LESSON MAKER PRO

Wave Shift Lab

Read and sketch sine and cosine graphs.

HIGH SCHOOL · PC.F.B.26.b

PC.F.B.26.b "Graph trigonometric functions and their inverses, showing period, midline, amplitude, and phase shift."

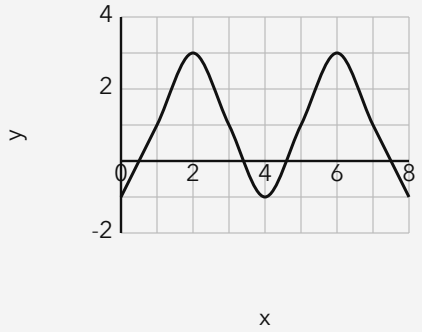
NAME _____ DATE _____

READ THE WAVE

The amplitude is half the distance from a wave's maximum to its minimum. The midline is halfway between them. The period is the horizontal distance between matching points on consecutive cycles, and a phase shift moves the wave left or right.

WORKED EXAMPLE

Use the plotted sine curve to find its amplitude, midline, period, and phase shift from $y = \sin(\pi x/2)$.

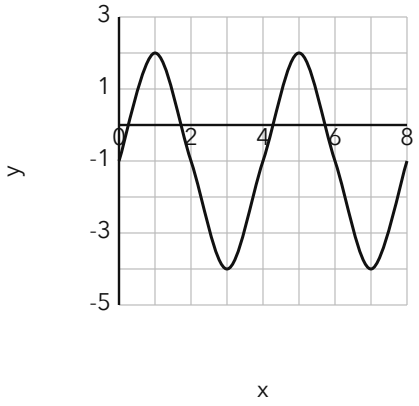


1. The maximum is 3 and the minimum is -1, so the amplitude is (3 - (-1))/2 = 2.
2. The midline is y = (3 + (-1))/2 = 1.
3. The peaks are 4 units apart, so the period is 4.
4. The curve crosses its midline going up at x = 1, so it is shifted right 1.

Answer: Amplitude 2; midline y = 1; period 4; phase shift right 1.

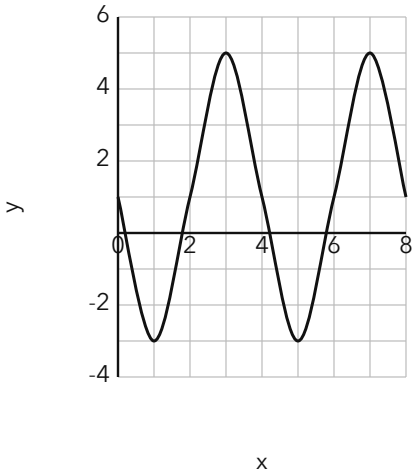
PRACTICE 6 problems

1 Use the curve to find its amplitude and midline.



ANSWER _____

2 Read the curve as a positive cosine wave. Find its period and its phase shift to the right.



ANSWER _____

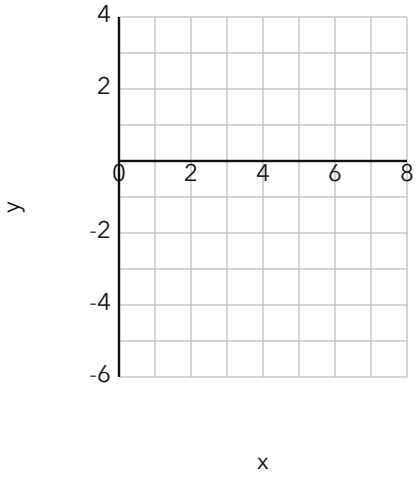
3 Find the amplitude and period of $y = 5 \sin(\pi(x - 3)/4) + 2$.

