Assignment

Write

Describe the types of situations that can be modeled using trigonometric functions.

Remember

The key characteristics of periodic functions, including period, amplitude, midline, and phase shift, are used to model components of real-world situations.

Practice

1. The height of a roller coaster can be modeled by the function $f(x) = 20\cos\left(\frac{\pi}{60}x\right) + 30$, where x represents the horizontal distance from the start of the ride in meters, and $f(x)$ represents the vertical height of the ride in meters.
   a. Determine the amplitude of the function. What does it represent in terms of this problem situation?
   b. Determine the period of the function. What does it represent in terms of this problem situation?
   c. Determine the vertical shift of the function. What does it represent in terms of this problem situation?
2. The table shows the average monthly high temperature for a town in Tennessee. This data can be modeled with a sine function.

Month	1	2	3	4	5	6	7	8	9	10	11	12
Average High Temperature (°F)	50	53	60	71	80	87	90	89	84	73	59	50

a. Plot the points from the table using the number of the month for your independent variable and the average high temperature for your dependent variable.
b. Determine the amplitude, period, and vertical shift of the function that could be used to model this data. Explain your reasoning.
c. Use technology to perform a sinusoidal regression for the data. Write the regression equation. Is this model a good fit for the data? Explain your reasoning.

Stretch

1. The data in the tables show the fraction of the Moon illuminated at midnight each day in the month of February, 2018. This data can be modeled with a sine function.

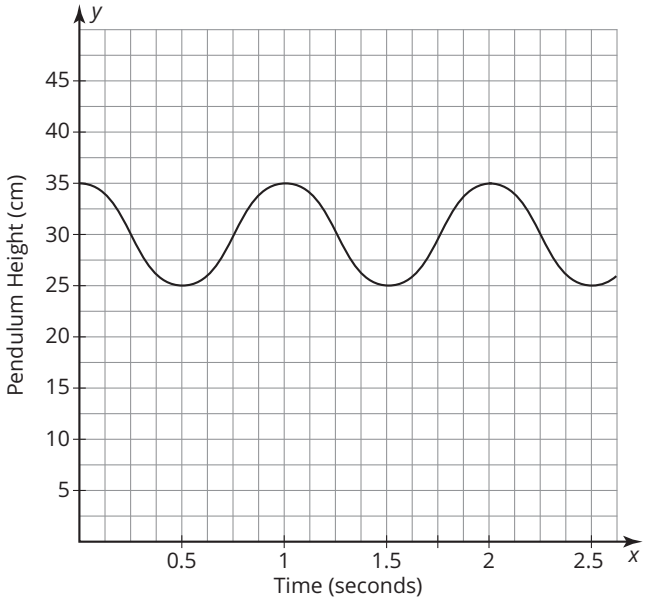
Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Fraction of Moon Illuminated	0.99	0.96	0.90	0.83	0.74	0.64	0.55	0.45	0.35	0.27	0.19	0.12	0.07	0.03

Day	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Fraction of Moon Illuminated	0	0	0.02	0.05	0.11	0.18	0.27	0.38	0.49	0.6	0.71	0.81	0.89	0.95

a. Plot the points from the table using the number of the day for the independent variable and the fraction of the Moon illuminated for the dependent variable.
b. Determine the amplitude and period of the function that could be used to model this data. Explain your reasoning.
c. Use technology to perform a sinusoidal regression for the data. Write the regression equation. Is this model a good fit for the data? Explain your reasoning.

Review

1. Use a periodicity identity to list three solutions for the equation $\cos x = -\frac{1}{2}$.
2. Solve the equation over the domain of all real numbers: $5 + 4\cos\theta = 3$.
3. A pendulum clock swings back and forth. At rest, the pendulum is 25 cm above the base. At the highest point of the swing, the pendulum is 35 cm above the base. It takes the pendulum 2 seconds to swing back and forth. The graph shows the height of the pendulum above the base as a function of seconds. Assume the pendulum is released from its highest point.
   a. Determine the amplitude of the function.
   b. Determine the period of the function.
   c. Determine the height of the pendulum at 3.75 seconds.



4. Solve each equation. Round your answers to the thousandths, if necessary.
   a. $\left(\frac{2}{3}\right)^x = 5^{3-x}$
   b. $2\log_5 x = 3\log_5 2$