of Depression:

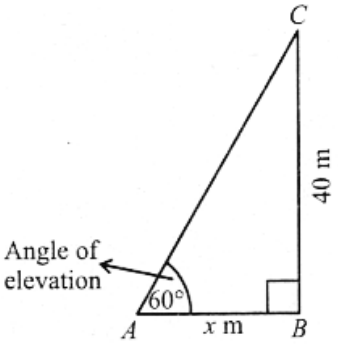
The angle between the horizontal line AD (eye level) and a line from the eye A to the top of building (B) is called an angle of elevation.



The angle between the horizontal line AD (eye level) and the line from the eye 'A' to the foot of the building (C) is called the angle of depression.

Example 19:

The angle of elevation of the top of a pole 40 m high is 60° when seen from a point on the ground level. Find the distance of the point from the foot of the pole.



Solution:

In the triangle ABC, we have

$m\overline{BC} = 40\,\text{m}$

$m\angle A = 60°$

Let $m\overline{AB} = x$ (the point B is the foot of the pole BC)

In right angled triangle ABC,

$$\tan 60° = \frac{m\overline{BC}}{m\overline{AB}}$$

$$\sqrt{3} = \frac{40}{x}$$

$$\Rightarrow \quad x = \frac{40}{\sqrt{3}}$$

$$\Rightarrow \quad x = 23.09\,\text{m}$$

Hence, distance of the point form the foot of the pole $= 23.09\,\text{m}$

Example 20:

From the top of a lookout tower, the angle of depression of a building has on the ground level of 45°. How far is a man on the ground from the tower, if the height of the tower is 30 m?

Solution:

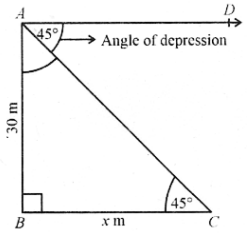
In the triangle ABC, AB is the tower and point C is the position of man. We have

$m\overline{AB} = 30\,\text{m}$

$m\angle CAD = m\angle C = 45°$

$m\overline{BC} = xm = ?$

Let x be the base of right angled triangle ABC,



$$\tan 45° = \frac{m\overline{AB}}{m\overline{BC}}$$

$$\Rightarrow \quad 1 = \frac{30}{x}$$

$$\Rightarrow \quad x = 30\,\text{m}$$