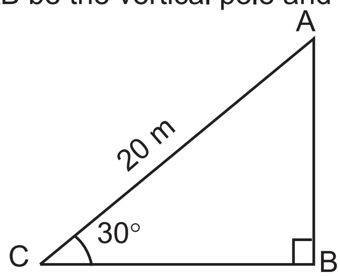
SELF ASSESSMENT TEST SOLUTIONS

1. Let AB be the vertical pole and CA be the 20 m long rope.



In ΔABC , we have

$$\sin 30^\circ = \frac{AB}{AC}$$

$$\frac{1}{2} = \frac{AB}{AC}$$

$$\frac{1}{2} = \frac{AB}{20} \Rightarrow AB = 10m$$

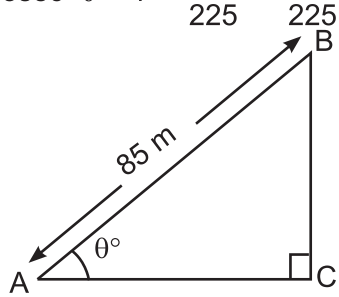
So (b) is the correct option.

2. Given, $\tan\theta = \frac{15}{8}$

$$\Rightarrow \cot\theta = \frac{8}{15} \Rightarrow \cot^2\theta = \frac{64}{225}$$

ie. $\operatorname{cosec}^2\theta - 1 = \frac{64}{225}$

$$\operatorname{cosec}^2\theta = 1 + \frac{64}{225} = \frac{289}{225}$$



$$\operatorname{cosec}\theta = \sqrt{\frac{289}{225}} = \frac{17}{15}$$

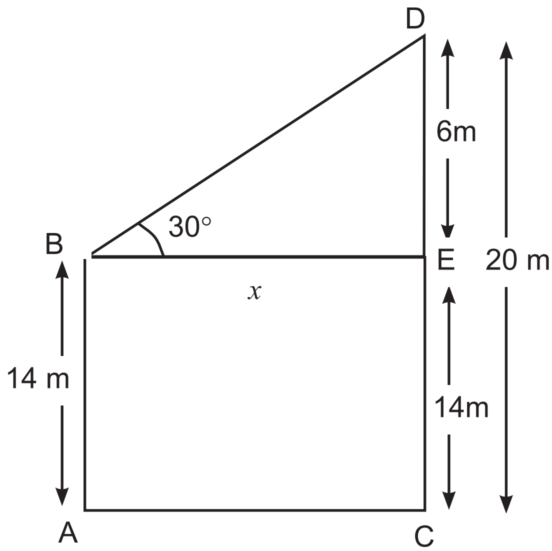
$$\Rightarrow \sin\theta = \frac{15}{17}$$

In ΔABC, $\sin\theta = \frac{BC}{AB}$

$$\frac{15}{17} = \frac{BC}{85} \Rightarrow BC = 75m$$

So (a) is the correct option.

3.



$$DE = 20 - 14 = 6 \text{ m}$$

In ΔBDE, $\sin 30° = \dfrac{DE}{BD}$

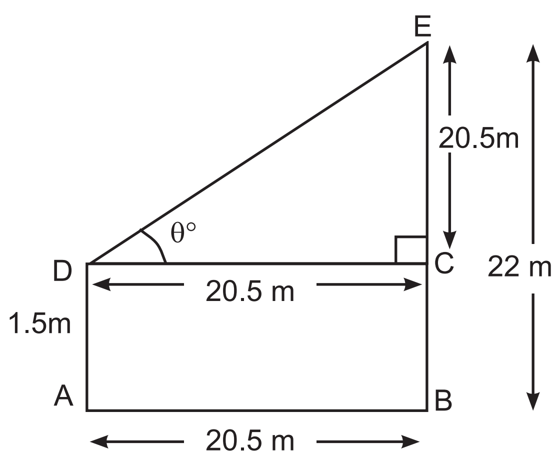
$$\frac{1}{2} = \frac{6}{BD}$$

$\Rightarrow$ $BD = 12\text{m}$

So (a) is the correct option.

