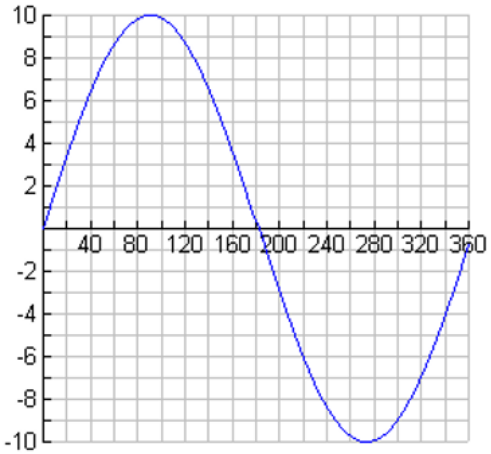
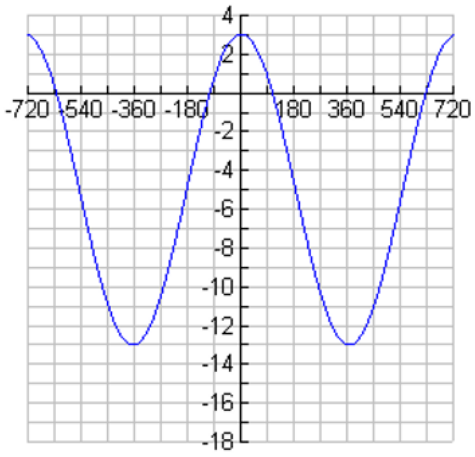
Warm - up #1

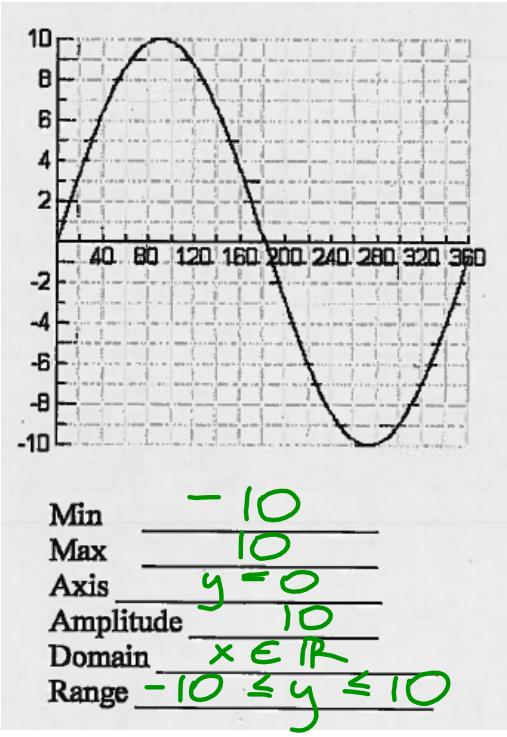


Min _____
Max _____
Axis _____
Amplitude _____
Domain _____
Range _____
Period _____



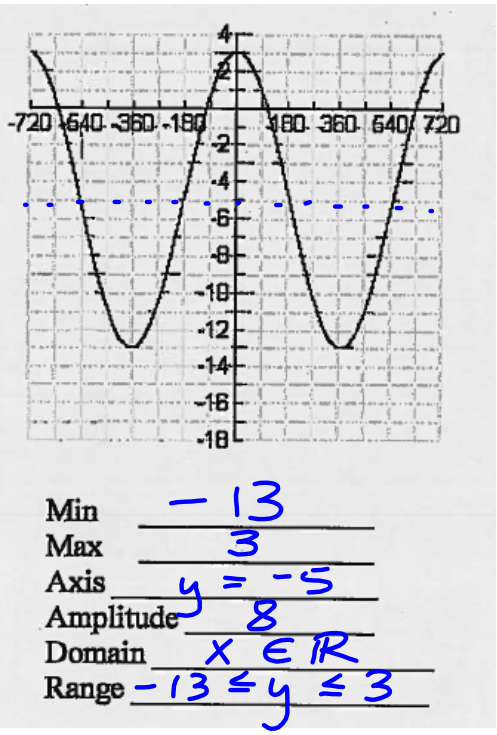
Min _____
Max _____
Axis _____
Amplitude _____
Domain _____
Range _____
Period _____

