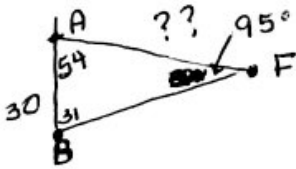


Law of Sines & Cosines Applications

Set up and solve each problem. Start by drawing a picture! Show all work.

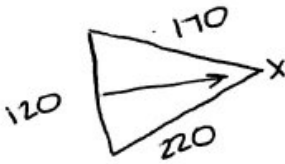
1. A fire tower at point A is 30 km north of a fire tower at point B. A fire at point F is observed to the east by both towers. If $\angle FAB = 54^\circ$ and $\angle ABF = 31^\circ$, how far away is the fire from tower A?



$$\frac{\sin 95}{30} = \frac{\sin 31}{x}$$

$$x = 15.51 \text{ km}$$

2. A farmer has a triangular field with sides 120 yards, 170 yards, and 220 yards. What is the smallest angle of his field?



$$120^2 = 170^2 + 220^2 - 2(170)(220)\cos x$$

$$0.8409 = \cos x$$

$$\angle x = 32.76^\circ$$

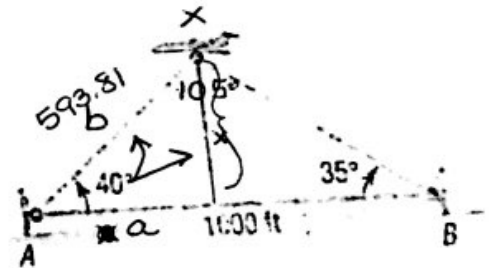
3. An aircraft is spotted by two observers who are 1000 feet apart. As the airplane passes over the line joining them, each observer takes a sighting of the angle of elevation to the plane, as indicated in the figure. How high is the airplane? Hint: The plane is not in the middle of the two people.

$$\frac{\sin 105}{1000} = \frac{\sin 35}{b}$$

$$b = \frac{1000 \sin 35}{\sin 105} = 593.81$$

$$\sin 40 = \frac{x}{593.81}$$

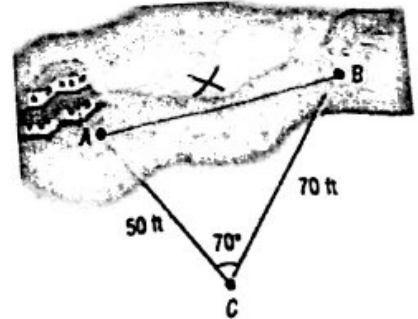
$$x = 381.69 \text{ ft}$$



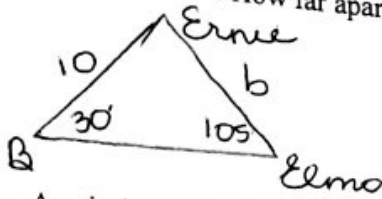
4. Consult the figure. To find the distance from the house at A to the house at B, a surveyor measures the angle ACB, which is found to be 70° , and then walks off the distance to each house, 50 feet and 70 feet respectively. How far apart are the houses?

$$x^2 = 50^2 + 70^2 - 2(50)(70)\cos 70^\circ$$

$$x = 70.75 \text{ ft}$$



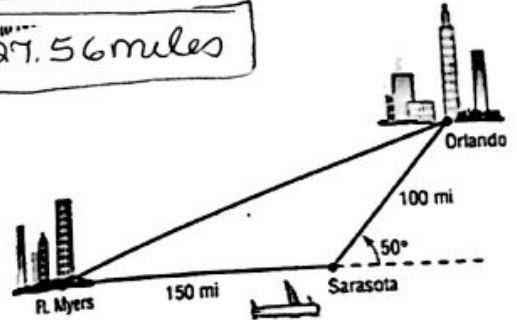
5. 3 friends are camping in the woods, Bert, Ernie and Elmo. They each have their own tent and the tents are set up in a Triangle. Bert and Ernie are 10m apart. The angle formed at Bert is 30° . The angle formed at Elmo is 105° . How far apart are Ernie and Elmo?



