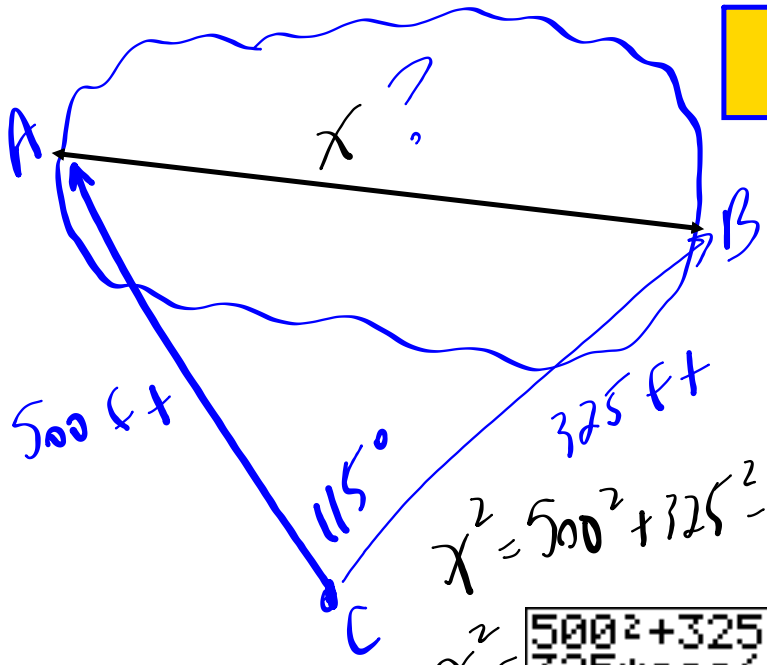
Warm Up $a^2 = b^2 + c^2 - 2bc\cos A$

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)?

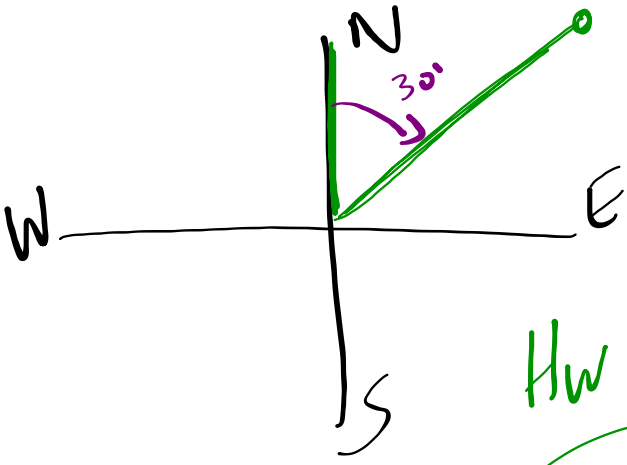


$x^2 = 500^2 + 325^2 - 2(500)(325)\cos 115$

x^2 = 500²+325²-2*500*325*cos(115)
492975.9351

x = √(Ans
702.1224502

702 km



N 30° E

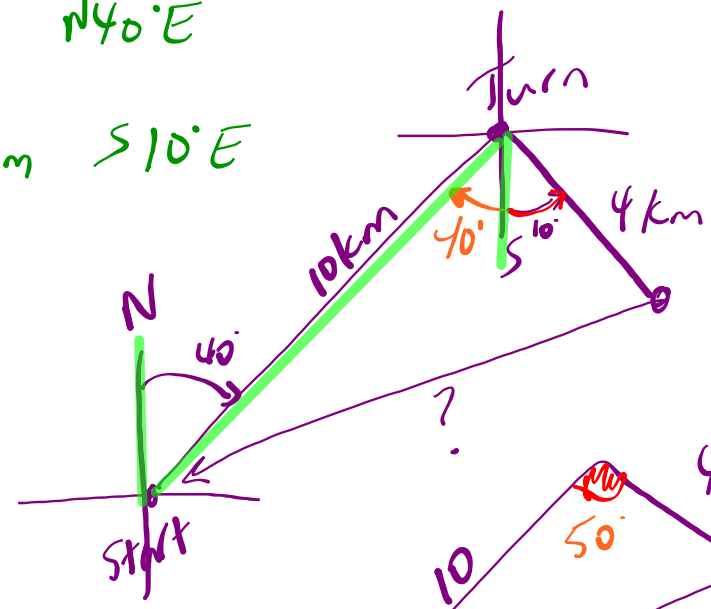
" 30° East of North "

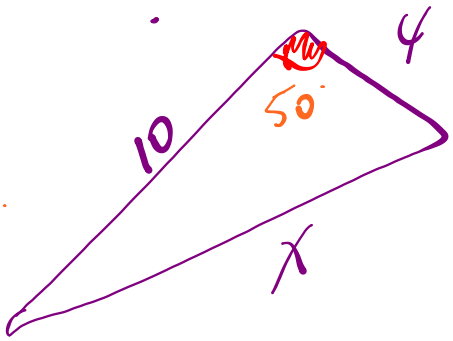
HW questions

(11) start 10 km N40°E

Turn 4km S10°E

Lodge ?