4. BE be the height of the tower and AD be the height of the observer.

$EC = BE - BC = 22 - 1.5 = 20.5\text{m}$ [BC = AD]

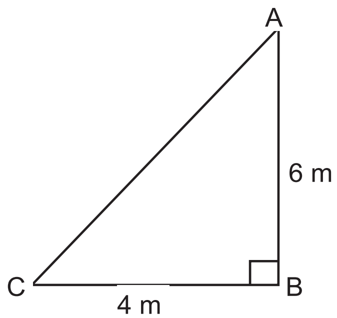


$$\tan\theta = \frac{CE}{DC} = \frac{20.5}{20.5} = 1$$

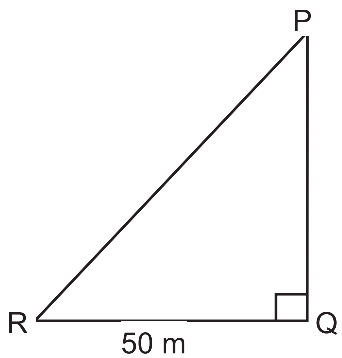
$\Rightarrow \theta = 45°$

So (b) is the correct option.

5. Let AB be height of tree and BC its shadow.



Now let PQ be height of pole and QR be its shadow. At the same time, the angle of elevation of tree and poles are equal i.e $\Delta ABC \sim PQR$



$$\Rightarrow \quad \frac{AB}{BC} = \frac{PQ}{QR}$$

$$\frac{6}{4} = \frac{PQ}{50}$$

$$PQ = \frac{50 \times 6}{4} = 75\text{m}$$

So (a) is the correct option.

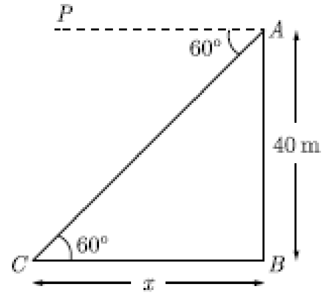
6. Let AB be the light house, C be the position of the boat and CB = x

Given, $\angle PAC = 60^\circ \Rightarrow \angle ACB = 60^\circ$

Now in ΔABC, $\tan 60^\circ = \frac{AB}{BC}$.

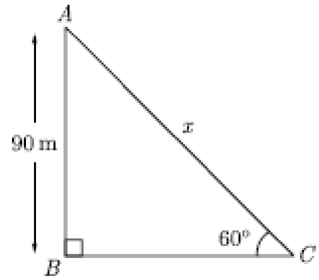
$$\sqrt{3} = \frac{40}{x}.$$

$$x = \frac{40}{\sqrt{3}} = \frac{40 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = \frac{40\sqrt{3}}{3} \text{ m}$$



ie. the boat is $\frac{40\sqrt{3}}{3}$m away from the foot of light house.

7.



In right $\triangle ABC$, $\sin 60^\circ = \frac{AB}{AC}$

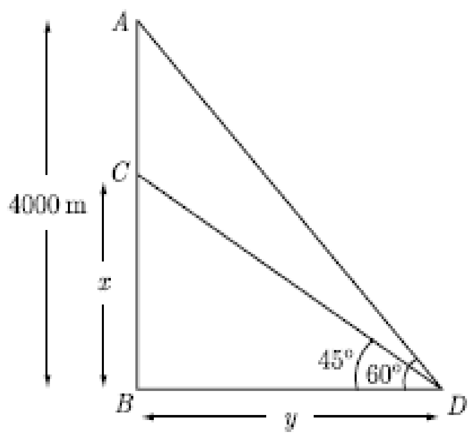
$$\frac{\sqrt{3}}{2} = \frac{90}{x}$$

$$x = \frac{90 \times 2}{\sqrt{3}} = \frac{180}{\sqrt{3}} \text{ m} = \frac{180 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = 60\sqrt{3}$$

$$= 60 \times 1.732 = 103.92 \text{ m.}$$

ie. length of string is 103.92 m.

