

Section 4.8 Applications and Models

Objective: In this lesson you learned how to use trigonometric functions to model and solve real-life problems.

Important Vocabulary

Bearing

I. Trigonometry and Bearings

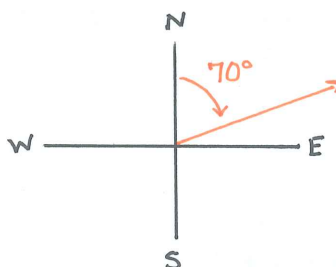
Used to give directions in surveying and navigation, a **bearing** measures: the acute angle a path or line of sight makes with a fixed North-South Line

What you should learn:

How to solve real-life problems involving directional bearings

The bearing $N 70^\circ E$ means:

70° East of North



II. Harmonic Motion

The vibration, oscillation, or rotation of an object under ideal conditions such that the object's uniform and regular motion can be described by a sine or cosine function is called simple harmonic motion.

What you should learn:

How to solve real-life problems involving harmonic motion

A point that moves on a coordinate line is said to be in **simple harmonic motion** if: its distance d from the origin at time t , is given by either $d = a \sin \omega t$ or $d = a \cos \omega t$, where a and ω are \mathbb{R} such that $\omega > 0$.

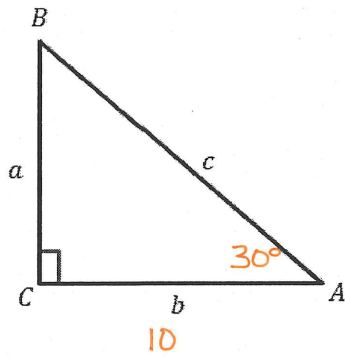
The simple harmonic motion has amplitude $|a|$, period $\frac{2\pi}{\omega}$, and frequency $\frac{\omega}{2\pi}$.

GREEK LETTER "OMEGA"

Section 4.8 Examples – Applications and Models

(1) Solve the right triangle shown in the figure.

$$A = 30^\circ, b = 10$$



$$\tan 30^\circ = \frac{a}{10}$$

$$\frac{1}{\sqrt{3}} = \frac{a}{10}$$

$$a = \frac{10}{\sqrt{3}}$$

$$a = \frac{10\sqrt{3}}{3}$$

$$m\angle B = 60^\circ$$

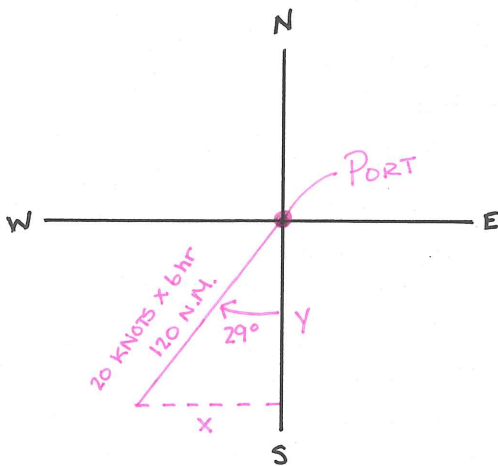
Pythagorean Theorem!

$$a^2 + b^2 = c^2$$

$$\left(\frac{10}{\sqrt{3}}\right)^2 + 10^2 = c^2$$

$$c = 11.5$$

(2) A ship leaves port at noon and has a bearing of S 29° W. The ship sails at 20 knots. How many nautical miles south and how many nautical miles west does the ship travel by 6:00 P.M.?



DISTANCE FROM PORT

$$20 \text{ KNOTS} \times 6 \text{ hrs} = 120 \text{ N.M.}$$

$$\cos 29^\circ = \frac{y}{120}$$

CHECK YOUR CALCULATOR MODE!

$$y = 104.95$$

105 NAUTICAL MILES SOUTH

$$\sin 29^\circ = \frac{x}{120}$$

$$x = 58.17$$

58 NAUTICAL MILES WEST