7.1 High Noon and Sunset Shadows

A Develop Understanding Task

In this task we revisit the amusement park Ferris wheel that caused Carlos so much anxiety. Recall the following facts from previous tasks:

- The Ferris wheel has a radius of 25 feet
- The center of the Ferris wheel is 30 feet above the ground
- The Ferris wheel makes one complete rotation counterclockwise every 20 seconds

The amusement park Ferris wheel is located next to a high-rise office complex. At sunset, the moving carts cast a shadow on the exterior wall of the high-rise building. As the Ferris wheel turns, you can watch the shadow of a rider rise and fall along the surface of the building. In fact, you know an equation that would describe the motion of this "sunset shadow."

1. Write the equation of this "sunset shadow."

At noon, when the sun is directly overhead, a rider casts a shadow that moves left and right along the ground as the Ferris wheel turns. In fact, you know an equation that would describe the motion of this "high noon shadow."

2. Write the equation of this "high noon shadow."

3. Based on your previous work, you probably wrote these equations in terms of the angle of rotation being measured in degrees. Revise you equations so the angle of rotation is measured in radians.

   a. The "sunset shadow" equation in terms of radians:

   b. The "high noon shadow" equation in terms of radians:

4. In the equations you wrote in question 3, where on the Ferris wheel was the rider located at time $t = 0$? (We will refer to the position as the rider's *initial position* on the wheel.)

5. Revise your equations from question 3 so that the rider's initial position at $t = 0$ is at the top of the wheel.

   a. The "sunset shadow" equation, initial position at the top of the wheel:

   b. The "high noon shadow" equation, initial position at the top of the wheel:

6. Revise your equations from question 3 so that the rider's initial position at $t = 0$ is at the bottom of the wheel.

   a. The "sunset shadow" equation, initial position at the bottom of the wheel:

   b. The "high noon shadow" equation, initial position at the bottom of the wheel:

7. Revise your equations from question 3 so that the rider's initial position at $t = 0$ is at the point farthest to the left of the wheel.

   a. The "sunset shadow" equation, initial position at the point farthest to the left of the wheel:

   b. The "high noon shadow" equation, initial position at the point farthest to the left of the wheel:

8. Revise your equations from question 3 so that the rider's initial position at $t = 0$ is halfway between the farthest point to the right on the wheel and the top of the wheel.

   a. The "sunset shadow" equation, initial position halfway between the farthest point to the right on the wheel and the top of the wheel:

   b. The "high noon shadow" equation, initial position halfway between the farthest point to the right on the wheel and the top of the wheel:

9. Revise your equations from question 3 so that the wheel rotates twice as fast.

   a. The "sunset shadow" equation for the wheel rotating twice as fast:

   b. The "high noon shadow" equation for the wheel rotating twice as fast:

10. Revise your equations from question 3 so that the radius of the wheel is twice as large and the center of the wheel is twice as high.

    a. The "sunset shadow" equation for a radius twice as large and the center twice as high:

    b. The "high noon shadow" equation for a radius twice as large and the center twice as high:

11. Carlos wrote his "sunset equation" for the height of the rider in question #5 as $h(t) = 50\sin\left(\frac{\pi}{10}t + \frac{\pi}{2}\right) + 30$. Clarita wrote her equation for the same problem as $h(t) = 50\sin\left(\frac{\pi}{10}(t+5)\right) + 30$.

    a. Are both of these equations equivalent? How do you know?

    b. Carlos says his equation represents starting the rider at an initial position at the top of the wheel. What does Clarita's equation represent?

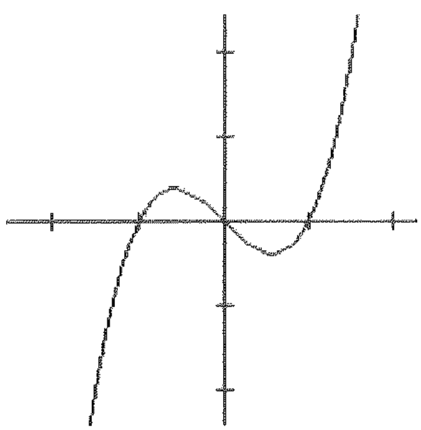
READY, SET, GO! Name Period Date

READY

Topic: Recalling invertible functions and even and odd functions

Indicate which of the following functions have an inverse that is a function. If the function has an inverse, sketch it in. (Remember, the inverse will reflect across the y = x line. Sketch that in, too.) Finally, label each one as *even*, *odd*, or *neither*. Recall that an *even* function is symmetric with the y-axis, while an *odd* function is symmetric with respect to the origin.

1.



