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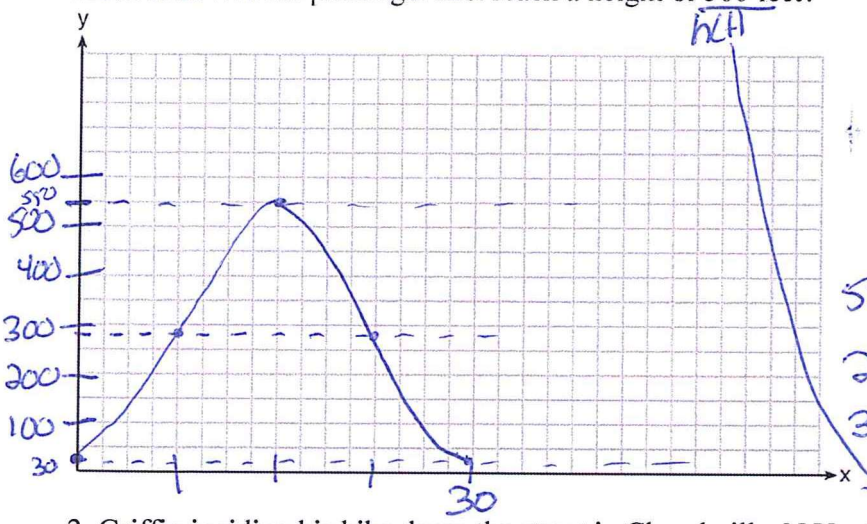
Date _____
Algebra II

Graphing Sinusoidal Models

1. The High Roller, a Ferris wheel in Las Vegas, Nevada, opened in March 2014. A passenger's height, in feet, above the ground after t minutes can be modeled by the equation $h(t) = -260\cos\left(\frac{\pi}{15}t\right) + 290$. Graph one full cycle of $h(t)$ on the axes provided. Identify the period and state its meaning in the context of the problem. To the *nearest tenth of a* ~~second~~ minute, after how much time will the passenger first reach a height of 500 feet?



$h(t) = -260\cos\left(\frac{\pi}{15}t\right) + 290$

amp = 260 $\quad p = \frac{2\pi}{\frac{\pi}{15}}$

−cos

freq = $\frac{\pi}{15}$

shift = 290

$\frac{2\pi}{1} \cdot \frac{15}{\pi} = 30$

550 ——

290 — —

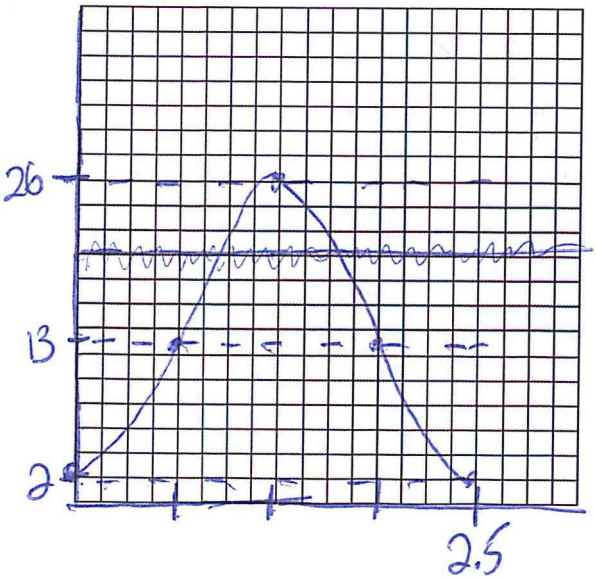
30 ——

Period = 30
It takes 30 mins for the Ferris wheel to complete one full rotation

$500 = -260\cos\left(\frac{\pi}{15}t\right) + 290$

y1 = 500
y2 = −260cos(π/15 t) + 290
Intersect
x = 9 max = 550
12.0 mins

2. Griffin is riding his bike down the street in Churchville, N.Y. at a constant speed, when a nail gets caught in one of his tires. The height of the nail above the ground, in inches, can be represented by the trigonometric function $f(t) = -13\cos(0.8\pi t) + 13$, where t represents the time (in seconds) since the nail first became caught in the tire. Determine the period of $f(t)$. Interpret what the period represents in this context. On the grid below, graph *at least one* cycle of $f(t)$ that includes the y-intercept of the function. Does the height of the nail ever reach 30 inches above the ground? Justify your answer.