Warm - up



Min -10
Max 10
Axis $y = 0$
Amplitude 10
Domain $x \in \mathbb{R}$
Range $-10 \leq y \leq 10$

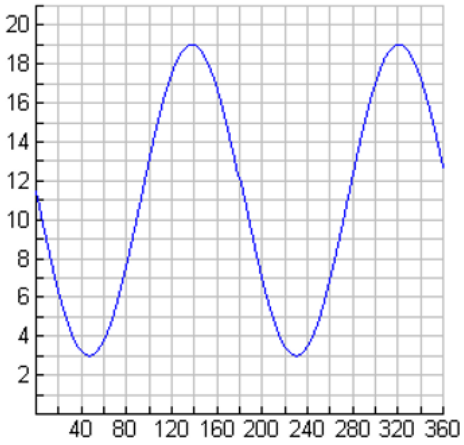
Period = 360°



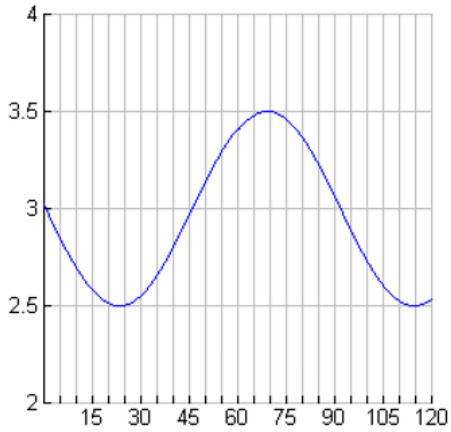
Min -13
Max 3
Axis $y = -5$
Amplitude 8
Domain $x \in \mathbb{R}$
Range $-13 \leq y \leq 3$

Period = 720°

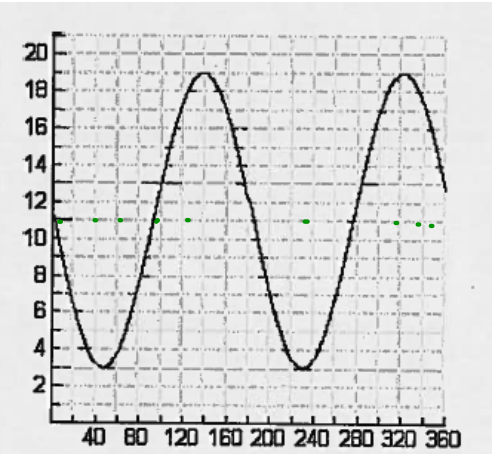
Warm - up #2



Min _____
Max _____
Axis _____
Amplitude _____
Domain _____
Range _____
Period _____

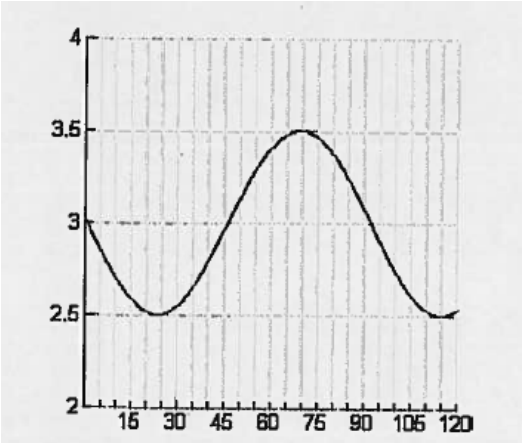


Min _____
Max _____
Axis _____
Amplitude _____
Domain _____
Range _____
Period _____



Min 3
Max 19
Axis $y = 11$
Amplitude 8
Domain $x \in \mathbb{R}$
Range $3 \leq y \leq 19$

Period = 180°



Min 2.5
Max 3.5
Axis $y = 3$
Amplitude 0.5
Domain $x \in \mathbb{R}$
Range $2.5 \leq y \leq 3.5$

Period = 90°

Interpreting Sinusoidal Functions

Learning Goals

- describe the various terms related to periodic motion
- model the motion of various objects with a sinusoidal function

Draw a sketch of the motion and determine if it is periodic, sinusoidal, both or neither.

