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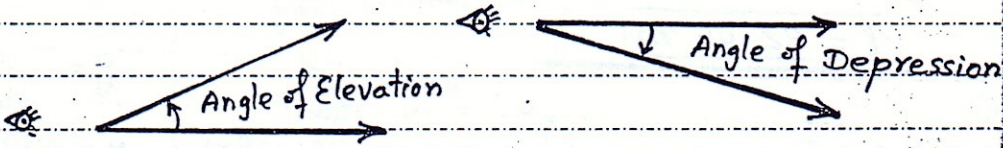
Angle of Elevation:-

The angle subtend by an object above the eye level is called angle of elevation.

Angle of Depression:-

The angle subtend by an object below the eye level is called angle of Depression.



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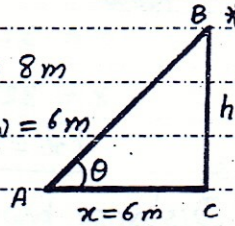
EXERCISE: 12.3

Q.1

(h) height of Pole = 8m

(x) length of Shadow = 6m

$\theta = ?$



From $\triangle ABC$

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

$\tan\theta = 1.3333$

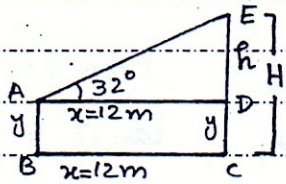
$\theta = \tan^{-1}(1.3333)$

$\boxed{\theta = 53^\circ 8'}$

Q.2 Height of man (y) = 18dm = 1.8 m

$\theta = 32^\circ$

(x) Dis. of man and tree = 12 m



From $\triangle ADE$

$\tan 32^\circ = \frac{h}{12}$

$h = 12 \times \tan 32^\circ = 12 \times 0.6249$

$h = 7.50$ m

Height of tree = y + h

$H = 1.8 + 7.5$

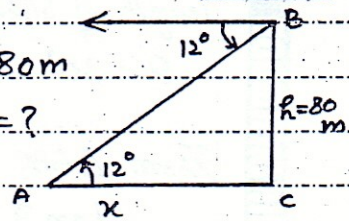
$\boxed{H = 9.3 \text{ m}}$

Q.3

(h) height = 80m

(x) Distance = ?

$\theta = 12^\circ$



From $\triangle ABC$

$\tan 12^\circ = \frac{80}{x}$

$x = \frac{80}{\tan 12^\circ} = \frac{80}{0.2126}$

$\boxed{x = 376.37 \text{ m}}$

Q.4 $\theta = 24^\circ$ with wall.

(l) length of ladder = ?

(x) Distance from wall = 5m

From $\triangle ABC$

$\sin 24^\circ = \frac{x}{l}$

$l = \frac{5}{\sin 24^\circ}$

$l = \frac{5}{0.4067}$

$l = 12.29 \text{ m}$

So

Length of ladder = 12.29 m

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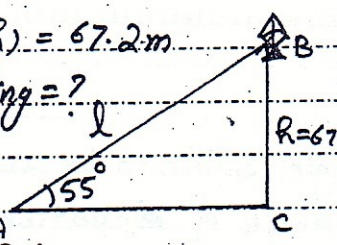
Q.5/ height (h) = 67.2 m

length of String = ?

$\theta = 55°$



From ΔABC

$$\sin 55° = \frac{h}{l} = \frac{67.2}{l}$$

$$\Rightarrow l = \frac{67.2}{0.819}$$

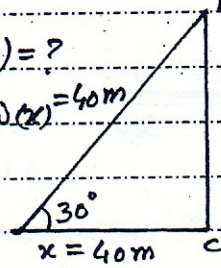
$$\boxed{l = 82.04\ m}$$

Q.6/

h (height of Pole) = ?

length of shadow (x) = 40 m

$\theta = 30°$



From ΔABC

$$\tan 30° = \frac{h}{40}$$

$$h = 40 \times \tan 30°$$

$$h = 40 \times 0.577$$

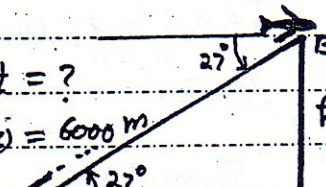
$$\boxed{h = 23.09\ m}$$

Q.7

(h) height = ?

Distance (x) = 6000 m

$\theta = 27°$



From ΔABC

$$\tan 27° = \frac{h}{6000m}$$

$$h = 6000 \times \tan 27°$$

$$h = 6000 \times 0.5095$$

$$h = 3057.15\ m$$

So height of plane is 3057.15 m.

