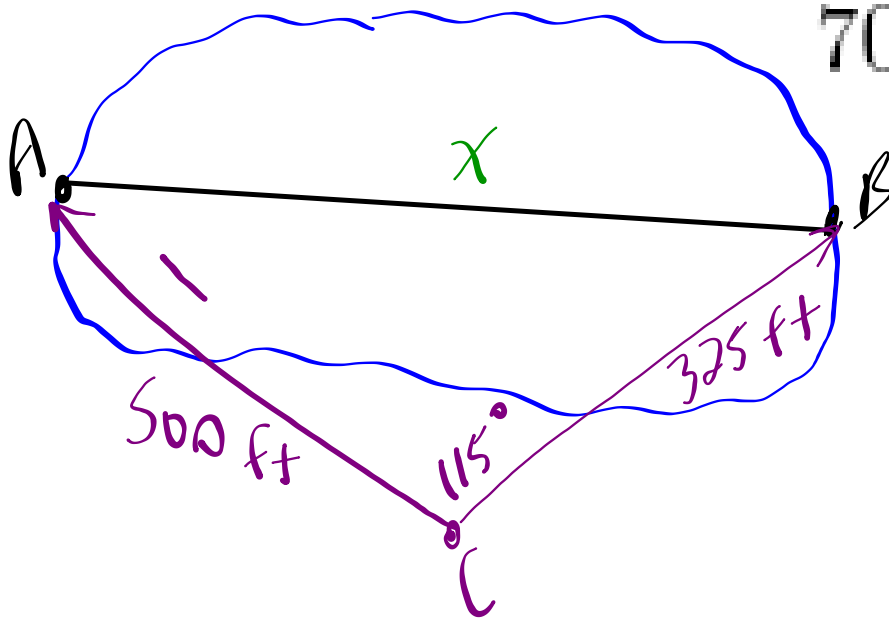


Warm Up $a^2 = b^2 + c^2 - 2bc \cos A$

To find the length AB of a small lake, a surveyor at point C measures angle ACB to be 115° , length AC to be 500 feet, and length BC to be 325 feet. What is the length of the lake (to the nearest foot)?

