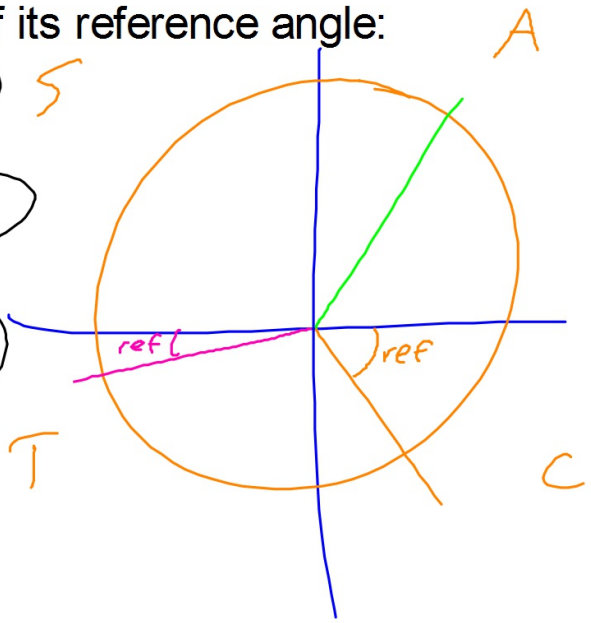
Warm Up

Express each function in terms of its reference angle:

1. sin(300°) $= -\sin(60°)$ ref: 60°
2. cos(7π/3) $= \cos\left(\frac{\pi}{3}\right)$ ref: $\frac{7\pi}{3} - 2\pi = \frac{\pi}{3}$
3. tan(200°) $= \tan(20°)$ ref: 20°



Objective: SWBAT model and solve problems with trig functions

Agenda:

- Warm Up
- Quiz
- Notes
- Practice: Modeling with Trig Functions
- Reflection

Quiz

You may use your Unit Circle for the quiz.

$2\cos(x-1)+3$

phase shift: right 1 unit (radian)

vertical shift: up 3

Modeling Part 1

If you have the equation:

1. solve the equation (you may need an inverse trig function)
2. interpret the solution, if needed

ex) The rotation of a Ferris wheel is modelled by the equation

$$h = 26\cos\left(2\pi\frac{(t-25)}{50}\right)+27$$

where h is the height above ground. Suppose you get on at $t = 0$ at the bottom. How high will you be after 35 s?

$t = 35$

$h = 26\cos\left(2\pi\frac{(35-25)}{50}\right)+27$

$= 26\cos\left(\frac{2\pi}{5}\right)+27 \approx 35$ ft

Examples

At a seaport, the depth of the water, h meters, at time t hours, during a certain day is given by

$$h = 2.5\sin 2\pi\frac{(t-4)}{12.4} + 1.6$$

What is the depth of the water at 3:00 am?

$= 2.5\sin\left(2\pi\frac{(3-4)}{12.4}\right)+1.6$

≈ 0.39 m

At a seaport, the depth of the water, h meters, at time t hours, during a certain day is given by

$$h = 6.0\cos 2\pi\frac{(t-8)}{12.4} + 14$$

At what time will the water be 10 m high?

$10 = 6\cos\left(2\pi\frac{(t-8)}{12.4}\right)+14$ (−14)

$-4 = 6\cos\left(2\pi\left(\frac{t-8}{12.4}\right)\right)$ (÷6)

$-\frac{2}{3} = \cos\left(2\pi\left(\frac{t-8}{12.4}\right)\right)$

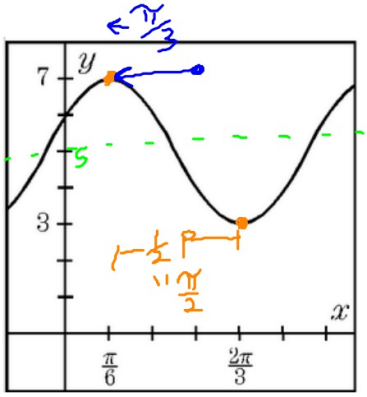
$\cos^{-1}\left(-\frac{2}{3}\right) = 2\pi\left(\frac{t-8}{12.4}\right)$

Modeling Part 2

If you don't have the equation:

1. Decide whether to use sine or cosine
2. Use the max & min to find the midline and amplitude
3. Find the period & frequency
4. Plug the numbers into the equation form

ex) Write an equation for a sine function that fits the graph:



midline: 5 amp: 2

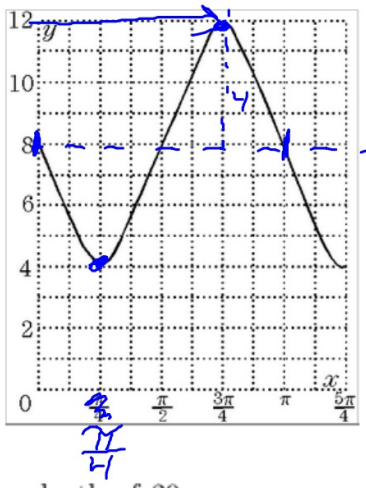
$P = \pi = \frac{2\pi}{b} \rightarrow b = 2$

$y = 2\sin(2(x+\frac{\pi}{3}))+5$

Write a cosine function that models the graph:

$4\cos\left(2\left(x-\frac{3\pi}{4}\right)\right)+8$

$-4\cos\left(2\left(x-\frac{\pi}{4}\right)\right)+8$



On a typical day at an oceanport, the water has a maximum depth of 20 m at 8:00 am. The minimum depth of 12 m occurs 6.2 h later. Assume that the relationship between the depth of water and time is a sinusoidal function. Write an equation for the depth of the water at any time, t hours.

Practice

problem set from Problem-Attic

Reflection

When is it easier to use cosine instead of sine?