8. Let the height first plane be AB = 4000 m and the height of second plane be BC = x m.



Here $\angle BDC = 45^\circ$ and $\angle BDA = 60^\circ$

In $\triangle CBD$, $\tan 45^\circ = \frac{x}{y}$ $\Rightarrow x = y$ ....(1)

In $\triangle ABD$, $\tan 60^\circ = \frac{4000}{y}$

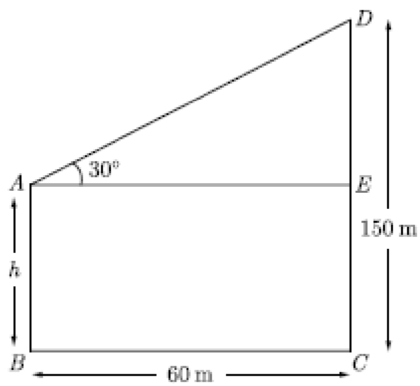
$$\sqrt{3} = \frac{4000}{y}$$

$$y = \frac{4000\sqrt{3}}{3} = 2306.67 \text{ m}$$

Now vertical distance between the two aeroplanes = 4000 - y [from (1)]

$= 4000 - 2306.67 = 1693.33$ m

9. Let AB and CD be the two towers. Let the height of the shorter tower AB = h .



Here BC = AE = 60 m, DE = DC - EC = 150 - h

In Δ AED, $\tan 30^\circ = \frac{DE}{AE}$

$$\frac{1}{\sqrt{3}} = \frac{150 - h}{60}$$

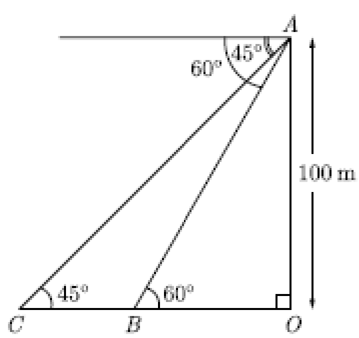
$$150\sqrt{3} - h\sqrt{3} = 60$$

$$\sqrt{3}h = 150\sqrt{3} - 60$$

$$\sqrt{3}h = 150\sqrt{3} - 20\sqrt{3} \times \sqrt{3}$$

$$h = (150 - 20\sqrt{3})\text{ m}$$

10. Let A be a point on top of building and B and C be two objects.



Here $\angle ACO = 45^\circ$ and $\angle ABO = 60^\circ$

In ΔAOC, $\tan 45^\circ = \frac{AO}{CO}$

$$1 = \frac{100}{CO}$$

$\Rightarrow$ CO = 100 m

In ΔAOB, $\tan 60° = \frac{AO}{OB}$

$$\sqrt{3} = \frac{100}{OB}$$

$$\Rightarrow \quad OB = \frac{100}{\sqrt{3}}.$$

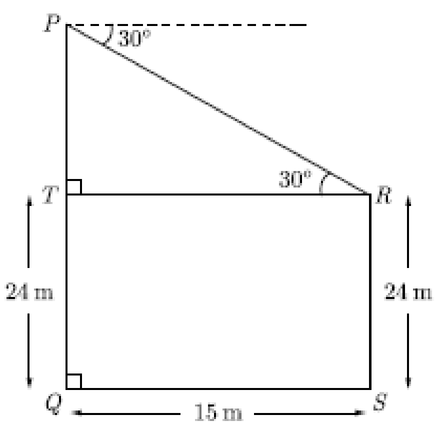
ie. $BC = CO - OB = 100 - \frac{100}{\sqrt{3}}.$

$$= 100\left(1 - \frac{1}{\sqrt{3}}\right) = 100\frac{(\sqrt{3}-1)}{\sqrt{3}}.$$

$$= 100\frac{(\sqrt{3}-1)}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}.$$

$$= \frac{100(3-\sqrt{3})}{3} \text{ m.}$$

11. Let RS be first pole and PQ be second pole.



In ΔPTR, $\tan 30° = \frac{PT}{TR}$.