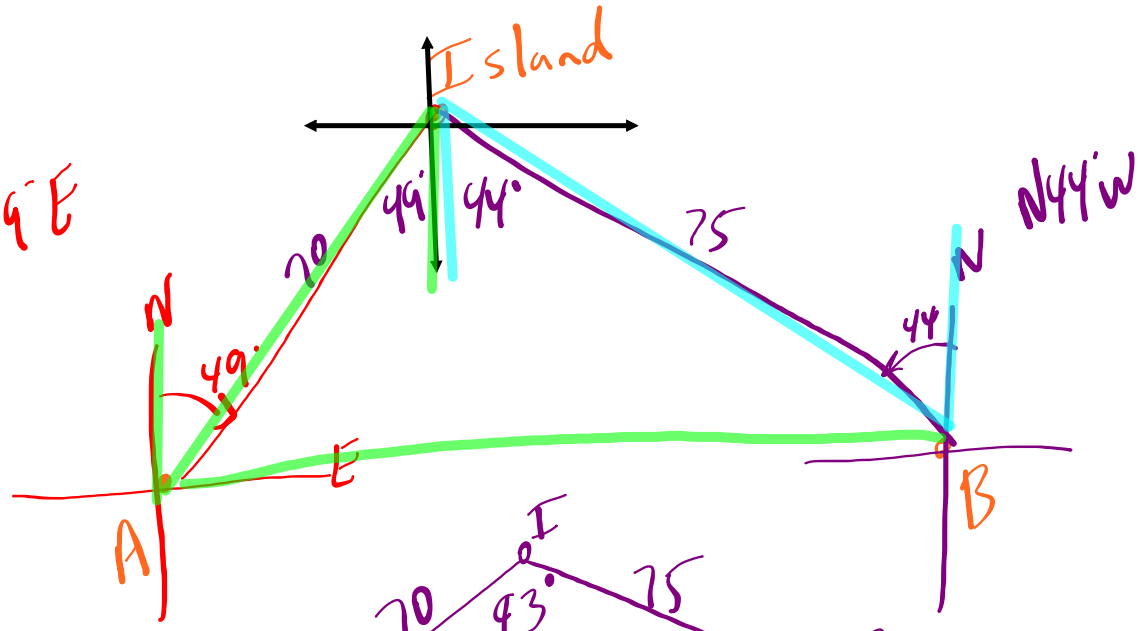


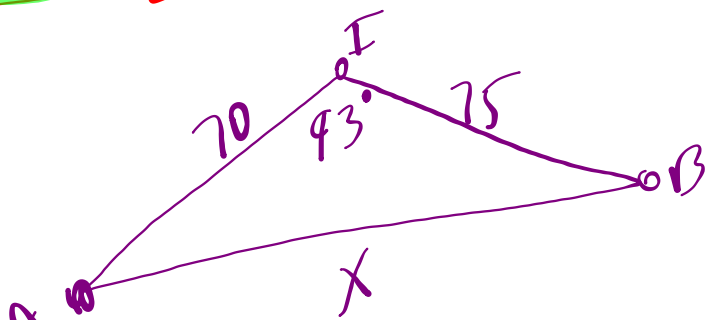
$x^2 = 10^2 + y^2 - 2(10)(y)\cos 50°$

$x^2 =$

```
10²+4²-2*10*4*co
s(50)
          64.57699123
√(Ans
          8.035981037
■ x=
```

(12)





$x^2 = 70^2 + 75^2 - 2(70)(75)\cos 93°$

x^2

70²+75²-2*70*75*cos(93
11074.52754
√(Ans
105.2355812

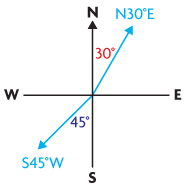
$x =$ 105 km

Applications: Bearings

NOTE:

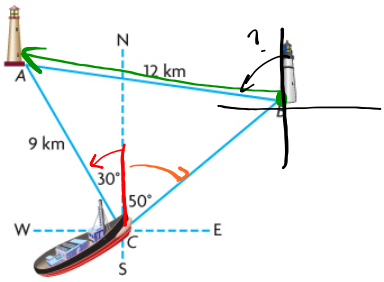
Communication Tip

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

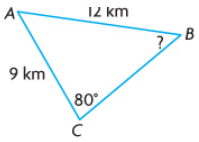


Ex #1:(p. 122) **Using reasoning to determine the measure of an angle**

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°W and the lighthouse to his right is located at N50°E. Determine the compass direction he must follow when he leaves lighthouse *B* for lighthouse *A*.



Compass Rose Animation



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

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

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.

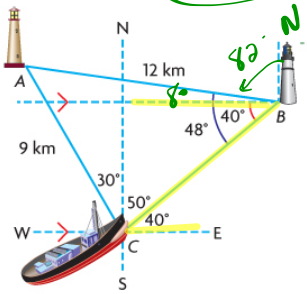
I used the proportion with sin *B* and sin *C* in the numerators so the unknown would be in the numerator.

$$\frac{\sin B}{9} = \frac{\sin 80°}{12}$$
$$9\left(\frac{\sin B}{9}\right) = 9\left(\frac{\sin 80°}{12}\right)$$
$$\sin B = 9\left(\frac{\sin 80°}{12}\right)$$
$$\sin B = 0.7386...$$
$$\angle B = \sin^{-1}(0.7386...)$$
$$\angle B = 47.612...°$$

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

The measure of $\angle B$ is 48°.

