Graphing Trig Functions

Name AK
Period ____ Date _____

Instructions: Complete the following worksheet. Do your graphs on graph paper. Carefully label your axes. The "incremental points" should be readily apparent from the graphs. Your graphs will be graded on neatness, accuracy and completeness.

A. The tides in the Bay of Fundy between New Brunswick and Nova Scotia are among the largest in the world. Assume the depth (d) of the water channel changes over time and is modeled by the function:

$d = 29\sin\left(\frac{\pi}{6}t\right)+32$ where t is the number of hours after midnight (e.g., t=14 corresponds to 2pm)

1. Analyze the function by completing the following:

Sinusoidal axis:	y=32
Amplitude:	29
Range:	y∈[3,61]
Period:	12
Increment:	3
Phase shift:	None

$2\pi \div \frac{\pi}{6} = 2\pi \cdot \frac{6}{\pi}$

2. Graph (*by hand*) the function over <u>two</u> complete cycles.

Check with calc

3. Answer the following questions about the graph of the function:

a. At what times does high tide occur 3pm
b. What is the depth at high tide 61 ft
c. At what times does low tide occur 9pm
d. What is the depth at low tide 3 ft
e. A fishing captain wishes to unload his catch at a pier on the channel. His boat requires a depth of at least 10 feet of water. Use your graph to estimate during what hours of the day he is <u>unable</u> to reach the pier 7:38am to 10:24pm.

B. Blood pressure is the force per unit area (in millimeters of mercury) against the walls of blood vessels. As the heart muscle contracts, the pressure rises and falls. Assume an individual's blood pressure can be modeled by the function:

$P = 90 - 20\cos\frac{5\pi}{2}t$ where t is the time (in seconds).

1. Analyze the function by completing the following:

Sinusoidal axis:	$y = 90$
Amplitude:	20
Range:	$y \in [70, 110]$
Period:	$4/5$
Increment:	$1/5$
Phase shift:	None

$2\pi \cdot \frac{2}{5\pi}$

2. Graph (*by hand*) the function over <u>three</u> complete cycles.

Check w/ Calc

3. Answer the following questions about the graph of the function:

a. What is the maximum pressure for this individual 110

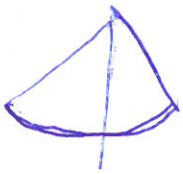
b. What is the minimum pressure for this individual 70

c. How long does it take to complete one cycle 4/5 sec

d. If each cycle of the graph corresponds to one heart beat, what is the individual's pulse rate (i.e., heart beats per minute) 75 bpm.

$\frac{1 \text{ beat}}{4/5 \text{ sec}} = \frac{x \text{ beats}}{60 \text{ sec}}$.

Name _____



Algebra II H

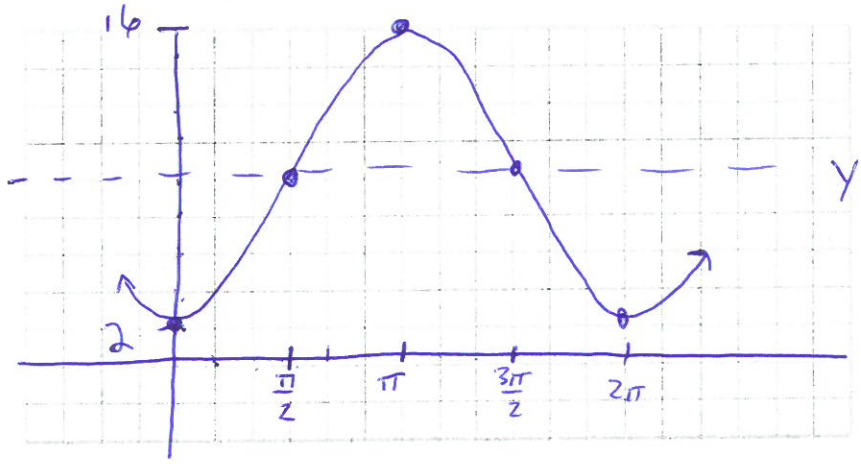
6.3 - Modeling with Trigonometric Functions Homework

1. The motion of a pendulum can be modeled by the function $d = 4\cos(8\pi t)$, where d is the horizontal displacement (in inches) of the pendulum relative to its position at rest and t is the time (in seconds). Find and interpret the period and amplitude in the context of the situation.

Amplitude → 4 inch, how far it swings from middle in either direction

Period → $\frac{2\pi}{8\pi} = \frac{1}{4}$ sec. How long the pendulum takes to swing back to its original position.

