Numeric Response Questions

Height and Distance

Q.1 The angle of elevation of the top of a tower at any point on the ground is 30° and moving 200 meters towards the tower it becomes 45°. If the height of tower is $k(\sqrt{3} + 1)$ then find k.

Q.2 One chimney is 30 m higher than another. A person standing at a distance of 100 m, from the lower chimney observes their tops to be in line and inclined at an angle of $\tan^{-1}(0.6)$ to the horizon. Then find the distance of the person from the higher chimney.

Q.3 The angle of elevation of the top of two vertical towers as seen from the middle point of the line joining the foot of the towers are 60° and 30° respectively. If the ratio of the heights of the towers is $k : 1$ then find k.

Q.4 A man from the top of a 300 metres high tower sees a car moving towards the tower at an angle of depression 30°. After some time, the angle of depression becomes 60°, If the distance (in meters) travelled by the car during this time is $k\sqrt{3}$, then find k.

Q.5 The angle of elevation of the top of an incomplete vertical pillar at a horizontal distance of 100 m from its base is 45°. If the angle of elevation of the top of the complete pillar at the same point is 60°, if the difference in the height of complete and incomplete pillar is $k(\sqrt{3} - 1)$ then find k.

Q.6 A tree is broken by wind, its upper part touches the ground at a point 10 m from the foot of the tree and makes an angle of 45° with the ground. Then find the entire length of the tree.

Q.7 Find the height of the chimney when it is found that on walking towards it 50 meters in the horizontal line through its base, the angle of elevation of its top changes from 30° to 60°.

Q.8 The angle of elevation of the top of a vertical tower from a point A, due east of it is 45°, The angle of elevation of the top of the same tower from a point B, due south of A is $30''$. If the distance between A and B is $54\sqrt{2}$ m, then find the height of the tower (in metres).

Q.9 An observer on the top of a tree, finds, the angle of depression of a car moving towards the tree to be a0%. After 3 minutes this angle becomes 60°, After how much more time, the car will reach the tree-

Q.10 ABCD is a square plot. The angle of elevation of the top of a pole standing at D from A or C is 30° and that from B is θ, if $\tan \theta$ is $\frac{1}{\sqrt{k}}$ then find k.

Q.11 A person standing on the bank of a river observes that the angle subtended by a tree on the opposite bank is 60°. When he retires 40 m from the bank, he finds the angle to be 30°, then find the breadth of the river.

Q.12 A vertical pole consists of two portions the lower being one-third of the whole. If the upper portion subtends an angle $\tan^{-1}\frac{1}{2}$ at a point in a horizontal plane through the foot of the pole and 40 m from it then find the height of pole.

Q.13 From the top of a light house 60 meters high with its base at the sea level, the angle of depression of a boat 15°. If the distance of the boat from the foot of the light house (in meters) is $k(2+\sqrt{3})$, then find k.

Q.14 If two vertical poles 20 m and 80 m high stand apart on a horizontal plane, then find the height (in m) of the point of intersection of the lines joining the top of each pole to the foot of other.

Q.15 The angle of elevation of the top of a tower from a point 20 m away from its base is 45°. Then find the height of the tower.

ANSWER KEY

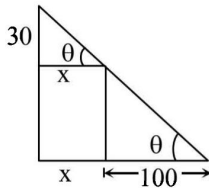|					
1. 100.00	**2.** 150.00	**3.** 3.00	**4.** 200.00	**5.** 100.00	**6.** 24.14
7. 43.30	**8.** 54.00	**9.** 1.50	**10.** 6.00	**11.** 20.00	**12.** 120.00
13. 60.00	**14.** 16.00	**15.** 20.00			

Hints & Solutions

1.
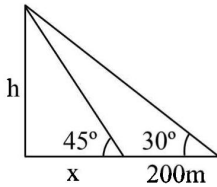
$$\frac{h}{h+200} = \frac{1}{\sqrt{3}}$$

$$\sqrt{3}\,h - h = 200$$
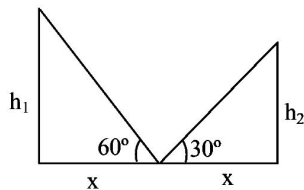
$$h = \frac{200}{\sqrt{3}-1} \ m$$
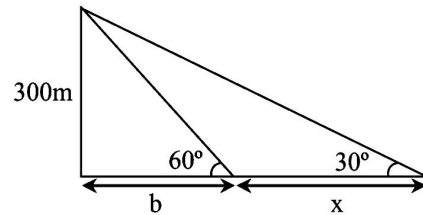
2.

$$\tan\theta = 0.6 = \frac{30}{x}$$

x = 50

Ans. 150 m

3.

$$\frac{h_1}{x} = \tan 60^\circ = \sqrt{3}$$

$$\frac{h_2}{x} = \tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$\frac{h_2}{h_1} = \frac{3}{1}$$
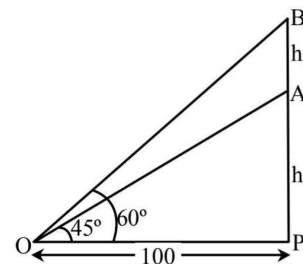
4.

