Name _______________ Date _____________
Mr. Schlansky Algebra II

Sinusoidal Applications

1. Which statement is *incorrect* for the graph of the function $y=-3\cos\left[\frac{\pi}{3}(x-4)\right]+7$?

1) The period is 6.
2) The amplitude is 3.
3) The range is [4,10].
4) The midline is $y=-4$.

2. Which function's graph has a period of 8 and reaches a maximum height of 1 if at least one full period is graphed?

1) $y=-4\cos\left(\frac{\pi}{4}x\right)-3$
2) $y=-4\cos\left(\frac{\pi}{4}x\right)+5$
3) $y=-4\cos(8x)-3$
4) $y=-4\cos(8x)+5$

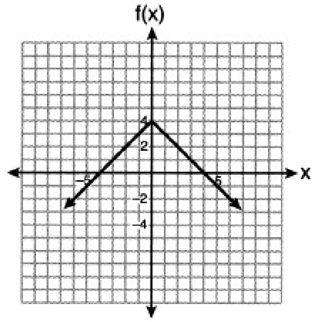
3. The equation below can be used to model the height of a tide in feet, $H(t)$, on a beach at t hours.

$$H(t)=4.8\sin\left(\frac{\pi}{6}(t+3)\right)+5.1$$

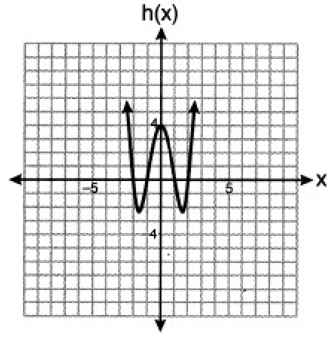
Using this function, the amplitude of the tide is

1) $\frac{\pi}{6}$
2) 4.8
3) 3
4) 5.1

4. Which function has a maximum y-value of 4 and a midline of $y=1$?

1)


2) $g(x)=-3\cos(x)+1$

3)


4) $j(x)=4\sin(x)+1$

5. The depth of the water, $d(t)$, in feet, on a given day at Thunder Bay, t hours after midnight is modeled by $d(t) = 5\sin\left(\frac{\pi}{6}(t-5)\right) + 7$. Which statement about the Thunder Bay tide is *false*?

1) A low tide occurred at 2 a.m.
2) The maximum depth of the water was 12 feet.
3) The water depth at 9 a.m. was approximately 11 feet.
4) The difference in water depth between high tide and low tide is 14 feet.

6. A person's lung capacity can be modeled by the function $C(t) = 250\sin\left(\frac{2\pi}{5}t\right) + 2450$, where $C(t)$ represents the volume in mL present in the lungs after t seconds. State the maximum value of this function over one full cycle, and explain what this value represents.

7. Based on climate data that have been collected in Bar Harbor, Maine, the average monthly temperature, in degrees F, can be modeled by the equation $B(x) = 23.914\sin(0.508x - 2.116) + 55.300$. The same governmental agency collected average monthly temperature data for Phoenix, Arizona, and found the temperatures could be modeled by the equation $P(x) = 20.238\sin(0.525x - 2.148) + 86.729$. Which statement can *not* be concluded based on the average monthly temperature models x months after starting data collection?

1) The average monthly temperature variation is more in Bar Harbor than in Phoenix.
2) The midline average monthly temperature for Bar Harbor is lower than the midline temperature for Phoenix.
3) The maximum average monthly temperature for Bar Harbor is 79° F, to the nearest degree.
4) The minimum average monthly temperature for Phoenix is 20° F, to the nearest degree.

8. The average monthly temperature of a city can be modeled by a cosine graph. Melissa has been living in Phoenix, Arizona, where the average annual temperature is 75°F. She would like to move, and live in a location where the average annual temperature is 62°F. When examining the graphs of the average monthly temperatures for various locations, Melissa should focus on the

1) amplitude
2) horizontal shift
3) period
4) midline

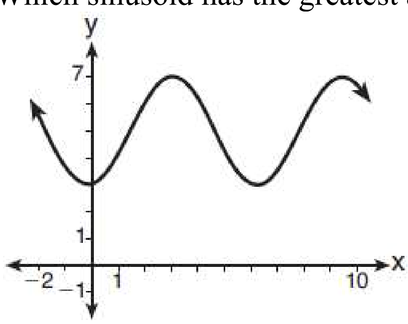
9. Tides are a periodic rise and fall of ocean water. On a typical day at a seaport, to predict the time of the next high tide, the most important value to have would be the

1) time between consecutive low tides
2) time when the tide height is 20 feet
3) average depth of water over a 24-hour period
4) difference between the water heights at low and high tide

