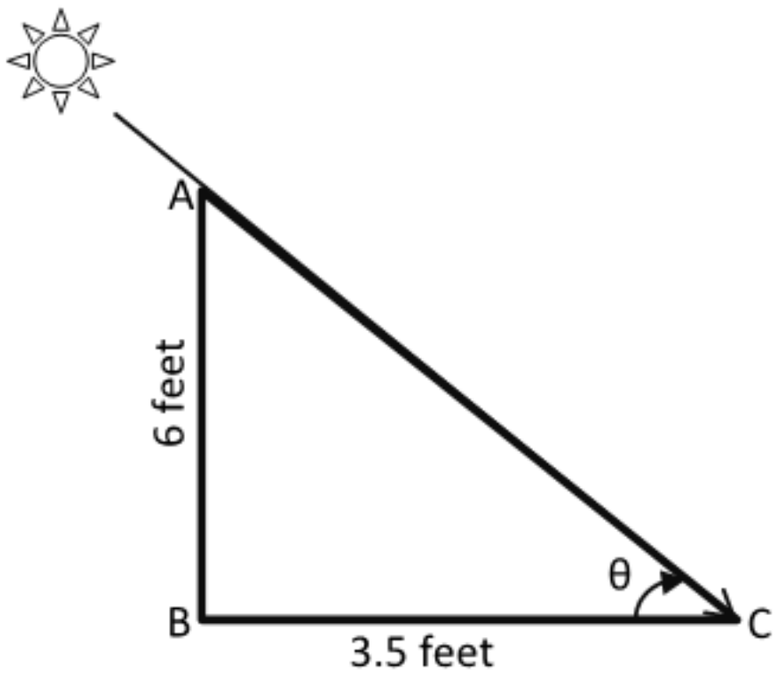
Exercise 7.5

Q. 1: Find the angle of elevation of the sun if a 6 feet man casts a 3.5 feet shadow.



From figure we have

$tan\theta = \frac{AB}{BC}$

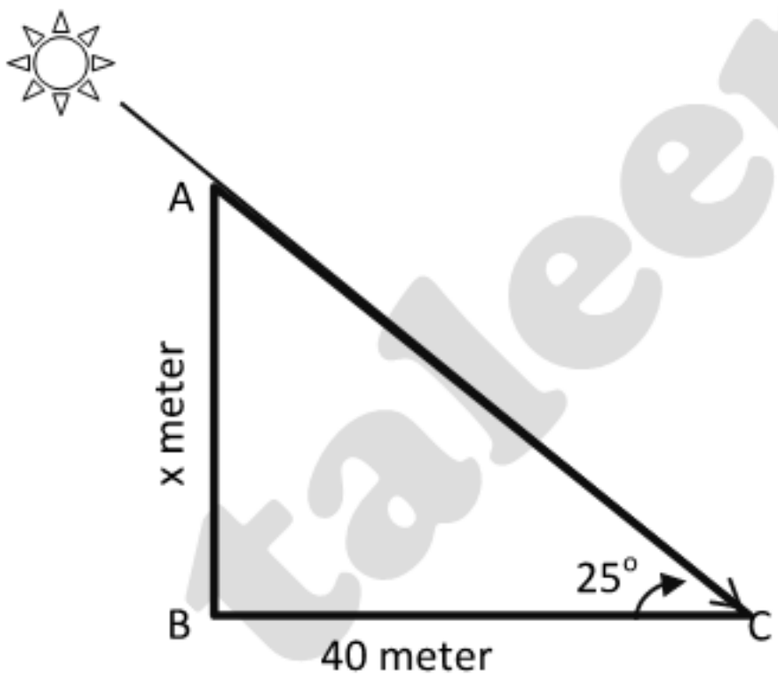
$tan\theta = \frac{6}{3.5}$

$tan\theta = 1.714$

$\theta = tan^{-1}(1.714)$

$\theta = 59.74°$

Q. 2: A tree casts a 40 meter shadow when the angel of elevation of the sun is 25°. Find the height of the tree.



From figure we have

$tan\theta = \frac{AB}{BC}$