$f(t) = -13\cos(0.8\pi t) + 13$

amp = 13 $\quad p = \frac{2\pi}{0.8\pi}$

−cos

freq = 0.8π $\quad p = 2.5$

shift = 13

Period = 2.5
It takes 2.5 seconds for the bike wheel to make one full rotation

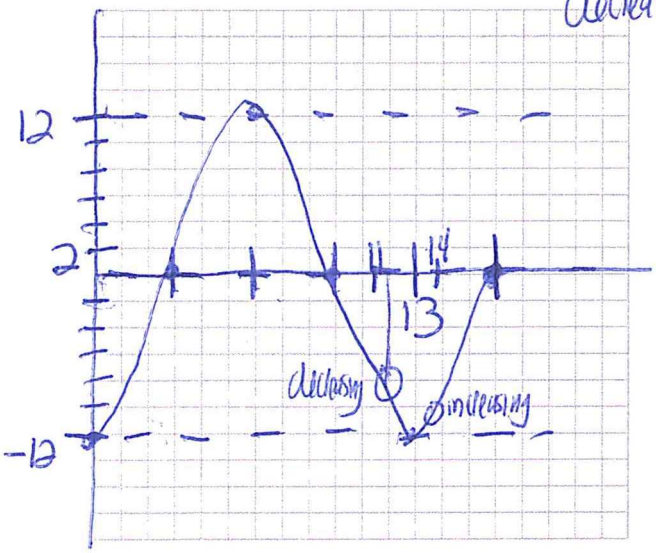
26 ——

13 — —

0 ——

No, the nail never reaches 30 inches because the maximum height is 26 in

3. The ocean tides near Carter Beach follow a repeating pattern over time, which can be modeled by the equation $h(t) = -12\cos\left(\frac{2\pi}{13}t\right)$ where $h(t)$ represents height above sea level and t represents hours after 8:30 AM. On the grid below, graph one cycle of this function. Determine the period and state its meaning in the context of the problem. People who fish in Carter Beach know that a certain species of fish is most plentiful when the water level is increasing. Explain whether you would recommend fishing for this species at 7:30 p.m. or 10:30 p.m. using evidence from the given context.



t=11 decreasing

$h(t) = -12\cos\left(\frac{2\pi}{13}t\right) = 0$ t=H increasing

amp=12

-cos

freq=$\frac{2\pi}{13}$

shift=0

$P = \frac{2\pi}{\frac{2\pi}{13}}$

$\frac{2\pi}{1}\cdot\frac{13}{2\pi} = 13$

Period=13

It is 13 hours between low tides or it takes 13 hour for one complete cycle of the tide

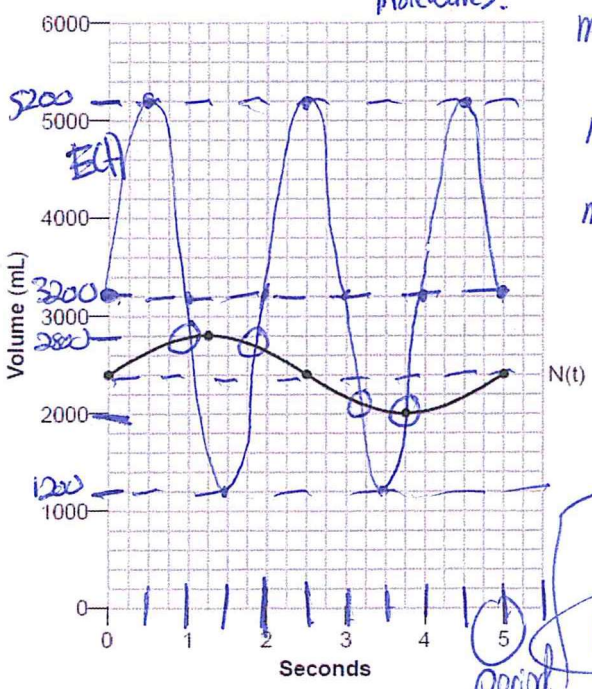
12 ——

0 — —

-12 ——

10:30 (t=14) the graph is increasing

4. The volume of air in an average lung during breathing can be modeled by the graph below. Using the graph, write an equation for $N(t)$, in the form $N(t) = A\sin(Bt) + C$. That same lung, when engaged in exercise, has a volume that can be modeled by $E(t) = 2000\sin(\pi t) + 3200$, where $E(t)$ is volume in mL and t is time in seconds. Graph *at least one* cycle of $E(t)$ on the same grid as $N(t)$. How many times during the 5-second interval will $N(t) = E(t)$?



molecules!