$$\frac{1}{\sqrt{3}} = \frac{PT}{15}.$$

$$PT = \frac{15}{\sqrt{3}} = 5\sqrt{3}$$

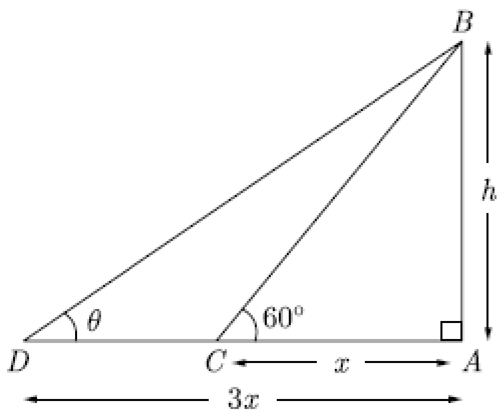
$$= 5 \times 1.732 = 8.66$$

$$PQ = PT + TQ$$

$$= 8.66 + 24 = 32.66 \text{ m}$$

So the height of the second pole is 32.66 m.

12. Let AB be tower of height h, AC be the shadow at elevation of sun of 60°.



In ΔBAC, $\tan 60° = \frac{AB}{AC}$

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

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

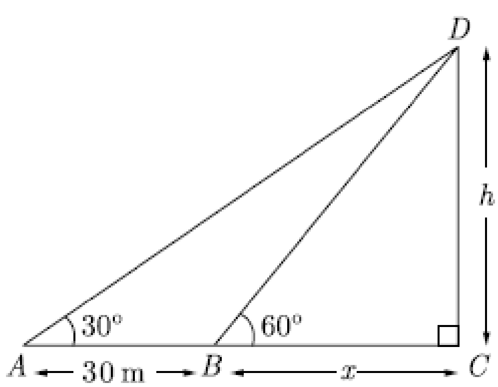
In ΔBAD, $\tan\theta = \frac{AB}{AD}$

$$\frac{h}{3x} = \tan\theta$$

ie. $\frac{x\sqrt{3}}{3x} = \frac{1}{\sqrt{3}} = \tan 30°$. [From (1)]

$\Rightarrow \theta = 30°$.

13. Let CD be the tree of height h . Let A be the position of person after moving 30 m away from point B on bank of river. Let BC = x be the width of the river.



In ΔDBC, $\frac{h}{x} = \tan 60°$

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

In ΔADC, $\frac{h}{x+30} = \tan 30° = \frac{1}{\sqrt{3}}$

$$\sqrt{3}h = x + 30$$

$3x = x + 30$ [From (1)]

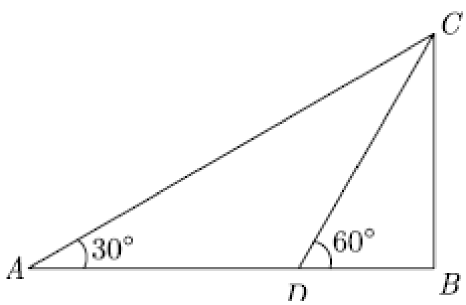
$\Rightarrow \quad x = 15$ m

(1) $\Rightarrow \quad h = \sqrt{3} \times 15 = 15\sqrt{3}$

$= 15 \times 1.732 = 25.98$ m

So the height of tree is 25.98 m and width of river is 15 m.

14.



Here D is the first position and A is position after 2 minutes.

Height of the light house, BC = 100 m

In ΔCBD, $\tan 60^\circ = \frac{BC}{BD}$

$\sqrt{3} = \frac{100}{BD}$

$BD = \frac{100}{\sqrt{3}}$ m

In ΔABC, $\tan 30^\circ = \frac{BC}{AB}$

$\frac{1}{\sqrt{3}} = \frac{100}{AB}$

$AB = 100\sqrt{3}$

So the distance travelled in 2 min = AD = AB - DB = $100\sqrt{3} - \frac{100}{\sqrt{3}}$

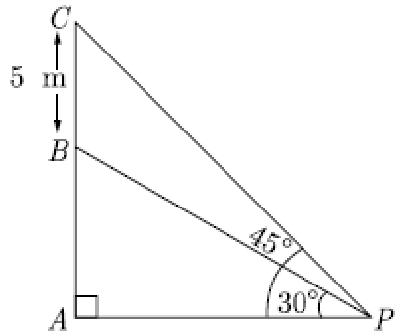
$= 173.2 - \frac{100}{3}\sqrt{3}$

$= 173.2 - 57.73 = 115.47$ m

Speed, s $= \frac{d}{t} = \frac{115.47 \text{ m}}{2 \text{ min}}$.