$$b = 5.18 \text{ m}$$

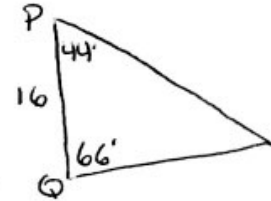
6. An airplane flies from Ft Myers to Sarasota, a distance of 150 miles, and then turns through an angle of 50° and flies to Orlando, a distance of 100 miles. How far is it from Ft. Myers to Orlando?

$$x = 227.56 \text{ miles}$$

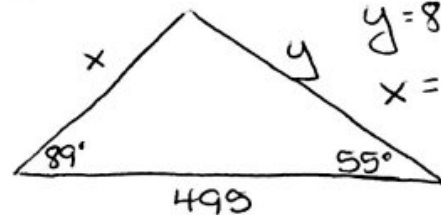


7. From lighthouses P and Q which lie on a straight line, 16 km apart, a disabled ship S is sighted. If $\angle SPQ = 44^\circ$ and $\angle SQP = 66^\circ$, find the distance from S to the nearer lighthouse.

$$11.83 \text{ km}$$



8. Two surveyors are determining the distance to a tower located between them but across the river. The first one determines that the line of sight to the tower makes an angle of 89° with the bank of the river. 495 m downstream another surveyor determines his line of sight to the tower is 55° to the tower with the river. How far is each surveyor to the tower?

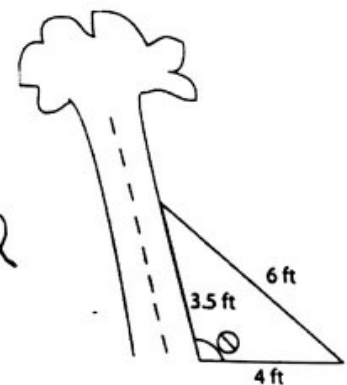


$$y = 842.02 \text{ m}$$

$$x = 689.84 \text{ m}$$

9. After the hurricane, the small tree in my neighbor's yard was leaning. To keep it from falling, we nailed a 6-foot strap into the ground 4 feet from the base of the tree. We attached the strap to the tree $3\frac{1}{2}$ feet above the ground. How far from vertical was the tree leaning?


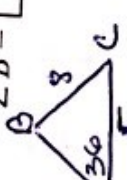
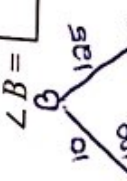
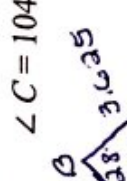
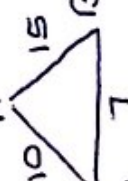

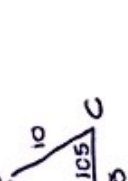

$\theta = 106.07^\circ$
 so 16.07°
 from
 Vertical



Law of Sines / Law of Cosines

Name Key

Directions: You are given pieces of information relating to the sides and angles of $\triangle ABC$. Solve for the missing piece using Law of Sines and/or Law of Cosines. Round answers to the nearest hundredth. Please show your work. Correct answers are amid the list at the bottom of the page.