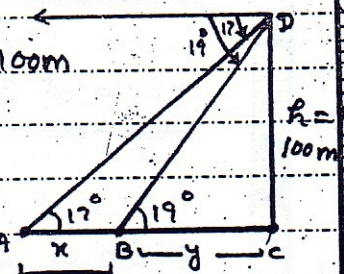
Q.8

height (h) = 100 m

$\theta_1 = 17°$

$\theta_2 = 19°$

(x) Distance b/w Ships = ?



From ΔADC

$$\tan 17° = \frac{100}{x+y}$$

$$x+y = \frac{100}{\tan 17°}$$

$$x+y = 327.09\ m$$

From ΔBCD

$$\tan 19° = \frac{100}{y}$$

$$y = \frac{100}{\tan 19°}$$

$$y = 290.42\ m$$

Now

$$x = 327.09 - y$$

$$x = 327.09 - 290.42$$

$$\boxed{x = 36.67\ m}$$

So Distance b/w Ships = 36.67 m

Q.9 Height of tree (h) = ?

$\theta_1 = 12°$

$\theta_2 = 15°$

$x = 30\ m$

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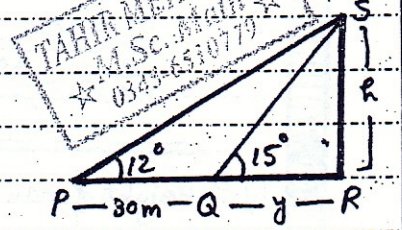

From ΔPRS

$$\tan 12° = \frac{h}{30+y}$$

$$(y+30) = \frac{h}{\tan 12}$$

$$y + 30 = 4.7046h$$

From ①

$$3.732h + 30 = 4.7046h$$

$$4.7046h - 3.732h = 30$$

$$0.9726h = 30$$

$$\boxed{h = 30.84\ m}$$

So height of tree = 30.84 m.

From ΔQRS

$$\tan 15° = \frac{h}{y}$$

$$h = y \tan 15°$$

$$y = \frac{h}{\tan 15°}$$

$$y = 3.732h \quad \text{—①}$$

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Chapter : 12 (Ist Year) ⑦

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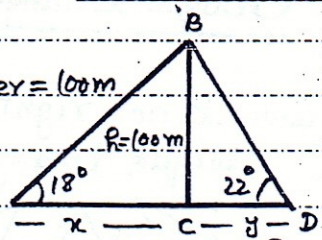
Q.10



(h) height of tower = 100m

$\theta_1 = 18°$

$\theta_2 = 22°$

Distance b/w men $(x+y) = ?$

From ΔABC

$\tan 18° = \frac{100}{x}$

$x = \frac{100}{\tan 18°}$

$x = 307.77 m$

From ΔBCD

$\tan 22° = \frac{100}{y}$

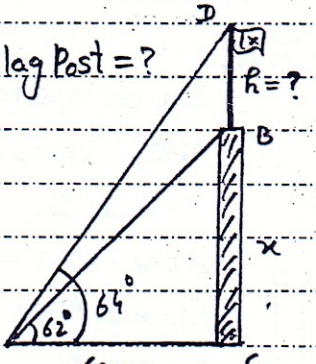
$y = \frac{100}{\tan 22°}$

$y = 247.51 m$

Now $x+y = 307.77 + 247.51$

$\boxed{x+y = 555.28 m}$

Q.11



(h) height of Flag Post = ?

$\theta_1 = 62°$

$\theta_2 = 64°$

From ΔABC

$\tan 62° = \frac{x}{60}$

$x = 60 \times \tan 62°$

$x = 112.84 m$

Now From ΔACD

$\tan 64° = \frac{h+x}{60}$

$x + h = 60 \times \tan 64°$

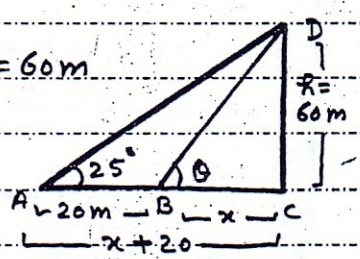
$112.84 + h = 123.02 m$

$h = 123.02 - 112.84$

$h = 10.18 m$

So height of Flag Staff = 10.18 m

Q.12



h (height) = 60m

$\theta_1 = 25°$

$\theta = ?$

From ΔACD

$\tan 25° = \frac{60}{x+20}$

$x+20 = \frac{60}{\tan 25} = 128.67 m$

$x = 128.67 - 20$

$x = 108.67 m$

Now From ΔBCD

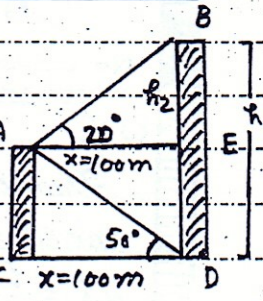
$\tan\theta = \frac{h}{x} = \frac{60}{108.67}$

