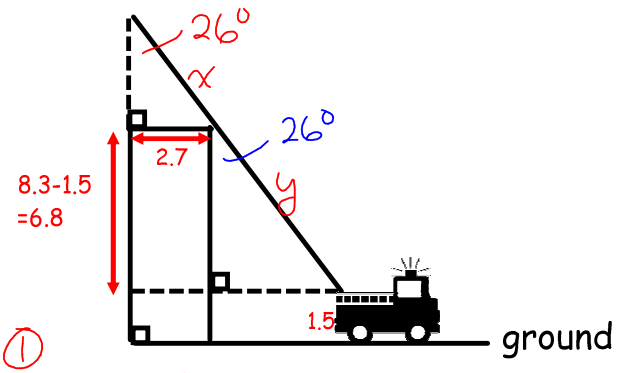
4.5 Solving Problems Using Acute Angle

Ex 1: Using right angle models

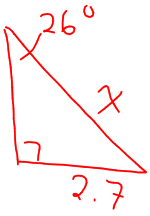
A ladder leaning against a building makes an angle of 26° with the vertical. The ladder just touches the building and the man at the top of the ladder is directly above a point 2.7m in from the edge of the building. If the building is 8.3m and the bottom of the ladder is on the truck, 1.5 m above the ground, how long is the ladder?

Picture it:

side view



①

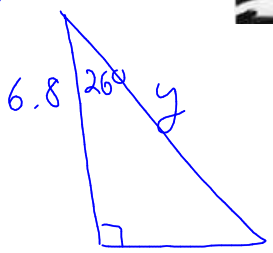


$\sin 26^\circ = \frac{2.7}{x}$

$x = \frac{2.7}{\sin 26^\circ}$

$\doteq 6.16$

②



$\cos 26^\circ = \frac{6.8}{y}$

$y = \frac{6.8}{\cos 26^\circ}$

$\doteq 7.57$

Length of ladder $= 6.16 + 7.57$

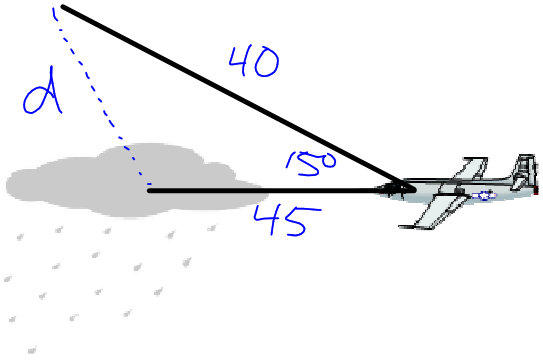
$= 13.73$

∴ the ladder is approx. 13.73m

Ex 2:

While cruising at a speed of 400 km/h you identify a storm cloud 45 km away. To avoid turbulence you start elevating up at an angle of elevation of 15 ° . If you maintain the same speed and direction for 6 min, how far will you be from the storm cloud in 6 minutes?

Picture it:



Distance = speed x time (watch your units)

$d = 400\left(\frac{6 \text{ min}}{60 \text{ min in 1 hr}}\right)$

$= 40$ km

Cosine law!

$d^2 = 40^2 + 45^2 - 2(40)(45)\cos 15°$

$d^2 \doteq 3625 - 3477.33$

$d^2 \doteq 147.67$

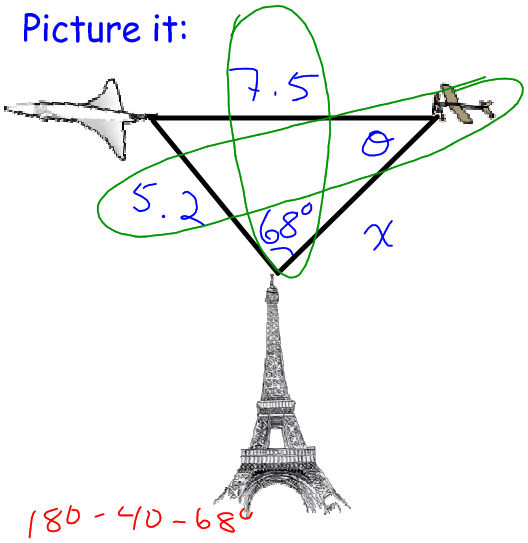
$d \doteq 12.15$

∴ You will be approx. 12.15 km

Ex 3:
A jet and a plane are 7.5 km from each other (at the same altitude, jet is ahead of the plane). From the top of the Eifle tower the airplanes are separated on an angle of 68°. If the jet is 5.2 km from the top of the tower, how far is the plane from the top of the Eifle tower?

Two steps!

Picture it:



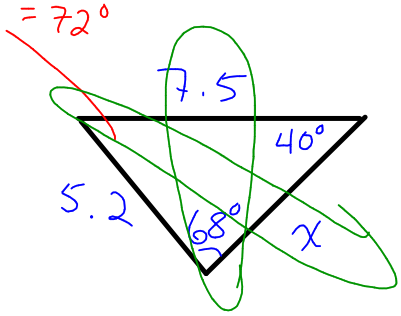
$$\frac{\sin\theta}{5.2} = \frac{\sin 68^\circ}{7.5}$$

$$\sin\theta = 5.2 \cdot \frac{\sin 68^\circ}{7.5}$$

$$\theta = \sin^{-1}\left(5.2 \cdot \frac{\sin 68^\circ}{7.5}\right)$$

$$\approx 40^\circ$$

$180 - 40 - 68^\circ = 72^\circ$



$$\frac{x}{\sin 72^\circ} = \frac{7.5}{\sin 68^\circ}$$

$$x = \sin 72^\circ \cdot \frac{7.5}{\sin 68}$$

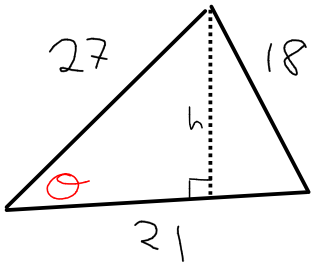
$$\approx 7.69$$

∴ The plane is approx. 7.69 km from the tower

Ex 4:

A bolt of material covers $100m^2$, and you can buy full bolts only. How many bolts would be needed to make a triangular sail with dimensions of 27m x 21m x 18m ?

Recall $A = \frac{bh}{2}$



$\cos\theta = \frac{27^2 + 21^2 - 18^2}{2(27)(21)}$

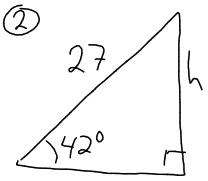
$\cos\theta = \frac{846}{1134}$

$\theta = \cos^{-1}\left(\frac{846}{1134}\right)$

$\doteq 42°$

Steps
- Find angle using cosine law
- Use primary trig to find h
- Find Area
- Find # bolts needed

②



$\sin 42° = \frac{h}{27}$

$h \doteq 18.1$

③ $A = \frac{b \cdot h}{2}$

$= \frac{21(18.1)}{2}$

$\doteq 189.7$

④ How many bolts?

$\frac{189.7}{100} \doteq 1.9$

* Must buy full bolts....

∴ We need 2 bolts

Hmwk:
Making Decisions Handout
p 309 #1, 3-7,9,12,13
Try some questions from the mid chapter review p 314-315