Assignment

Write

Describe a real-world example of a damping function.

Remember

A trigonometric function and an exponential function can be combined to model a periodic function whose amplitude decreases over time. The function that is multiplied to the periodic function is called a damping function.

Practice

1. Jordan is swinging on a rope swing that swings over a creek. When he jumps on the swing, he is 20 feet away from the center of the creek. He then swings out to 20 feet past the center of the creek to the other side. As he swings, he pumps his legs to keep his swinging motion constant. Amelia times Jordan as he swings. Jordan's distance in feet from the center of the creek, d, can be modeled with a trigonometric function of the time he swings, t, in seconds. It takes Jordan 2 seconds to swing from one side of the creek to the other.
   a. Sketch the graph of a function that could be used to model this problem situation.
   b. Write the equation of the cosine function, $d(t)$, that can be used to model the distance Jordan is from the center of the creek as a function of time.
   c. Use the equation from part (b) to determine Jordan's distance from the center of the creek at 9.5 seconds. Round your answer to the nearest foot.
   d. Use the equation from part (b) to determine when Jordan is 6 feet from the center of the creek. Round your answer to the nearest tenth of a second.
2. Amelia is swinging on a rope swing over a creek. When she jumps on the swing, she is 20 feet away from the center of the creek. She then swings out past the center of the creek toward the other side. She decides that she will not pump her legs to keep the swing moving and will just let it swing until it stops. Jordan times Amelia as she swings. Suppose Amelia's distance on each side of the creek decreases at a rate of 20% on each swing. It takes her 2 seconds to swing toward the other side of the creek on her first swing.
   a. Determine the distance Amelia swings past the center of the creek on her first trip over the creek on her initial swing.
   b. Determine the distance Amelia swings past the center of the creek on her second trip over the creek.
   c. Write an equation to represent Amelia's distance, d, in terms of the time, t, after each trip across the creek. Hint: It takes 2 seconds for Amelia to swing from one side of the creek to the other.
   d. Let the function $d(t) = -20\cos\left(\frac{\pi}{2}t\right)$ represent Amelia's distance from the center of the creek if she was swinging at a constant rate back and forth. Use this function to write a new function that represents Amelia's actual distance from the center of the creek given that her distance decreases by 20% each time she swings back over the creek.
   e. Determine Amelia's distance from the center of the creek after 10 seconds. Round your answer to the nearest foot.

Stretch

1. Lian is swinging on a rope swing over a creek. As she swings, she pumps her legs to keep her swinging motion constant. The table shows her distances from the center of the creek from the moment she jumps on the swing until 8 seconds have passed.

Time (seconds)	0	1	2	3	4	5	6	7	8
Distance (feet)	−15	0	15	0	−15	0	15	0	−15

   a. Sketch the graph of a function that could be used to model this problem situation.
   b. Write the equation of the cosine function, $d(t)$, that can be used to model the distance Lian is from the center of the creek as a function of time.

When Lian is at the spot where she first jumped on the swing, she decides to stop pumping her legs and just let it swing until it stops. The table shows her distances from the center of the creek from the moment she stops pumping her legs until 8 seconds have passed.

Time (seconds)	0	1	2	3	4	5	6	7	8
Distance (feet)	−15	0	11.25	0	−8.4375	0	6.328125	0	−4.74609375

c. Sketch the graph of a function that could be used to model this problem situation.
d. Write an equation to represent Lian's distance, d, in terms of the time, t, after each trip across the creek.
e. Use your function from part (b) to write a new function to represent Lian's actual distance from the center of the creek in terms of the time, t.

Review

1. A person is riding a Ferris wheel. The graph shows the person's height from the ground in feet as a function of time in seconds. The time starts when the rider boards the ride.
   a. Determine the amplitude of the function. Explain your reasoning.
   b. Calculate the period and value of B of the function. Explain your reasoning.
   c. Determine the values of C and D of the function if a cosine function is used to model the problem situation. Explain how you determined your answers.
   d. Write a trigonometric function to model the height of the rider from the ground as a function of time.
2. Add the rational expressions.
   a. $\frac{6}{x-1} + \frac{x}{4}$
   b. $\frac{3}{x-1} + \frac{4}{x+2}$