4.2 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.

$$A = 9 \qquad B = \frac{2\pi}{14} = \frac{\pi}{7}$$
$$C = 6 \qquad D: \cos 6 \text{ or } 20$$
$$ -\cos 13$$
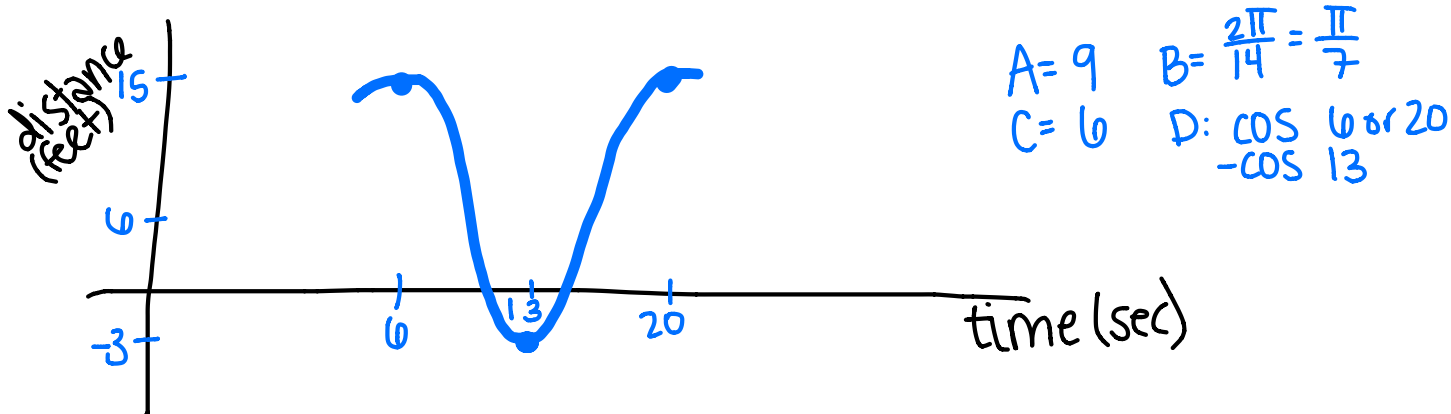
   b.) Write an equation for this sinusoid.

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

   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?
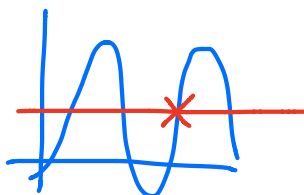
$y = 0$ .874 sec, coming out of water

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

$y = 10$ y_1 = function
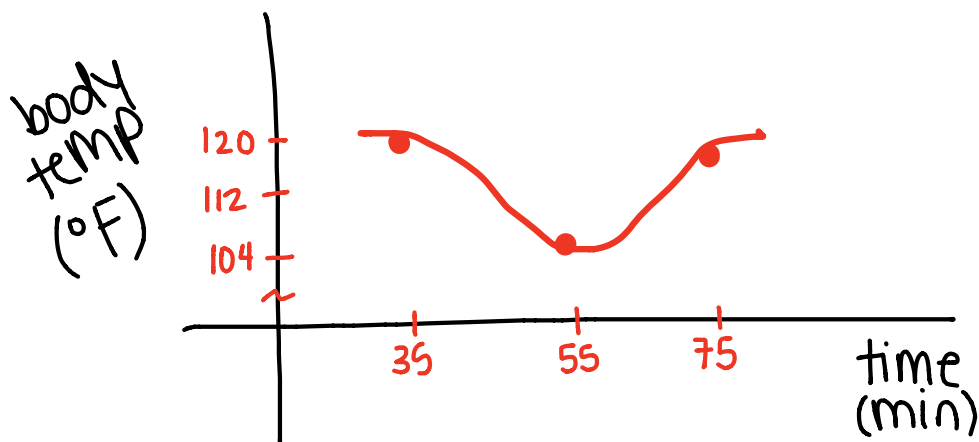3rd time $y_2 = 10$ 17.526 sec

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 $120°$ F. 20 minutes after that it reaches its next low, $104°$ F.

a.) Sketch a graph of this sinusoid.

$A = 8 \qquad B = \frac{2\pi}{40} = \frac{\pi}{20}$

$C = 112 \qquad D: \cos 35 \text{ or } 75$

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?

$X = 0 \qquad 117.657 °F$

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

$Y_1 = \text{function}$
$Y_2 = 114$

3.391 sec
26.609 sec
43.491 sec

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.
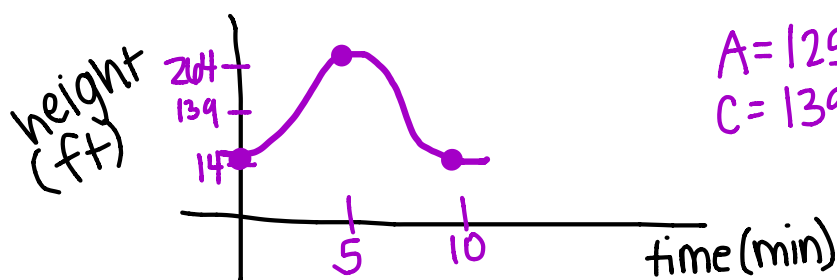
height (ft)

$A = 125$ $B = \frac{2\pi}{10} = \frac{\pi}{5}$

$C = 139$ D: $\cos 5$

$-\cos 0$ or 10

time (min)

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

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

c.) How high was Grover after 16 minutes?

$x = 16$ 240.127 ft

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

$y = 200$ ft 16.689 min