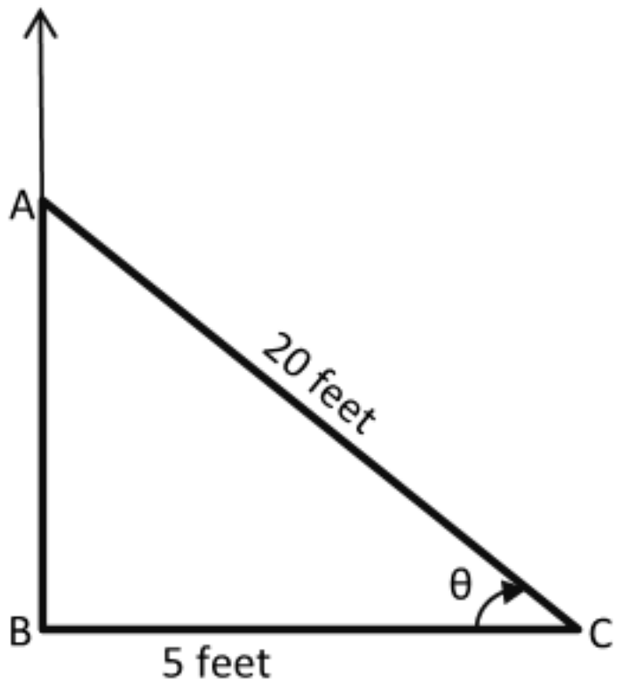
$tan25 = \frac{x}{40}$

$x = 40(tan25)$

$x = 40(0.4663)$

$x = 18.652\ meter$

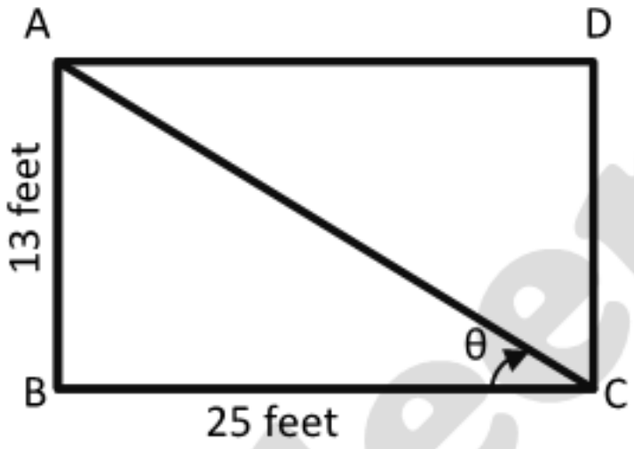
Q. 3: A 20 feet long ladder is leaning against a wall. The bottom of the ladder is 5 feet from the base of the wall. Find the acute angle (angle of elevation) the ladder makes with the ground.



From figure we have

$$cos\theta = \frac{BC}{AC}$$
$$cos\theta = \frac{5}{20}$$
$$cos\theta = 0.25$$
$$\theta = cos^{-1}(0.25)$$
$$\theta = 75.52°$$

