
Complete the following problems. Show all work to receive full credit.

1. Two ships leave a harbor entrance at the same time. The first ship is traveling a constant 18 miles per hour, while the second is traveling at a constant 22 miles per hour. If the angle between their courses is 123° , how far apart are they after 2 hours?

$$a^2 = 44^2 + 36^2 - 2(36)(44) \cos 123^\circ$$

$$a^2 \approx 4957.416463$$

$$a \approx 70.409 \text{ miles}$$

2. A hot-air balloon is held at a constant altitude by two ropes that are anchored to the ground. One rope is 120 feet long and makes an angle of 65° with the ground. The other rope is 115 feet long. What is the distance between the points on the ground at which the two ropes are anchored?

Let A be the angle at the ground. Then

$$\frac{\sin A}{120} = \frac{\sin 65^\circ}{115}$$

$$\sin A \approx .9458$$

$$A \approx 71.034^\circ \text{ or } 108.966^\circ$$

There are two cases to consider.

$$\begin{array}{l|l} A = 71.034 & A = 108.966 \\ C = 43.966 & C = 6.034 \\ \frac{\sin 43.966^\circ}{x} = \frac{\sin 65^\circ}{115} & \frac{\sin 6.034^\circ}{x} = \frac{\sin 65^\circ}{115} \\ x \approx 88.090 & 13.339 \end{array}$$

Therefore, they are either 88.090 or 13.339 feet apart.

3. Find $\sin \frac{3\pi}{4}$.

$$\sin \frac{3\pi}{4} = \frac{\sqrt{2}}{2}$$