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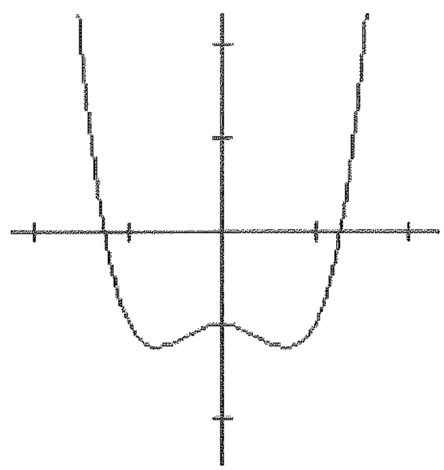

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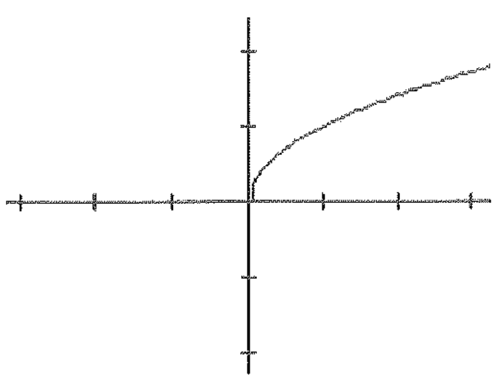

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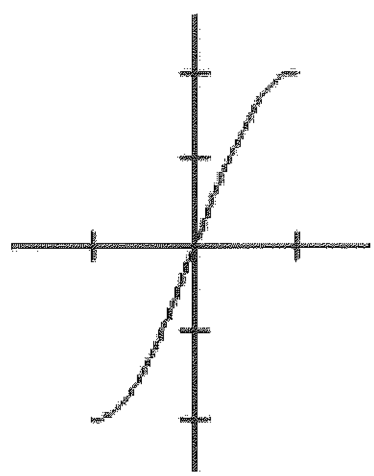
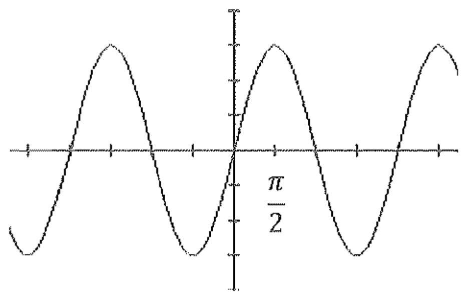


SET

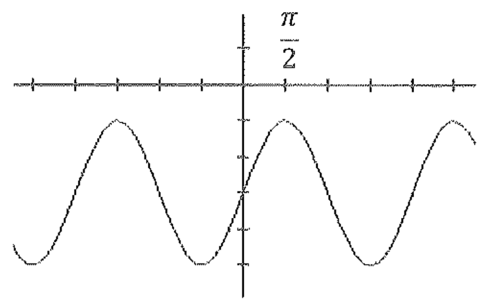
Topic: Connecting transformed trig graphs with their equations

State the period, amplitude, vertical shift, and phase shift of the function shown in the graph. Then write the equation. Use the same trigonometric function as the one that is given.