$= 57.74$ m/min

15. Let AB denotes the height of the tower and BC denotes the height of the flag. As per given information in question we have drawn the figure as given below.



In ΔBAP, $\tan 30^\circ = \frac{AB}{AP}$.

$$\frac{1}{\sqrt{3}} = \frac{AB}{AP}.$$

$$AP = \sqrt{3}\, AB \quad ....(1)$$

In ΔCAP, $\tan 45^\circ = \frac{AC}{AP}$

$$1 = \frac{AC}{AP}.$$

$$AP = AC = (AB + BC)$$

ie. $$AP = (AB + 5)\text{ m} \quad .....(2)$$

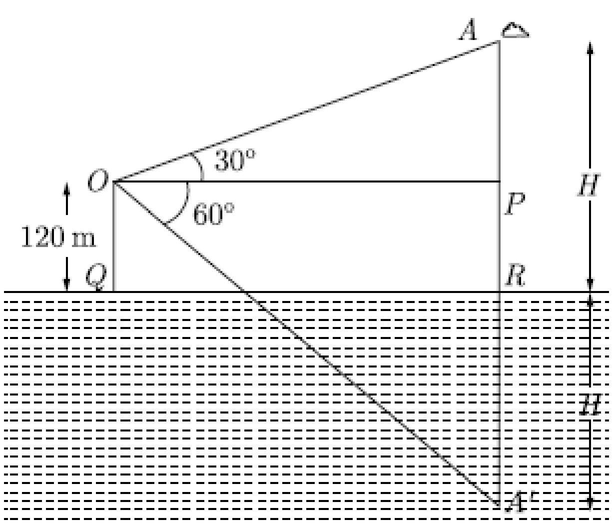
From (1) and (2), $(AB + 5) = \sqrt{3}\, AB$

$$5 = \sqrt{3}AB - AB$$

$$AB = \frac{5}{(\sqrt{3} - 1)} = \frac{5}{(1.732 - 1)} = \frac{5}{0.732} = 6.8306\text{ m.}$$

So the height of the tower, AB = 6.8306 m.

16.



Here A is cloud and A' is its refection.

In ΔAOP, $\tan 30^\circ = \frac{PA}{OP}$

$$\frac{1}{\sqrt{3}} = \frac{H - 120}{OP}$$

$$OP = \sqrt{3}(H - 120) \quad ...(1)$$

In $\Delta OPA'$, $\tan 60^\circ = \frac{PA'}{OP}$

$$\sqrt{3} = \frac{H + 120}{OP}$$

$$OP = \frac{H + 120}{\sqrt{3}} \quad ...(2)$$

From (1) and (2), $\frac{H + 120}{\sqrt{3}} = \sqrt{3}(H - 120)$

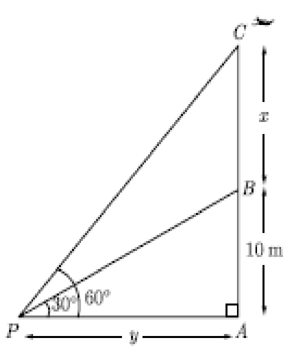
$$H + 120 = 3(H - 120)$$

$$H + 120 = 3H - 360$$

$$2H = 480 \Rightarrow H = 240$$

So height of cloud is 240 m.

17.