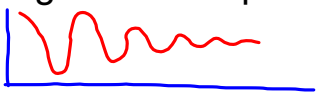
a. spring bounces up and down

b. pebble stuck in the tire of a car

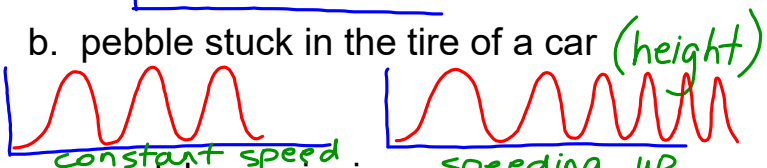
c. pendulum swinging

Draw a sketch of the motion and determine if it is periodic, sinusoidal, both or neither.

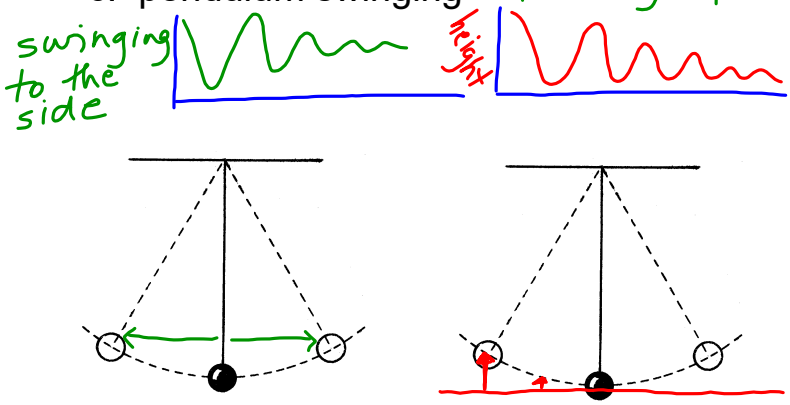
a. spring bounces up and down



b. pebble stuck in the tire of a car



c. pendulum swinging

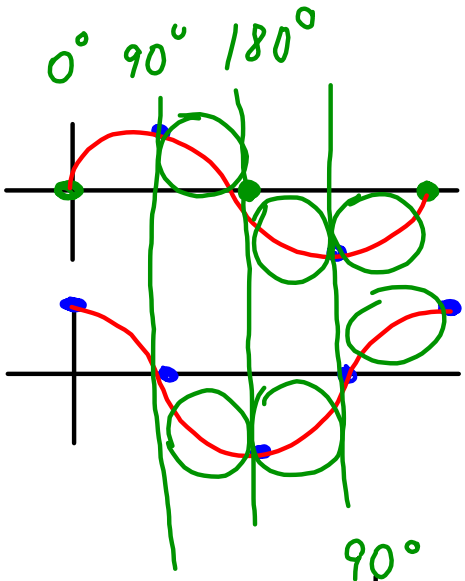


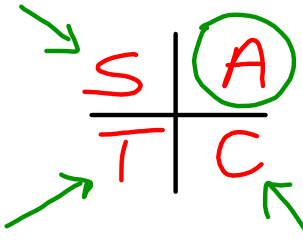
Turn on the video

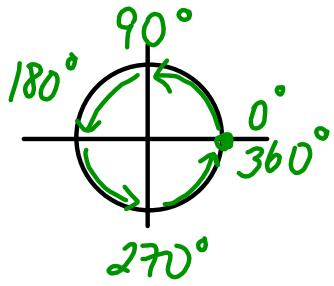
Recall:

y=sin θ

y=cos θ

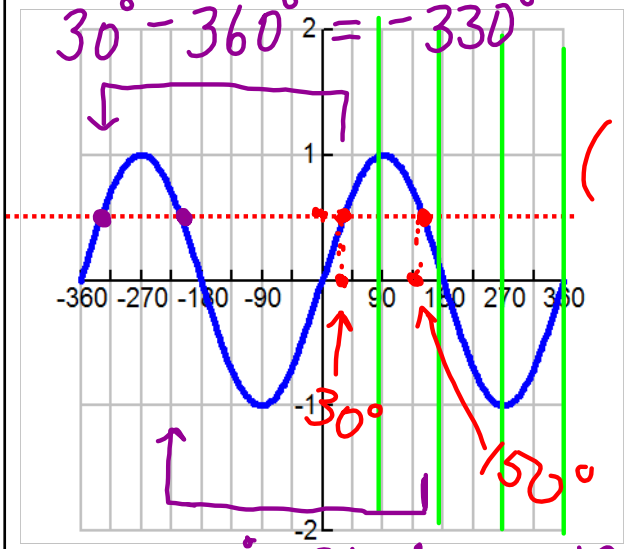


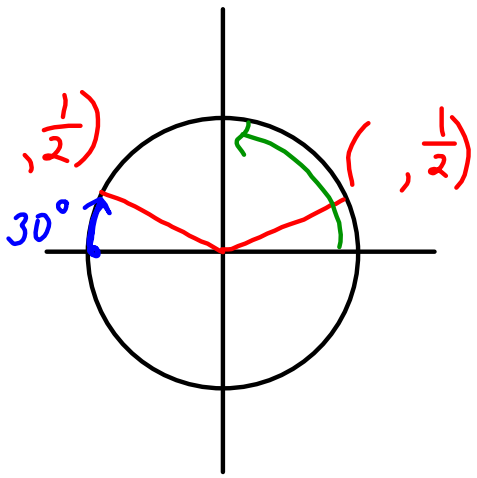




Does CAST apply to the sine function?

$\sin x = \frac{1}{2}$





$(0°, 0), (90°, 1), (180°, 0), (270°, -1), (360°, 0)$

$y = \sin\theta$ and $y = \cos\theta$ can be used to model situations that involve repetative motions.

Amplitude - depends on the situation

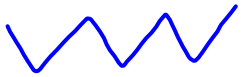
- radius of a circle

1 cycle - corresponds to 1 period

Speed - can be calculated by

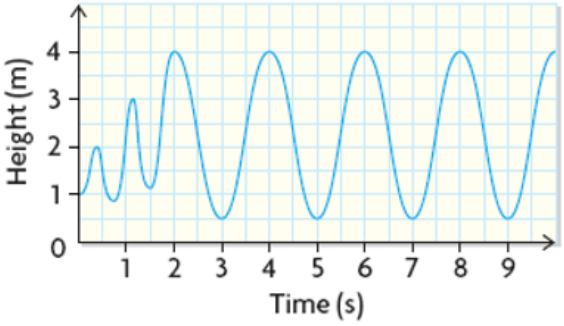
$$v = \frac{\text{distance}}{\text{time}} = \frac{\text{circumference of a circular rotation}}{\text{period}}$$

distance is not linear

swimmer 

Pause the video -- Try on Your Own #1

2. Nolan is jumping on a trampoline. The graph shows how high his feet are above the ground.



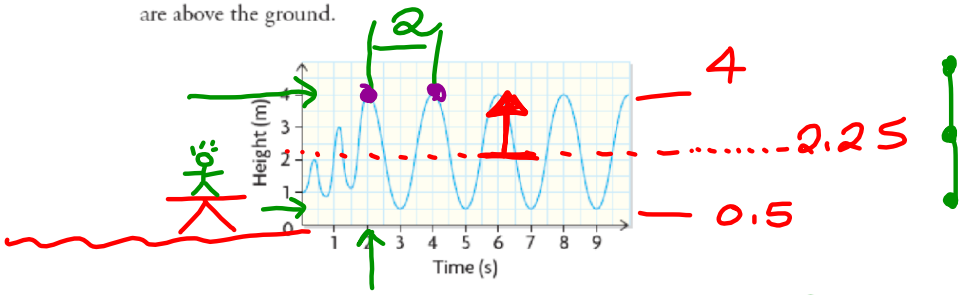
a) How long does it take for Nolan's jumping to become periodic? What is happening during these first few seconds?

b) What is the period of the curve? What does *period* mean in this context?

c) Write an equation for the axis of the periodic portion of the curve.

d) What is the amplitude of the sinusoidal portion of the curve? What does *amplitude* mean in this context?

2. Nolan is jumping on a trampoline. The graph shows how high his feet are above the ground.



a) How long does it take for Nolan's jumping to become periodic? What is happening during these first few seconds?
b) What is the period of the curve? What does *period* mean in this context?
c) Write an equation for the axis of the periodic portion of the curve.
d) What is the amplitude of the sinusoidal portion of the curve? What does *amplitude* mean in this context?