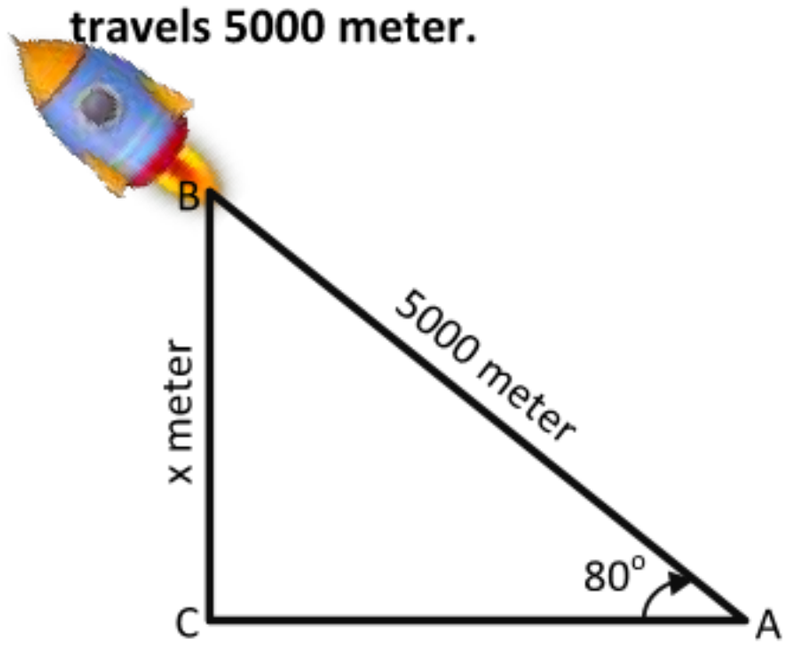
Q. 4: The base of a rectangle is 25 feet and the height of the rectangle is 13 feet. Find the angle that the diagonal of the rectangle makes with the base.



From figure we have

$$tan\theta = \frac{AB}{BC}$$
$$tan\theta = \frac{13}{25}$$
$$tan\theta = 0.52$$
$$\theta = tan^{-1}(0.52)$$
$$\theta = 27.47°$$

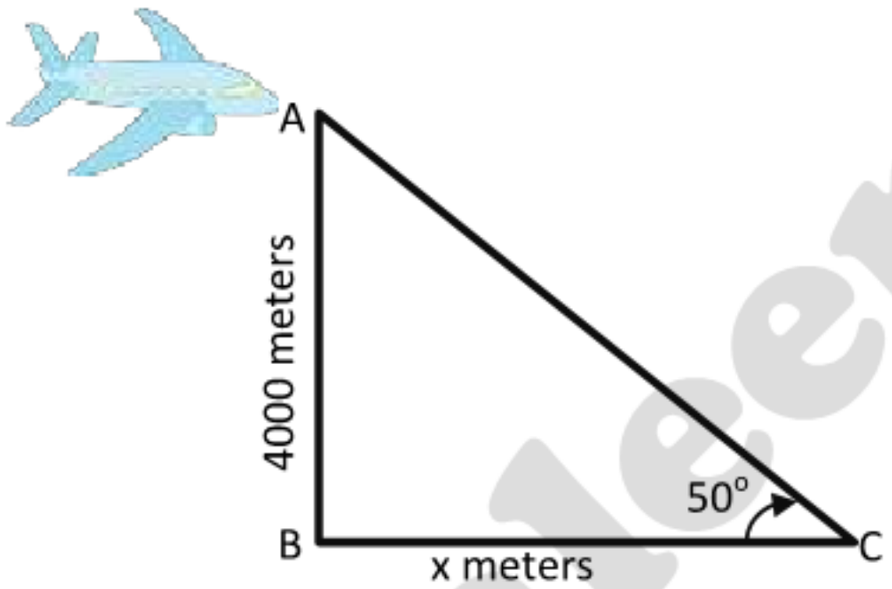
Q. 5: A rocket is launched and climbs at a constant angle of 80°. Find the altitude of the rocket after it travels 5000 meter.



From figure we have

$$sin\theta = \frac{BC}{AB}$$
$$sin80 = \frac{x}{5000}$$
$$x = 5000(sin80)$$
$$x = 5000(0.9848)$$
$$x = 4924.04\ meter$$