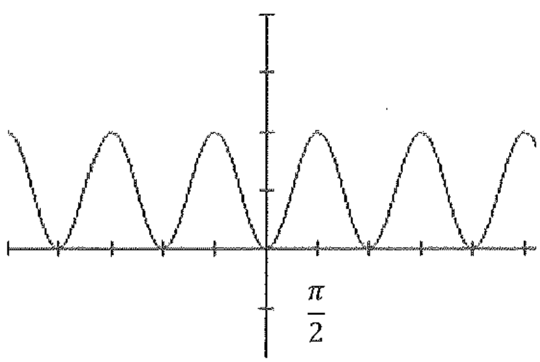
5. $y = \sin x$



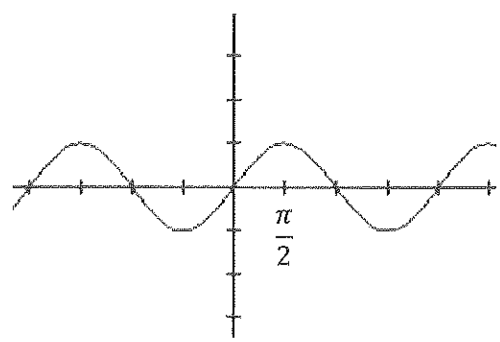
6. $y = \sin x$



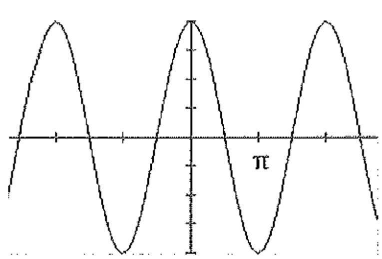
7. $y = \cos x$



8. $y = \cos x$



9. $y = \sin x$



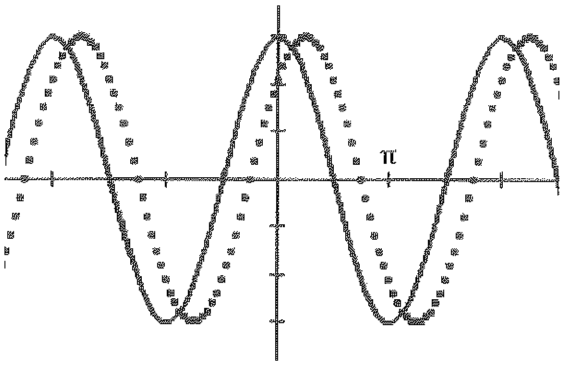
10. The cofunction identity states that $\sin\theta = \cos(90° - \theta)$ *and* $\sin(\theta - 90°) = \cos\theta$. How does this identity relate to the graph in #9?

Explain where you would see this identity in a right triangle.

Describe the relationships between the graphs of $f(x)$ - solid and $g(x)$ - dotted.

Then write their equations.

11.



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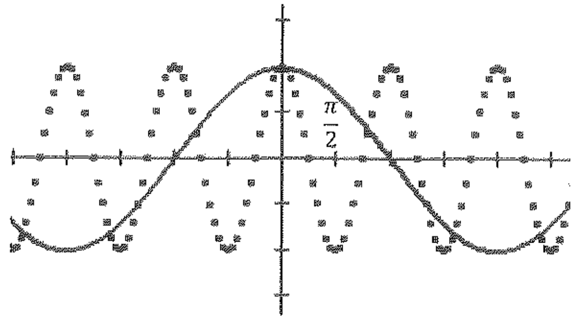
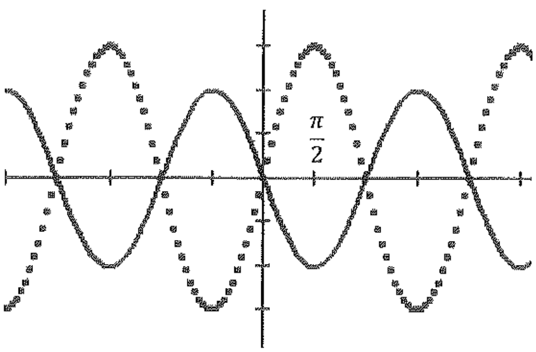


13. This graph could be interpreted as a shift or a reflection. Write the equations both ways.



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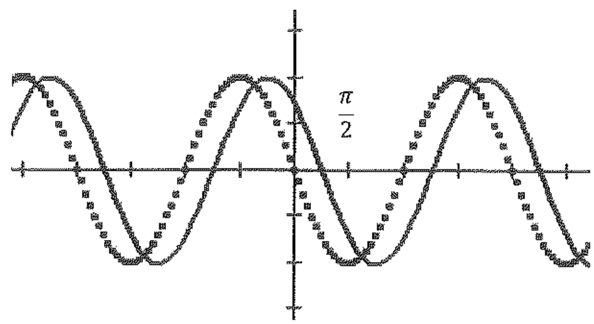
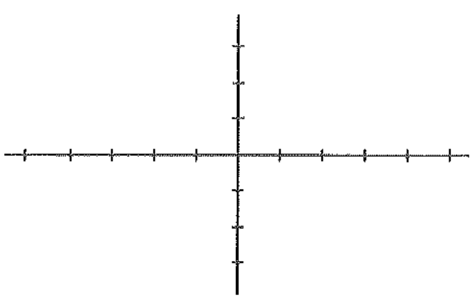
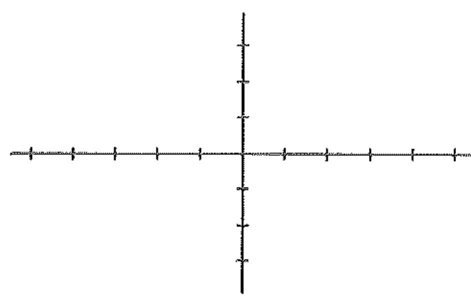


Sketch the graph of the function.
(Include 2 full periods. Label the scale of your horizontal axis.)

15. $y = 3\sin\left(x - \frac{\pi}{2}\right)$



16. $y = -2\cos(x + \pi)$



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GO

Topic: Finding angles of rotation for the same trig ratio

Name two values for θ (angles of rotation) that have the given trig ratio. $0 < \theta \leq 2\pi$.

17. $\sin\theta = \frac{\sqrt{2}}{2}$

18. $\cos\theta = \frac{\sqrt{2}}{2}$

19. $\cos\theta = -\frac{1}{2}$

20. $\sin\theta = 0$

21. $\sin\theta = -\frac{\sqrt{3}}{2}$

22. $\cos\theta = -\frac{\sqrt{3}}{2}$

23. For which angles of rotation does $\sin\theta = \cos\theta$?