

Developing Trigonometric Functions from Properties...

Develop a trigonometric function that fits the following description...

- Models a sine function
- Period is 120°
- Graph is reflected in x -axis
- Wave has a range of $-8 \leq y \leq 2$
- Graph has a phase shift of 60° right
- Graph has a vertical translation of 3 units down

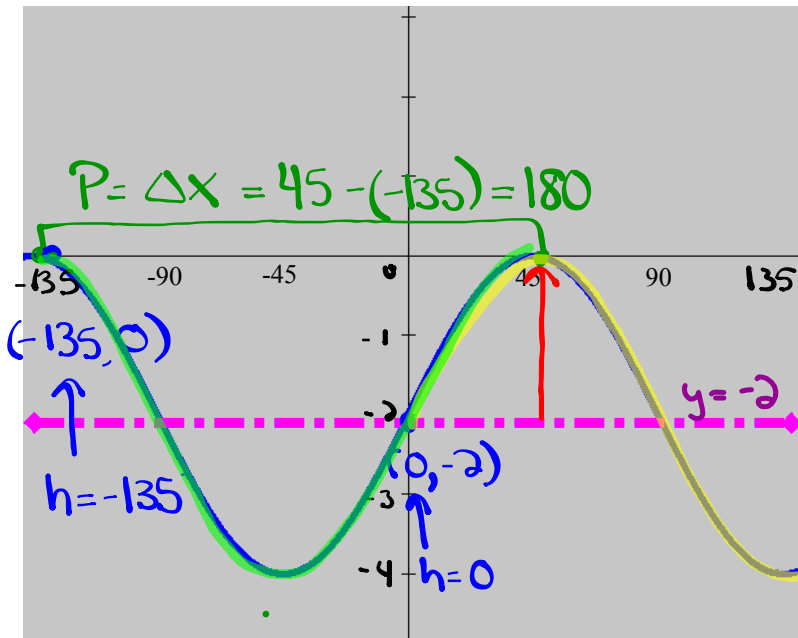
...Now we must learn how to identify all of the above information from a graph.

Developing the Equation of a Sinusoidal Function

STEPS: $y = a \sin[b(x-h)] + k$

- 1) Identify & label the **sinusoidal axis**.
- 2) Determine the **amplitude**, **period** & vertical translation.
- 3) Pick a trig function & determine the corresponding **phase shift**.

- the choices are: **positive sine**, **positive cosine**, negative sine, negative cosine