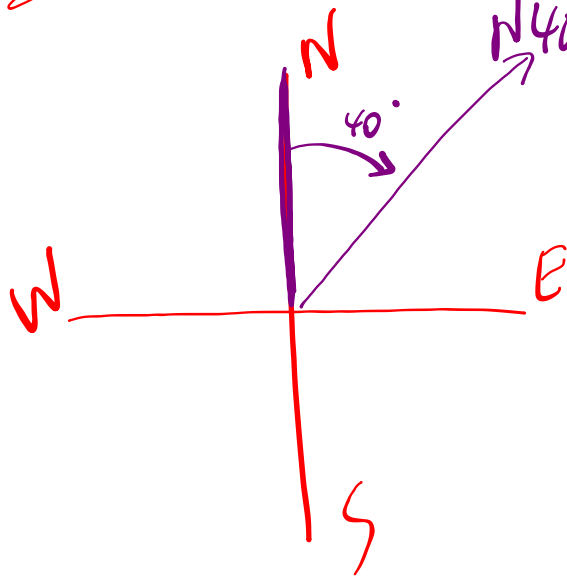
702 feet



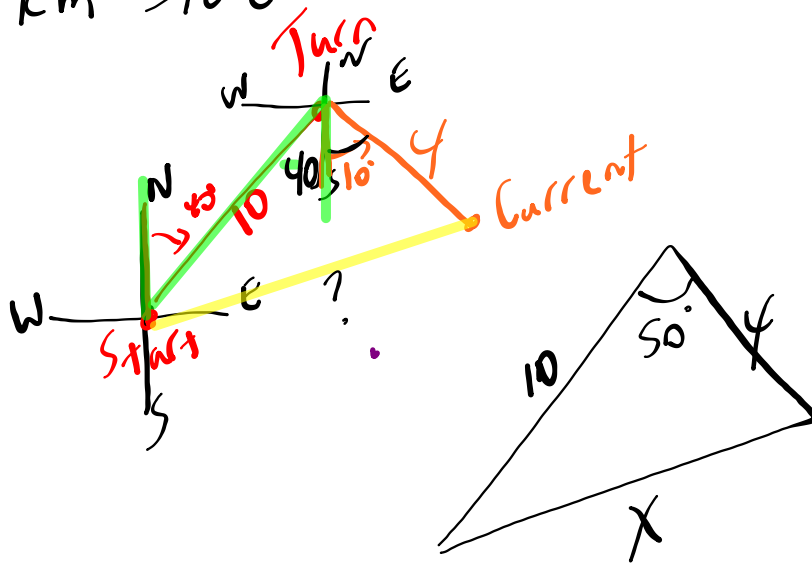
$$x^2 = 500^2 + 325^2 - 2(500)(325) \cos(115^\circ)$$

$x^2 =$	$500^2 + 325^2 - 2 * 500 * 325 * \cos(115)$
	492975.9351
	$\sqrt{\text{Ans}}$
	$x = 702.1224502$

HW: # 9-12 (10.12)



- (11) #1) 10 km N 40° E
- #2) 4 km S 10° E



$$X^2 = 10^2 + 4^2 - 2(10)(4)\cos 50^\circ$$

$$X^2 = 10^2 + 4^2 - 2 \cdot 10 \cdot 4 \cdot \cos(50)$$

$$X^2 = 64.57699123$$

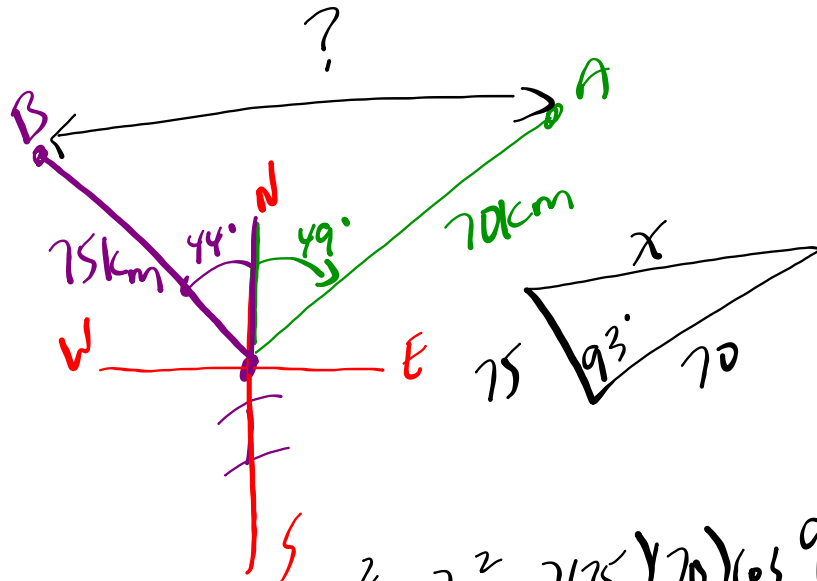
$$\sqrt{\text{Ans}} = 8.035981037$$

$X = 8.0 \text{ km}$

12

A
N 49° E

B
N 44° W



$$X^2 = 75^2 + 70^2 - 2(75)(70)\cos 93^\circ$$

$$X^2 =$$

$75^2 + 70^2 - 2 * 70 * 75 * \cos(93)$ 11074.52754 $\sqrt{\text{Ans}}$ 105.2355812

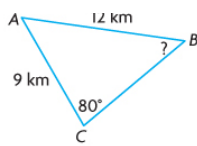
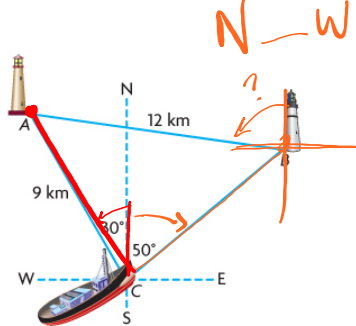
$$X =$$

