Algebra 2 Trig – Worksheet and HW
Applications of sinusoids

REMEMBER:

Need to know before mastering a Trig story problem:

1.

2.

3.

4.

5.

Problem 1: The average daily temperature T (in degrees Fahrenheit) for a certain city is $T = 45 - 23\cos\left[\frac{2\pi}{365}(t-32)\right]$ where t is the time in days, with t = 1 corresponding to January 1.

a) What does y represent?

b) What does x represent?

c) What is the SA? _________ What is the amplitude? ___________

What does this mean?

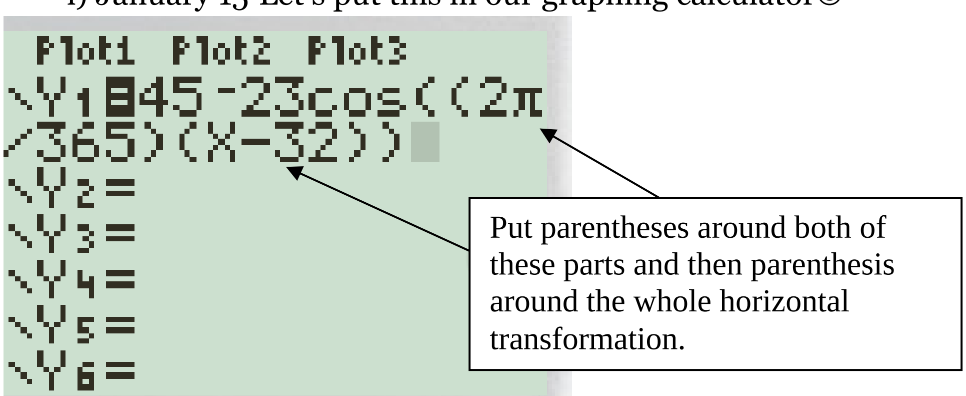
d) What is the period of the cos equation?

e) Why would there be a phase shift?

Now we are ready to answer some questions☺

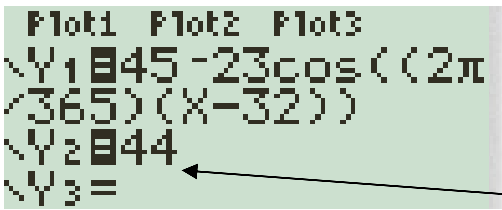
a) Find the average daily temperatures for the following days:

i) January 15 Let's put this in our graphing calculator☺

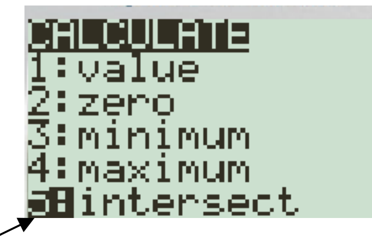


ii) October 18 (t = 291 days)

b) Use your graphing calculator to approximate the time of year when the temperature reaches 44°F.



Enter the y value in Y_2 and then use intersect feature to solve for x (day of the year)☺



Problem 2: A company that produces a seasonal product forecasts monthly sales over the next 2 years to be $S = 23.1 + 4.3\sin\left(\frac{\pi t}{6}\right)$ where S is measured in thousands of units and t is measured in months, with t = 1 representing January 2016.

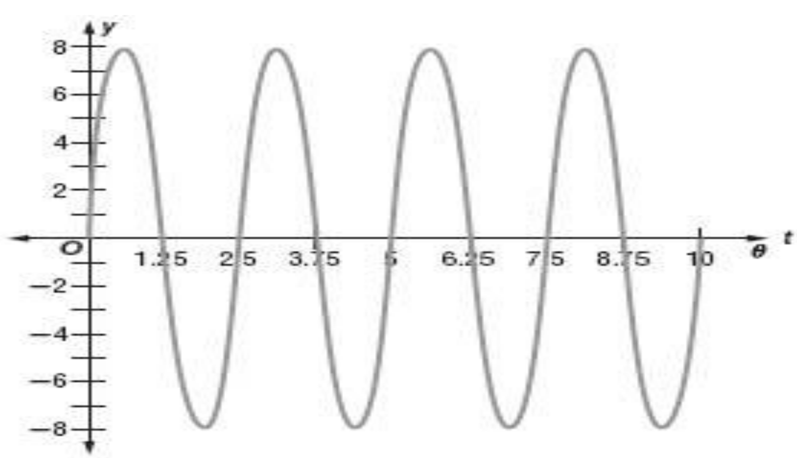
a) Predict sales for the following months:

i) February 2016

ii) September 2016

b) Use your graphing calculator to approximate when the sales will reach 20 thousands of units for the first time.

Problem 3: As Charles swims a 25 meter sprint, the position of his right hand relative to the water surface can be modeled by the graph below, where *h* is the height of the hand in inches from the water level and *t* is the seconds past the start of the sprint. Write an equation describing the graph.



Problem 4: The following chart gives functions which model the wave patterns of different colors of light emitted from a particular source, where y is the height of the wave in nanometers and t is the length from the start of the wave in nanometers.

Color	Function
Red	$y = 300 \sin\left(\frac{\pi}{350}t\right)$
Orange	$y = 125 \sin\left(\frac{\pi}{305}t\right)$
Yellow	$y = 460 \sin\left(\frac{\pi}{290}t\right)$
Green	$y = 200 \sin\left(\frac{\pi}{260}t\right)$
Blue	$y = 40 \sin\left(\frac{\pi}{235}t\right)$
Violet	$y = 80 \sin\left(\frac{\pi}{210}t\right)$

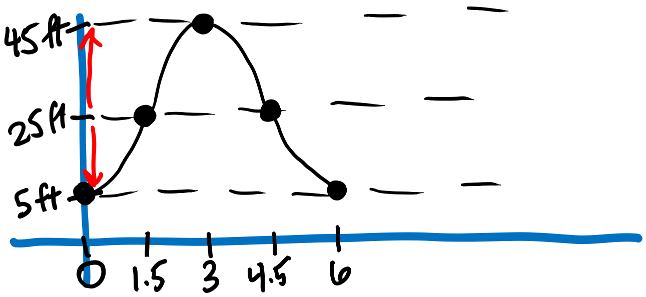
a) What is the amplitude and period of the green light wave function?

b) The intensity of a light wave corresponds directly to its amplitude. Which color is the most intense?

c) The color of light depends on the period of the wave. Which color has the shortest period? The longest period?

Problem 5: As you ride a Ferris wheel, your distance from the ground varies sinusoidally with time. Assume that you get on the ride at the lowest point of the ferris wheel, 5 feet above the ground. You find that it takes you 3 seconds to reach the top of the ferris wheel 45 feet above the ground. If x represents the seconds that have elapsed since you started riding the ferris wheel and y represents the number of feet above the ground...

a) Sketch a graph.



period = 6 sec

amp = 20
midline = 25
phase shift = 0
$\frac{2\pi}{B} = 6$ $6B = 2\pi$
$B = \frac{2\pi}{6} = \frac{\pi}{3}$

b) Write an equation using cos.

$Y_1 = -20\cos\left(\frac{\pi}{3}(\theta)\right) + 25$

c) How high are you above the ground after 15 seconds? 45 ft (from graph)

d) How many seconds does it take for you to first reach 38 feet above the ground?

x-min = 0
x-max = 6
y-min: 5
y-max = 45

$Y_2 = 38$

x = 2.18 seconds

* USE INTERSECT

e) What is the diameter of the ferris wheel?

40 ft

Problem 6: In a certain forest, the leaf density can be modeled by the equation $y = 20 + 15 \sin\left(\frac{\pi}{6}(t-3)\right)$ where y represents the number of leaves per square foot and t represents the number of months after January, 2015.

a) Determine the period of this function. What does this period represent?

b) *What* is the maximum leaf density that occurs in this forest and *when* does this occur? (Sketch a graph to help you find your answer!)

c) What is the leaf density in July, 2016? July, 2017? July 2018?