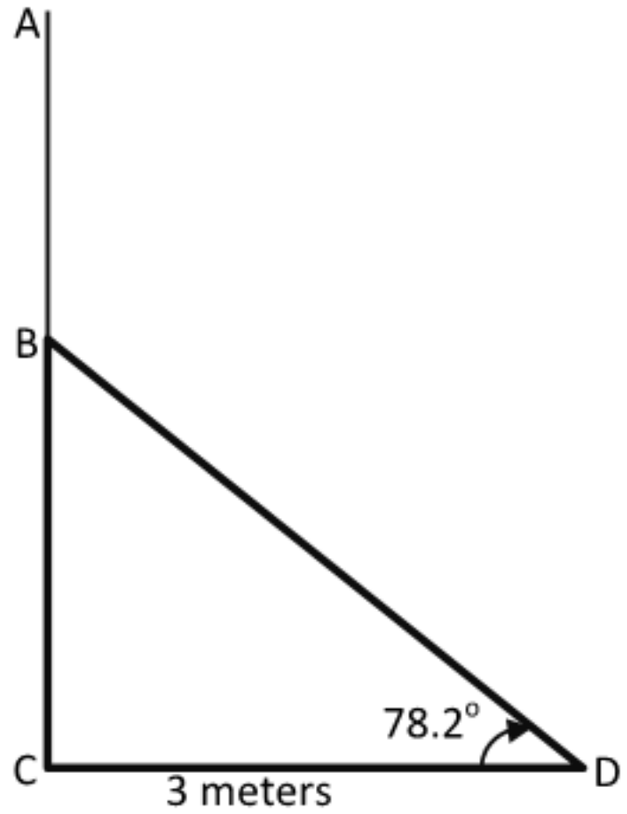
Q. 6: An aeroplane pilot flying at an attitude of 4000m wishes to make an approach to an airport at an angle of 50° with the horizontal. How far from the airport will the plane be when the pilot begins to descent?



From figure we have

$$tan\theta = \frac{AB}{BC}$$
$$tan50 = \frac{4000}{x}$$
$$x = \frac{4000}{tan50}$$
$$x = \frac{4000}{1.1918}$$
$$x = 3356.3\ meters$$

Q. 6: A guy wire (supporting wire) runs from the middle of a utility pole to the ground. The wire makes an angle of 78.2^{o} with the ground and touch the ground 3 meters from the base of the pole. Find the height of the pole.



From figure we have

$tan\theta = \frac{BC}{CD}$

$tan78.2 = \frac{BC}{3}$

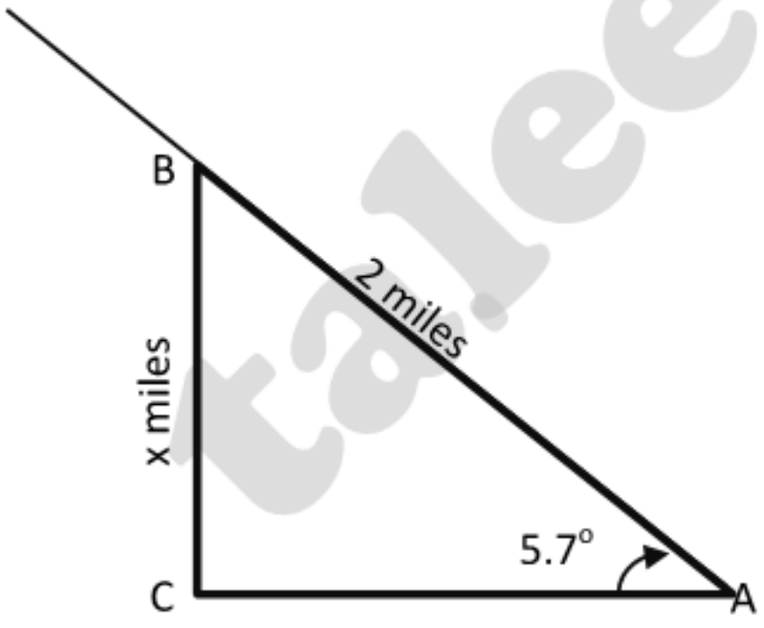
$BC = 3(tan78.2)$

$BC = 3(4.7867)$

$BC = 14.36$

$Height\ of\ pole = 2BC = 2(14.36) = 28.72$ meters

Q. 8: A road is inclined at an angle 5.7^{o}. Suppose that we drive 2 miles up this road starting from sea level. How high above sea level are we?