$\tan\theta = 0.5521$

$\theta = \tan^{-1}(0.5521)$

$\theta = 28° 54' 16''$

Q.13



From ΔACD

$\tan 50° = \frac{h_1}{100}$

$h_1 = 100 \times \tan 50°$ ... ①

$h_1 = 119.18 m$

Now From ΔABE

$\tan 20° = \frac{h_2}{100}$

$h_2 = 100 \times \tan 20°$

$h_2 = 36.40 m$ ... ②

(h) height of building B = $h_1 + h_2$

$h = 36.40 + 119.18$

$\boxed{h = 155.58 m}$

Tahir. Mahmood
M.Sc.(Math)
0345 6510779

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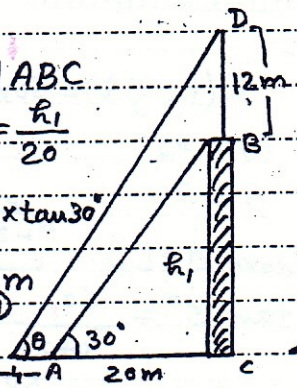
Q.14



From ΔABC

$$\tan 30^\circ = \frac{h_1}{20}$$

$$h_1 = 20 \times \tan 30^\circ$$

$$h_1 = 11.55\ m \quad \text{---(1)}$$

Now from ΔECD

$$\tan\theta = \frac{h_1 + 12}{20+4}$$

$$\tan\theta = \frac{11.55+12}{24}$$

$$\tan\theta = \frac{23.55}{24}$$

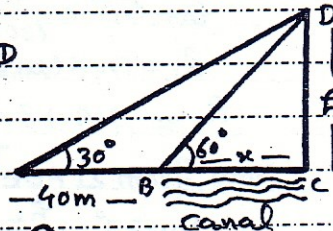
$$\tan\theta = 0.98125$$

$$\theta = \tan^{-1}(0.98125)$$

$$\theta = 44^\circ 27' 15''$$

New angle of elevation is $44^\circ 27' 15''$.

Q.15



From ΔBCD

$$\tan 60^\circ = \frac{h}{x}$$

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

$$h = \sqrt{3}x \quad \text{---(1)}$$

New from ΔACD

$$\tan 30^\circ = \frac{h}{x+40}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{x+40}$$

$$x+40 = \sqrt{3}h$$

$$x+40 = \sqrt{3}(\sqrt{3}x)$$

$$x+40 = 3x$$

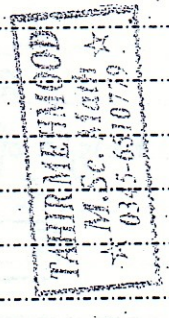
$$40 = 3x - x = 2x$$

$$\boxed{x = 20m}$$

Now

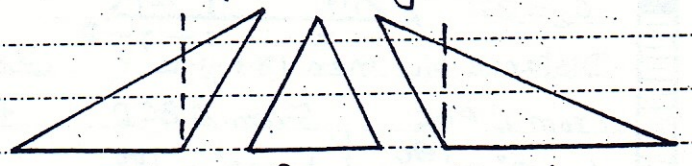
$$h = \sqrt{3} \times 20 = 34.64$$

$$\boxed{h = 34.64\ m}$$



Oblique Triangle:-

"A triangle which is not right triangle is called oblique triangle."



Solution of Oblique triangle:-

Oblique triangles can be solved by the following Laws:

V.V.Imp.

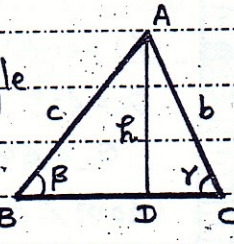
Law of Sines:-

In any triangle ABC

$$\frac{a}{\sin\alpha} = \frac{b}{\sin\beta} = \frac{c}{\sin\gamma}$$

is called Law of Sines.

Proof:-



In oblique triangle ABC, Draw $AD \perp BC$

where $|AD| = h$

From ΔABD and ΔADC

$$\sin\beta = \frac{h}{c} \qquad \sin\gamma = \frac{h}{b}$$

$$h = c\sin\beta \qquad h = b\sin\gamma$$

$$\Rightarrow c\sin\beta = b\sin\gamma$$

$$\Rightarrow \frac{b}{\sin\beta} = \frac{c}{\sin\gamma} \quad \text{---(A)}$$

Similarly by drawing $\perp$ from B to AC and C to AB

$$\frac{a}{\sin\alpha} = \frac{c}{\sin\gamma} \text{---(B)} \quad \text{and} \quad \frac{a}{\sin\alpha} = \frac{b}{\sin\beta} \text{---(C)}$$

From (A), (B), (C)

$$\frac{a}{\sin\alpha} = \frac{b}{\sin\beta} = \frac{c}{\sin\gamma}$$

which is Law of Sines.

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