Problem 7: The population of predators and prey in a closed ecological system tends to vary periodically over time. In a certain system, the population of snakes S can be represented by $S = 100 + 20\sin(\frac{\pi}{5}t)$, where t is the number of years since January 1, 2015. In that same system, the population of rats can be represented by $R = 200 + 75\sin(\frac{\pi}{5}t - \frac{\pi}{10})$.

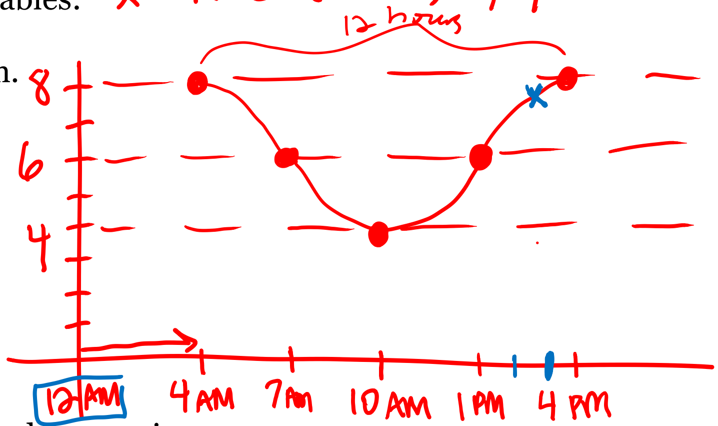
a) What is the maximum snake population and when is it first reached?

b) What is the minimum rat population and when is it first reached?

Problem 8: The average depth of water at the end of a dock is 6 feet. The height of the tide varies sinusoidally with time. The amplitude of the tide is 2 feet. High tide occurs at 4 AM. At 10 AM you notice the tide is at its lowest.

a) Define your variables: x = time (hours), y = height (ft)

b) Sketch the graph.



$\frac{2\pi}{B} = 12$ $\quad 12B = 2\pi$

$B = \frac{2\pi}{12} = \frac{\pi}{6}$

c) Write the particular equation.

$y = 2\cos\left(\frac{\pi}{6}(\theta - 4)\right) + 6$

d) Where will it be at 3 **PM** (be careful!)?

x = 15 use table $y = 7.73$ ft

HW

Problem 9: The population of dragonflies on a small puddle in the San Antonio River varies sinusoidally with the days in October. On October 4th the population was at its maximum of 3200 and on October 14th it was at its minimum of 600 dragonflies.

a) Define your variables:

b) Sketch the graph.

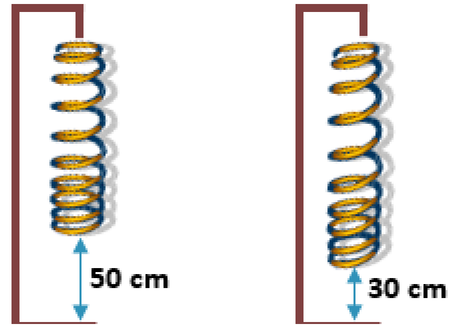
c) Write the particular equation.

d) How many dragonflies where there on Oct. 1st?

e) Using your calculator, find the first day in October when there were 1000 dragonflies.

HW

Problem 10: A long spring is bouncing up and down. As it bounces, its distance from the floor varies sinusoidally with time. You start a stopwatch. When the stopwatch reads 0.3 seconds, the weight first reaches its maximum, 50 cm above the floor. When the stopwatch reads 1.8 seconds, the spring reaches its low point, only 30 cm above the ground.



a) Sketch a graph of this sinusoidal function

b) Write the particular equation.

c) Predict the distance from the floor when the stopwatch reads 7.2 seconds.

d) What was the distance from the floor when you started the stopwatch?