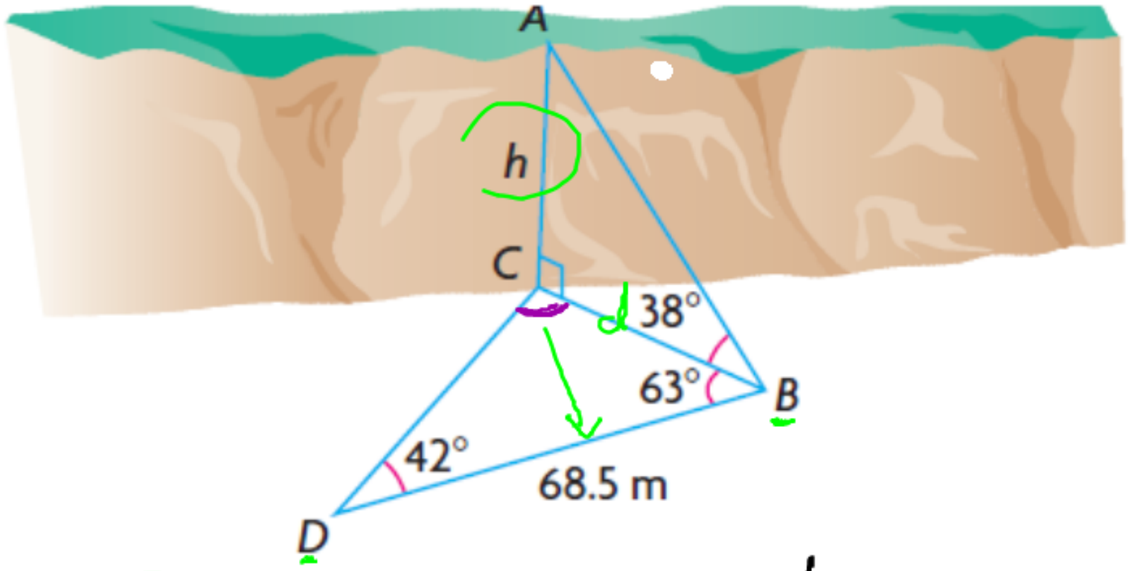
5.8 3D Trigonometry: no glasses required.

From point *B*, Manny uses a clinometer to determine the angle of elevation to the top of a cliff as 38°. From point *D*, 68.5 m 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°.



$$\tan 38 = \frac{h}{47.5}$$

$$47.5 \tan 38 = h$$

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

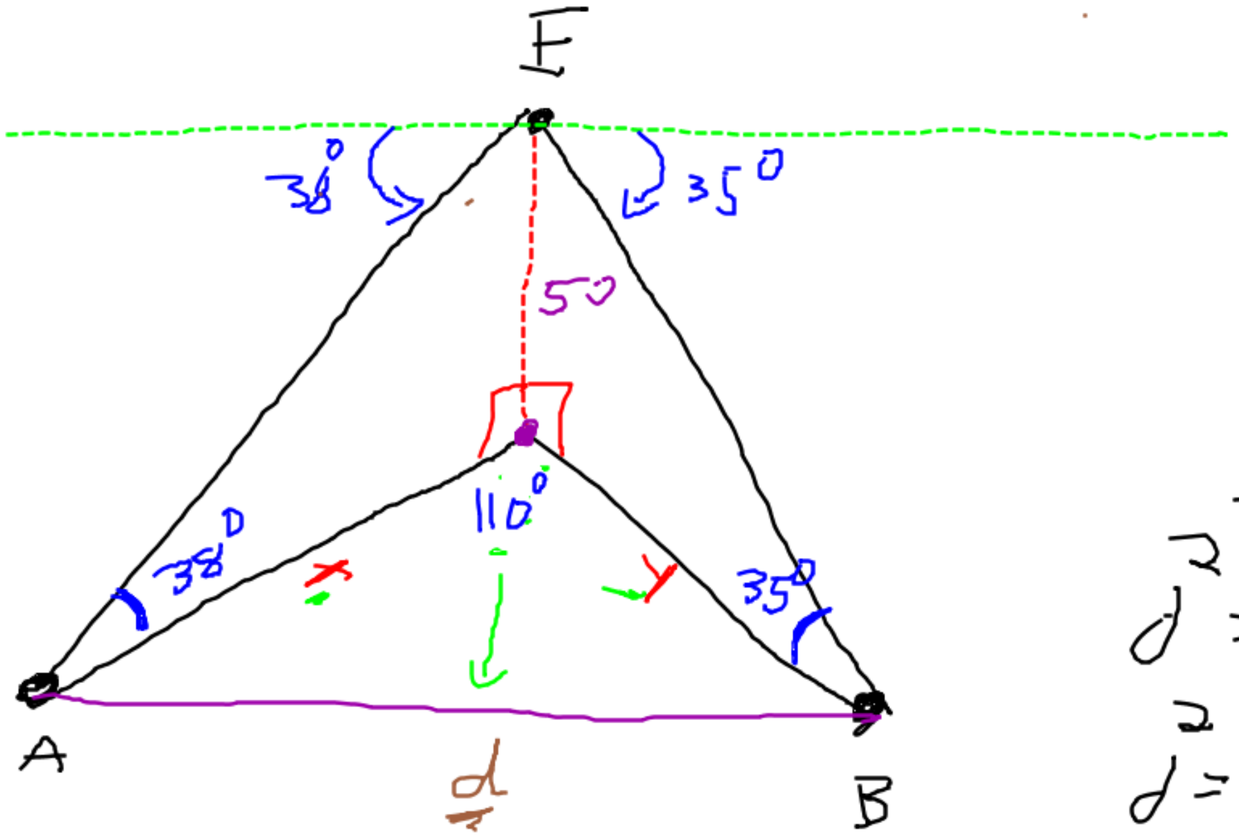
$\angle DCB = 180 - 42 - 63$

$= 75^\circ$

$$\frac{d}{\sin 42} = \frac{68.5}{\sin 75}$$

$$d = \frac{68.5 \sin 42}{\sin 75} = 47.5\text{m}$$

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?



$\tan 38 = \frac{50}{x}$

$x = \frac{50}{\tan 38} = 64 \text{ m}$

$\tan 35 = \frac{50}{y}$

$y = \frac{50}{\tan 35} = 71.4$

$d^2 = 64^2 + 71.4^2 - 2(64)(71.4)\cos 110$

$d^2 = 12319.75$

$d = 111 \text{ m}$