From figure we have

$sin\theta = \frac{BC}{AB}$

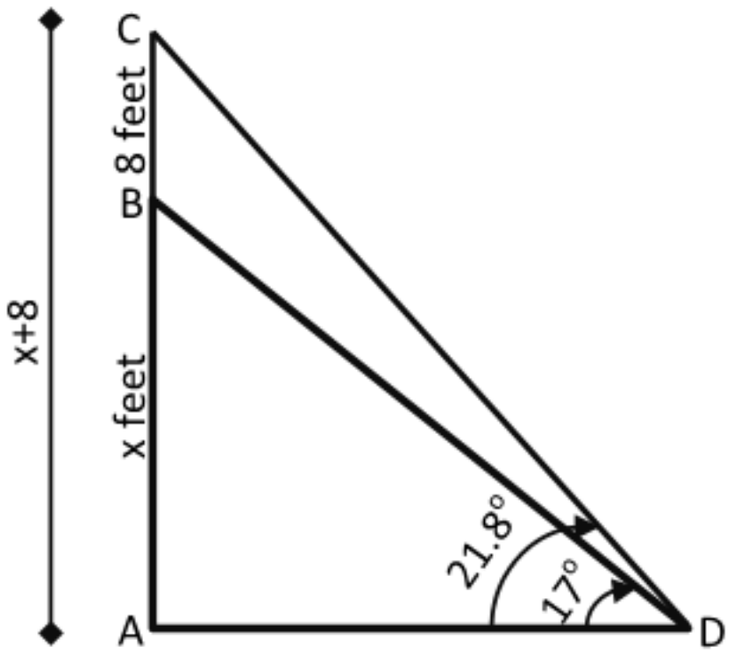
$sin5.7 = \frac{x}{2}$

$x = 2(sin5.7)$

$x = 2(0.0993)$

$x = 0.199\ miles$

Q. 9: A television antenna of 8 feet height is located on the top of a house. From a point on the ground the angle of elevation to the top of the house is 17° and the angle of elevation to the top of the antenna is 21.8°. find the height of the house.



From figure we have

In ΔABD

$$tan\theta = \frac{AB}{AD}$$

$$tan17 = \frac{x}{AD}$$

$$AD = \frac{x}{tan17} \text{ ---------- (i)}$$

In ΔACD

$$tan\theta = \frac{AC}{AD}$$

$$tan21.8 = \frac{x+8}{AD}$$

$$AD = \frac{x+8}{tan21.8} \text{ ---------- (ii)}$$

Comparing (i) and (ii)

