Q.2 Find θ , if

(i) $\sin\theta = 0.5791$

$\Rightarrow \quad \theta = \sin^{-1}(0.5791) = 35^{o}\,23'$

(ii) $\cos\theta = 0.9316$

$\theta = \cos^{-1}(0.9316) = 21^{o}\,18'$

(iii) $\cos\theta = 0.5257$

$\theta = \cos^{-1}(0.5257) = 58^{o}\,17'$

(iv) $\tan\theta = 1.705$

$\theta = \tan^{-1}(1.705) = 59^{o}\,36'$

(v) $\tan\theta = 21.943$

$\theta = \tan^{-1}(21.943) = 87^{o}\,23'$

(vi) $\sin\theta = 0.5186$

$\theta = \sin^{-1}(0.5186) = 31^{o}\,14'$

EXERCISE 12.2

Q.1 Find the unknown angles and sides of the following triangles.

(i) $\alpha = 45^{o}$, $\beta = 90^{o}$, $\gamma = m\angle B$

(ii) $\alpha = 60^{o}$, $\beta = 90^{o}$, $\gamma = m\angle c$

(iii) $\alpha = 90^{o}$, $\beta = m\angle B$, $\gamma = m\angle c$

Solution:

(i) $\alpha = 45^{o}$, $\beta = 90^{o}$, $\gamma = m\angle B$

since α, β, γ are angles of triangle

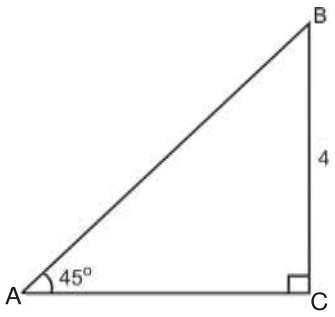
so $\alpha + \beta + \gamma = 180°$

$45^{o} + 90^{o} + m < B = 180^{o}$

$m\angle B = 45^{o}$

$\sin 45^{o} = \dfrac{BC}{AB}$

$\sin 45^{o} = \dfrac{4}{AB}$



$$\frac{1}{\sqrt{2}} = \frac{4}{AB} \Rightarrow \boxed{AB = 4\sqrt{2}}$$

$$\cos 45^\circ = \frac{AC}{AB}$$

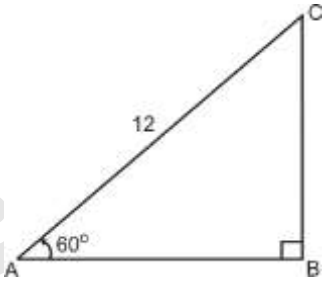
$$\frac{1}{\sqrt{2}} = \frac{AC}{4\sqrt{2}} \Rightarrow \boxed{AC = 4}$$

(ii) $\alpha = 60^\circ$, $\beta = 90^\circ$, $\gamma = m\angle c$

since $\alpha + \beta + \gamma = 180^\circ$

$60^\circ + 90^\circ + \gamma = 180^\circ$

$\gamma = 30^\circ$



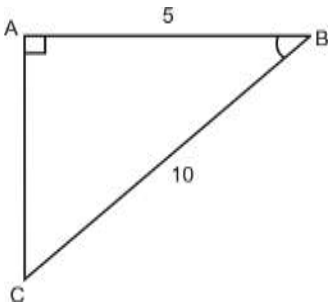
$$\sin 60^\circ = \frac{BC}{AC}$$

$$\frac{\sqrt{3}}{2} = \frac{BC}{12} \Rightarrow BC = \frac{\sqrt{3}}{2} \times 12 = 6\sqrt{3}$$

$$\cos 60^\circ = \frac{AB}{AC}$$

$$\frac{1}{2} = \frac{AB}{6\sqrt{3}} \Rightarrow AB = \frac{6\sqrt{3}}{2} = 3\sqrt{3}$$

(iii) $\alpha = 90^\circ$, $\beta = m\angle B$, $\gamma = m\angle c$



$$\cos \beta = \frac{AB}{BC}$$

$$\cos \beta = \frac{5}{10}$$

$$\beta = \cos^{-1}\left(\frac{1}{2}\right) = 60^\circ$$

$$\sin 60^\circ = \frac{AC}{BC}$$

$$\sin 60^\circ = \frac{AC}{10}$$

$$\boxed{AC = 8.66}$$

$\alpha + \beta + \gamma = 180^\circ$

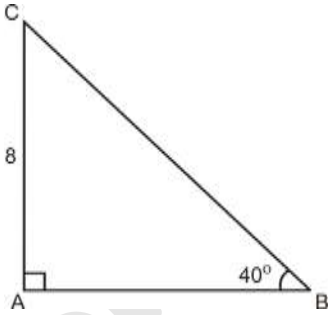
$90^\circ + 60^\circ + \gamma = 180^\circ$