N(t) intersect E(t)

$E(t) = 2000\sin(\pi t) + 3200$

$\text{midline} = \frac{\text{min}+\text{max}}{2}$

$\text{midline} = \frac{2000+2800}{2}$

midline = 2400

amp=400

+sin

freq=$\frac{2\pi}{5}$

shift=2400

amp=2000

+sin

freq=π

shift=3200

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

P=2

5200 ——

3200 — —

1200 ——

4 intersections

$N(t) = 400\sin\left(\frac{2\pi}{5}t\right) + 2400$

period

57. The resting blood pressure of an adult patient can be modeled by the function P below, where $P(t)$ is the pressure in millimeters of mercury after time t in seconds.

$$P(t) = 24\cos(3\pi t) + 120$$

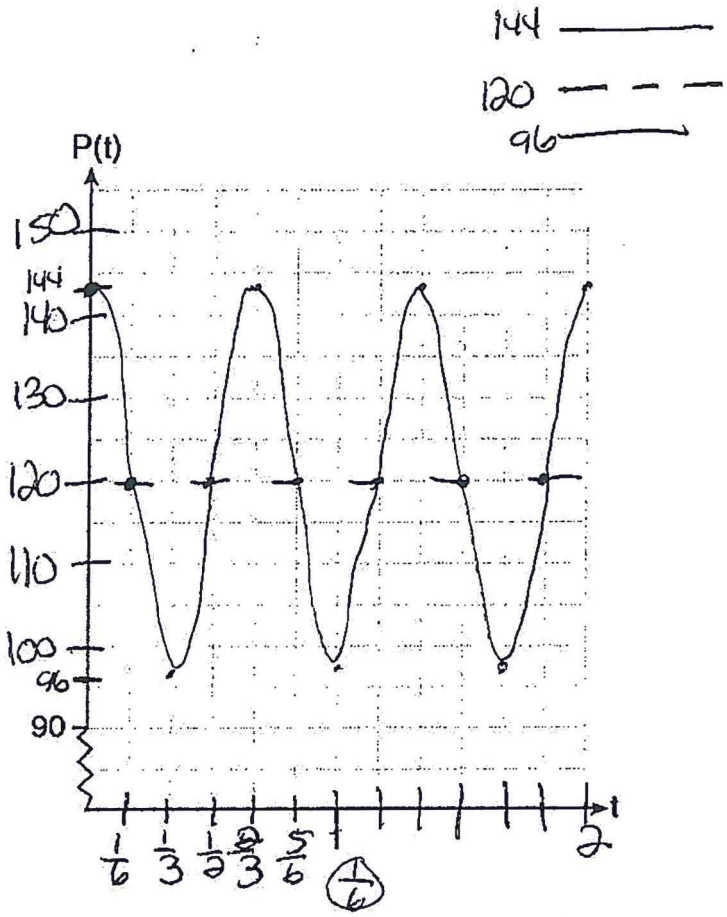
On the set of axes below, graph $y = P(t)$ over the domain $0 \le t \le 2$.

amp sin freq x shift
$24\cos(3\pi t) + 120$
amp = 24
+cos
freq = 3π
shift = 120

$P = \frac{2\pi}{f}$

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

$P = \frac{2}{3}$



Determine the period of P. Explain what this value represents in the given context. Normal resting blood pressure for an adult is 120 over 80. This means that the blood pressure oscillates between a maximum of 120 and a minimum of 80. Adults with high blood pressure (above 140 over 90) and adults with low blood pressure (below 90 over 60) may be at risk for health disorders. Classify the given patient's blood pressure as low, normal, or high and explain your reasoning.

$P = \frac{2}{3}$

It takes $\frac{2}{3}$ of a second for blood pressure to drop down and come back up.

High Blood Pressure
144 > 140 and 96 > 90