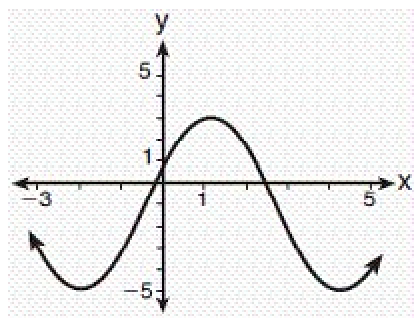
10. Consider the function $h(x) = 2\sin(3x) + 1$ and the function q represented in the table below. Determine which function has the *smaller* minimum value for the domain $[-2, 2]$. Justify your answer.

x	$q(x)$
−2	−8
−1	0
0	0
1	−2
2	0

11. Which sinusoid has the greatest amplitude?

1) 

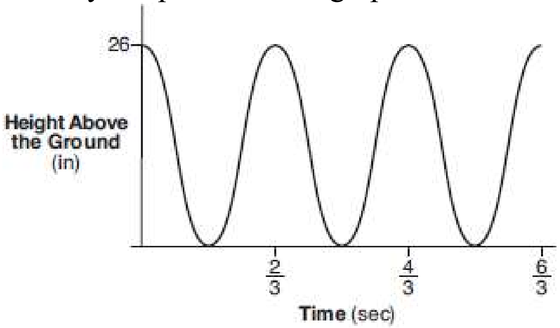
2) $y = 3\sin(\theta - 3) + 5$

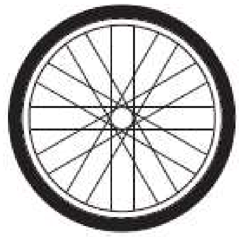
3) 

4) $y = -5\sin(\theta - 1) - 3$

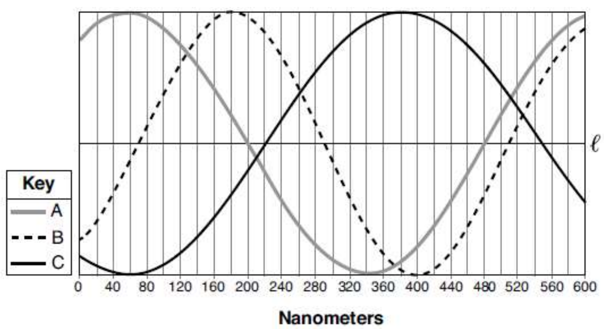
12. The graph below represents the height above the ground, h, in inches, of a point on a triathlete's bike wheel during a training ride in terms of time, t, in seconds.

Identify the period of the graph and describe what the period represents in this context.





13. Visible light can be represented by sinusoidal waves. Three visible light waves are shown in the graph below. The midline of each wave is labeled ℓ. Based on the graph, which light wave has the longest period? Justify your answer.



14. The Sea Dragon, a pendulum ride at an amusement park, moves from its central position at rest according to the trigonometric function $P(t) = -10\sin(\frac{\pi}{3}t)$, where t represents time, in seconds. How many seconds does it take the pendulum to complete one full cycle?

1) 5
2) 6
3) 3
4) 10

15. A wave displayed by an oscilloscope is represented by the equation $y = 3\sin x$. What is the period of this function?

1) 2π
2) 2
3) 3
4) 3π

16. The height above ground for a person riding a Ferris wheel after t seconds is modeled by $h(t) = 150\sin\left(\frac{\pi}{45}t + 67.5\right) + 160$ feet. How many seconds does it take to go from the bottom of the wheel to the top of the wheel?

1) 10
2) 45
3) 90
4) 150

17. As θ increases from $-\frac{\pi}{2}$ to 0 radians, the value of $\cos\theta$ will

1) decrease from 1 to 0
2) decrease from 0 to -1
3) increase from -1 to 0
4) increase from 0 to 1

18. Given $p(\theta) = 3\sin\left(\frac{1}{2}\theta\right)$ on the interval $-\pi < \theta < \pi$, the function p

1) decreases, then increases
2) increases, then decreases
3) decreases throughout the interval
4) increases throughout the interval

19. As x increases from 0 to $\frac{\pi}{2}$, the graph of the equation $y = 2\tan x$ will

1) increase from 0 to 2
2) decrease from 0 to -2
3) increase without limit
4) decrease without limit

20. As x increases from $\frac{3\pi}{2}$ to 2π, the graph of $y = \csc x$ will

1) increase without limit
2) decrease without limit
3) increase to -1
4) decrease to 1

21. As x increases from $-\frac{\pi}{2}$ to 0, the graph of $y = \sec x$ will

1) increase without limit
2) decrease without limit
3) increase to -1
4) decrease to 1