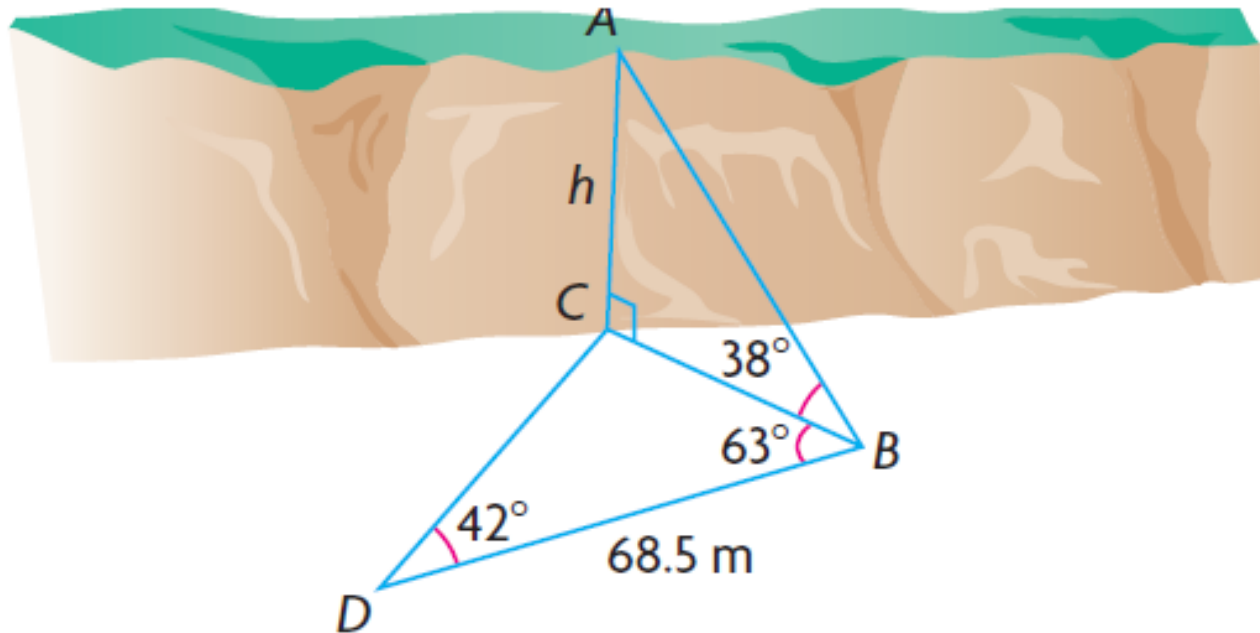


5.8 - Solving 3D Problems by Using Trigonometry

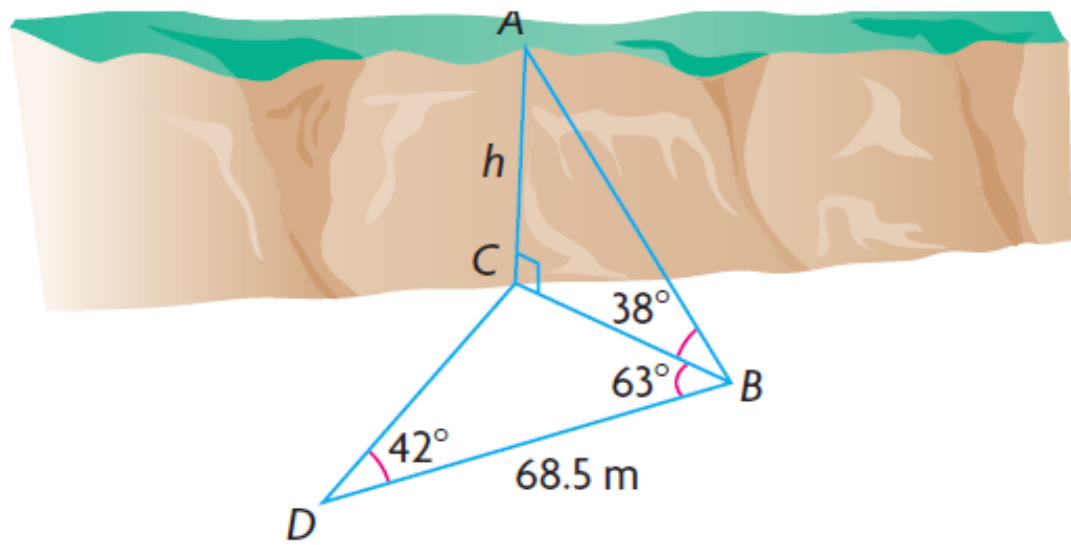
- From Point B, Manny uses a clinometer to determine the angle of elevation to the top of a cliff to be 38° . From point D, 68.5m away from Manny, Joe estimates the angle between the base of the cliff, himself and Manny to be 42° , while Manny estimates the angle between the base of the cliff, himself, and his friend Joe to be 63° .



What is the height of the cliff to the nearest tenth of a meter?

