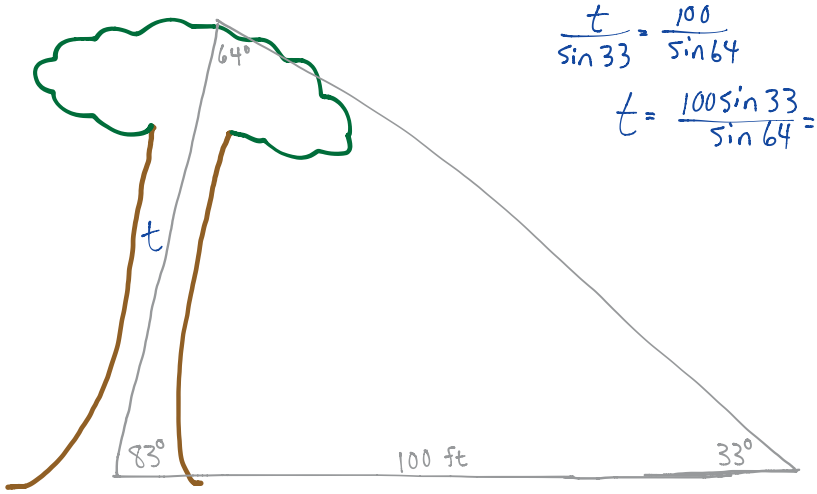
1.5 Applications of Law of Sines and Cosines
Worksheet # 1

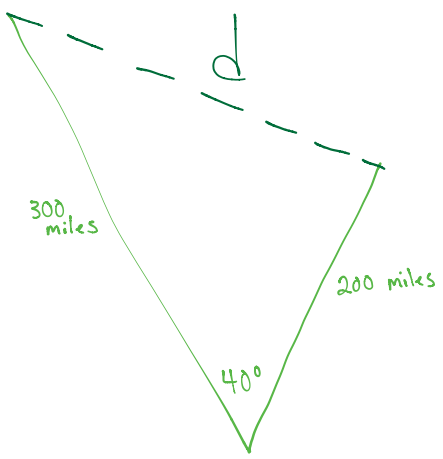
1. John wants to measure the height of a tree. He walks exactly 100 feet from the base of the tree and looks up. The angle from the ground to the top of the tree is 33º. This particular tree grows at an angle of 83º with respect to the ground rather than vertically (90º). How tall is the tree?



$$\frac{t}{\sin 33} = \frac{100}{\sin 64}$$

$$t = \frac{100 \sin 33}{\sin 64} = 60.597 \text{ ft} \Rightarrow \text{the length of the tree}$$

2. Two airplanes leave an airport, and the angle between their flight paths is 40º. An hour later, one plane has traveled 300 miles while the other has traveled 200 miles. How far apart are the planes at this time?



SAS means Law of Cosines

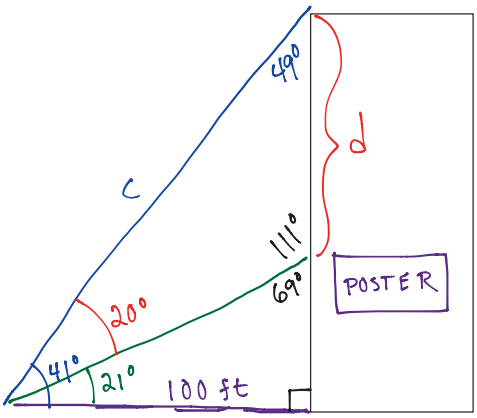
$$d^2 = 300^2 + 200^2 - 2(300)(200)\cos 40^\circ$$

$$= 38074.66683$$

$$d \approx 195.127 \text{ miles}$$

3. A building is of unknown height. At a distance of 100 feet away from the building, an observer notices that the angle of elevation to the top of the building is 41º and that the angle of elevation to a poster on the side of the building is 21º. How far is the poster from the roof of the building?

First find c using tangent



$$\frac{100}{c} = \sin 49^\circ$$

$$c = \frac{100}{\sin 49}$$

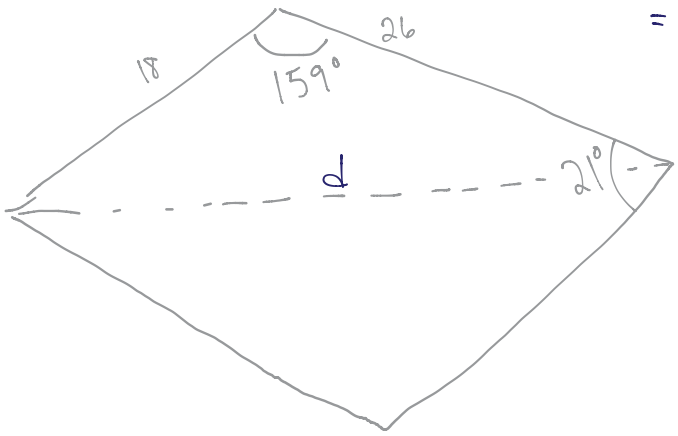
$$c \approx \underbrace{132.581 \text{ ft}}_{\text{remember to use the exact value of this answer, i.e. store on calculator}}$$

$$\frac{d}{\sin 20^\circ} = \frac{c}{\sin 111}$$

$$d = \frac{c \sin 20}{\sin 111}$$

$$d \approx 48.542 \text{ ft}$$

4. A parallelogram has sides of 18 and 26, and an angle of 21°. Find the length of the longer diagonal and the area of the parallelogram.



$d^2 = 18^2 + 26^2 - 2(18)(26)\cos 159$

$= 1873.831279$

$d \approx 43.288$

$\text{Area}_{\triangle} = \frac{1}{2}(18)(26)\sin 159$

$\text{Area}_{\parallelogram} = (18)(26)\sin 159 \approx 167.716$

6. Mary is sailing across the ocean from Marker A to Marker B which are 4 miles apart. After sailing 1.8 miles she realizes she is 6° off-course. To the nearest tenth of a mile, how far from Marker B is she when she realizes her error?

See solution to #1 on first Modeling with Triangles worksheet