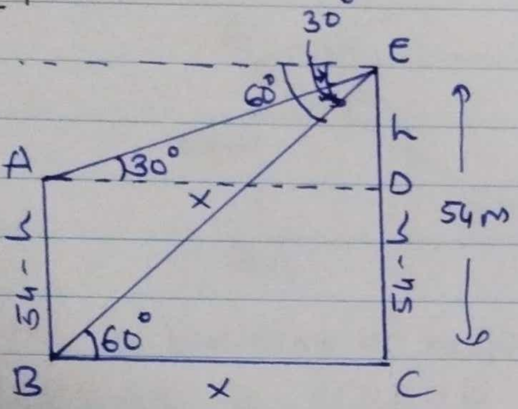
Name:- Amit Anand Chawarekar Date:- 05/March/22

Assignment 1 (Height & Distances)

Q.2) There are two temples, one on each bank of a river just opposite to each other. One temple is 54m high. From the top of this temple, the angles of depression of the top and foot of other temple are 30° & 60° respectively. The length of temple is;

a) 18 m b) 36 m c) $36\sqrt{3}$ m d) $18\sqrt{3}$ m

= Sol^n:-



Let AB and CE be two temples

Let CE = 54m & AB = 54-h m

D = h mtrs, $\angle CBE = 60^\circ$,

$\angle DAE = 30^\circ$

Now, let x be distance between two rivers.

$\therefore$ In ΔADE,

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

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

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

Again in ΔBCE

$\Rightarrow \tan 60^\circ = \frac{54}{x}$

$\Rightarrow \sqrt{3} = \frac{54}{x}$

$\Rightarrow \sqrt{3} = \frac{54}{h\sqrt{3}}$

$h = \frac{54}{\sqrt{3}.\sqrt{3}}$

$\boxed{h = 18}$ m

$\therefore$ length of other temple is

$54 - h = 54 - 18$

$\boxed{= 36}$ m

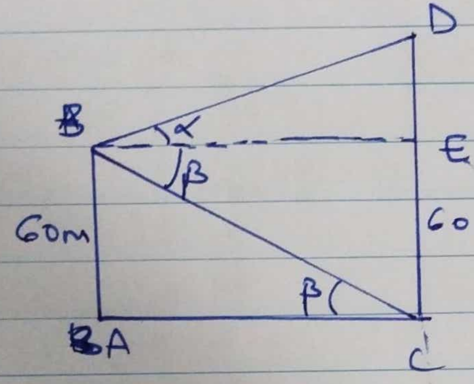
Q.3] From the top of building 60m high, the angle of elevation and depression of top and foot of another building are α and β respectively. Find height of second building.

a) $60(1+\tan\alpha\tan\beta)$ b) $60(1-\cot\alpha\tan\beta)$ c) $60(1+\tan\alpha\cot\beta)$

d) $60(1-\tan\alpha\cot\beta)$

=

~~best~~



Let AB is building of height 60cm & CD is second building

$\therefore \angle DBE = \alpha$ & $\angle CBE = \beta$

$\therefore$ In ΔBAC, $\tan\beta = \dfrac{60}{AC} \Rightarrow AC = \cancel{\tan\beta}\dfrac{60}{\tan\beta} \Rightarrow \boxed{AC = 60\cot\beta}$

$\because AC = BE$

$\therefore \boxed{BE = 60\cot\beta}$

Now in ΔBED, $\tan\alpha = \dfrac{DE}{BE}$

$= \tan\alpha = \dfrac{DE}{60\cot\beta} \Rightarrow \boxed{DE = \tan\alpha \cdot 60\cot\beta}$

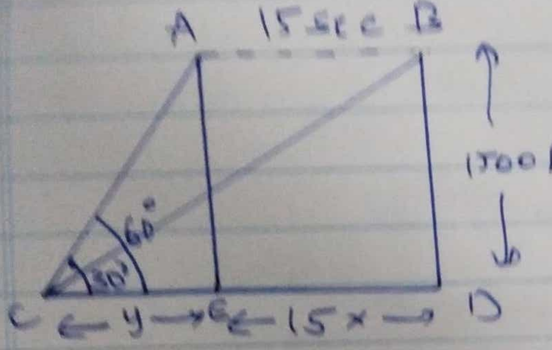
$\therefore$ Height of building (second) $= 60 + DE$

$= 60 + 60\tan\alpha\cot\beta$

$\boxed{= 60(1+\tan\alpha\cot\beta)}$

Q4] The angle of elevation of an aeroplane from a point on ground is 60°. After 15 seconds flight, the elevation changes to 30°. If aeroplane is flying at height of $1500\sqrt{3}$ m, find speed of plane.

a) 300 m/sec b) 200 m/sec c) 100 m/s d) 150 m/sec



Let A be Aeroplane, and B be a Aeroplane after 15 seconds.

Let C be a point on ground.

