Name ____ Date __________

5.6 Modeling with Trigonometric Functions

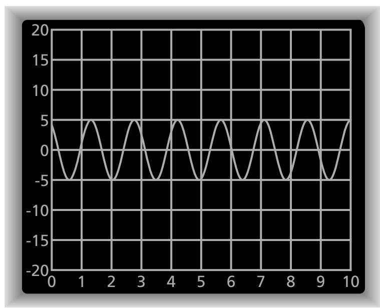
For use with Exploration 5.6

Essential Question What are the characteristics of the real-life problems that can be modeled by trigonometric functions?

1 EXPLORATION: Modeling Electric Currents

Work with a partner. Find a sine function that models the electric current shown in each oscilloscope screen. State the amplitude and period of the graph.

a.



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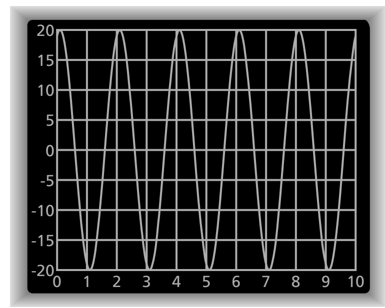
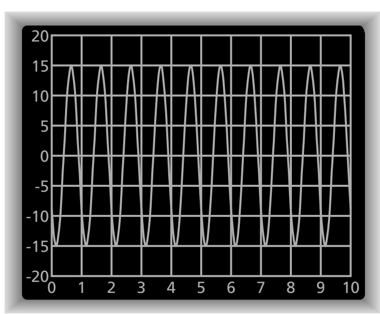


c.



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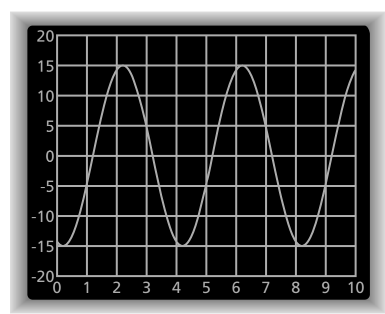
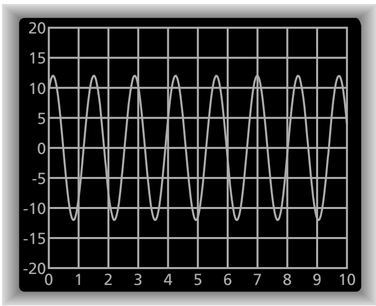
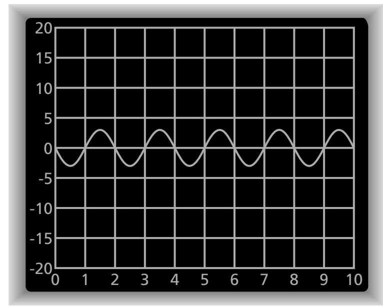


1 EXPLORATION: Modeling Electric Currents (continued)

e.



f.



Communicate Your Answer

2. What are the characteristics of the real-life problems that can be modeled by trigonometric functions?

3. Use the Internet or some other reference to find examples of real-life situations that can be modeled by trigonometric functions.

Name ____ Date __________

5.6 Practice

For use after Lesson 5.6

Notes:

Worked-Out Examples

Example #1

Find the frequency of the function.

$y = \sin 3x$

The period is $\frac{2\pi}{3}$.

$$\begin{aligned} \text{frequency} &= \frac{1}{\text{period}} \\ &= \frac{1}{\frac{2\pi}{3}} \\ &= \frac{3}{2\pi} \end{aligned}$$

Example #2

Find the frequency of the function.

$y = \cos \frac{\pi x}{4}$

The period is 8.

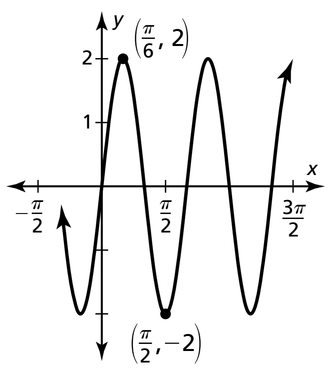
$$\begin{aligned} \text{frequency} &= \frac{1}{\text{period}} \\ &= \frac{1}{8} \end{aligned}$$

Practice A

1. An alternating current generator (AC generator) converts motion to electricity by generating sinusoidal voltage. Assuming that there is no vertical offset and phase shift, the voltage oscillates between −170 volts and +170 volts with a frequency of 60 hertz. Write and graph a sine model that gives the voltage V as a function of the time t (in seconds).