2. The height h (in feet) of a swing above the ground can be modeled by the function $h = -8\cos\theta + 10$ where the pivot is 10 feet above the ground, the rope is 8 feet long, and θ is the angle that the rope makes with the vertical. Graph the function. What is the height of the swing when θ is 45° ?



$h = -8\cos 45 + 10$

$h = -8\left(\frac{\sqrt{2}}{2}\right) + 10$

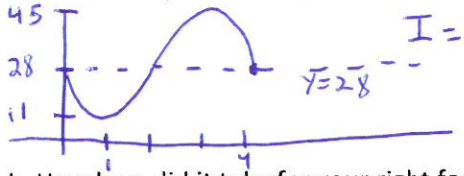
$h \approx 4.34$ ft

3. The water depth d (in feet) for the Bay of Fundy can be modeled by $d = 35 - 28\cos\left(\frac{\pi}{6.2}t\right)$, where t is the time in hours and $t = 0$ represents midnight. Use a graphing calculator to graph the function. At what time(s) is the water depth 7 feet?

3:06 am + 12:24 hrs min

4. As you ride a bicycle, the distance between your foot and the pavement varies sinusoidally with time. Suppose that you start with your right foot in the middle of the highest and the lowest point and you push down. When you have gone 1 second, your right foot first reaches its lowest point, 11 cm about the pavement. The high points are 45 cm above the pavement.

a. Write an equation of this function based on the information above.



I = 1 → Period 4

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

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

$y = -17\sin\left(\frac{\pi}{2}x\right) + 28$

b. How long did it take for your right foot to get back to where it started when it began pedaling?

~~4 sec~~ 2 sec

c. Find the first two positive times that the bike has traveled when your right foot is 35 cm above the pavement.

$35 = -17\sin\left(\frac{\pi}{2}x\right) + 28$

$\frac{-7}{17} = \sin\left(\frac{\pi}{2}x\right)$

$\sin^{-1}\left(\frac{-7}{17}\right) = \frac{\pi}{2}x$

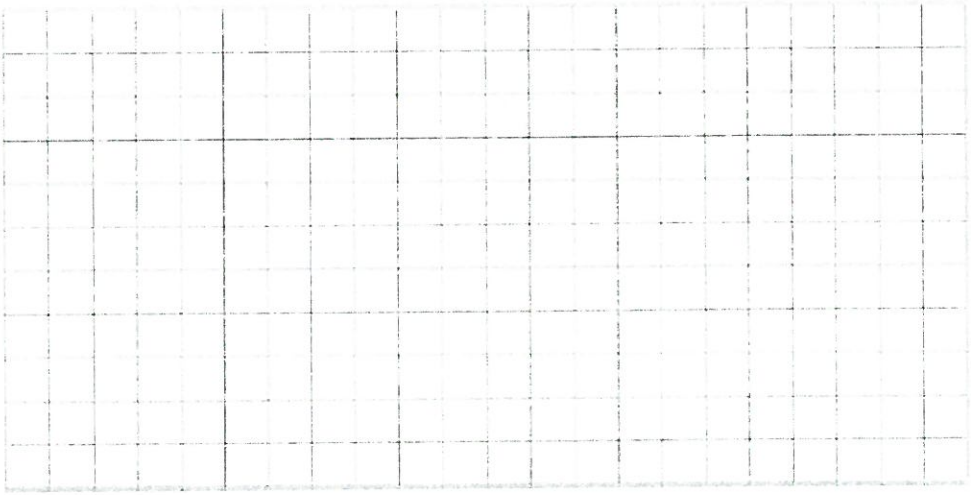
$3.6 = \frac{\pi}{2}x$ $\quad x = 2.3$

$5.9 = \frac{\pi}{2}x$ $\quad x = 3.8$

5. One of the largest Ferris Wheels in the world is the London Eye, a wheel that is 135 meters high and provides a 30 minute, slow-moving "flight" over the Thames River. Suppose that we assume that the London Eye has a diameter of 130 meters and that the lowest point of the wheel is 5 meters above the Thames River. The wheel makes one complete revolution every 30 minutes. Dorothy and her friends begin their ride at the lowest point at ~~12~~ noon (t = 0 minutes).

Class

a. Sketch a graph that relates Dorothy's height above the Thames to time.



b. Write an equation that models Dorothy's height off the ground at any time.

c. How high is Dorothy off the Thames at each of the following times?

i. 12:15

ii. 12:10

iii. 12:20

d. When the London Eye is more than 110 meters above the Thames, the riders have a view of Trafalger Square. How long will riders have this view each revolution?