Amp = 2 $a = \pm 2$

Period = 180

$b = \frac{360}{P} = \frac{360}{180} = 2$

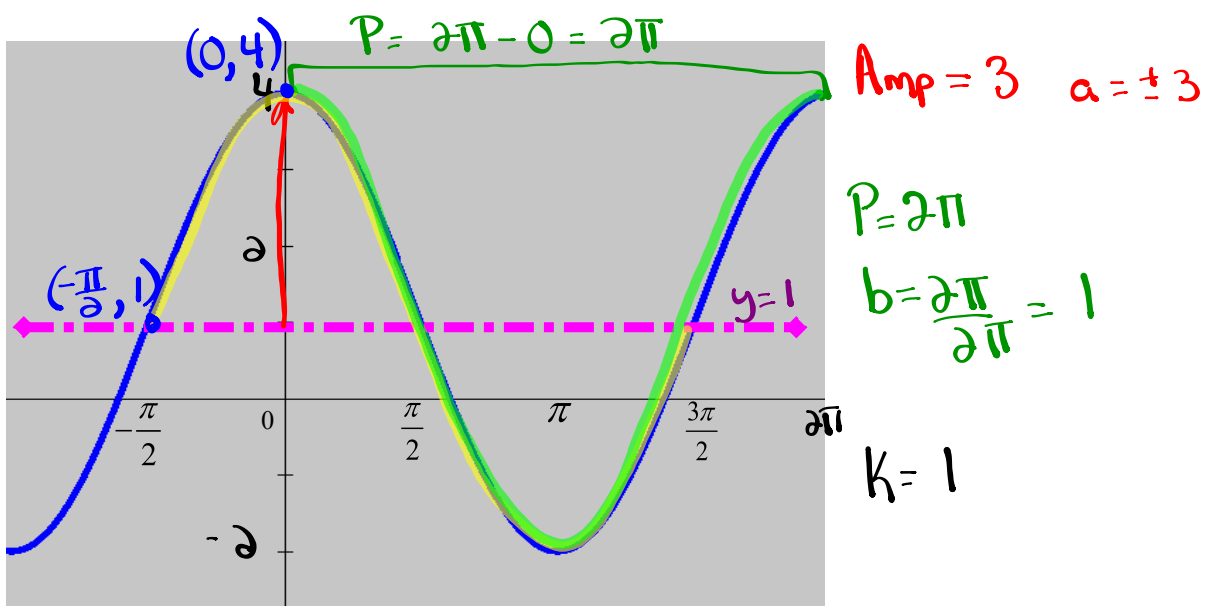
VT: $k = -2$

$y = \sin x \quad (h=0)$
 $y = 2 \sin[2(x-0)] - 2$
 $y = 2 \sin[2(x)] - 2$

$y = \cos x \quad (h=-135)$
 $y = 2 \cos[2(x+135)] - 2$

Finding an Equation from a Graph:

Determine a sine and a cosine equation for this graph



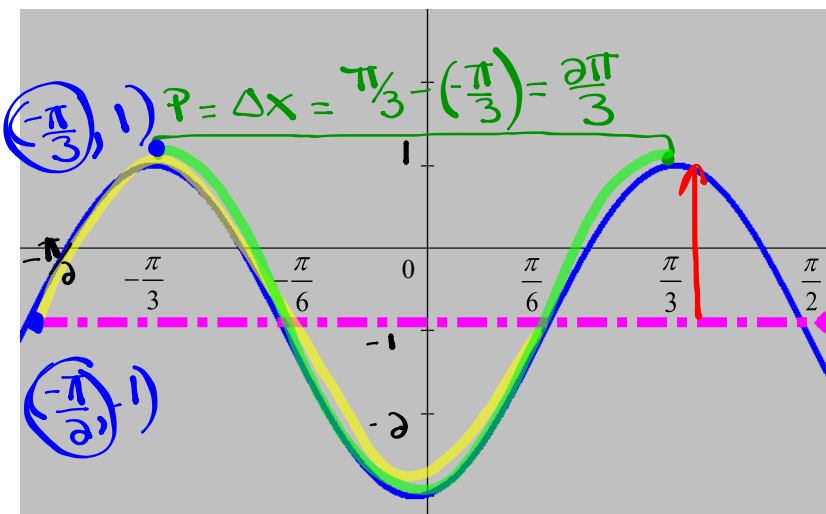
$$y = \sin x \quad (h = -\frac{\pi}{2})$$