$X = 105 \text{ km}$

Applications: Bearings

Ex #1:(p. 122) Using reasoning to determine the measure of an angle

The captain of a small boat is delivering supplies to two lighthouses, as shown. His compass indicates that the lighthouse to his left is located at $N30^\circ W$ and the lighthouse to his right is located at $N50^\circ E$. Determine the compass direction he must follow when he leaves lighthouse B for lighthouse A .



$$\frac{\sin B}{AC} = \frac{\sin C}{AB}$$

I drew a diagram. I labelled the sides of the triangle I knew and the angle I wanted to determine.

I knew AC , AB , and $\angle C$, and I wanted to determine $\angle B$. So I used the sine law that includes these four quantities.

I used the proportion with $\sin B$ and $\sin C$ in the numerators so the unknown would be in the numerator.

$$\frac{\sin B}{9} = \frac{\sin 80^\circ}{12}$$

$$9\left(\frac{\sin B}{9}\right) = 9\left(\frac{\sin 80^\circ}{12}\right)$$

$$\sin B = 9\left(\frac{\sin 80^\circ}{12}\right)$$

$$\sin B = 0.7386\dots$$

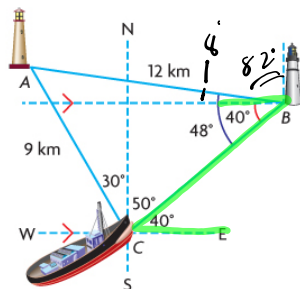
$$\angle B = \sin^{-1}(0.7386\dots)$$

$$\angle B = 47.612\dots^\circ$$

I substituted the given information and then solved for $\sin B$.

The measure of $\angle B$ is 48° .

The answer seems reasonable. $\angle B$ must be less than 80° , because 9 km is less than 12 km.



The captain must head $N82^\circ W$ from lighthouse B .

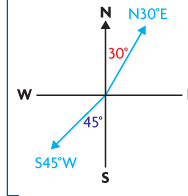
I drew a diagram and marked the angles I knew. I knew east-west lines are all parallel, so the alternate interior angle at B must be 40° .

The line segment from lighthouse B to lighthouse A makes an 8° angle with west-east. I subtracted this from 90° to determine the direction west of north.

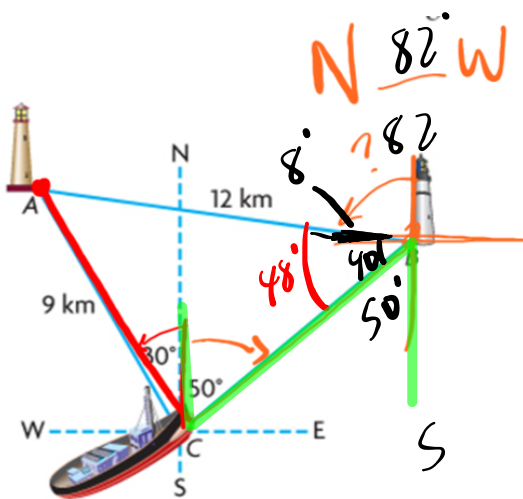
NOTE:

Communication **Tip**

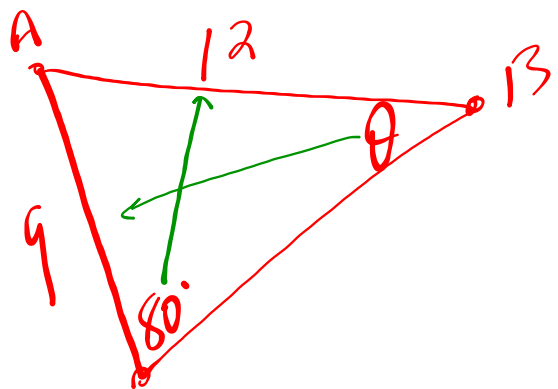
Directions are often stated in terms of north and south on a compass. For example, $N30^\circ E$ means travelling in a direction 30° east of north. $S45^\circ W$ means travelling in a direction 45° west of south.



