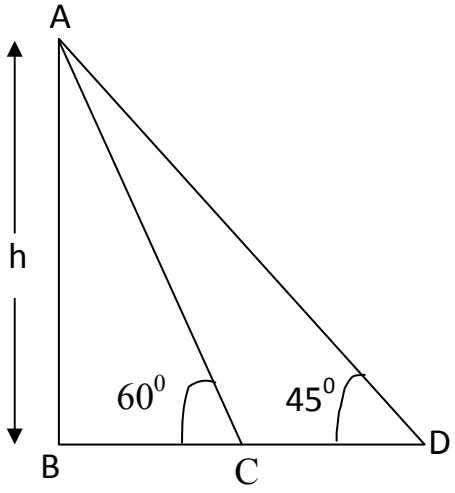
1. The shadow of a tower on the ground is increased by 24 meters, when the angle of elevation of the sun is changed from 60^0 to 45^0. What is the height of the tower?

Solution: The height of the tower, AB = h meters.

Angle of elevation, $\angle BCA = 60^0$

Angle of elevation, $\angle BDA = 45^0$



Shed CD = 24 meters

Let, BC = x meters

Now, in right angled ΔABC

$\tan \angle ADB = \frac{AB}{BC}$

$\Longrightarrow \tan 60^0 = \frac{h}{x}$

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

$\Longrightarrow x = \frac{h}{\sqrt{3}} = 0.577h$

Again, in ΔABD,

Now in Δ ABD,

$\tan \angle BDA = \frac{AB}{BD}$

$\Longrightarrow \tan 45^0 = \frac{h}{BC + CD}$

$\Longrightarrow 1 = \frac{h}{x + 24}$

$\Longrightarrow h = .0577h + 24$ [$\because x = 0.577\ h$]

$\Longrightarrow h - 0.0577h = 24$

$\Longrightarrow h\,(1 - 0.577\,) = 24$

$\Longrightarrow h = \frac{24}{1 - 0.577}$

$\Longrightarrow h = 56.79$

Therefore, the height of the building is 56.79 meter.

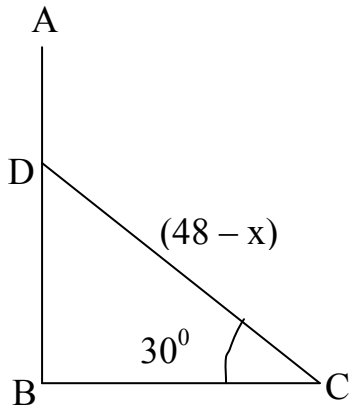
Answer: 56.79 meter.

2. A pole of 48 meters long breaks such that the two parts are completely separated and the upper part makes an angle 30^0 with the ground. At what height did the pole break?

Solution: Let, the pole AB = 48 meters. Let, the pole breaks at point D which is x meter distance from B and not completely separated from the pole. It makes an angle 30^0 at C.

So, $\angle BCD = 30^0$, BD = x meter and CD = DA = (48 – x) meter

Now, in right angled ΔBCD



$\sin \angle BCD = \frac{BD}{CD}$

$\Longrightarrow \sin 30^0 = \frac{x}{48 - x}$

$\Longrightarrow \frac{1}{2} = \frac{x}{48 - x}$

$\Longrightarrow 2x = 48 - x$

$\Longrightarrow 2x + x = 48$

$\Longrightarrow 3x = 48$

$\Longrightarrow x = 16$

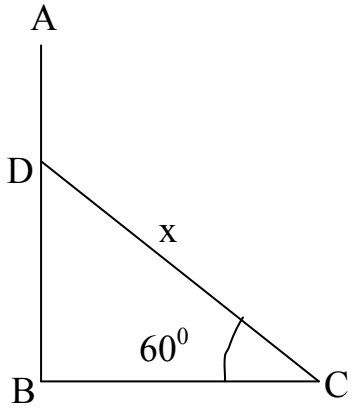
Answer: 16 meter.

3. A pole of 64 meter long breaks into two parts without complete separation and makes an angle 60^0 with the ground. Find the length of the broken part of the pole.

Solution: Let, the pole AB = 64 meters. Let, the pole breaks at point D which is x meter distance from B and not completely separated from the pole. It makes an angle 60^0 at C.

So, $\angle BCD = 30^0$, BD = (64 – x) meter and CD = DA = x meter

Now, in right angled ΔBCD



$\sin \angle BCD = \frac{BD}{CD}$

$\Longrightarrow \sin 60^0 = \frac{64 - x}{x}$

$\Longrightarrow \frac{\sqrt{3}}{2} = \frac{64 - x}{x}$

$\Longrightarrow \sqrt{3}x = 128 - 2x$

$\Longrightarrow \sqrt{3}x + 2x = 128$

$\Longrightarrow x(\sqrt{3}+2) = 128$

$\Longrightarrow x = \frac{128}{\sqrt{3}+2}$

$\Longrightarrow x = 34.297$

Answer: 34. 297 meter.