So, $\angle ECA = 60^\circ$ & $\angle DCB = 30^\circ$

Now, let speed of Aeroplane $= x$

$\because$ Speed $= \dfrac{\text{Distance}}{\text{time}}$

Distance = speed × time

$\boxed{D = 15x}$

$\therefore ED = 15x$

from ΔACE, $\tan 60^\circ = \dfrac{1500\sqrt{3}}{y}$

$(\because CE = y)$

$\Rightarrow \sqrt{3} = \dfrac{1500\sqrt{3}}{y}$

$\therefore \boxed{y = 1500}$

from ΔBCD, $\tan 30^\circ = \dfrac{1500\sqrt{3}}{15x + y}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{1500\sqrt{3}}{15x + 1500}$

$\Rightarrow 1 = \dfrac{1500\sqrt{3}\cdot\sqrt{3}}{15(x+100)}$

$\Rightarrow \cancel{15}^{1}(x+100) = \cancel{1500}^{100} \times 3$

$x + 100 = 300$

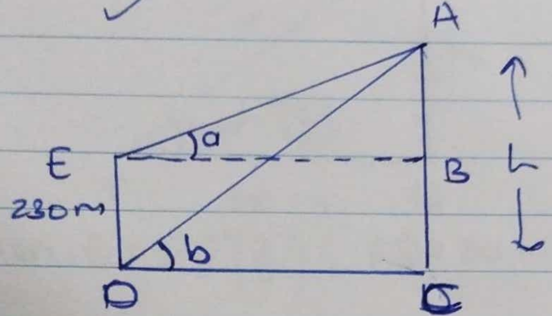
$\boxed{x = 200 \text{ m/s}}$

$\therefore$ Speed of Aeroplane is 200 m/s.

Q.5] From the foot and top of a building of height 230 m, a person observes the top of tower with angles of elevation of b & a respectively. What is distance between the top of these buildings if $\tan a = \frac{5}{12}$ & $\tan b = \frac{4}{5}$.

a) 400 m b) ~~650 m~~ c) 600 m d) 250 m

=



let ED be building & AC be tower.

Given, $ED = 230m$, $\angle ADC = b$

$\angle AEB = a$,

$\tan a = \frac{5}{12}$, $\tan B = \frac{4}{5}$

let $AC = h$.

Required distance = AE

Now, from ΔABE, $\tan a = \frac{AB}{BE}$

$$\frac{5}{12} = \frac{h-230}{BE}$$

$$\therefore \boxed{BE = \frac{12(h-230)}{5}} \quad —①$$

from ΔACD, $\tan B = \frac{h}{CD}$

$$\therefore \boxed{CD = \frac{5h}{4}} \quad —②$$

Now, according to diagram.

$BE = CD$

$$\therefore \frac{12(h-230)}{5} = \frac{5h}{4}$$

$$12h - 2760 = \frac{25h}{4}$$

$$48h - 25h = 11040$$

$$\therefore \boxed{h = 480m} \quad —③$$

Now, in ΔABE, $\tan a = \frac{5}{12}$

$\therefore$ hypo $= \sqrt{5^2 + 12^2}$

hypo(AE) = 13

Now $\sin a = \frac{5}{13}$

Now, $AB = AC - BC = 480 - 230 = 250$ ④

=

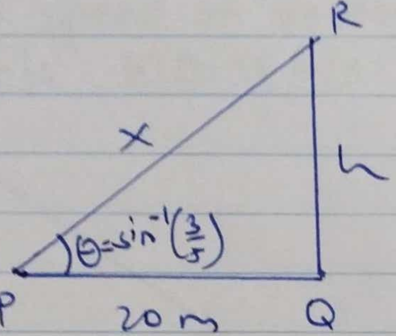
Now, $\sin a = \frac{5}{13}$

$$\frac{AB}{AE} = \frac{5}{13}$$

$$AE = AB \times \frac{5}{13} = 250 \times \frac{5}{13} = \boxed{650m}$$

Q.7] The angle of elevation of top of the tower from a point on ground is $\sin^{-1}\left(\frac{3}{5}\right)$. If the point of observation is 20m away from foot of tower, what is height of tower?

a) 15m b) 12 m c) 9m d) 18m



Given $\theta=\sin^{-1}\left(\frac{3}{5}\right)$, $PQ = 20$ m

let $QR = h$, $PR = x$

From ΔPQR,

$\sin\theta = \frac{h}{x}$

$\sin\left(\sin^{-1}\left(\frac{3}{5}\right)\right) = \frac{h}{x}$

$\frac{3}{5} = \frac{h}{x}$

$\boxed{x = \frac{5h}{3}}$ — ②

Now using pythagoras theorem, in ΔPQR

$PR^2 = PQ^2 + QR^2$

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

$\left(\frac{5h}{3}\right)^2 = (20)^2 + h^2$

$\frac{25h^2}{9} = 400 + h^2$

$\frac{25h^2}{9} - h^2 = 400$

$\frac{25h^2 - 9h^2}{9} = 400$

$\frac{16h^2}{9} = 400$

$\frac{4h}{3} = 20$

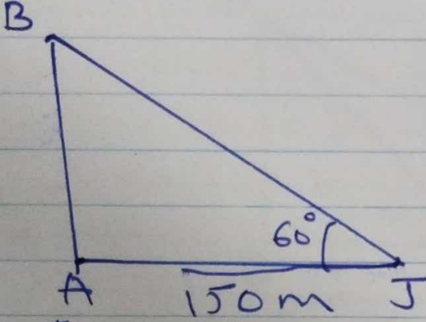
$4h = 60$

$\boxed{h = 15\text{ m}}$

Q.8] A balloon leaves the earth at point A and rises vertically at uniform speed. At the end of 2 mins, John finds the angular elevation of balloon at 60°. If the point at which John is standing is 150 m away from point A, what is speed of balloon?

a) 2.16 m/s b) 0.72 m/s c) 0.63 m/s d) 3.87 m/s.

