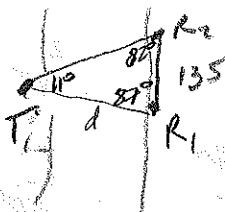


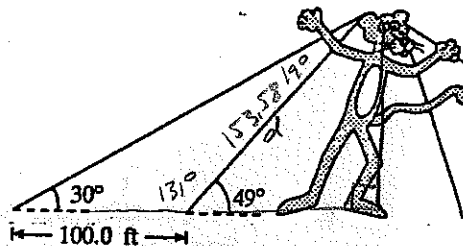
1. A surveyor wishes to find the distance from a rock on the east side of a river to a tree on the opposite bank. On the east side of the river he locates a second rock 135 feet from the first one. From each rock he measures the angle between the line connecting the two rocks and the tree. The angle from the first rock is  $87^\circ$  and from the second rock is  $82^\circ$ . Find the desired distance.



$$\frac{135}{\sin 11^\circ} = \frac{d}{\sin 82^\circ}$$

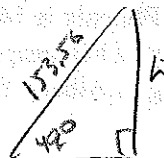
$$d = 135 \frac{\sin 82^\circ}{\sin 11^\circ} = \boxed{700.6 \text{ ft}}$$

2. Find the height of a giant helium balloon used in a Thanksgiving Day parade given that two guy wires are attached as shown in the figure at the right.



$$\frac{100}{\sin 19^\circ} = \frac{d}{\sin 30^\circ}$$

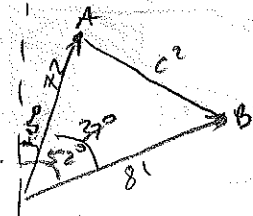
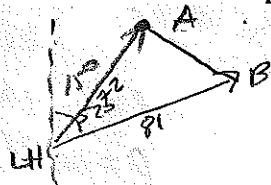
$$d = 100 \frac{\sin 30^\circ}{\sin 19^\circ} = 153.58$$



$$\sin 49^\circ = \frac{h}{153.58}$$

$$h = \boxed{115.9 \text{ ft}}$$

3. Ship A is 72 miles from a lighthouse on the shore. Its bearing from the lighthouse is  $N 15^\circ E$ . Ship B is 81 miles from the same lighthouse. Its bearing from the lighthouse is  $N 52^\circ E$ . Find the number of miles between the two ships.

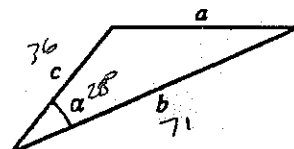


$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$c^2 = 72^2 + 81^2 - 2(72)(81) \cos 37^\circ$$

$$c = \boxed{49.29 \text{ miles}}$$

4. In order to determine the distance between two aircraft, a tracking station continuously determines the distance to each aircraft and the angle  $\alpha$  between them. Determine the distance between the planes when  $\alpha = 28^\circ$ ,  $b = 71$  miles, and  $c = 36$  miles.

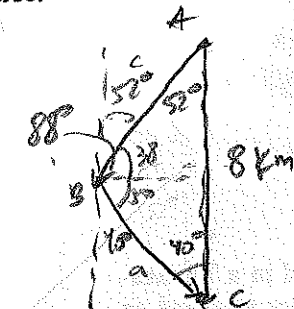


$$a^2 = b^2 + c^2 - 2bc \cos \alpha$$

$$a^2 = 71^2 + 36^2 - 2(71)(36) \cos 28^\circ$$

$$a = \boxed{42.7 \text{ miles}}$$

5. The course for a boat race starts at point A and proceeds in the direction of  $S52^\circ W$  to point B, then in the direction  $S40^\circ E$  to point C, and finally back to point A. The point C lies 8 kilometers directly south of point A. Approximate the total distance of the race course.