$$y = 3\sin\left[1\left(x + \frac{\pi}{2}\right)\right] + 1$$

$$y = \cos x \quad (h = 0)$$

$$y = 3\cos\left[1(x - 0)\right] + 1$$

Determine a sine and a cosine equation for this graph



Amp = 2 a = ±2

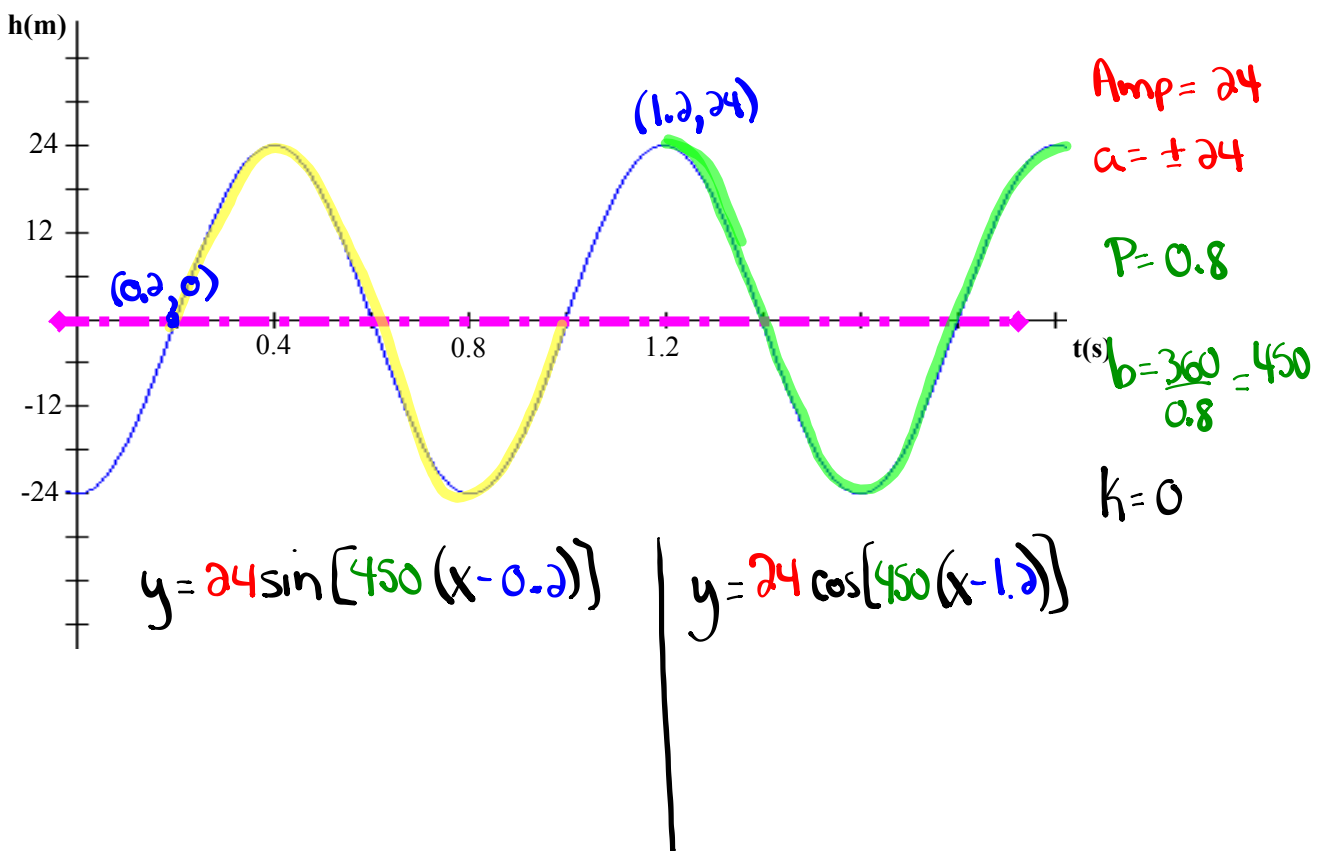
Period = $\frac{2\pi}{3}$

$b = \frac{2\pi}{P} = 2\pi \div \frac{2\pi}{3}$
 $= \frac{2\pi}{1} \times \frac{3}{2\pi} = 3$