=



Given, at point A balloon rises.

$t = 2 \text{ mins} = 120 \text{ sec}$

$\angle AJB = 60°$

let speed $= x$

Now, speed $= \frac{\text{Dist}}{\text{time}}$

Dist = Speed × time

Dist = $x \times 120$

$\boxed{\text{Dist}(AB) = 120x}$ mtrs

Now In ΔABJ,

$\tan 60° = \frac{AB}{AJ}$

$\sqrt{3} = \frac{\cancel{120}^{4} x}{\cancel{180}_{5}}$

$x = \frac{5\sqrt{3}}{4}$

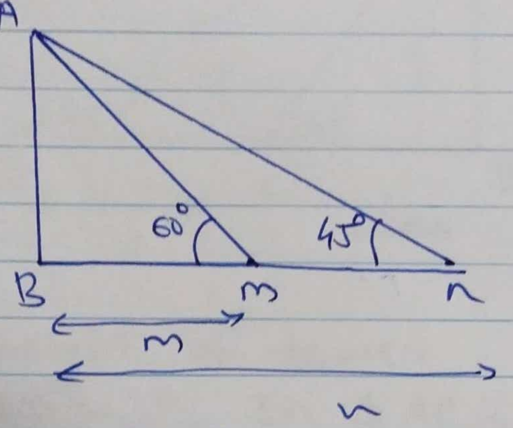
$x = \frac{5}{4} \cdot 1.732$

$\boxed{x = 2.165 \text{ mtrs}}$

Q.9] Angle of elevation of pole are 60° & 45° from points at distances m and n on ground resp, Here m ~~are~~ when measured from base of pole is less than n. What is height of pole?

a) $\sqrt{mn\sqrt{3}}$ units b) $\sqrt{mn^{n}\sqrt{3}}$ units

c) $\sqrt{3mn}$ units d) $\sqrt{mn}$ units.



Now, In ΔABM,

$$\tan 60^\circ = \frac{AB}{m}$$

$$\sqrt{3} = \frac{AB}{m}$$

$$\boxed{\sqrt{3}m = AB} \quad -① $$

In ΔABN,

$$\tan 45^\circ = \frac{AB}{n}$$

$$1 = \frac{AB}{n}$$

$$AB = n \quad -②$$

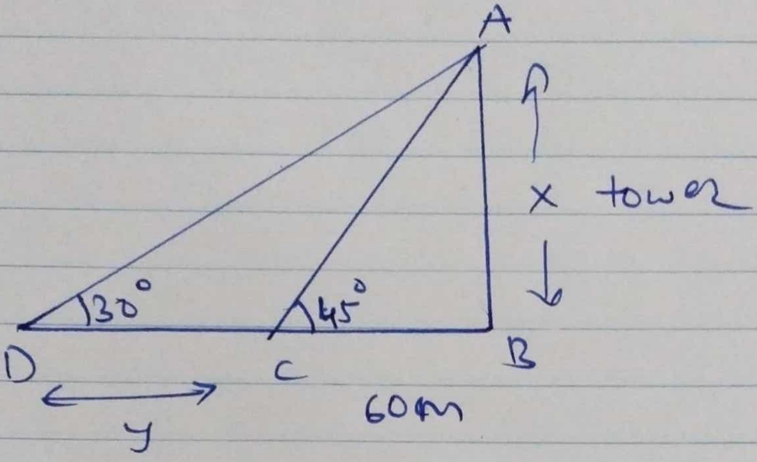
$\therefore$ Multplying eq^n ① & ②

$$\sqrt{3}m \times n = AB^2$$

$$\boxed{\therefore AB = \sqrt{\sqrt{3}\, m \times n}}$$

Q.1] Question

~~a)~~ 32 kmph b) 36 kmph c) 38 km/h d) 40 km/h e) 42 km/h



let x be height of tower

~~then tan45° = x~~ In ΔACB,

$$\tan 45^\circ = \frac{x}{60}$$

$$\therefore \boxed{x = 60m}$$

In ΔADB,

$$\tan 60^\circ = \frac{y+60}{x}$$

$$\sqrt{3} = \frac{y+60}{60}$$

$$60\sqrt{3} - 60 = y$$

$$\boxed{y = 60(\sqrt{3}-1)}$$

Now, speed of boat $= \frac{60(\sqrt{3}-1)}{5}$ m/s

$= \frac{60(\cancel{1}.0.732)}{5}$ m/s

$= 8.784 \times \frac{18}{5}$ km/h $= \boxed{31.6 \text{ km/h}}$