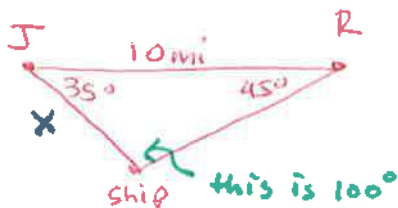


# Law of Sines and Cosines Word Problems

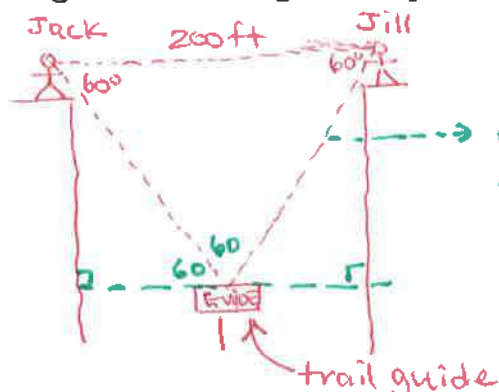
1. Juan and Romella are standing at the seashore 10 miles apart. The coastline is a straight line between them. Both can see the same ship in the water. The angle between the coastline and the line between the ship and Juan is 35 degrees. The angle between the coastline and the line between the ship and Romella is 45 degrees. How far is the ship from Juan?



$$\frac{10}{\sin 100} = \frac{x}{\sin 45}$$

$$\sin 45 = \frac{10}{\sin 100} = x \approx 7.2 \text{ miles}$$

2. Jack is on one side of a 200-foot-wide canyon and Jill is on the other. Jack and Jill can both see the trail guide at an angle of depression of 60 degrees. How far are they from the trail guide?



a little too easy! Equiangular, equilateral triangle. So all lengths are equal.

$\therefore$  length to trail guide is 200!

3. Tom, Dick, and Harry are camping in their tents. If the distance between Tom and Dick is 153 feet, the distance between Tom and Harry is 201 feet, and the distance between Dick and Harry is 175 feet, what is the angle between Dick, Harry, and Tom?

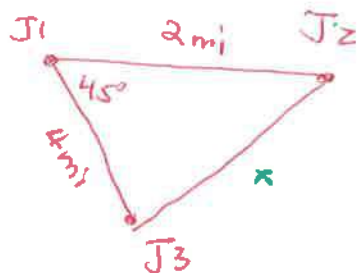


$$d^2 = c^2 + b^2 - 2cb \cos D$$

$$201^2 = 153^2 + 175^2 - 2(153)(175) \cos D$$

$$\frac{201^2 - 153^2 - 175^2}{-2(153)(175)} = \cos D =$$

4. Three boats are at sea: Jenny one (J1), Jenny two (J2), and Jenny three (J3). The crew of J1 can see both J2 and J3. The angle between the line of sight to J2 and the line of sight to J3 is 45 degrees. If the distance between J1 and J2 is 2 miles and the distance between J1 and J3 is 4 miles, what is the distance between J2 and J3?



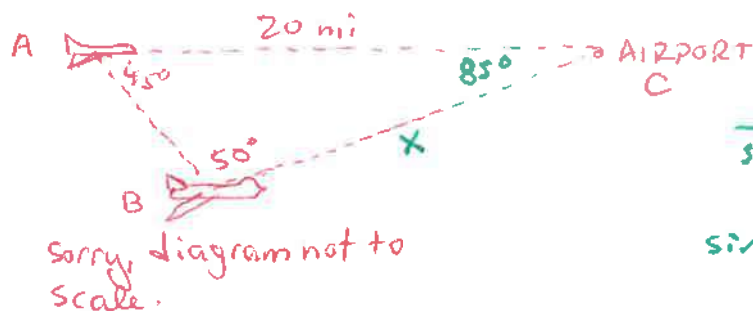
$$x^2 = 2^2 + 4^2 - 2(2)(4) \cos 45^\circ$$

$$x^2 = 8.686$$

$$x = 2.94$$

# Law of Sines and Cosines Word Problems

5. Airplane A is flying directly toward the airport which is 20 miles away. The pilot notices airplane B 45 degrees to her right. Airplane B is also flying directly toward the airport. The pilot of airplane B calculates that airplane A is 50 degrees to his left. Based on that information, how far is airplane B from the airport?



$$\frac{20}{\sin 50^\circ} = \frac{x}{\sin 45^\circ}$$

$$\sin 45^\circ \cdot \frac{20}{\sin 50^\circ} = x \approx \boxed{18.5}$$

6. A plane leaves JFK International Airport and travels due west at 570 mi/hr. Another plane leaves 20 minutes later and travels 22° west of north at the rate of 585 mi/h. To the nearest ten miles, how far apart are they 40 minutes after the second plane leaves.