$$\frac{x}{tan17} = \frac{x+8}{tan21.8}$$

$$\frac{x}{0.3057} = \frac{x+8}{0.4}$$

$$0.4x = 0.3057(x+8)$$

$$0.4x = 0.3057x + 2.4456$$

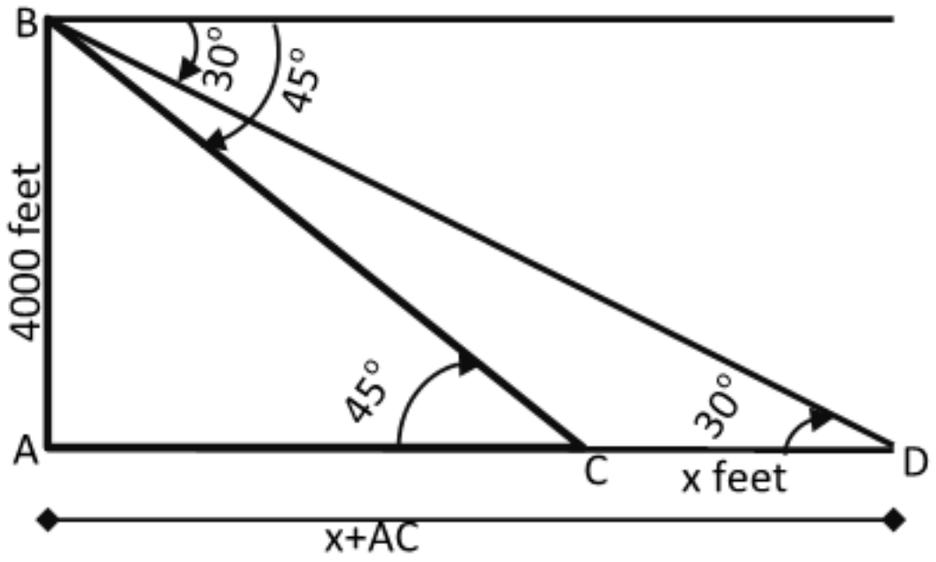
$$0.4x - 0.3057x = 2.4456$$

$$0.0943x = 2.4456$$

$$x = \frac{2.4456}{0.0943}$$

$$x = 25.93 feet$$

Q. 10: From an observation point, the angles of depression of two boats in line with this point are found to 30^{o} and 45^{o}. Find the distance between the two boats if the point of observation is 4000 feet high.