2 secs
2 seconds

Axis $= \frac{\max + \min}{2} = \frac{4 + 0.5}{2} = 2.25$

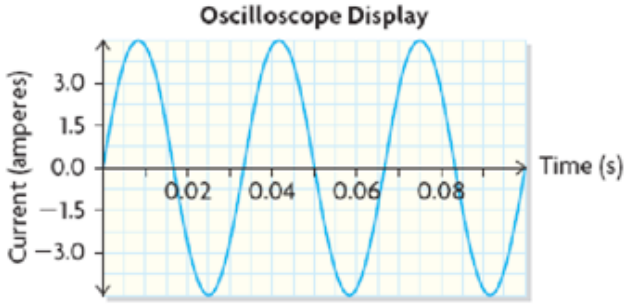
$y = 2.25$

Amplitude $= \frac{\max - \min}{2} = \frac{4 - 0.5}{2} = \frac{3.5}{2} = 1.75$

The End of the Video - Complete the following ...

Try On Your Own #2

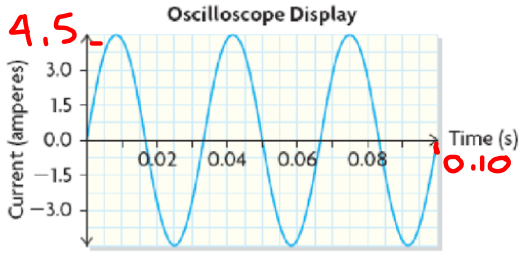
4. An oscilloscope hooked up to an AC (alternating current) circuit shows a sine curve on its display:



a) What is the period of the function?
b) What is the equation of the axis of the function?
c) What is the amplitude of the function?
d) State the units of measure for each of your answers above.

Try On Your Own #2 - Solution

4. An oscilloscope hooked up to an AC (alternating current) circuit shows a sine curve on its display:



4.5

0.10

a) What is the period of the function?
b) What is the equation of the axis of the function?
c) What is the amplitude of the function?
d) State the units of measure for each of your answers above.

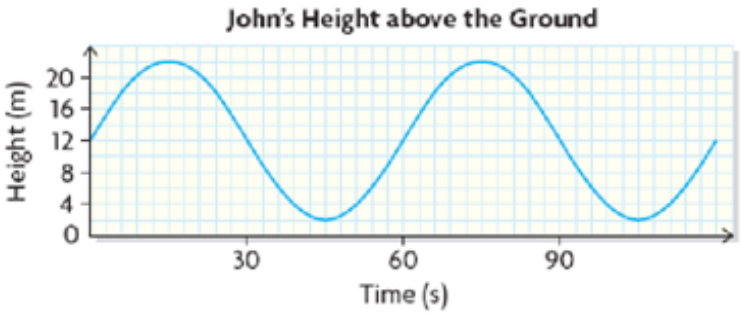
3 cycles → 0.10 sec
1 cycle → $\frac{0.10}{3}$
$= 0.033$ s

axis $y = 0$
amperes

Amplitude
$a = 4.5$
amperes

Try On Your Own #3

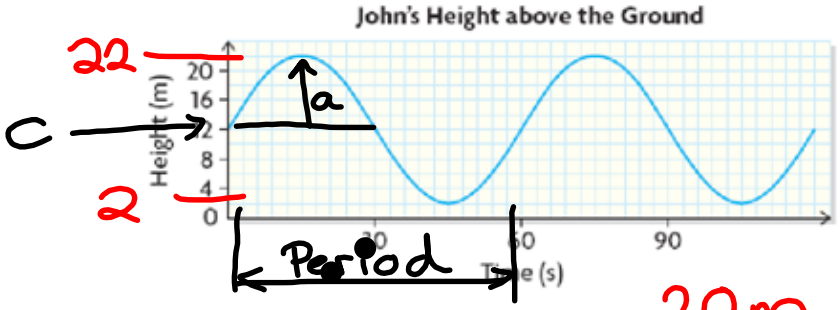
9. The graph shows John's height above the ground as a function of time as he rides a Ferris wheel.



a) What is the diameter of the Ferris wheel?
b) What is John's initial height above the ground?
c) At what height did John board the Ferris wheel?
d) How high above the ground is the axle on the wheel?