As discussed in class, these <sup>types of</sup> will not be on the quiz because of the "navigational" aspect underlined above.

7. Flights 104 and 217 are both approaching O'Hare International Airport from directions directly opposite one another and at an altitude of 2.5 miles. The pilot on flight 104 reports an angle of depression of  $17^\circ 47'$  to the tower, and the pilot on flight 217 reports an angle of depression of  $12^\circ 39'$  to the tower. Calculate the distance between the planes.

① convert minutes to degrees.

17.8° and 12.7°

② Find one side so I can use law of sines to finish.

$$\sin 17.8^\circ = \frac{2.5}{x}$$

$$8.17 = \frac{x \approx 2.5}{\sin 17.8^\circ}$$

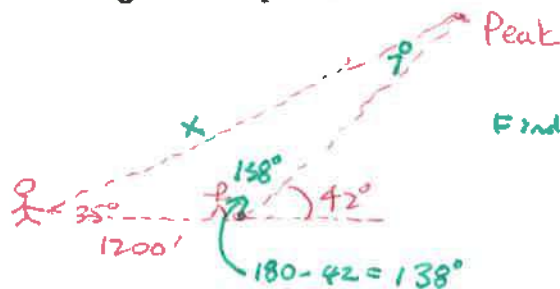


this angle must be  $180 - 17.8 - 12.7^\circ = 149.5^\circ$

$$\frac{y}{\sin 149.5^\circ} = \frac{8.17}{\sin 12.7^\circ} \quad Y \approx 18.9 \text{ mi}$$

# Law of Sines and Cosines Word Problems

8. Matt measures the angle of elevation of the peak of a mountain as  $35^\circ$ . Susie, who is 1200 feet closer on a straight level path, measures the angle of elevation as  $42^\circ$ . How high is the mountain?



Find missing angles. Law of sines after that.

$$\frac{x}{\sin 138^\circ} = \frac{1200}{\sin 7^\circ}$$

$$x \approx 6589'$$

Draw a New Triangle to Find height.

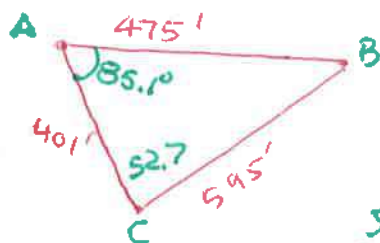


$$\sin 35^\circ = \frac{h}{6589}$$

$$6589 \cdot \sin 35^\circ = \frac{h}{6589} \cdot 6589$$

$$3779' = h$$

9. A triangular playground has sides of lengths 475 feet, 595 feet, and 401 feet. What are the measures of the angles between the sides, to the nearest tenth of a degree?



Find largest angle first. LOC  $\neq A$ .

$$595^2 = 401^2 + 475^2 - 2(401)(475)\cos A$$

$$\frac{595^2 - 401^2 - 475^2}{-2(401)(475)} = \cos A$$

$$0.0850531 = \cos A$$

$$85.1^\circ = A$$

$$\frac{\sin 85.1}{595} = \frac{\sin C}{475}$$

$$180^\circ - 52.7 - 85.1^\circ = 42.2^\circ$$

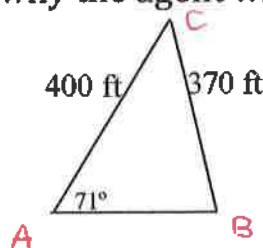
$$.795401 = \sin C$$

$$52.7^\circ = C$$

$$B = 42.2^\circ$$

## Law of Sines and Cosines Word Problems

10. A real estate agent has just taken a trigonometry class at the local community college. She is considering purchasing a piece of property and is waiting for the surveyor's report before closing the deal. If the surveyor submits a drawing as in the figure below, explain why the agent will reject the sale.



Ambiguous case of LOS.

Evaluate

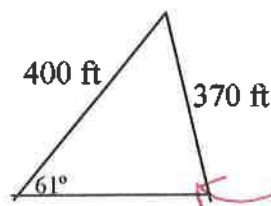
$$a \neq b \sin A$$

$$370 < 400 \sin 71^\circ$$

$$370 < 378$$

This distance is too short to create a triangle.

11. The surveyor admits to his mistake and revises his drawing as in the next figure. This time the real estate agent refuses to complete the deal until additional information is supplied. What additional information is the real estate agent looking for to complete her knowledge about the parcel of land?



with the given angle of  $61^\circ$ , you can create two triangles. The surveyor must find one more angle. It doesn't matter which one.