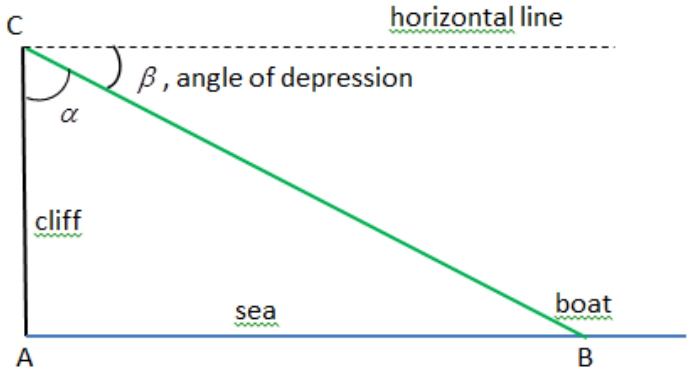
Answer on Question #71010 – Math – Trigonometry

Question

From the top of a cliff 126 meters high, the angle of depression of a boat is 20.7 degrees. How far is the boat from the foot of the cliff?

Solution

The angle of depression is the angle β measured downward from the horizontal line in the direction of sight of a boat (see figure).



By condition of the problem $\beta = 20.7°$. Then we can find the angle α between the cliff, AC, and the line of sight of a boat, CB:

$$\alpha = 90° - \beta = 90° - 20.7° = 69.7°$$

Now we consider ΔABC which is the right triangle since $m\angle CAB = 90°$. The tangent ratio for an acute angle α in this triangle is

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

Then we get the distance from the foot of the cliff A to the boat B, that is AB:

$$AB = AC \cdot \tan\alpha$$

Substituting $AC = 126\ m$ and $\tan\alpha = \tan 69.7° \approx 2.7$ we get

$$AB = 126 \cdot 2.7 \approx 340\ m$$

Answer: the distance from the foot of the cliff to the boat is 340 m.