Try On Your Own #3 - Solution

9. The graph shows John's height above the ground as a function of time as he rides a Ferris wheel.



a=10
c=12

a) What is the ~~diameter~~ of the Ferris wheel? 20 m
b) What is John's initial height above the ground? 12 m
c) At what height did John board the Ferris wheel? 12 m
d) How high above the ground is the axle on the wheel? 12 m

Try On Your Own #4

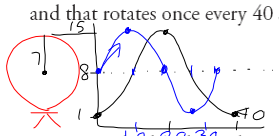
6. Sketch a height-versus-time graph of the sinusoidal function that models each situation. Draw at least three cycles. Assume that the first point plotted on each graph is at the lowest possible height.
   a) A Ferris wheel with a radius of 7 m, whose axle is 8 m above the ground, and that rotates once every 40 s
   b) A water wheel with a radius of 3 m, whose centre is at water level, and that rotates once every 15 s
   c) A bicycle tire with a radius of 40 cm and that rotates once every 2 s
   d) A girl lying on an air mattress in a wave pool that is 3 m deep, with waves 0.5 m in height that occur at 7 s intervals

Try On Your Own #4 - Solution

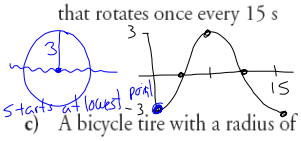
P. 371 # 6 - Sketch the Graphs

6. Sketch a height-versus-time graph of the sinusoidal function that models each situation. Draw at least three cycles. Assume that the first point plotted on each graph is at the lowest possible height.

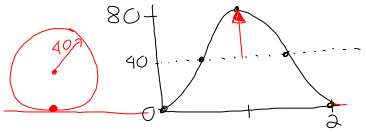
a) A Ferris wheel with a radius of 7 m, whose axle is 8 m above the ground, and that rotates once every 40 s



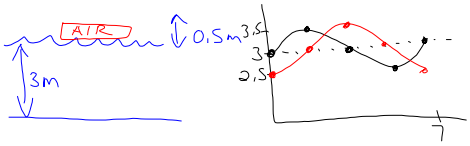
b) A water wheel with a radius of 3 m, whose centre is at water level, and that rotates once every 15 s



c) A bicycle tire with a radius of 40 cm and that rotates once every 2 s



d) A girl lying on an air mattress in a wave pool that is 3 m deep, with waves 0.5 m in height that occur at 7 s intervals

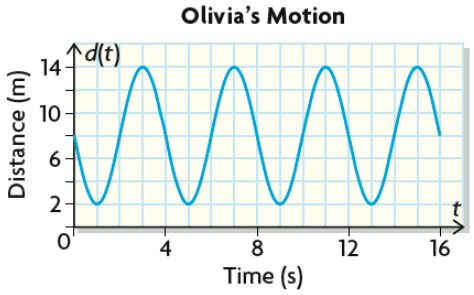


Optional Additional Practise

pg 371 # 1, 4, 14

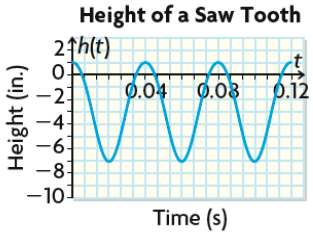
see text book for answers

1. Olivia was swinging back and forth in front of a motion detector when the detector was activated. Her distance from the detector in terms of time can be modelled by the graph shown.