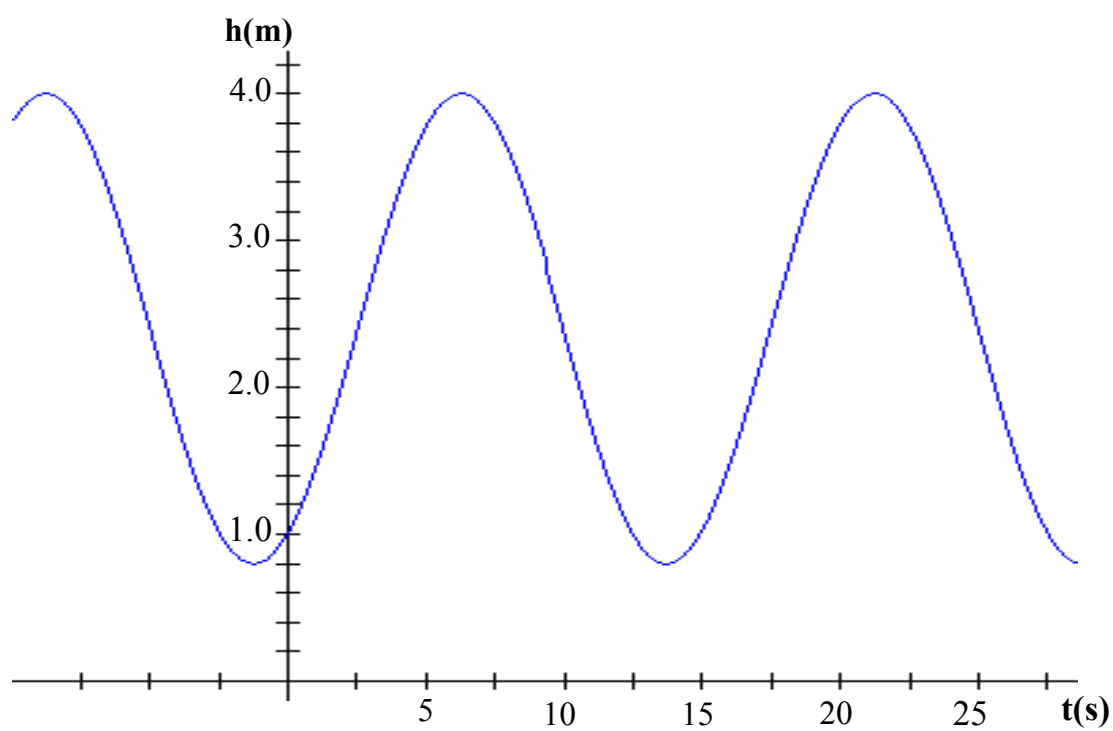
VT: k = -1

$y = \sin x \quad (h = -\frac{\pi}{2})$ $y = 2 \sin [3(x + \frac{\pi}{2})] - 1$	$y = \cos x \quad (h = -\frac{\pi}{3})$ $y = 2 \cos [3(x + \frac{\pi}{3})] - 1$
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Determine a sine and a cosine equation for this graph



Find 4 equations to describe the graph.



EXTRA PRACTICE...

Worksheet: #28 a) - f)

Applications of Sinusoidal Relations

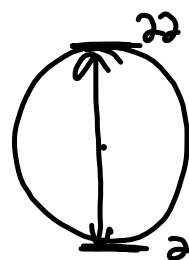
- Strategy: (1) Translate ALL key pieces of information from the problem.
 (2) Draw a sketch with ALL key points identified.
 (3) Develop an equation that models the problem.
 (4) Answer the question(s) being asked.

CHECK??? Do the numbers make sense?

* Radius = Amp.

* Count by $\frac{P}{4}$ on x-axis

* min + diameter = max
 min + radius = sin axis



$r = 10$
 min = 2
 max = ?

* From max to min or min to max is half the period

Ex: max @ 10s $P = 10s$
 min @ 15s
 max @ 20s

Applications of Sinusoidal Functions

A carnival Ferris wheel with a radius of 14 m makes one complete revolution every 16 seconds. The bottom of the wheel is 1.5 m above the ground. If a person is at the top of the wheel when a stop watch is started, determine how high above the ground that person will be after 1 minute and 7 seconds? Sketch one period of this function.