ANSWER _____

4 Find the phase shift and midline of $y = -3 \cos(\pi(x + 1)/3) - 2$.

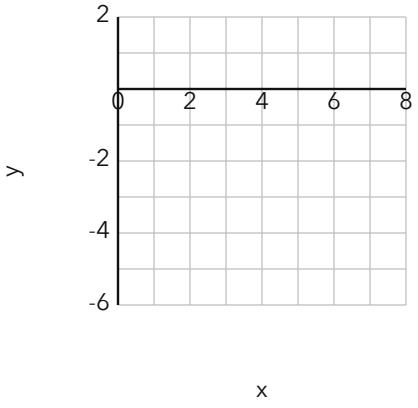
ANSWER _____

5 On the grid, sketch one cycle of $y = 4 \sin(\pi x/3) - 1$ from $x = 0$ to $x = 6$. Plot its five quarter-cycle points.



ANSWER _____

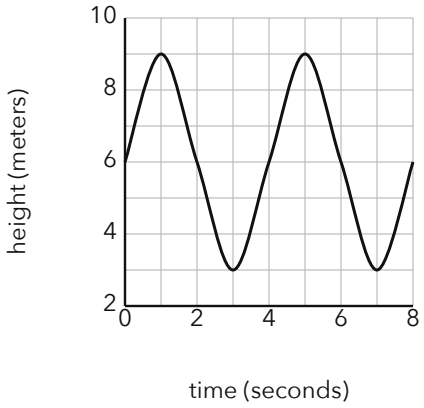
6 On the grid, sketch one cycle of $y = 3 \cos(\pi(x - 2)/2) - 2$ from $x = 2$ to $x = 6$. Plot its five quarter-cycle points.



ANSWER _____

APPLY IT Show your work

1 In a game, a floating platform follows the height curve shown. The horizontal axis shows time in seconds, and the vertical axis shows height in meters. What is its greatest height? How many seconds pass between high points?



ANSWER _____

2 A music app models the changing level of a looping sound effect with $L(t) = 4 \cos(\pi(t - 2)/3) + 6$, where t is in seconds. Find the level's midline and the time for one full loop.

WORK SPACE

ANSWER _____

CHALLENGE One step up

The graph of $y = 4 \sin(\pi x/6)$ is restricted to $-3 \le x \le 3$ so that it has an inverse function. Its graph passes through (-3, -4), (0, 0), and (3, 4). Give the three matching points on the inverse graph and the inverse's domain and range. Explain why the restriction is needed.

WORK SPACE AND ANSWER

ANSWER KEY

Wave Shift Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use the curve to find its amplitude and midline.	**Amplitude 3; midline y = -1.**
2	Read the curve as a positive cosine wave. Find its period and its phase shift to the right.	**Period 4; phase shift right 3.**
3	Find the amplitude and period of y = 5 sin(π(x - 3)/4) + 2.	**Amplitude 5; period 8.**
4	Find the phase shift and midline of y = -3 cos(π(x + 1)/3) - 2.	**Phase shift left 1; midline y = -2.**
5	On the grid, sketch one cycle of y = 4 sin(πx/3) - 1 from x = 0 to x = 6. Plot its five quarter-cycle points.	**Plot (0, -1), (3/2, 3), (3, -1), (9/2, -5), and (6, -1), then draw a smooth curve through them.**
6	On the grid, sketch one cycle of y = 3 cos(π(x - 2)/2) - 2 from x = 2 to x = 6. Plot its five quarter-cycle points.	**Plot (2, 1), (3, -2), (4, -5), (5, -2), and (6, 1), then draw a smooth curve through them.**

PART 2 · APPLY IT

1. **Greatest height: 9 meters; time between high points: 4 seconds.** The peaks reach 9 meters. They occur at 1 second and 5 seconds, which are 4 seconds apart.
2. **Midline L = 6; one full loop takes 6 seconds.** The vertical shift gives the midline L = 6. The period is 2π divided by π/3, or 6 seconds.

CHALLENGE

Inverse points: (-4, -3), (0, 0), and (4, 3). Domain: -4 ≤ x ≤ 4; range: -3 ≤ y ≤ 3. The restriction keeps the sine function increasing, so each output has only one input.

Accept equivalent descriptions of phase shifts that produce the same graph if the reference wave is clear. For sketches, check the five plotted points and the smooth wave through them.