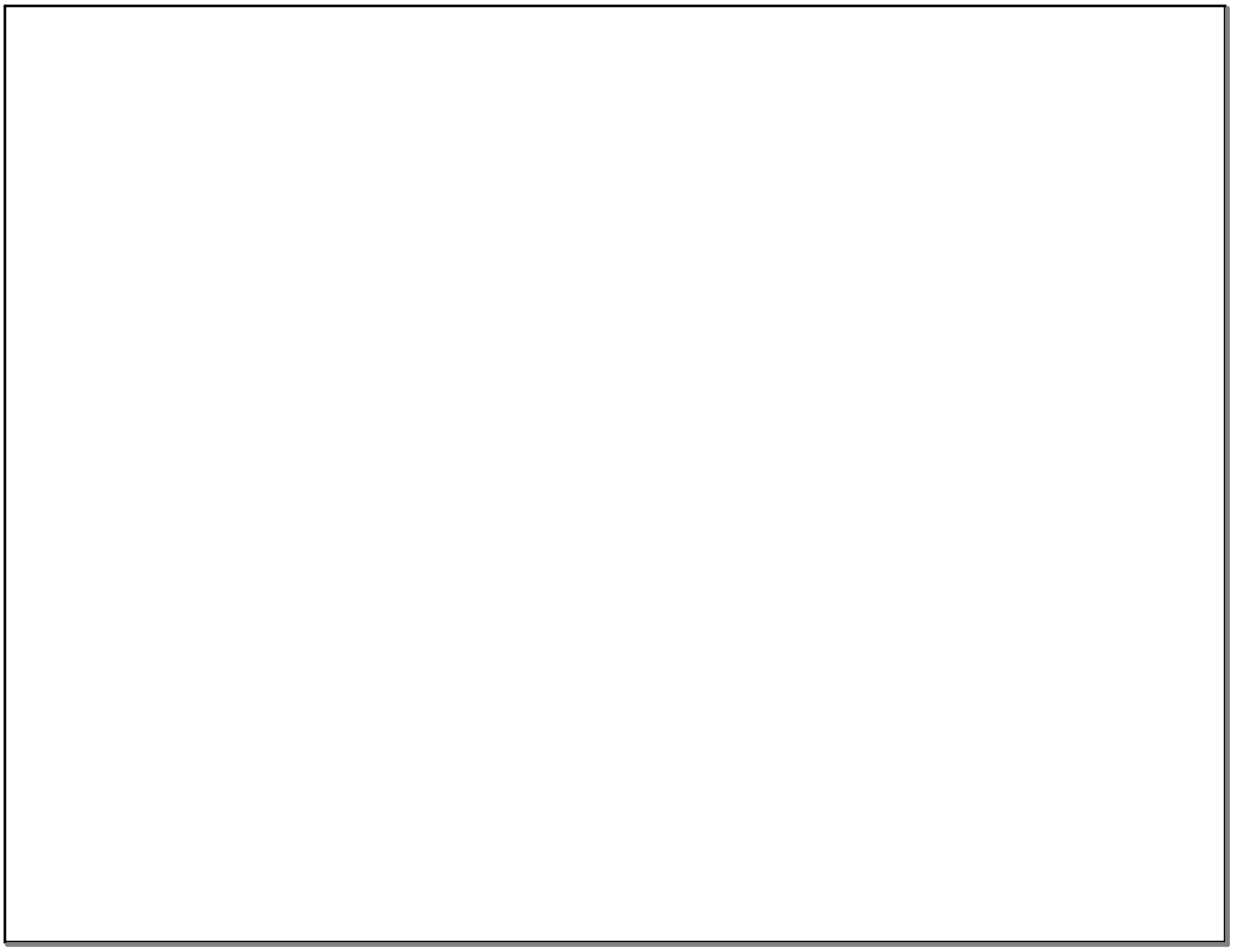
a) What is the equation of the axis, and what does it represent in this situation?
b) What is the amplitude of this function?
c) What is the period of this function, and what does it represent in this situation?
d) How close did Olivia get to the motion detector?
e) At $t = 7$ s, would it be safe to run between Olivia and the motion detector? Explain your reasoning.
f) If the motion detector was activated as soon as Olivia started to swing from at rest, how would the graph change? (You may draw a diagram or a sketch.) Would the resulting graph be sinusoidal? Why or why not?

4. K Evan's teacher gave him a graph to help him understand the speed at which a tooth on a saw blade travels. The graph shows the height of one tooth on the circular blade relative to the cutting surface relative to time.



a) How high above the cutting surface is the blade set?
b) What is the period of the function, and what does it represent in this situation?
c) What is the amplitude of the function, and what does it represent in this situation?
d) How fast is a tooth on the circular cutting blade travelling in inches per second?

14. C How many pieces of information do you need to know to sketch a sinusoidal function. What pieces of information could they be?



Attachments

Unit Circle copy.gsp

Unit Circle Functions .gsp

Desktop (create shortcut).DeskLink

MCR3U - Page 363 #5.tns

sinusoidal transformations.pptx