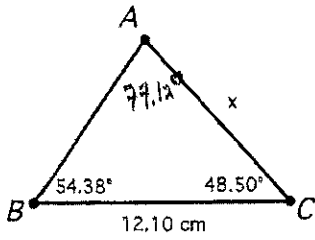


C-Level

1) Solve for x. [13 pts]

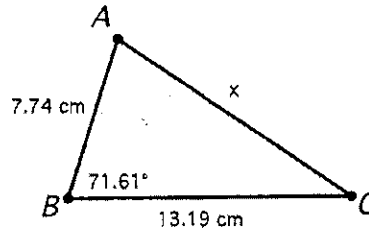


$$\begin{aligned} &180 \\ &- 54.38 \\ &- 48.50 \\ \hline &77.12^\circ \end{aligned}$$

$$\frac{x}{\sin(54.38)} = \frac{12.10}{\sin(77.12)}$$

$$x = 10.09 \text{ cm}$$

2) Solve for x. [13 pts]

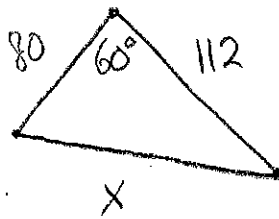
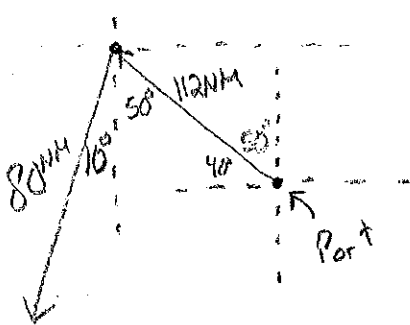


$$\begin{aligned} x^2 &= 7.74^2 + 13.19^2 - 2(7.74)(13.19)\cos(71.61) \\ x^2 &= 169.468 \end{aligned}$$

$$x = 13.02 \text{ cm}$$

3) A boat leaves port on a heading of N50°W traveling at 14 knots for 8 hours. The boat then turns to a heading of S10°W traveling at 16 knots for 5 hours. [12 pts]

- a) Draw a diagram of the boat's path.
- b) Determine how far the boat is from where it left port.



$$x^2 = 80^2 + 80^2 - 2(80)(80)\cos(60)$$

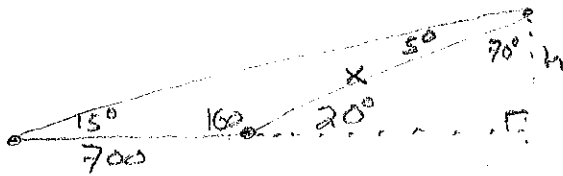
$$x^2 = 9984$$

$$x = 99.92$$

It is 99.92 NM away from port

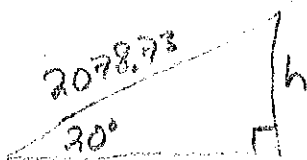
A/B-Level

4) Two sensors are spaced 700 feet apart along the approach to a small airport. When an aircraft is nearing the airport, the angle of elevation from the first sensor to the aircraft is 20°, and that from the second sensor is 15°. Determine how high the aircraft is at this time. [4 pts]



$$\frac{700}{\sin(5^\circ)} = \frac{x}{\sin(15^\circ)}$$

$$2078.7354 = x$$



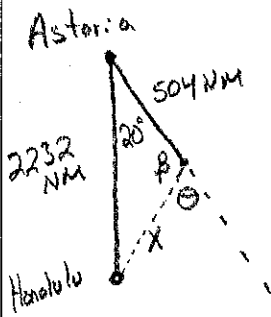
$$\sin(20) = \frac{h}{2078.73}$$

$$710.97 = h$$

It is 710.97 feet up

A/B-Level

- 5) A cruise ship leaves Astoria, Oregon on a direct trip to Honolulu, Hawaii, which is 2,232 nautical miles (NM) away. The cruise ship captain travels off the direct course by 20° traveling at 28 knots for 18 hours due to a typhoon in the Pacific ocean. [4 pts]
- Draw a diagram given the description
 - How far is the cruise ship from Astoria after 18 hours?
 - Through what angle should the cruise ship turn to correct it's course?
 - How much time has been added to the trip because of this? (Assume the speed remains 28 knots).



b) 504 NM away

c) $X^2 = 504^2 + 2232^2 - 2(504)(2232)\cos 20$
 $X = 1766.82$

The captain should turn 25.601° toward Honolulu.

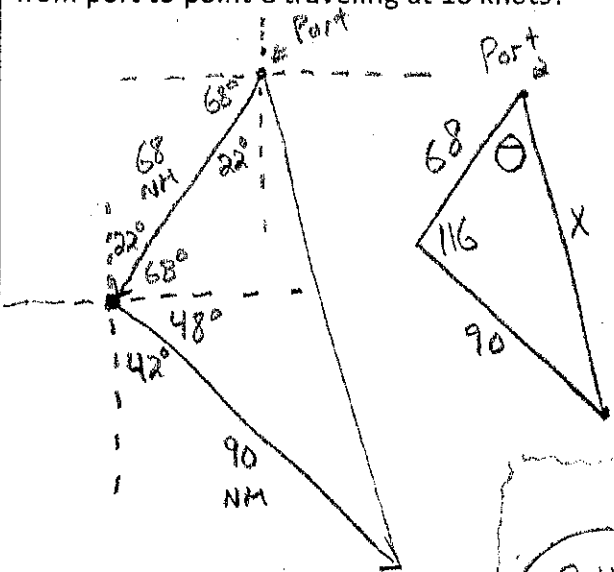
$\frac{\sin \beta}{2232} = \frac{\sin 20}{1766.82}$
 $\sin \beta = 0.4321$
 $\beta = 25.601^\circ$
 $180 - 25.601 = 154.399^\circ$
 $\theta = 25.601^\circ$

Normal Trip:
 $\frac{2232}{28} = 79.71$ hours

This Trip:
 $\frac{504 + 1766.82}{28} = 81.1$ hours

d) Time Added:
 $\frac{81.1 - 79.71}{1} = 1.39$ hours added

- 6) A boat leaves port on a heading of $S22^\circ W$ traveling at 17 knots for 4 hours. The boat then turns to a heading of $S42^\circ E$ traveling at 18 knots for 5 hours. [4 pts]
- Draw a diagram of the boat's path.
 - Determine how far the boat is from where it left port.
 - What is the heading from port to the location of the boat after 9 hours?
 - If the ending location of the boat is referred to as point C, how much time would be saved by traveling straight from port to point C traveling at 16 knots?



$X^2 = 68^2 + 90^2 - 2(68)(90)\cos(116)$
 $X = 134.5$

b) It's 134.5 NM away

c) $\frac{\sin \theta}{90} = \frac{\sin(116)}{134.5}$
 $\sin \theta = 0.6014$
 $\theta = 36.97^\circ$

$\frac{36.97^\circ - 22^\circ}{1} = 14.97^\circ$

$S14.97^\circ E$

d) $\frac{134.5}{16} = 8.406$ hours vs. 9 hours

$\frac{9 - 8.406}{1} = 0.594$

0.594 hours would have been saved