From figure we have

In ΔABC

$$tan\theta = \frac{AB}{AC}$$

$$tan45 = \frac{4000}{AC}$$

$$AC = \frac{4000}{tan45}$$

$$AC = 4000$$

In ΔABD

$$tan\theta = \frac{AB}{AD}$$

$$tan30 = \frac{4000}{x+AC}$$

$$0.5774 = \frac{4000}{x+4000}$$

$$0.5774(x + 4000) = 4000$$

$$0.5774x + 2309.6 = 4000$$

$$0.5774x = 4000 - 2309.6$$

$$0.5774x = 1690.4$$

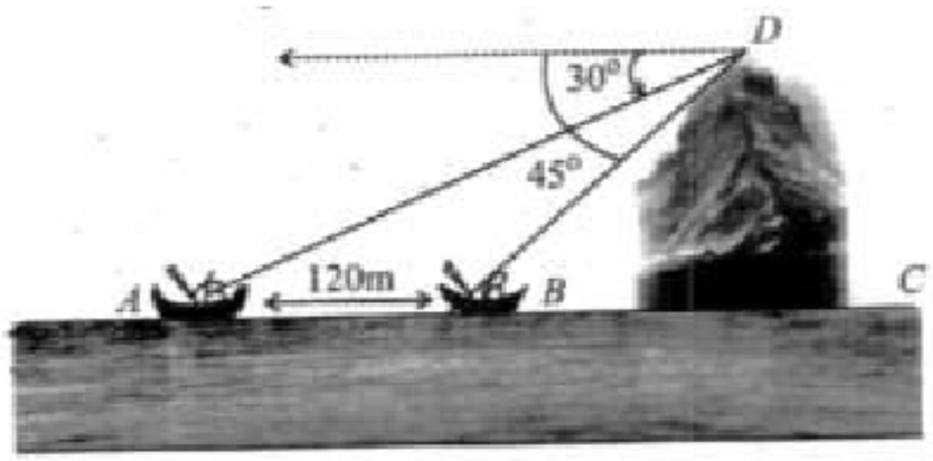
$$x = \frac{1690.4}{0.5774}$$

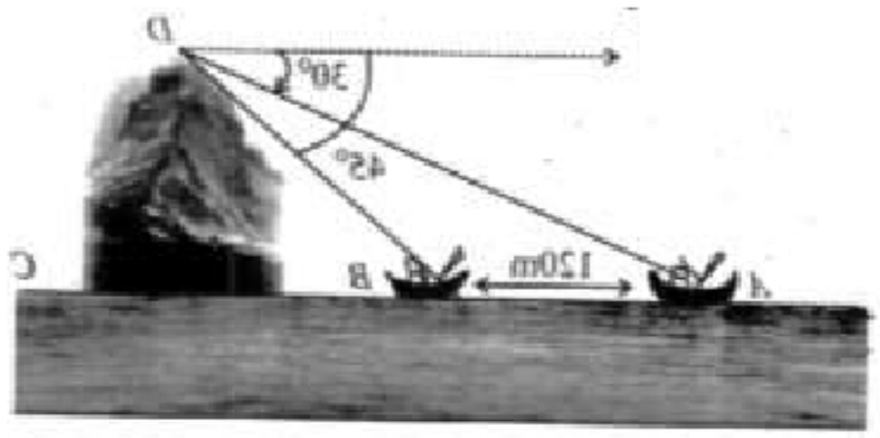
$$x = 2927.61 feet$$

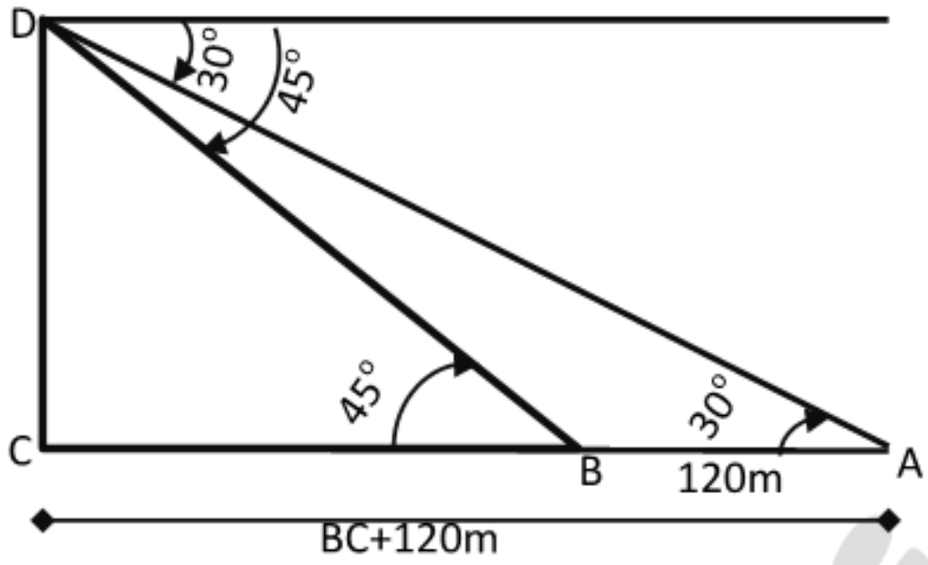
Q. 11: Two ships, which are in line with the base of a vertical cliff, are 120 meters apart. The angles of depression from the top of the cliff to the ships are 30° and 45°, as shown in the diagram.

(a) Calculate the distance BC

(b) Calculate the height CD, of the cliff.