Height of the helicopter from ground = (10 + x) m

In ΔBAP, $\tan 30^\circ = \frac{AB}{AP}$

$$\frac{1}{\sqrt{3}} = \frac{10}{y}$$

$$y = 10\sqrt{3} \quad ....(1)$$

In ΔCAP, $\frac{AC}{PA} = \tan 60^\circ$

$$\frac{10 + x}{y} = \sqrt{3}$$

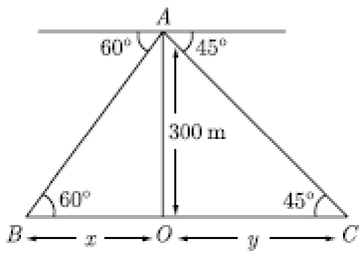
$$10 + x = y\sqrt{3} \quad ....(2)$$

From (1) and (2), $10 + x = 10\sqrt{3} \times \sqrt{3} = 30$

$x = 20$

ie. the height of the helicopter above the ground is 20 + 10 = 30 m.

18.



In ΔAOC, $\frac{AO}{OC} = \tan 45°$

$\frac{300}{y} = 1 \Rightarrow y = 300$ m

In ΔAOB, $\frac{AO}{BO} = \tan 60°$

$\frac{300}{x} = \sqrt{3}$

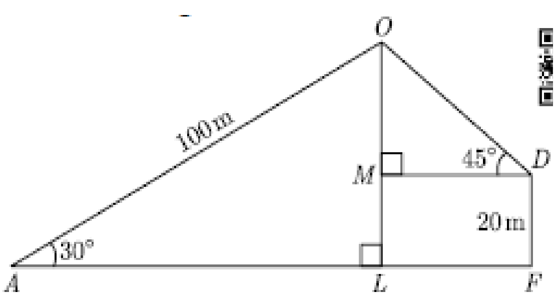
$\Rightarrow x = \frac{300}{\sqrt{3}} = 100\sqrt{3}$

BC $= y + x = 300 + 100\sqrt{3}$

$= 300 + 100 \times 1.732 = 473.2$ m

So the width of river is 473.2 m.

19. Let O be the position of the bird and A be the position of the boy. Let FD be the building and D be the position of the girl.



In ΔOLA, $\frac{OL}{AO} = \sin 30°$

$\frac{OL}{100} = \frac{1}{2} \Rightarrow OL = 50$m

OM $=$ OL $-$ML

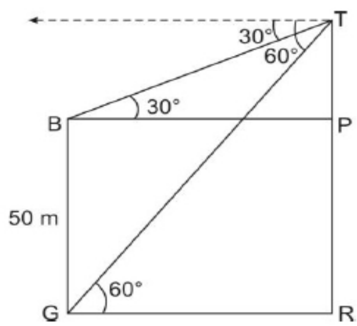
$=$ OL $-$ FD $= 50 - 20 = 30$ m

In ΔOMD, $\frac{OM}{OD} = \sin 45°$

$\frac{30}{OD} = \frac{1}{\sqrt{2}}$

$OD = 30\sqrt{2}$ m

ie. the distance of the bird from the girl = $30\sqrt{2}$ m

20. 

In Δ BTP, $\tan 30° = \frac{TP}{BP}$ $\Rightarrow \frac{1}{\sqrt{3}} = \frac{TP}{BP}$

$\Rightarrow BP = TP\sqrt{3}$ .... (i)

In Δ GTR, $\tan 60° = \frac{TR}{GR}$ $\Rightarrow \sqrt{3} = \frac{TR}{GR}$

$\Rightarrow GR = \frac{TR}{\sqrt{3}}$ .... (ii)

Now, $TP\sqrt{3} = \frac{TR}{\sqrt{3}}$ (as BP = GR)

$\Rightarrow 3TP = TP + PR$

$\Rightarrow 2TP = BG$

$\Rightarrow TP = \frac{50}{2}$ m = 25 m

Now, TR = TP + PR = (25 + 50) m.

Height of tower, TR = 75 m.

Distance between building and tower, $GR = \frac{TR}{\sqrt{3}}$

$\Rightarrow GR = \frac{75}{\sqrt{3}}$ m = $25\sqrt{3}$ m