$$\text{Amp} = 14$$

$$P = 16$$

$$\text{min} = 1.5$$

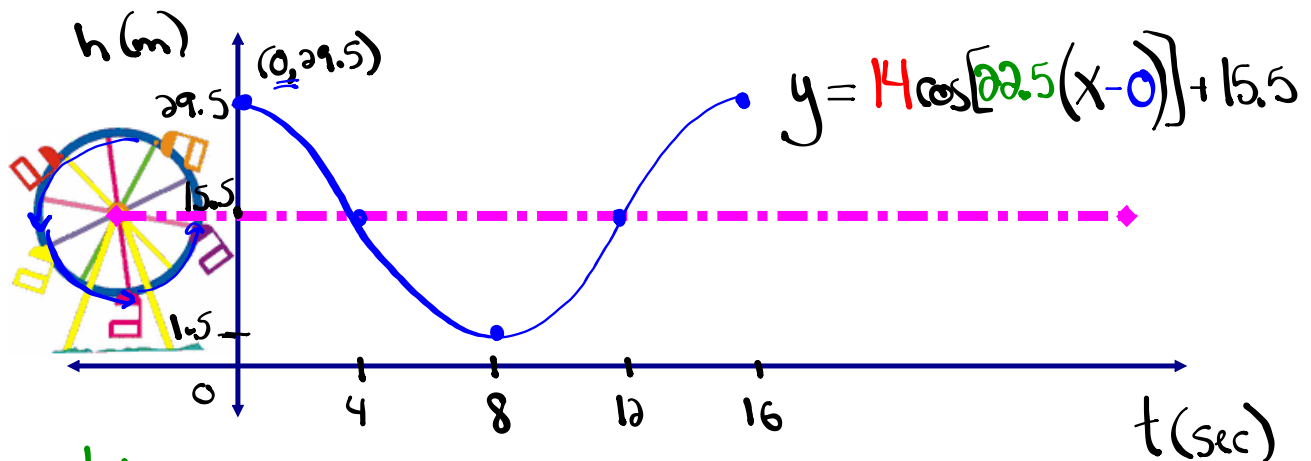
$$y = \cos x$$

$$a = \pm 14$$

$$b = \frac{360}{16} = 22.5$$

$$\text{max} = 29.5 \quad (\text{min} + \text{diameter})$$

$$k = 15.5 \quad (\text{min} + \text{radius})$$



$$\text{count by } \frac{16}{4} = 4$$

$$1 \text{ min and } 7 \text{ seconds} = \underline{\underline{67}} \text{ sec}$$

$$y = 14 \cos[22.5(x)] + 15.5$$

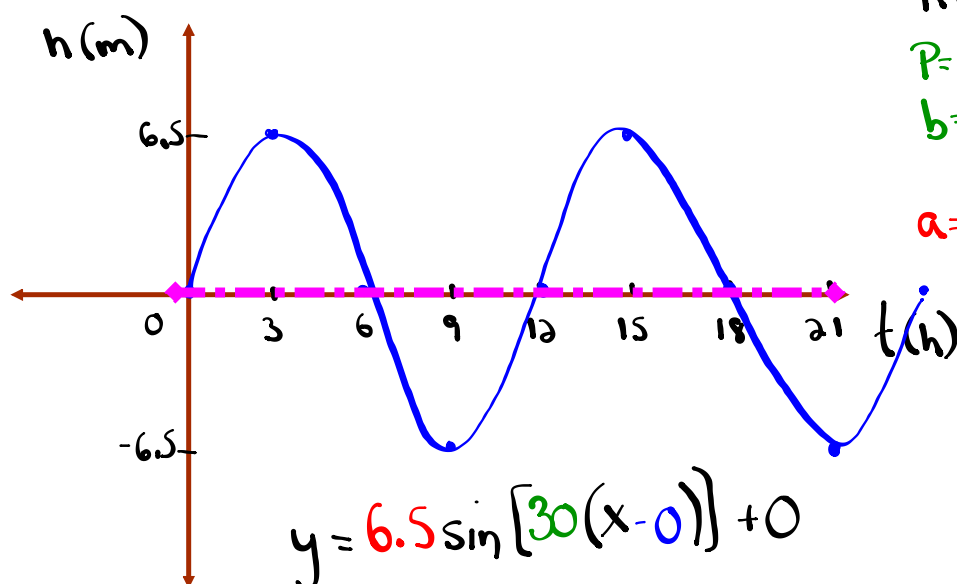
$$y = 14 \cos[22.5(67)] + 15.5$$

$$y = 20.86 \text{ m}$$

Ocean Tides

The alternating half-daily cycles of the rise and fall of the ocean are called tides. Tides in one section of the Bay of Fundy caused the water level to rise 6.5m above mean sea-level and to drop 6.5m below. The tide completes one cycle every 12 h. Assuming the height of water with respect to mean sea-level to be modelled by a sine function,

- (a) draw the graph for a the motion of the tides for one complete day;
 (b) find an equation for the graph in (a).