From figure we have

In ΔBCD

$$tan\theta = \frac{CD}{BC}$$

$$tan45 = \frac{CD}{BC}$$

$$1 = \frac{CD}{BC}$$

$$BC = CD$$

In ΔACD

$$tan\theta = \frac{CD}{AC}$$

$$tan30 = \frac{CD}{BC+120}$$

As, $BC = CD$ So,

$$tan30 = \frac{BC}{BC+120}$$

$$0.5774 = \frac{BC}{BC+120}$$

$$0.5774(BC + 120) = BC$$

$$0.5774BC + 69.288 = BC$$

$$0.5774BC - BC = -69.288$$

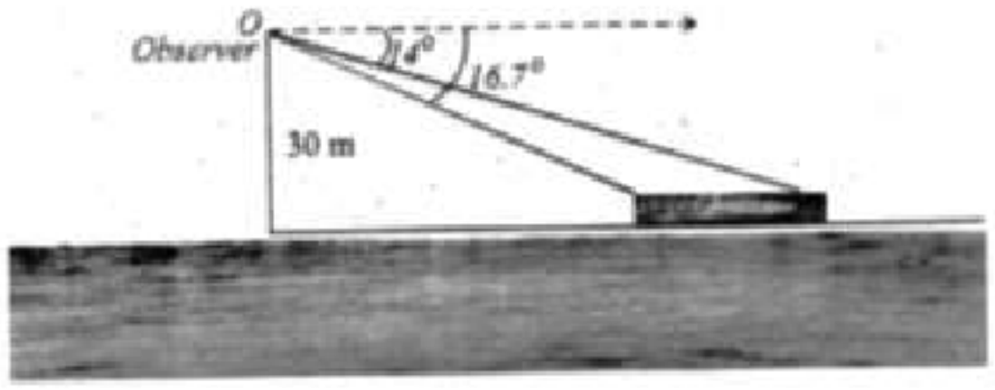
$$-0.4226BC = -69.288$$

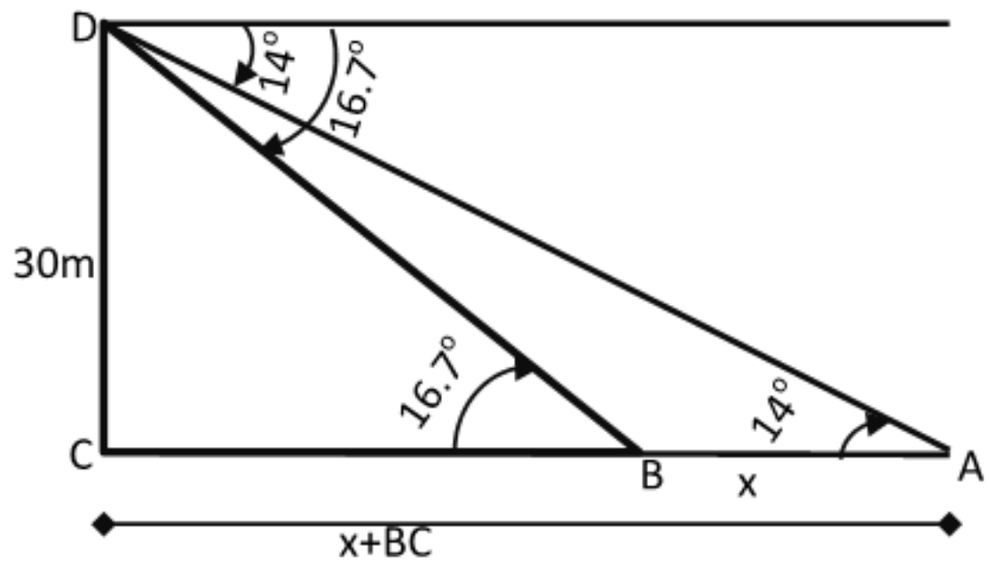
$$BC = \frac{-69.288}{-0.4226}$$

$$BC = 169.93 meters$$

Also CD = 169.93 meters.

Q. 12: Suppose that we are standing on a bridge 30 feet above a river watching a log (piece of wood) floating toward us. If the angle with the horizontal to the front of the log is 16.7° and angle with the horizontal to the back of the log is 14°. How long is the log?





From figure we have

In ΔBCD

$$tan\theta = \frac{CD}{BC}$$

$$tan16.7 = \frac{30}{BC}$$

$$BC = \frac{30}{tan16.7}$$

$$BC = \frac{30}{0.3}$$

$$BC = 100m$$

In ΔACD

$$tan\theta = \frac{CD}{AC}$$

$$tan14 = \frac{30}{x+BC}$$

As, $BC = 100$ So,

$$tan14 = \frac{30}{x+100}$$

$$0.2493 = \frac{30}{x+100}$$

$$0.2493(x + 100) = 30$$

$$0.2493x + 24.93 = 30$$

$$0.2493x = 30 - 24.93$$

$$0.2493x = 5.07$$

$$x = \frac{5.07}{0.2493}$$

$$x = 20.33\ meter$$