10 Many variations on the sine and cosine functions are also periodic functions.

a. Find the amplitude, period, and y-displacement for each of the following functions.

i. $y = 2 \cos(-x) + 3$

ii. $y = -3 \sin 0.1x + 5$

iii. $y = 12 \sin 3x - 8$

b. Suppose data from a periodic variable are fit well by a function of the form $y = a \cos bx + c$ where $a < 0$ and $b > 0$. A plot of the data suggests a y-displacement of -5, amplitude of 7, and period of 6π. Write a function rule for this data.

11 The center of a Ferris wheel in an amusement park is 7 meters above the ground and the Ferris wheel itself is 12 meters in diameter. The wheel turns counterclockwise at a constant rate and takes 20 seconds to make one complete revolution.

a. Yolanda and her friend enter their seat when it is directly below the wheel's center. Sketch a graph that you would expect to show their height above the ground during one minute at full rotational speed, starting from the entry point.

b. Make a table of values for the radian measure t and the height $h(t)$ of Yolanda's seat above the ground at 5 second intervals for the one-minute ride.

c. Use the data pairs in Part b to sketch a graph of the height $h(t)$ as a function of time t. Compare this graph to the one you drew by hand in Part a?

d. Is this function periodic? If so, what is its period? What is its amplitude?

e. Several functions that students predicted would fit the data in Part b are given below. In each case, $\frac{\pi}{10}$ is angular velocity in radians per second, t is time in seconds, and $h(t)$ is height in meters. Determine if any are good fits for the data.

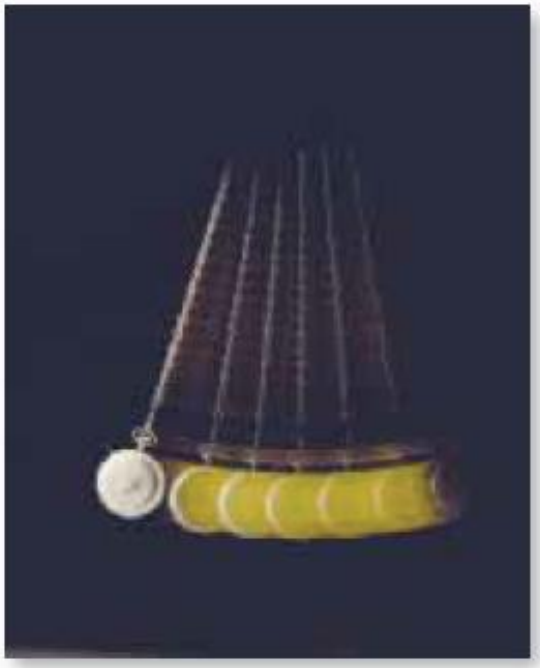
i. $h(t) = 6 \sin \frac{\pi t}{10} + 7$

ii. $h(t) = -6 \cos \frac{\pi t}{10} + 7$

iii. $h(t) = -6 \sin \frac{\pi}{10}(t + 5) + 7$

iv. $h(t) = 6 \cos \frac{\pi t}{10} + 7$

12 Suppose that you are trying to model the motion of a clock pendulum that moves as far as 5 inches to the right of vertical and swings with a period of 2 seconds.



a. Find variations of $d(t) = \cos t$ that fit the conditions for each part below.

i. A modeling function whose values range from -5 to 5 and has a period of 2π

ii. A modeling function that has a period of 2 and whose values range from -1 to 1

iii. A modeling function that has a period of 2 and whose values range from -5 to 5

b. How are the numbers in the function for Part aiii related to the motion of the pendulum you are modeling?

c. Graph the function that models the motion of the clock pendulum. Identify the coordinates of the t-intercepts and minimum and maximum points of the graph.

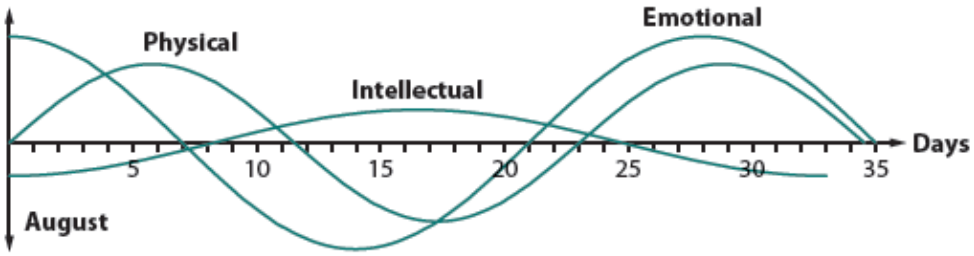
19 Use the language of geometric transformations to describe the relationships between the graphs of the following pairs of functions.

a. $-\cos t$ and $\cos t$

b. $5 + \sin t$ and $\sin t$

c. $5 \cos t$ and $\cos t$

26 The *biorhythm* theory asserts that a person's biological functioning is controlled by three inner rhythms which begin at birth: physical, emotional, and intellectual. These rhythms vary sinusoidally with time. Biorhythm graphs are used by athletes as well as industrial firms to predict potential "good" or "bad" performance days for a person. Use the labeled graphs below to determine the period of each biorhythm.



a. Physical **b.** Emotional **c.** Intellectual

d. According to biorhythm theory, when a cycle is near a high point, a person can perform well in an activity requiring the corresponding biological functioning. Similarly, low points in the cycle are associated with times of low performance. What date(s) would be best for a person to run a 10-km race?

41 Use each *NOW-NEXT* rule to produce a table of values that illustrates the pattern of change from the start value through 5 stages of change.

a. $NEXT = NOW + 2.5$, starting at 3

b. $NEXT = \frac{1}{2}NOW - 50$, starting at 450