$\boxed{\gamma = 30^o}$

(iv) $\alpha + \beta + \gamma = 180^o$

$90^o + 40^o + \gamma = 180^o$

$\boxed{\gamma = 50^o}$



$\sin 40^o = \frac{AC}{BC}$

$\sin 40^o = \frac{8}{BC}$

$\Rightarrow$ $\boxed{BC = 12.45}$

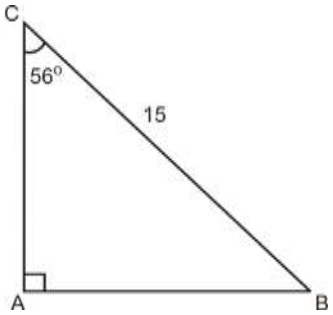
$\tan 40^o = \frac{AC}{AB} = \frac{8}{AB}$

$\boxed{AB = 9.53}$

(v) $\alpha + \beta + \gamma = 180^o$

$90^o + \beta + 56^o = 180^o$

$\boxed{\beta = 34^o}$



$\sin 56^o = \frac{AB}{BC}$

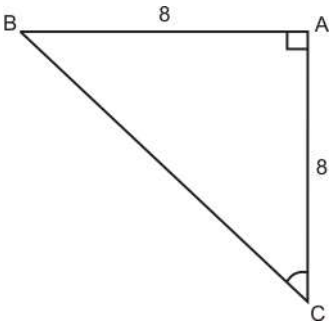
$\sin 56^o = \frac{AB}{15}$

$\Rightarrow$ $\boxed{AB = 12.44}$

$\cos 56^o = \frac{AC}{BC}$

$\cos 56^o = \frac{AC}{15}$

$\boxed{AC = 8.39}$



$\tan m\angle B = \frac{AC}{AB}$

$\tan m\angle B = \frac{8}{8}$

$m\angle B = \tan^{-1}(1)$

$\boxed{m\angle B = 45^o}$

$m\angle A + m\angle B + m\angle C = 180^o$

$45^o + 90^o + m\angle C = 180^o$

$\boxed{m\angle C = 45^o}$

$\sin 45^o = \frac{AC}{AB}$

$\frac{1}{\sqrt{2}} = \frac{8}{BC}$

$\boxed{BC = 8\sqrt{2}}$

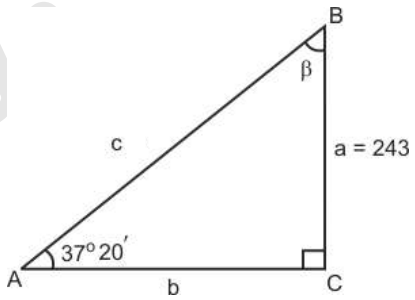
Q.2 Solve the right triangle ABC, in which $\gamma = 90°$ $\alpha = 37^o\,20'$, $a = 243$

Solution:

Since $\alpha + \beta + \gamma = 180^o$

$37^o\,20' + \beta + 90^o = 180^o$

$\boxed{\beta = 52^o\,40'}$



$\sin 37^o\,20' = \frac{BC}{AB}$

$\sin 37^o\,20' = \frac{243}{c}$

$\Rightarrow$ $\boxed{c = 400}$

$\cos 37^o\,20' = \frac{b}{c}$

$\cos 37^o\,20' = \frac{b}{400}$

$\boxed{b = 318.04}$

Q.3 $\gamma = 90^o$, $\alpha = 62^o\,40'$, $b = 796$

Solution:

Since $\alpha + \beta + \gamma = 180^o$

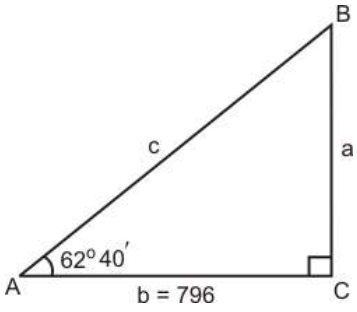
$62^o\,40' + \beta + 90^o = 180^o$

$\boxed{\beta = 27^o\,20'}$

$$\tan 62^o 40' = \frac{a}{b}$$

$$\tan 62^o 40' = \frac{a}{796}$$

$$\Rightarrow \boxed{a = 1540}$$



$$\sin 62^o 40' = \frac{a}{c}$$

$$\sin 62^o 40' = \frac{1540}{c}$$

$$\Rightarrow \boxed{c = 1733.55}$$

Q.4 $\gamma = 90^o$, $a = 3.28$, $b = 5.74$

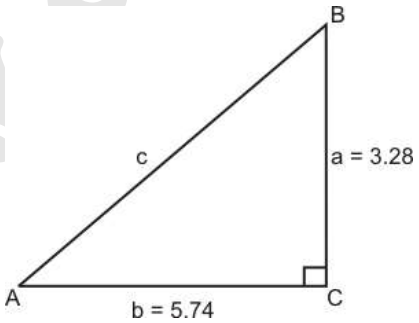
Solution:

$$\tan \alpha = \frac{a}{b}$$

$$\tan \alpha = \frac{3.28}{5.74}$$

$$\alpha = \tan^{-1}\left(\frac{3.28}{5.74}\right)$$

$$\Rightarrow \boxed{\alpha = 29^o 44'}$$



Since $\alpha + \beta + \gamma = 180^o$

$29^o 44' + \beta + 90^o = 180^o$

$$\boxed{\beta = 60^o 16'}$$

$$\sin 29^o 44' = \frac{3.28}{c}$$

$$\boxed{c = 6.61}$$

Q.5 $\gamma = 90^o$, $b = 68.4$, $c = 96.2$

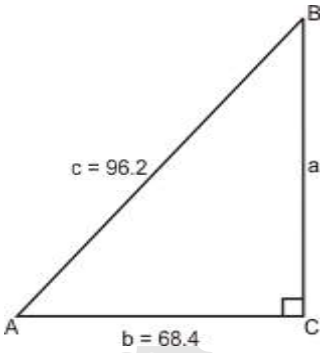
Solution:

$$\cos \alpha = \frac{b}{c}$$

$$\cos \alpha = \frac{68.4}{96.2}$$

$$\alpha = \cos^{-1}\left(\frac{68.4}{96.2}\right)$$

$$\Rightarrow \quad \boxed{\alpha = 44^{o}\,40'}$$



Since $\alpha + \beta + \gamma = 180^{o}$

$44^{o}\,40' + \beta + 90^{o} = 180^{o}$

$$\boxed{\beta = 45^{o}\,20'}$$

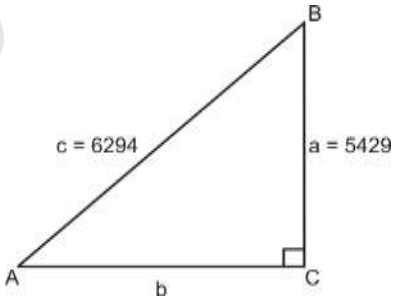
$$\sin\alpha = \frac{a}{c}$$

$$\sin 44^{o}\,40' = \frac{a}{96.2}$$

$$\boxed{a = 67.6}$$

Q.6 $\gamma = 90^{o}$, a = 5429 , c = 6294

Solution:



$$\sin\alpha = \frac{a}{c}$$

$$\sin\alpha = \frac{5429}{6294}$$

$$\alpha = \sin^{-1}\left(\frac{5429}{6294}\right)$$

$$\Rightarrow \quad \boxed{\alpha = 59^{o}\,36'}$$

Since $\alpha + \beta + \gamma = 180^{o}$

$59^{o}\,36' + \beta + 90^{o} = 180^{o}$

$$\boxed{\beta = 30^{o}\,24'}$$

$$\cos\alpha = \frac{b}{c}$$

$$\cos(59^{o}\,36') = \frac{b}{6294}$$

$$\boxed{b = 3184}$$

Q.7 $\gamma = 90^o$, $\beta = 50^o\,10'$, $c = 0.832$

Solution:

Since $\alpha + \beta + \gamma = 180^o$

$\alpha + 50^o\,10' + 90^o = 180^o$

$\boxed{\alpha = 39^o\,50'}$

$\sin\alpha = \frac{a}{c}$

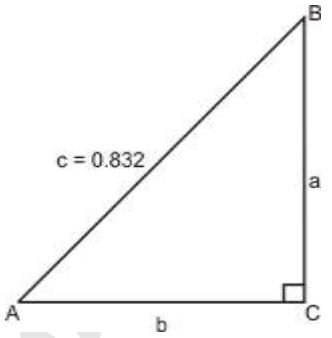
$\sin 39^o\,50' = \frac{a}{0.832}$

$\Rightarrow$ $\boxed{a = 0.5329}$

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

$\cos 39^o\,50' = \frac{0.5329}{b}$

$\boxed{c = 0.6939}$



EXERCISE 12.3

Q.1 **A vertical pole is 8m high and the length of its shadow is 6m. What is the angle of elevation of the sun at that moment?**

Solution:

Let the required angle be $= \theta$

We know that

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

$\tan\theta = \frac{8}{6}$

$\theta = \tan^{-1}\left(\frac{8}{6}\right)$

$\theta = 53^o\,7'$