

Word Problems Sinusoidal Curves

1. A lighthouse beam rotates in a circular pattern and its height above the water can be modeled using a sine function.
The light starts at the midpoint height of 40 feet, rises to a maximum height of 70 feet, and completes one full rotation every 24 seconds.
Write an equation to model the height of the light above the water.
2. A person rides a Ferris wheel where the rider starts at the highest point, 80 feet above the ground.
The wheel has a minimum height of 20 feet and completes one revolution every 40 seconds.
Using a cosine function, write an equation to model the rider's height above the ground.
3. A buoy floating in the ocean moves up and down with the waves.
The buoy oscillates between 2 feet and 10 feet above the ocean floor and starts at its midpoint height rising upward.
The motion repeats every 12 seconds.
Write a sine equation to model the buoy's height.
4. A pendulum swings back and forth so that its horizontal displacement can be modeled periodically.
The pendulum swings 6 inches to either side of its center position and starts at maximum displacement.
One complete swing cycle takes 2π seconds.
Write a cosine equation to model the pendulum's displacement.
5. A bicycle wheel reflector moves in a circular path.
The reflector starts at the midpoint height of 14 inches and rises to a maximum height of 26 inches.
The wheel completes one rotation every $\frac{\pi}{2}$ seconds.
Write a sine equation to model the reflector's height above the ground.
6. A diver standing on a platform bounces vertically on a springboard before diving.
The diver's height oscillates between 4 feet and 10 feet above the water and starts at the lowest point.
The motion repeats every $\frac{\pi}{3}$ seconds.
Write a cosine equation to model the diver's height.
7. The temperature inside a greenhouse varies periodically during the day.
The temperature fluctuates between 60°F and 84°F and starts at the average temperature increasing upward.
The cycle repeats every 24 hours.
Write a sine equation to model the temperature.

8. A seat on a carnival ride moves in a circular motion.
The rider starts at the minimum height of 5 feet and rises to a maximum height of 45 feet.
The ride completes one rotation every $\frac{\pi}{4}$ minutes.
Write a cosine equation to model the rider's height.
9. A point on the edge of a rotating fan blade moves vertically.
The point oscillates between -8 inches and 8 inches relative to the center and starts at maximum height.
The fan completes one rotation every $\frac{\pi}{6}$ seconds.
Write a cosine equation to model the point's vertical position.
- 10.** A child on a merry-go-round moves up and down slightly while riding.
The child's height varies between 3 feet and 7 feet above the platform and starts at the midpoint rising upward.
The motion repeats every $\frac{\pi}{2}$ seconds.
Write a sine equation to model the child's height.

Solutions Word Problems

1. Lighthouse Beam

Step 1: Find the midline

$$\frac{70 + 40 - 30}{2} = 40$$

So, the vertical shift is:

$$D = 40$$

Step 2: Find the amplitude

$$A = \frac{70 - 10}{2} = 30$$

Step 3: Find B

The period is 24 seconds.

$$B = \frac{2\pi}{24} = \frac{\pi}{12}$$

Step 4: Determine the function

The light starts at the midpoint and rises, so use sine.

$$y = 30\sin\left(\frac{\pi}{12}x\right) + 40$$

2. Ferris Wheel

Step 1: Midline

$$D = \frac{80 + 20}{2} = 50$$

Step 2: Amplitude

$$A = \frac{80 - 20}{2} = 30$$

Step 3: Find B

$$B = \frac{2\pi}{40} = \frac{\pi}{20}$$

Step 4: Choose the function

The rider starts at the maximum height, so use cosine.

$$y = 30\cos\left(\frac{\pi}{20}x\right) + 50$$

3. Ocean Buoy

Step 1: Midline

$$D = \frac{10 + 2}{2} = 6$$

Step 2: Amplitude

$$A = \frac{10 - 2}{2} = 4$$

Step 3: Find B

$$B = \frac{2\pi}{12} = \frac{\pi}{6}$$

Step 4: Equation

The buoy starts at the midpoint rising upward, so use sine.

$$y = 4\sin\left(\frac{\pi}{6}x\right) + 6$$

4. Pendulum

Step 1: Midline

The pendulum swings equally around the center.

$$D = 0$$

Step 2: Amplitude

$$A = 6$$

Step 3: Find B

The period is 2π .

$$B = \frac{2\pi}{2\pi} = 1$$

Step 4: Equation

It starts at maximum displacement, so use cosine.

$$y = 6\cos(x)$$

5. Bicycle Wheel Reflector

Step 1: Midline

$$D = \frac{26 + 14 - 2}{2} = 14$$

Step 2: Amplitude

$$A = \frac{26 - 2}{2} = 12$$

Step 3: Find B

$$B = \frac{2\pi}{\frac{\pi}{2}} = 4$$

Step 4: Equation

Starts at midpoint rising upward, so use sine.

$$y = 12\sin(4x) + 14$$

6. Diver on Springboard

Step 1: Midline

$$D = \frac{10 + 4}{2} = 7$$

Step 2: Amplitude

$$A = \frac{10 - 4}{2} = 3$$

Step 3: Find B

$$B = \frac{2\pi}{\frac{\pi}{3}} = 6$$

Step 4: Equation

Starts at the minimum height, so use negative cosine.

$$y = -3\cos(6x) + 7$$

7. Greenhouse Temperature

Step 1: Midline

$$D = \frac{84 + 60}{2} = 72$$

Step 2: Amplitude

$$A = \frac{84 - 60}{2} = 12$$

Step 3: Find B

$$B = \frac{2\pi}{24} = \frac{\pi}{12}$$

Step 4: Equation

Starts at the average temperature increasing upward.

$$y = 12\sin\left(\frac{\pi}{12}x\right) + 72$$

8. Carnival Ride

Step 1: Midline

$$D = \frac{45 + 5}{2} = 25$$

Step 2: Amplitude

$$A = \frac{45 - 5}{2} = 20$$

Step 3: Find B

$$B = \frac{2\pi}{\frac{\pi}{4}} = 8$$

Step 4: Equation

Starts at minimum height, so use negative cosine.

$$y = -20\cos(8x) + 25$$

9. Rotating Fan Blade

Step 1: Midline

$$D = 0$$

Step 2: Amplitude

$$A = 8$$

Step 3: Find B

$$B = \frac{2\pi}{\frac{\pi}{6}} = 12$$

Step 4: Equation

Starts at maximum height, so use cosine.

$$y = 8\cos(12x)$$

10. Merry-Go-Round

Step 1: Midline

$$D = \frac{7 + 3}{2} = 5$$

Step 2: Amplitude

$$A = \frac{7 - 3}{2} = 2$$

Step 3: Find B

$$B = \frac{2\pi}{\frac{\pi}{2}} = 4$$

Step 4: Equation

Starts at the midpoint rising upward, so use sine.

$$y = 2\sin(4x) + 5$$