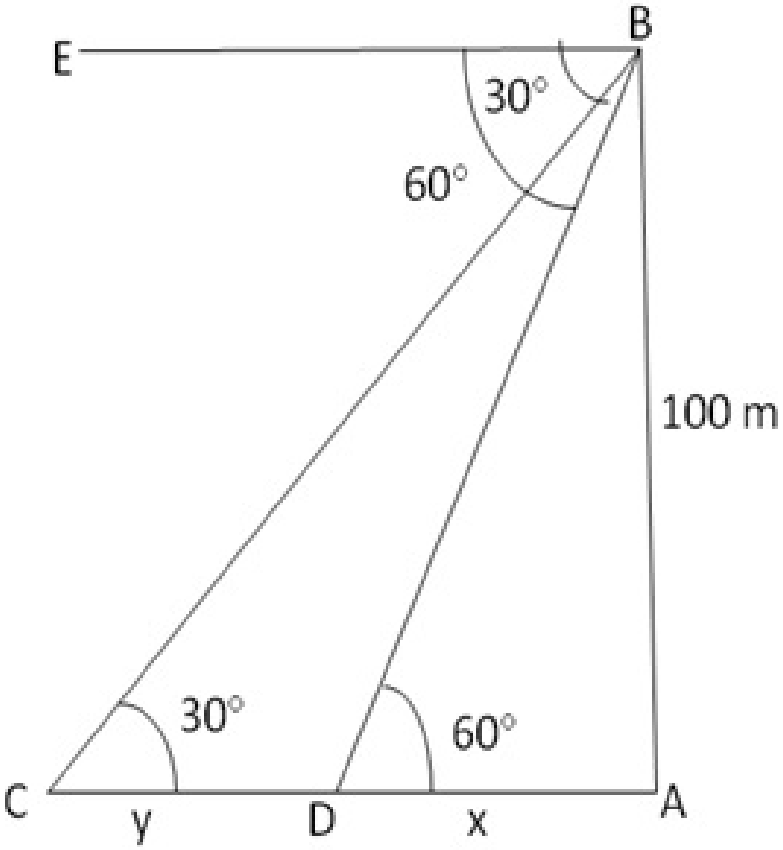
Question 19:
Let AB be the light house and let C and D be the positions of the ship.
Llet AD =x, CD = y



In Δ BDA,

$$\frac{x}{100} = \cot 60°$$

$$x = \frac{100}{\sqrt{3}}\,m$$

$$\text{Similarly in } \Delta BCA, \frac{x+y}{100} = \cot 30°$$

$$\Rightarrow (x+y) = 100\sqrt{3}m$$

$$y = (x+y) - x$$

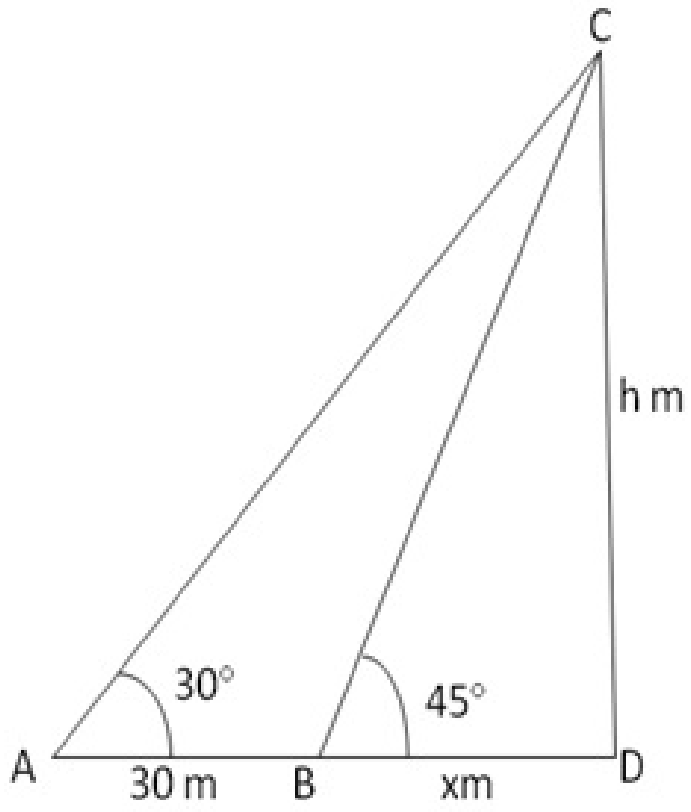
$$= \left(100\sqrt{3} - \frac{100}{\sqrt{3}}\right)m = \left(\frac{200}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}\right)m$$

$$= 115.46m$$

The distance travelled by the ship during the period of observation = 115.46 m

Question 20:

Let CD be the height of the building
Then, ∠CAB = 30°, ∠CBD = 45°, ∠ADC = 90° and AB = 30m
CD = h metres and BD = x metres.



From right Δ CAD, we have

$$\frac{CD}{DA} = \tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$\frac{h}{30+x} = \frac{1}{\sqrt{3}} \Rightarrow 30 + x = h\sqrt{3}$$

$$x = \left(h\sqrt{3} - 30\right)$$

From right Δ BCD, we have

$$\frac{CD}{BD} = \tan 45^\circ = 1 \Rightarrow \frac{h}{x} = 1 \Rightarrow h = x - - - (2)$$

$$\text{from}(1)\ \&\ (2), \text{we get}$$

$$h\sqrt{3} - 30 = h \Rightarrow h\sqrt{3} - h = 30$$

$$\Rightarrow h = \frac{30}{\left(\sqrt{3}-1\right)} \times \frac{\left(\sqrt{3}+1\right)}{\left(\sqrt{3}+1\right)} = \frac{30\sqrt{3}+30}{3-1} = \frac{30\left(\sqrt{3}+1\right)}{2}$$

$$\Rightarrow h = 15(1.732+1) = 15 \times 2.732 = 40.98$$

Putting h = 40.98 in (2), we get x = 40.98 m
Hence height of building = 40.98 m and Distance of its base from the point
A = AB = (30 + x) m
= (30 + 40.98) m = 70.98 m

********** END **********