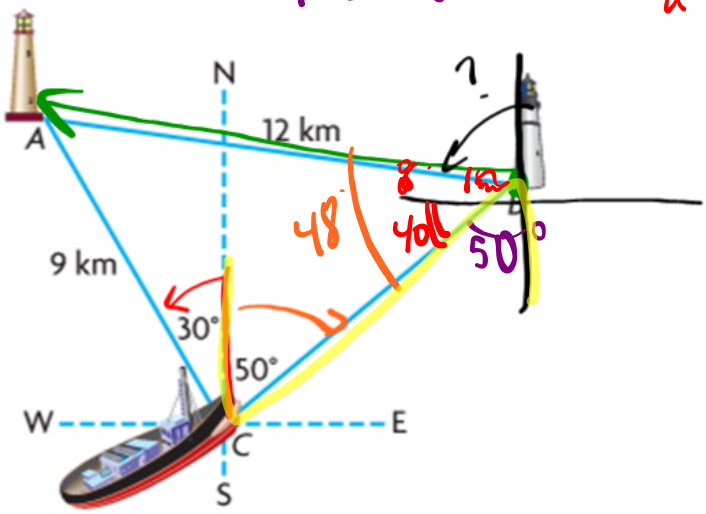
The answer seems reasonable. $\angle B$ must be less than 80°, because 9 km is less than 12 km.



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°.

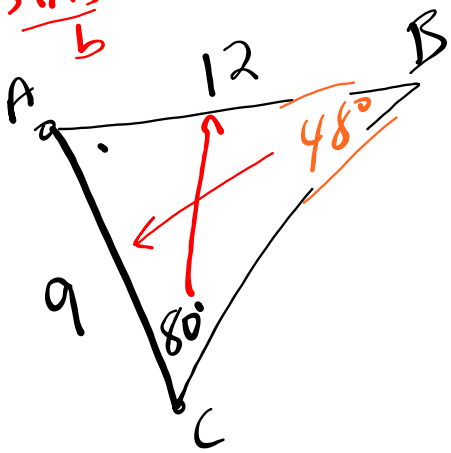
The captain must head N82°W from lighthouse *B*.

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.



N82°W

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



$\frac{9}{\sin\theta} = \frac{9}{\sin 80°}$ / 12

$\sin^{-1}\sin\theta = \sin^{-1}(0.7386)$

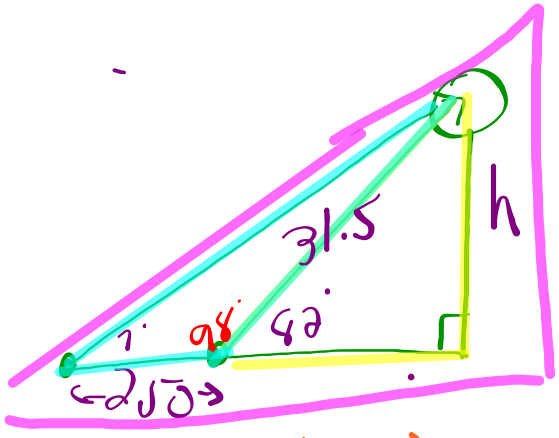
$\theta = 48°$

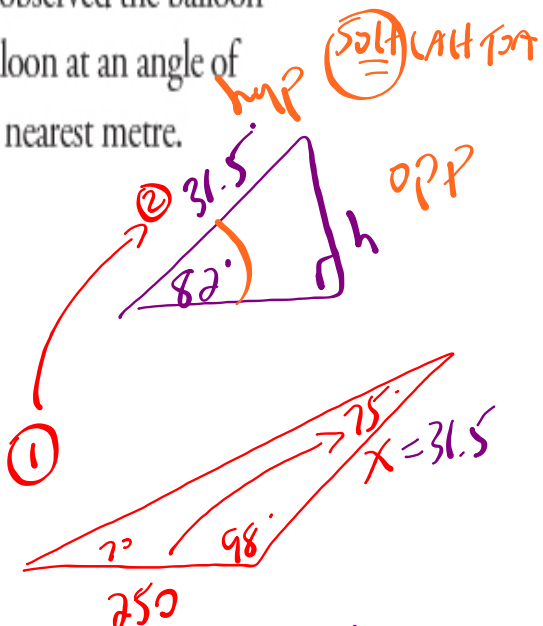
EX #2: Solving an application question...

(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.





$\frac{31.5}{1}\sin 82° = \frac{h}{31.5}$ (31.5)

$31.2 = h$

$\frac{X \sin 7°}{\sin 7°} = \frac{250 \sin 7°}{\sin 75°}$

$X = 31.5$

HOMEWORK: More Applications/Word Problems

Page 154 #5, 9, 10
Page 154 #11 & 12 (bearings - see examples)
Page 172 #9, 12, 14