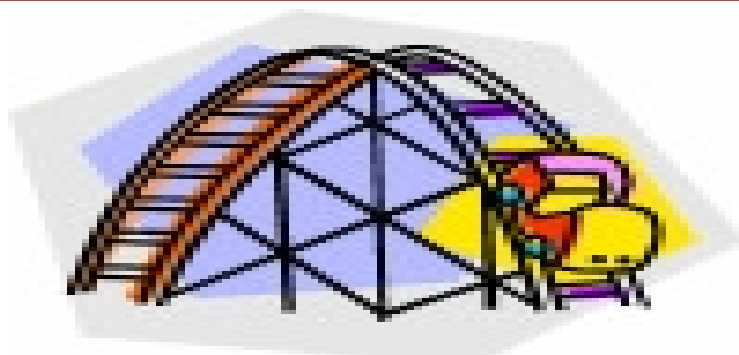


$$y = 6.5 \sin [30(x-0)] + 0$$

$$y = 6.5 \sin [30x]$$

Homework

Roller Coaster



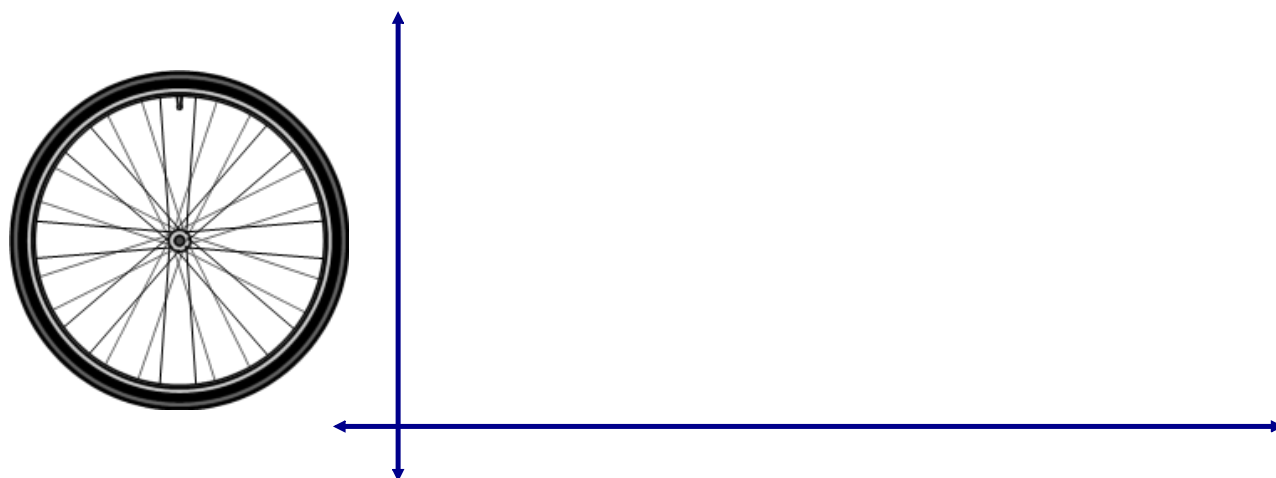
John climbs on a roller coaster at Six Flags Amusement Park. An observer starts a stopwatch and observes that John is at a maximum height of 12 m at $t = 13.2$ s. At $t = 14.6$ s, John reaches a minimum height of 4 m.

- Sketch a graph of the function.
- Find an equation that expresses John's height in terms of time.
- How high is John above the ground at $t = 20.8$ s?



Now, your turn...

