LESSON MAKER PRO

Wave Pattern Detective

Read, sketch, and compare trigonometric graphs.

HIGH SCHOOL · MT.PLUS.ALG.TRIG.3

MT.PLUS.ALG.TRIG.3 "Graph trigonometric functions with and without the use of technology by: Graphing sine and cosine functions, identifying period, midline, and amplitude, and Graphing tangent functions, identifying period and asymptotes."

NAME _____ DATE _____

READ THE PATTERN

For sine and cosine graphs, the midline is halfway between the highest and lowest points. The amplitude is half the distance between those points, and the period is the horizontal distance until the pattern repeats. For a tangent graph, the period is the distance between neighboring vertical asymptotes.

WORKED EXAMPLE

Use the graph to find the midline, amplitude, and period. Each horizontal grid unit represents π/2 radians.

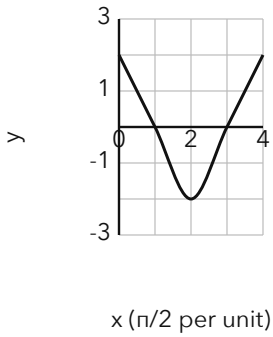


1. The highest value is 2, and the lowest is -8.
2. Midline: y = (2 + (-8))/2 = -3.
3. Amplitude: (2 - (-8))/2 = 5.
4. The pattern repeats from x = 0 to x = 2π, so the period is 2π.

Answer: Midline: y = -3; amplitude: 5; period: 2π.

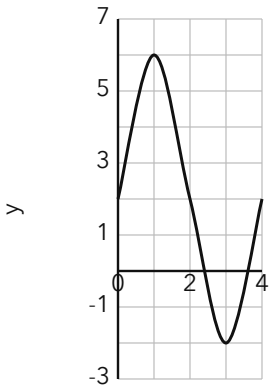
PRACTICE 6 problems

1 Use the graph to find the amplitude and midline. Each horizontal grid unit represents π/2 radians.



ANSWER _____

2 Use the graph to find the period and midline. Each horizontal grid unit represents π/4 radians.



ANSWER _____

3 Find the amplitude and period of $y = -2\cos(2x) + 1$.

ANSWER _____

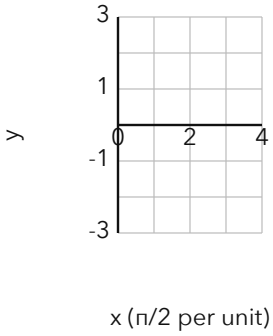
4 Find the amplitude and period of $y = 4\sin(x/2) - 1$.

ANSWER _____

5 For $y = \tan(2x)$, find the period and the two vertical asymptotes closest to $x = 0$.

ANSWER _____

6 On the grid, sketch $y = 2\sin x$ for $0 \le x \le 2\pi$. List the five key points using angles for x, not grid units. Each horizontal grid unit represents π/2 radians.



ANSWER _____

APPLY IT Show your work

1 At a music festival, a Ferris wheel seat's height h, in meters, is h = 12 + 10 cos(πt/20), where t is seconds after the seat reaches the top. Find the amplitude, midline, and period of the height graph.

WORK SPACE

ANSWER _____

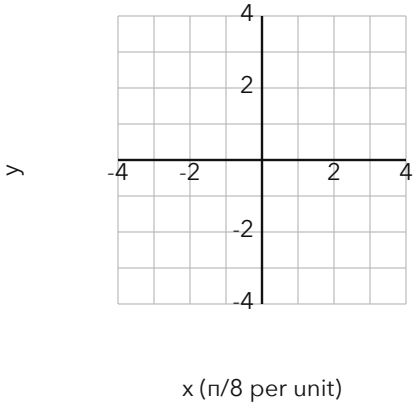
2 In a rhythm game, a rotating laser's angle from the floor is πt/4 radians after t seconds. Its slope is m = tan(πt/4). Find the slope graph's period and the first two positive times when the slope is undefined.

WORK SPACE

ANSWER _____

CHALLENGE One step up

On the grid, sketch y = tan(2x) for -π/2 < x < π/2. Mark its vertical asymptotes. State its period and x-intercept. Each horizontal grid unit represents π/8 radians.



WORK SPACE AND ANSWER

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use the graph to find the amplitude and midline. Each horizontal grid unit represents π/2 radians.	**Amplitude: 2; midline: y = 0.**
2	Use the graph to find the period and midline. Each horizontal grid unit represents π/4 radians.	**Period: π; midline: y = 2.**
3	Find the amplitude and period of y = -2 cos(2x) + 1.	**Amplitude: 2; period: π.**
4	Find the amplitude and period of y = 4 sin(x/2) - 1.	**Amplitude: 4; period: 4π.**
5	For y = tan(2x), find the period and the two vertical asymptotes closest to x = 0.	**Period: π/2; asymptotes: x = -π/4 and x = π/4.**
6	On the grid, sketch y = 2 sin x for 0 ≤ x ≤ 2π. List the five key points using angles for x, not grid units. Each horizontal grid unit represents π/2 radians.	**Plot (0, 0), (π/2, 2), (π, 0), (3π/2, -2), and (2π, 0), then connect them with a smooth sine curve.**

PART 2 · APPLY IT

1. **Amplitude: 10 m; midline: h = 12 m; period: 40 seconds.** The cosine coefficient gives an amplitude of 10, and the vertical shift gives a midline of 12. Set πt/20 = 2π to find a period of 40 seconds.
2. **Period: 4 seconds; undefined at t = 2 seconds and t = 6 seconds.** The tangent input increases by π every 4 seconds, so the slope repeats every 4 seconds. The first two positive inputs where tangent is undefined are π/2 and 3π/2, which occur at t = 2 and t = 6.

CHALLENGE

Period: π/2; vertical asymptotes: x = -π/4 and x = π/4; x-intercept: (0, 0). Draw three increasing branches between the asymptotes and the interval endpoints. Check points, in grid units, include (-3, 1), (-1, -1), (0, 0), (1, 1), and (3, -1).

Accept smooth sketches that pass through the key points and approach, but do not cross, the marked tangent asymptotes. Periods may be given with the units specified in each context.