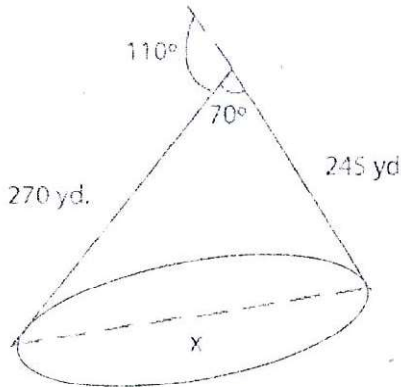


Word Problem Exercises: Law of Cosines

1. To approximate the length of a lake, a surveyor starts at one end of the lake and walks 245 yards. He then turns 110° and walks 270 yards until he arrives at the other end of the lake. Approximately how long is the lake?

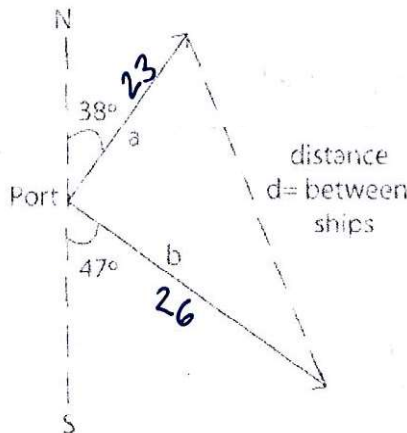


$$x^2 = 270^2 + 245^2 - 2(270)(245)\cos 70^\circ$$

$$x^2 = 87675.135$$

$$x \approx 296.1 \text{ yards.}$$

2. Two ships leave port at 4 p.m. One is headed at a bearing of N 38° E and is traveling at 11.5 miles per hour. The other is traveling 13 miles per hour at a bearing of S 47° E. How far apart are they when dinner is served at 6 p.m.?

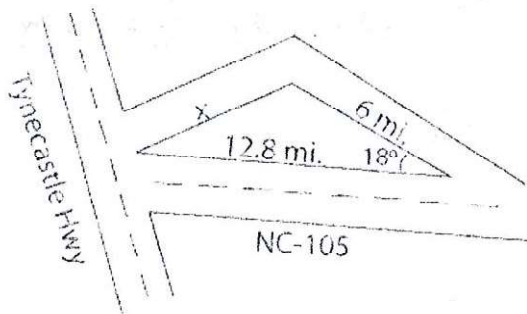


$$d^2 = 23^2 + 26^2 - 2(23)(26)\cos 95^\circ$$

$$d^2 = 1309.238$$

$$d = 36.18 \text{ miles}$$

3. You are heading to Beech Mountain for a ski trip. Unfortunately, state road 105 in North Carolina is blocked off due to a chemical spill. You have to get to Tynecastle Highway which leads to the resort at which you are staying. NC-105 would get you to Tynecastle Hwy in 12.8 miles. The detour begins with a 18° veer off onto a road that runs through the local city. After 6 miles, there is another turn that leads to Tynecastle Hwy. Assuming that both roads on the detour are straight, how many extra miles are you traveling to reach your destination?



$$x^2 = 6^2 + 12.8^2 - 2(6)(12.8)\cos 18^\circ$$

$$x^2 = 53.7577$$

$$x = 7.33$$

$$6 + 7.33 = 13.33 \text{ miles}$$

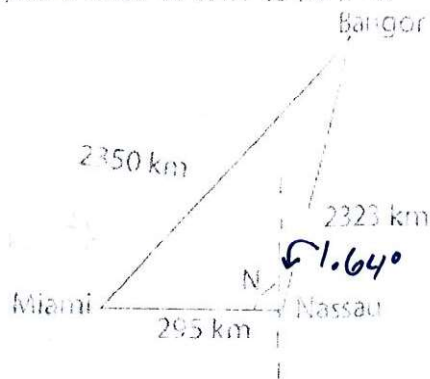
$$13.33 - 12.8 = \boxed{0.53 \text{ miles extra}}$$

4. The distance on a map from the airport in Miami, FL to the one in Nassau, Bahamas is 295 kilometers due east. Bangor, Maine is northeast of both cities; its airport is 2350 kilometers from Miami and 2323 kilometers from Nassau. What bearing would a plane need to take to fly from Nassau to Bangor?

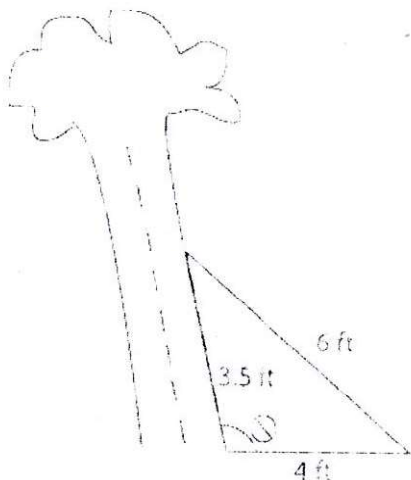
$$2350^2 = 295^2 + 2323^2 - 2(295)(2323)\cos X$$

$$X = 91.64^\circ$$

N 1.64° E



5. 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 1/2 feet above the ground. How far from vertical was the tree leaning?

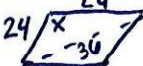


$$6^2 = 3.5^2 + 4^2 - 2(3.5)(4)\cos \theta$$

$$\theta = 106.07^\circ$$

$$106.07^\circ - 90^\circ = \mathbf{16.07^\circ \text{ From vertical}}$$

6. In a rhombus with a side of 24, the longer diagonal is 36. Find, to the nearest degree, the larger angle of the rhombus.



$$36^2 = 24^2 + 24^2 - 2(24)(24)\cos X$$

$$\mathbf{X = 97^\circ}$$

7. A triangular walking course has 2 sides of 230 feet and 360 feet, and the angle between these sides measures 38°. Find the length of the third side of the course, to the nearest foot.

$$x^2 = 230^2 + 360^2 - 2(230)(360)\cos 38^\circ$$

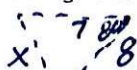
$$\mathbf{X = 228 \text{ Feet}}$$

8. Three sides of a triangle measure 20m, 30m, and 40m. Find the largest angle of the triangle to the nearest degree.

$$40^2 = 20^2 + 30^2 - 2(20)(30)\cos X$$

$$\mathbf{X = 104.48^\circ}$$

9. A flashlight was focused on the mirror forming an angle of 80 degrees. The length of the light from the flashlight to the mirror was 8 meters and the length of the reflected light to the wall was 7 meters. Find the distance from the flashlight to the end of the reflected light.



$$x^2 = 7^2 + 8^2 - 2(7)(8)\cos 80^\circ$$

$$x^2 = 93.5514$$

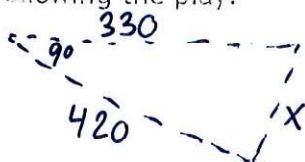
$$\mathbf{X = 9.67m}$$

10. Two airplanes leave an airport, and the angle between their flight paths is 40°. 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?

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

$$\mathbf{X = 195.13 \text{ miles}}$$

11. A baseball player in center field is playing approximately 330 feet from the television camera that is behind home plate. A batter hit a fly ball that goes to the wall that is 420 feet from the camera. Approximate the number of feet the center fielder had to run to make the catch if the camera turned 9° in the following play.



$$x^2 = 330^2 + 420^2 - 2(330)(420)\cos 9^\circ$$

$$\mathbf{X = 107.3 \text{ Feet}}$$