<p>① $\angle A = 30^\circ$ $a = 20$ $\angle B = 45^\circ$ $b = \square$</p>  <p>AA \Rightarrow $\frac{a \sin 30}{20} = \frac{a \sin 45}{b}$ $b \sin 30 = 20 \sin 45$ $b = \frac{20 \sin 45}{\sin 30} = 28.28$</p>	<p>② $\angle A = 36^\circ$ $a = 8$ $\angle B = \square^\circ$ $b = 5$</p>  <p>ASS *Check $\frac{8}{\sin 36} = \frac{5}{\sin B} \Rightarrow \angle B = \sin^{-1}(\frac{5 \sin 36}{8})$ $\angle B = 21.55^\circ$ $180 - \angle C = 158.45$ $\angle C = 21.55^\circ$</p>	<p>③ $\angle A = 100^\circ$ $a = 125$ $\angle B = \square^\circ$ $c = 10$</p>  <p>ASS *Check $\frac{125}{\sin 100} = \frac{10}{\sin C} \Rightarrow \angle C = \sin^{-1}(\frac{10 \sin 100}{125})$ $\angle C \approx 4.52^\circ$ $\angle B \approx 75.48^\circ$</p>	<p>④ $\angle B = 28^\circ$ $a = 3.625$ $\angle C = 104^\circ$ $b = \square$</p>  <p>AA \Rightarrow $\frac{a \sin 28}{3.625} = \frac{a \sin 28}{b}$ $b = \frac{3.625 \sin 28}{\sin 48}$ $b = 2.29$</p>
<p>⑤ $\angle A = \square^\circ$ $b = 10$ $a = 7$ $c = 15$</p>  <p>Law of Cosines $7^2 = 10^2 + 15^2 - 2(10)(15) \cos A$ $0.92 = \cos A$ $\angle A = \cos^{-1}(0.92)$ $\angle A = 23.07^\circ$</p>	<p>⑥ $\angle A = 135^\circ$ $b = 4$ $\angle B = \square^\circ$ $c = 9$</p>  <p>Law of Cosines $a^2 = 4^2 + 9^2 - 2(4)(9) \cos 135$ $a = 12.16$ $4^2 = 9^2 + 12.16^2 - 2(9)(12.16) \cos B$ $0.9258 = \cos B$ $\angle B = 13.45^\circ$</p>	<p>⑦ $\angle C = 105^\circ$ $b = 4.5$ $a = 10$ $c = \square$</p>  <p>Law of Cosines $c^2 = 4.5^2 + 10^2 - 2(4.5)(10) \cos 105$ $c = 11.98$</p>	<p>⑧ $\angle A = \square^\circ$ $b = 25$ $a = 55$ $c = 72$</p>  <p>Law of Cosines $55^2 = 72^2 + 25^2 - 2(72)(25) \cos A$ $0.7733 = \cos A$ $\angle A = \cos^{-1}(0.7733)$ $\angle A = 39.35^\circ$</p>

2.28	11.98	13.45	17.35	21.55	23.07	28.28	39.35	50.67	75.48
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Solve each triangle(s). Round your answers to two decimal places.

1) $m\angle A = 54^\circ$, $c = 27$ m, $a = 22$ m 2Δ

$$\angle A = 54^\circ \quad a = 22$$

$$\angle B = 42.8^\circ \quad b = 18.5$$

$$\angle C = 83.2^\circ \quad c = 27$$

$$\angle A = 54^\circ \quad a = 22$$

$$\angle B = 29.2^\circ \quad b = 13.3$$

$$\angle C = 96.8^\circ \quad c = 27$$

2) $m\angle A = 151^\circ$, $c = 11$ in, $a = 7$ in

no Δ

3) $c = 20$ in, $b = 22$ in, $a = 30$ in

$$\angle A = 91^\circ \quad a = 30$$

$$\angle B = 47.2^\circ \quad b = 22$$

$$\angle C = 41.8^\circ \quad c = 20$$

4) $a = 9.1$ yd, $m\angle B = 100^\circ$, $c = 13.2$ yd

$$\angle A = 31.2^\circ \quad a = 9.1 \text{ yd}$$

$$\angle B = 100^\circ \quad b = 17.3 \text{ yd}$$

$$\angle C = 48.8^\circ \quad c = 13.2 \text{ yd}$$

5) $m\angle B = 60^\circ$, $a = 24$ in, $b = 21$ in

2Δ

$$\angle A = 81.8^\circ \quad a = 24$$

$$\angle B = 60^\circ \quad b = 21$$

$$\angle C = 38.2^\circ \quad c = 15$$

$$\angle A = 98.2^\circ \quad a = 24$$

$$\angle B = 60^\circ \quad b = 21$$

$$\angle C = 21.8^\circ \quad c = 9$$

6) $m\angle B = 108^\circ$, $a = 23$ cm, $b = 25$ cm

$$\angle A = 61^\circ \quad a = 23'$$

$$\angle B = 108^\circ \quad b = 25$$

$$\angle C = 11^\circ \quad c = 5$$