In $\triangle DBC$:

$$\begin{aligned}\angle C &= 180^\circ - (63^\circ + 42^\circ) \\ &= 75^\circ\end{aligned}$$



In $\triangle DBC$:

$$\begin{aligned}\angle C &= 180^\circ - (63^\circ + 42^\circ) \\ &= 75^\circ\end{aligned}$$

$$BC \doteq 47.45 \text{ m}$$

$$\tan 38^\circ = \frac{h}{BC}$$

$$\tan 38^\circ = \frac{h}{47.45}$$

$$\tan 38^\circ \times 47.45 = \frac{h}{47.45} \times 47.45$$

$$37.1 \text{ m} \doteq h$$

$$\frac{BC}{\sin D} = \frac{BD}{\sin C}$$

$$\frac{BC}{\sin 42^\circ} = \frac{68.5}{\sin 75^\circ}$$

$$\overset{1}{\cancel{\sin 42^\circ}} \times \frac{BC}{\underset{1}{\cancel{\sin 42^\circ}}} = \sin 42^\circ \times \frac{68.5}{\sin 75^\circ}$$

$$BC = \sin 42^\circ \times \frac{68.5}{\sin 75^\circ}$$

Example #2

- Emma is on a 50 m high bridge and sees two boats anchored below. From her position, boat A has a bearing of 230° and boat B has a bearing of 120° . Emma estimates the angles of depression to be 38° for boat A and 35° for boat B. How far apart are the boats to the nearest metre?

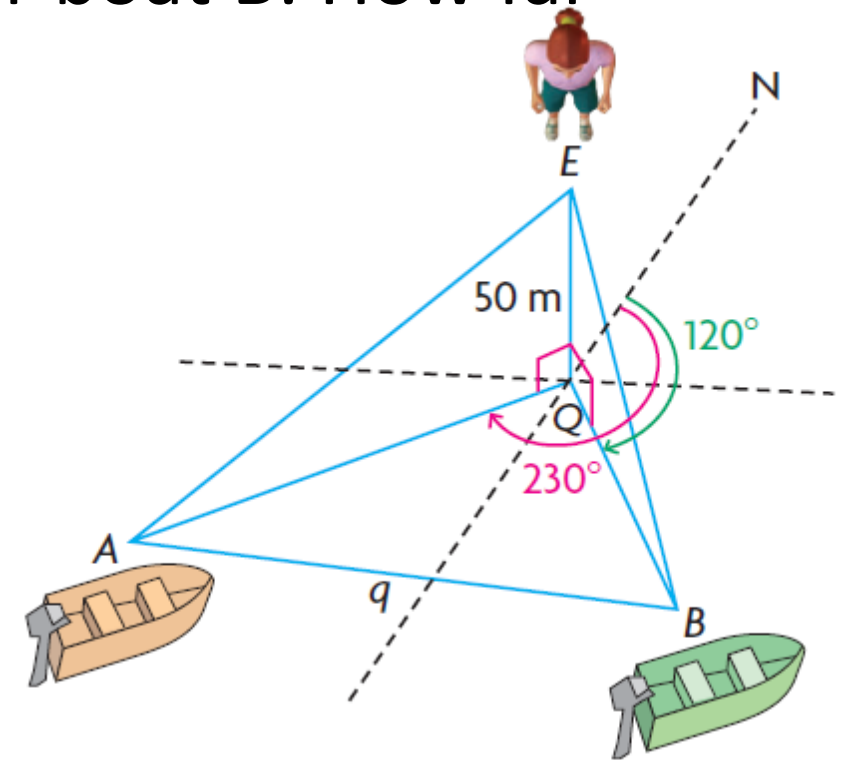
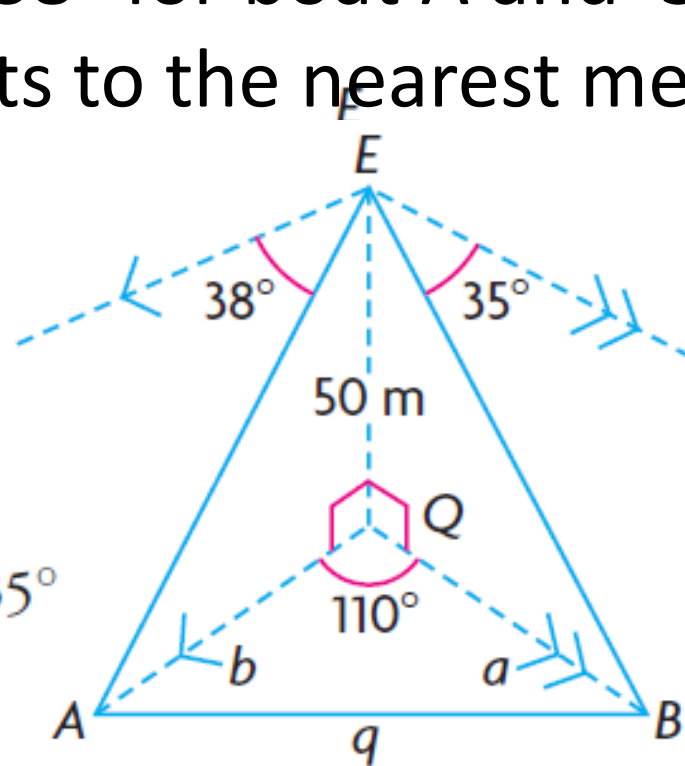
In $\triangle AQB$:

$$\angle Q = 230^\circ - 120^\circ$$

$$= 110^\circ$$

$$\angle EAQ = 38^\circ$$

$$\angle EBQ = 35^\circ$$



Ex. #2 cont'd

In $\triangle AEQ$:

$$\tan 38^\circ = \frac{50}{b}$$

$$b = \frac{50}{\tan 38^\circ}$$

$$b \doteq 64.0 \text{ m}$$

In $\triangle BEQ$:

$$\tan 35^\circ = \frac{50}{a}$$

$$a = \frac{50}{\tan 35^\circ}$$

$$a \doteq 71.4 \text{ m}$$

$$q^2 = b^2 + a^2 - 2ba \cos 110^\circ$$

$$q^2 = (64.0)^2 + (71.4)^2 - 2(64.0)(71.4)\cos 110^\circ$$

$$q = \sqrt{12\,320.6}$$

$$q \doteq 111 \text{ m}$$

The boats are about 111 m apart.

