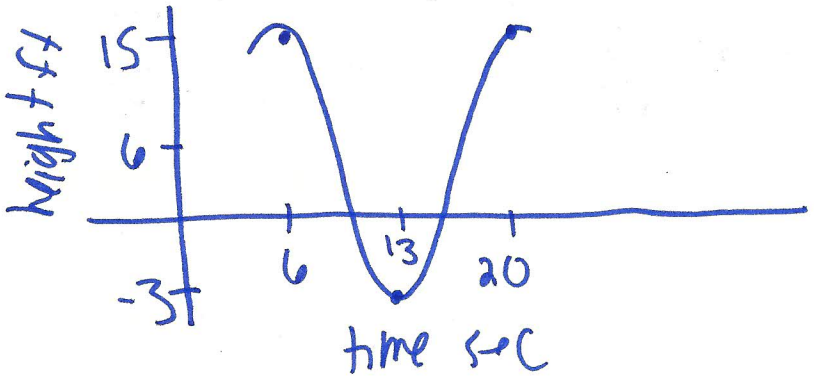
Sinusoidal Functions as Mathematical Models (1) Name:_____

1. Huckleberry Finn sat on the deck of a river steamboat. As the paddlewheel turned, a point on the paddle blade moved in such a way that its distance, d from the water's surface was a sinusoidal function of time. When his stopwatch read 6 seconds, the point was at its highest 15 feet above the water's surface. The wheel's diameter was 18 feet (part of the wheel is always underwater), and it completed a revolution every 14 seconds.

   a.) Sketch a graph of this sinusoid.




$A = 9$

$B = \frac{2\pi}{14} = \frac{\pi}{7}$

$C = 6$

$D = 6 \cos$

   b.) Write an equation for this sinusoid.

$y = 6 + 9\cos\frac{\pi}{7}(x-6)$

   c.) Where was the point when Huck started his stopwatch?

$x = 0$ 2.109 ft below surface

   d.) Where was the point when Huck's stopwatch read 20 seconds?

$x = 20$ 15 ft

   e.) What is the first positive value of time at which the point was at the water's surface? At that time, was it going into or coming out of the water?

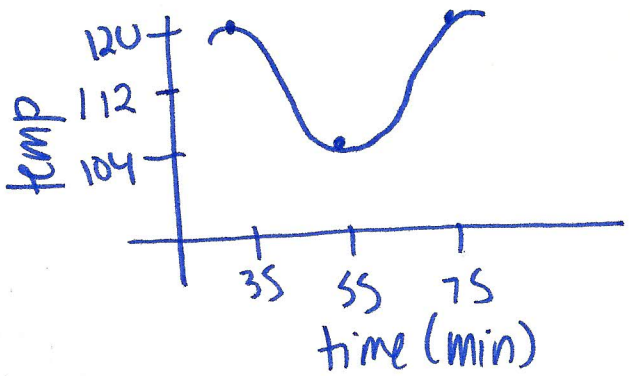
$y = 0$ .874 sec

   f.) When was the point 10 feet above the surface for the third time?

$y = 10$ 3rd time

2. Researches find a creature from an alien planet and discover that its body temperature varies sinusoidally with time. 35 minutes after they start timing, it reaches a high of $120^\circ$F. 20 minutes after that it reaches its next low, $104^\circ$F.

a.) Sketch a graph of this sinusoid.




$A = 8$

$B = \frac{2\pi}{40} = \frac{\pi}{20}$

$C = 112$

$D = 35$

b.) Write an equation expressing the alien's temperature in terms of minutes since the researchers starting timing.

$$y = 112 + 8\cos\frac{\pi}{20}(x - 35)$$

c.) What was its temperature when they started timing?

$x = 0$

$117.657^\circ$

d.) Find the first three times after they starting timing at which its temperature was $114^\circ$F.

$y = 114$

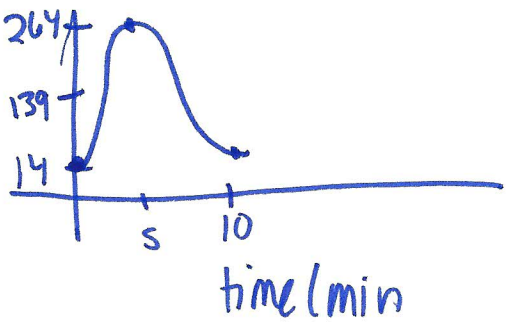
3.391 sec

26.609

43.491

3. The original Ferris wheel, built by George Ferris for the 1893 World's Fair, was much larger and slower than its modern counterparts. It had a diameter of 250 feet and contained 36 cars, each of which held 40 people. It made one revolution every 10 minutes and reached a maximum height of 264 feet. Grover Cleveland was given a private ride. He got on and the wheel starting slowly turning.

a.) Sketch a graph of this sinusoid.




$A = 125$

$B = \frac{2\pi}{10} = \frac{\pi}{5}$

$C = 139$

$D = 5$ or $-\cos 0$

b.) Write an equation expressing Grover's height above the ground in terms of time (in minutes) since the Ferris wheel started turning.

$y = 139 + 125 \cos \frac{\pi}{5}(x-5)$

or $y = 139 - 125 \cos \frac{\pi}{5} x$

c.) How high was Grover after 16 minutes?

$X = 16$

240.127ft

d.) When was he 200 feet above the ground for the 4th time?

$Y = 200$ Ft

16.689min