In Exercises 2–5, write a function for the sinusoid.

2.



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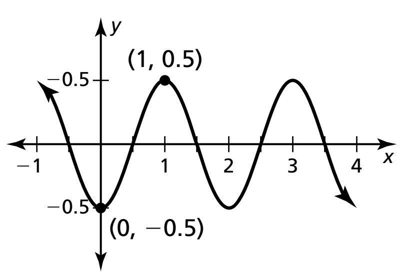

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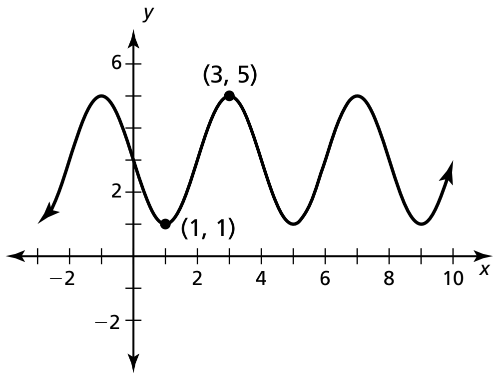

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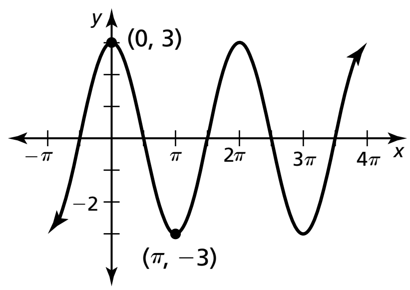


6. The pedal of a bicycle wheel is 7 inches long. The lowest point of the pedal is 4 inches above the ground. A cyclist pedals 3 revolutions per second. Write a model for the height h (in inches) of the pedal as a function of the time t (in seconds) given that the pedal is at its lowest point when $t = 0$.

7. The London Eye, the tallest Ferris wheel in Europe, has a diameter of 120 meters and the whole structure is 135 meters tall. The Ferris wheel completes one revolution in about 30 minutes. Write a model for the height h (in meters) of a passenger capsule as a function of the time t (in seconds) given that the capsule is at its highest point when $t = 0$.

Name ____ Date _________

Practice B

In Exercises 1–4, find the frequency of the function.

1. $y = \cos 3x$

2. $y = -\cos 4x - 3$

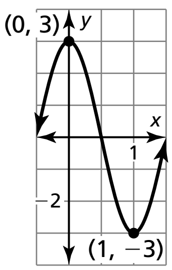
3. $y = \sin \frac{\pi x}{2}$

4. $y = 4 \cos 0.4x - 3$

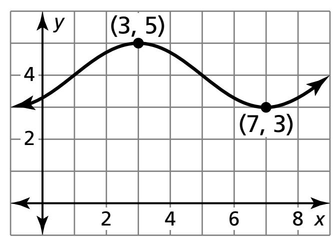
5. A sub-contra-octave A tuning fork (corresponds to the lowest note on a piano keyboard) vibrates with a frequency f of 27.5 hertz (cycles per second). You strike a sub-contra-octave A tuning fork with a force that produces a maximum pressure of 4 Pascals. Write and graph a sine model that gives the pressure P as a function of the time t (in seconds).

In Exercises 6 and 7, write a function for the sinusoid.

6.



7.



8. When you ride a Ferris wheel, your distance from the ground will vary with respect to the number of seconds that have elapsed since the wheel started. The table shows your height h (in meters) above the ground at time t as you ride the Ferris wheel.

t	0	1	2	3	4	5	6	7	8	9	10	11	12	15	20
h	1	2.3	5.8	10.2	13.7	15	13.7	10.2	5.8	2.3	1	2.3	5.8	15	1

a. Use sinusoidal regression to find a model that gives h as a function of t.

b. Predict your height above the ground after 42 seconds have elapsed.