$$\frac{8}{\sin 88^\circ} = \frac{a}{\sin 52^\circ} \quad a = \frac{8 \sin 52^\circ}{\sin 88^\circ} = 6.13 \text{ km}$$

$$\frac{8}{\sin 88^\circ} = \frac{c}{\sin 40^\circ} \quad c = \frac{8 \sin 40^\circ}{\sin 88^\circ} = 5.2 \text{ km}$$

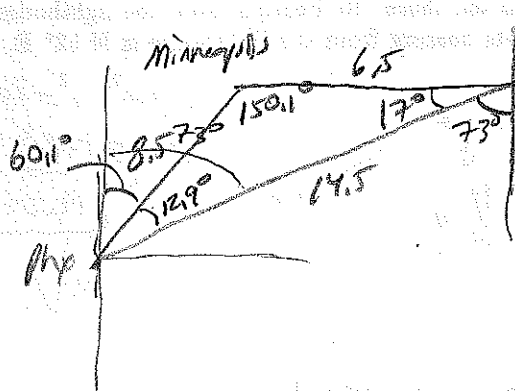
$$8 + 6.13 + 5.2 = \boxed{19.5 \text{ km}}$$

6. On a certain map, Minneapolis is 6.5 inches due west of Albany, Phoenix is 8.5 inches from Minneapolis, and Phoenix is 14.5 inches from Albany.

- a. Find the bearing of Minneapolis from Phoenix.  
 b. Find the bearing of Albany from Phoenix.

$$\boxed{N 60.1^\circ E}$$

$$\boxed{N 73^\circ E}$$



$$\cos P = \frac{8.5^2 + 14.5^2 - 6.5^2}{2(8.5)(14.5)}$$

$$\cos P = .977645$$

$$P = \cos^{-1}(.977645)$$

$$P = 12.9^\circ$$

$$\cos A = \frac{6.5^2 + 14.5^2 - 8.5^2}{2(6.5)(14.5)}$$

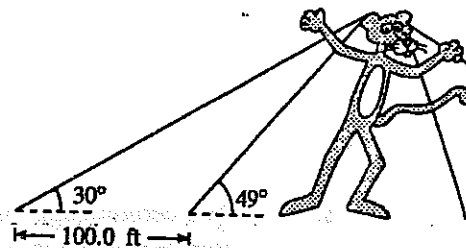
$$\cos A = .9562334$$

$$A = \cos^{-1}(.9562334)$$

$$A = 17^\circ$$

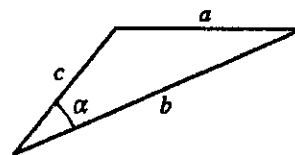
1. A surveyor wishes to find the distance from a rock on the east side of a river to a tree on the opposite bank. On the east side of the river he locates a second rock 135 feet from the first one. From each rock he measures the angle between the line connecting the two rocks and the tree. The angle from the first rock is  $87^\circ$  and from the second rock is  $82^\circ$ . Find the desired distance.

2. Find the height of a giant helium balloon used in a Thanksgiving Day parade given that two guy wires are attached as shown in the figure at the right.



3. Ship A is 72 miles from a lighthouse on the shore. Its bearing from the lighthouse is  $N 15^\circ E$ . Ship B is 81 miles from the same lighthouse. Its bearing from the lighthouse is  $N 52^\circ E$ . Find the number of miles between the two ships.

4. In order to determine the distance between two aircraft, a tracking station continuously determines the distance to each aircraft and the angle  $\alpha$  between them. Determine the distance between the planes when  $\alpha = 28^\circ$ ,  $b = 71$  miles, and  $c = 36$  miles.



5. The course for a boat race starts at point A and proceeds in the direction of  $S52^\circ W$  to point B, then in the direction  $S40^\circ E$  to point C, and finally back to point A. The point C lies 8 kilometers directly south of point A. Approximate the total distance of the race course.

6. On a certain map, Minneapolis is 6.5 inches due west of Albany, Phoenix is 8.5 inches from Minneapolis, and Phoenix is 14.5 inches from Albany.
- Find the bearing of Minneapolis from Phoenix.
  - Find the bearing of Albany from Phoenix.