Compass Rose Animation



$$\frac{\sin A}{a} = \frac{\sin B}{b} \Leftrightarrow \frac{\sin A}{\sin B} = \frac{a}{b}$$



$$\frac{9}{\sin \theta} = \frac{9}{\sin(80^\circ)}$$

$$\sin \theta = \frac{9 \sin(80^\circ)}{12}$$

$\frac{9 \sin(80^\circ)}{12}$ 0.7386058148 $\sin^{-1}(\text{Ans})$ 47.61278742

$\theta = 48^\circ$

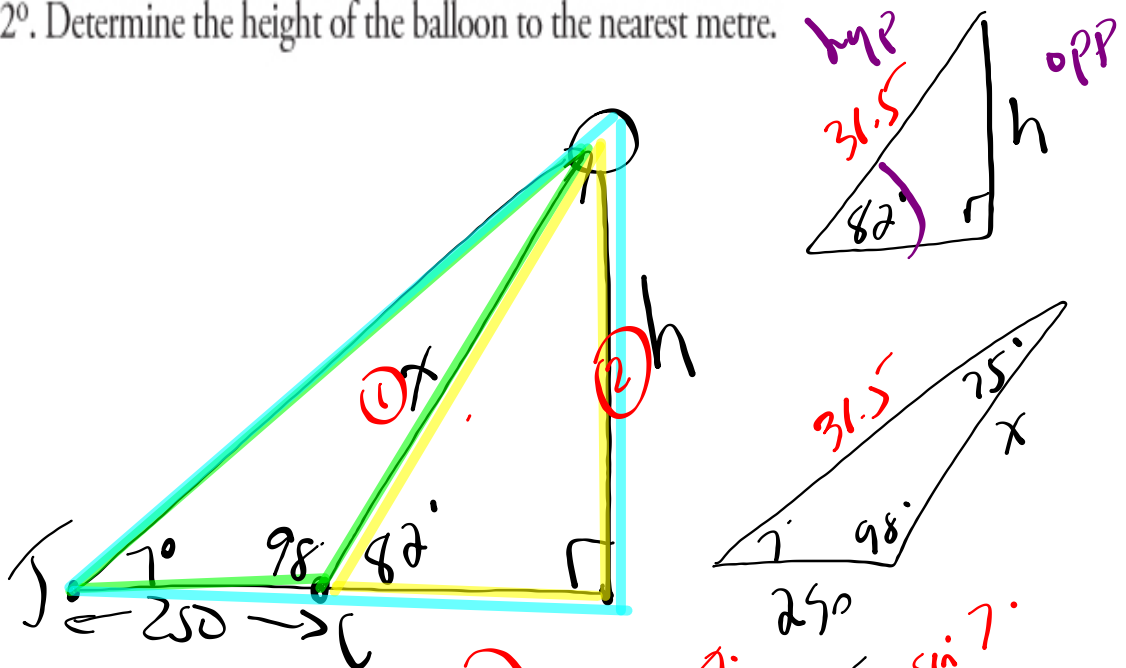
1

EX #2: Solving an application question...

(p. 166)

EXAMPLE 2 Solving a problem using the sine law

Colleen and Juan observed a tethered balloon advertising the opening of a new fitness centre. They were 250 m apart, joined by a line that passed directly below the balloon, and were on the same side of the balloon. Juan observed the balloon at an angle of elevation of 7° while Colleen observed the balloon at an angle of elevation of 82° . Determine the height of the balloon to the nearest metre.



$$\textcircled{1} \frac{x \sin 7^\circ}{\sin 75^\circ} = \frac{250 \sin 7^\circ}{\sin 75^\circ}$$

$$x = 31.5$$

$$\textcircled{2} \sin 82^\circ = \frac{h}{31.5}$$

$$31.2 \text{ m} = h$$

HOMEWORK: More Applications/Word Problems

Page 154 #5, 9, 10

Page 154 #11 & 12 (bearings - see examples)

Page 172 #9, 12, 14