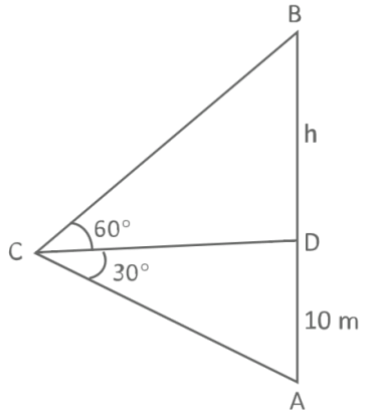
Height & Distance Question Answer

Q.1.A man is standing on the deck of a ship, which is 10m above water level. He observes the angle of elevation of the top of a light house as 60^0 and the angle of depression of the base of lighthouse as 30^0. Find the height of the light house.



Sol :

: Let AB is the light house and the man is standing at C so, $\angle BCD = 60^0$ and $\angle ACD = 30^0$.

Let BD = h

In ΔADC, $\tan 30^0 = 10/CD$

$\Rightarrow 1/\sqrt{3} = 10/CD \Rightarrow CD = 10\sqrt{3}m$

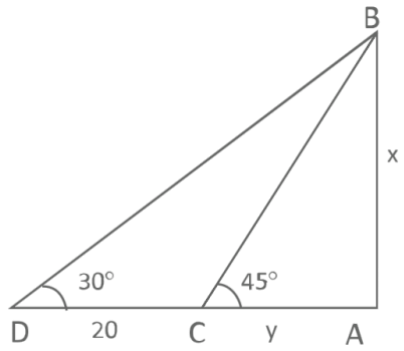
In ΔBDC, $\tan 60^0 = h/CD$

$\Rightarrow \sqrt{3} = h/10\sqrt{3}$

$\Rightarrow h = 30m$

So the height of the light house is AB = AD + BD = 10 + 30 = 40m

Q.2. A person standing on the bank of a river observes that the angle of elevation of the top of a tree on the opposite bank is 45^0. When he moves 20m away from the bank, he finds the angle of elevation to be 30^0. Find the height of the tree.



Sol :

Let AB = x is the tree and AC = y is the river. Let the angle of elevation at point C is 45^0 and at point D is 30^0 s.t. CD = 20 m

In ΔACB

$\tan 45^0 = x/y \Rightarrow 1 = x/y \Rightarrow x = y$ .....(1)

In ΔADB, $\tan 30^0 = AB/AD$

$\Rightarrow 1/\sqrt{3} = x/(20 + y)$

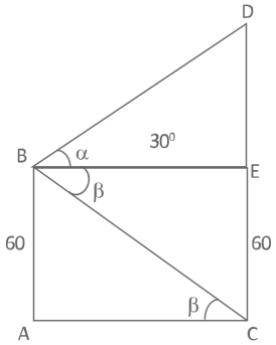
$\Rightarrow 1/\sqrt{3} = x/(20 + x)$ [∵ of (1)]

$\Rightarrow 20 + x = \sqrt{3}x \Rightarrow (\sqrt{3}-1)x = 20$

$\Rightarrow x = 20/(\sqrt{3} - 1) = 20/(\sqrt{3} - 1) \times (\sqrt{3} + 1)/(\sqrt{3} + 1) = [20(\sqrt{3} + 1)]/3-1 \Rightarrow x = [20(\sqrt{3} + 1)]/2$

$\Rightarrow x = 10(\sqrt{3} + 1)$m

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



Sol :

Let AB is the building of height 60m and CD is the second building such that ∠DBE = α and ∠CBE = ∠BCA =β.

In ΔBAC, tanβ = 60/AC

⇒ BE = AC = 60/tanβ = 60cotβ

In ΔBED, tan α = DE/BE ⇒ tanα = DE/60cotβ

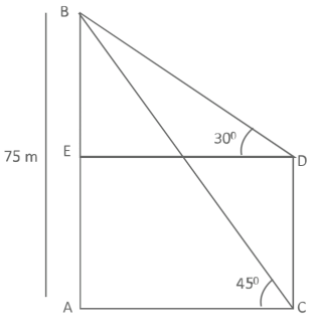
⇒ DE = 60 cot β tan α

∴ The height of the building = CD = CE + ED

= 60 + 60 cot β tan α

= 60 (1 + tan α cot β)

Q.4. From the top of a tower 75m high, the angles of depression of the top and bottom of a pole standing on the same plane as the tower are observed to be 30^0 and 45^0 respectively. Find the height of the pole.



Sol :

Let AB is the tower of height 75 m and CD is the pole, such that ∠BDE = 30^0 and ∠BCA = 45^0

In ΔBAC, tan 45^0 = AB/AC

⇒ 1 = AB/AC ⇒ AB = AC ⇒ AC = 75m

Now DE = AC = 75m

In ΔBED,

tan 30^0 = BE/DE

⇒ 1/√3 = BE/75 ⇒ BE = 75/√3m

⇒ BE = 25√3m = 43.3 m

Hence the height of the pole

= CD = AE = AB – BE = 75 – 43.3 = 31.7m