As $\tan 60^\circ = \dfrac{300}{b}$

$$\Rightarrow \ b = \frac{300}{\sqrt{3}}$$

Again, $\tan 30^\circ = \dfrac{300}{b+x}$

$$\Rightarrow \ b + x = 300\sqrt{3}$$

$$\Rightarrow \ x = 300\sqrt{3} - \frac{300}{\sqrt{3}} = \frac{600}{\sqrt{3}} = 200\sqrt{3}$$

5.

In $\triangle AOP$
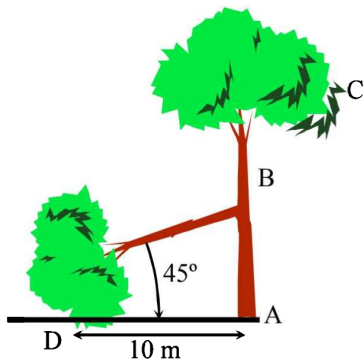
$\tan 45^\circ = \dfrac{h}{100} \Rightarrow h = 100m$

In $\triangle BOP$

$\tan 60^\circ = \dfrac{h + h_1}{100}$

$100\sqrt{3} = 100 + h_1$

$h_1 = 100(\sqrt{3} - 1)m$

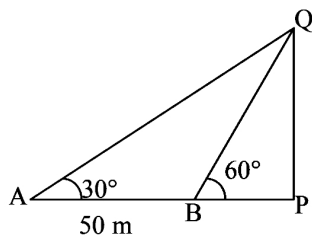**6.**

$\tan 45^\circ = \dfrac{AB}{AD}$

$\Rightarrow AB = 10$

$BD = 10\sqrt{2}$ then $AC = (10 + 10\sqrt{2})$

7. Let PQ be the chimney. A and B are the two points 50 meters apart. Let h be the height of the chimney .

$\Rightarrow BP = h \cot 60^\circ = \dfrac{h}{\sqrt{3}}$,
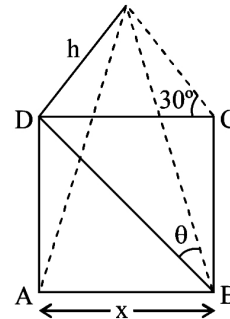
$AP = h \cot 30^\circ = h\sqrt{3}$

$\Rightarrow 50 = AP - BP$

$= h\sqrt{3} - \dfrac{h}{\sqrt{3}} = \dfrac{h(3-1)}{\sqrt{3}}$
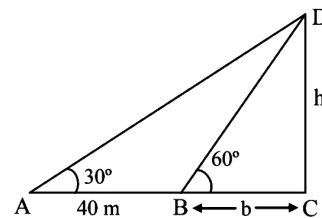
$\Rightarrow h = 25\sqrt{3}$ meters.

10.

$\tan 30^\circ = \dfrac{h}{x}$

$\tan \theta = \dfrac{h}{x\sqrt{2}}$

$\quad = \dfrac{\tan 30^\circ}{\sqrt{2}}$

$\quad = \dfrac{1}{\sqrt{6}}$

11.

Let BC = b m

In $\triangle BCD$;

$\cot 60^\circ = \dfrac{b}{h} \Rightarrow b = h \cot 60^\circ$ ....(i)

In $\triangle ACD$;

$\cot 30^\circ = \dfrac{40 + b}{h}$
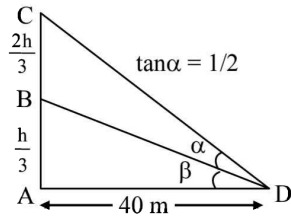
$\Rightarrow b + 40 = h \cot 30^\circ$ ....(ii)

By (i) & (ii)

$\Rightarrow \dfrac{b}{b + 40} = \dfrac{\cot 60^\circ}{\cot 30^\circ}$

$\Rightarrow b = 20 \text{ m}$

12.

In ΔABD

$\tan\beta = h/120$

In ΔACD

$\tan(\alpha + \beta) = h/40$

Then $\dfrac{1/2 + h/120}{1 - h/240} = \dfrac{h}{40}$
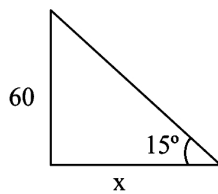
$\Rightarrow \dfrac{120 + 2h}{240 - h} = \dfrac{h}{40}$

$4800 + 80h = 240h - h^2$

$= h^2 - 160h + 4800 = 0$

$\Rightarrow h = 120$ m, $h = 40$ m

13.

$\dfrac{60}{x} = \tan 15^\circ = 2 - \sqrt{3}$

$x = 60(2 + \sqrt{3})$ m