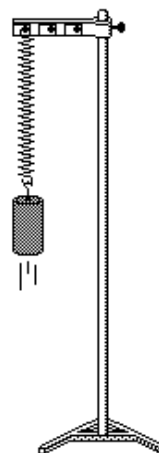
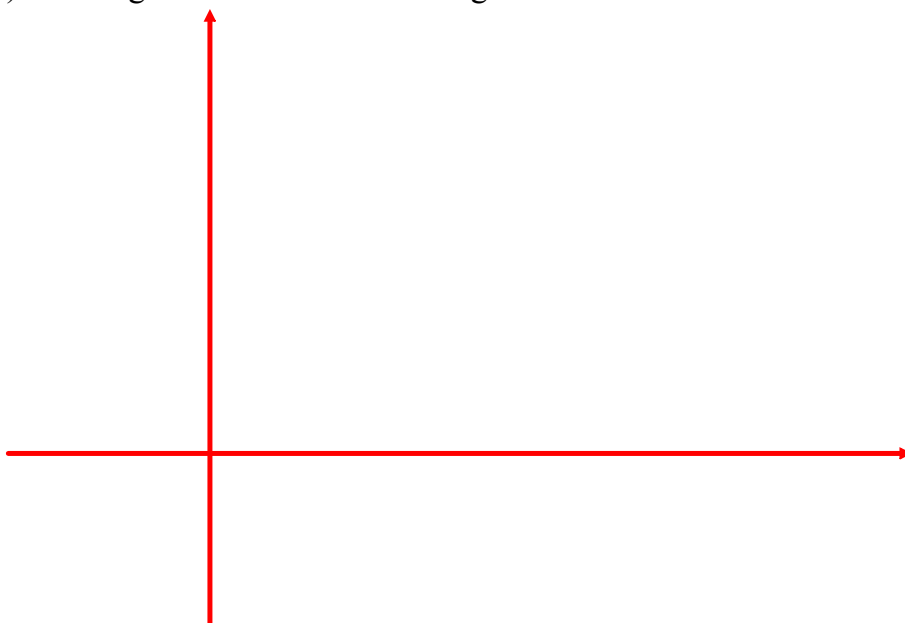
Johnny is driving his bike when a tack becomes stuck in his tire. The tire has a radius of 32 cm and makes one complete rotation every 500 ms. How high will the tack be above the ground 12.38 seconds after becoming lodged in his tire???



Spring Problem

A weight attached to a long spring is being bounced up and down by an electric motor. As it bounces, its distance from the floor varies periodically with time. You start a stopwatch. When the stopwatch reads 0.3 seconds, the weight reaches its first high point 60 cm above the ground. The next low point, 40 cm above the ground, occurs at 1.9 seconds.

- Sketch a graph of the function.
- Write an equation expressing the distance above the ground in terms of the numbers of seconds the stopwatch reads.
- How high is the mass above the ground after 17.2 seconds?

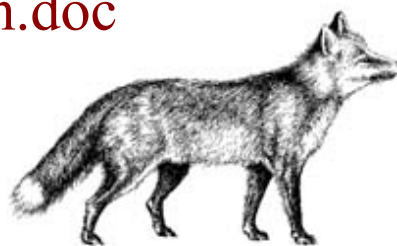


Biology!

Naturalists find that the populations of some animals varies periodically with time. Records started being taken at $t = 0$ years. A minimum number, 200 foxes, occurred when $t = 2.9$ years. The next maximum, 800 foxes, occurred at $t = 5.1$ years.

Give two different times at which the fox population is 625.

Bonus Soln - Fox Population.doc



Attachments

Worksheet - Finding the Equation.doc

Worksheet - Sketching Trigonometric Functions.doc

Worksheet Solns - Sketching Sinusoidal Relations.doc

Worksheet - Sketching Sinusoidal relations (sept06).pdf

Bonus Soln - Fox Population.doc

Worksheet Solns - Applications of Sinusoidal Relations.doc

Review - Practice Test for Sinusoidal Functions.doc

Review - Trigonometric Functions(3)(4).doc

Sketching Sinusoidal Functions #2.pdf

Sketching Sinusoidal Functions #2.doc

Sketching Sinusoidal Functions #3 (Solutions).doc

worksheet-sketching in radian measure.doc