LESSON MAKER PRO

Wave Model Match

Build sine and cosine models from key graph features.

HIGH SCHOOL · MA.912.T.3.1

MA.912.T.3.1 "Given a mathematical or real-world context, choose sine, cosine or tangent trigonometric functions to model periodic phenomena with specified amplitude, frequency, horizontal shift and midline."

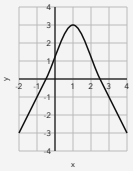
NAME _____ DATE _____

MODEL A CYCLE

In y = A sin(B(x - C)) + D or y = A cos(B(x - C)) + D, amplitude is |A|, the midline is y = D, the period is 2π/|B|, and the frequency is |B|/(2π). Use cosine for a cycle that starts at a high or low point, and use sine for a cycle that starts by crossing its midline.

WORKED EXAMPLE

The graph shows one cycle. Write a cosine model.



1. The maximum is 3 and minimum is -3, so A = 3 and D = 0.
2. The graph repeats from x = -2 to x = 4, so the period is 6.
3. A cosine peak occurs at x = 1, so shift right 1.
4. Use B = 2π/6 = π/3.

Answer: y = 3cos((π/3)(x - 1))

PRACTICE 4 problems

1 Write a cosine model with amplitude 2, period 2π, midline y = 4, and a maximum at x = 2.

ANSWER _____

2 Write a sine model with amplitude 5, period π, midline y = -2, and a rising midline crossing at x = 2.

ANSWER _____

3 For y = -7cos(2(x + 4)) + 5, state the amplitude and period.

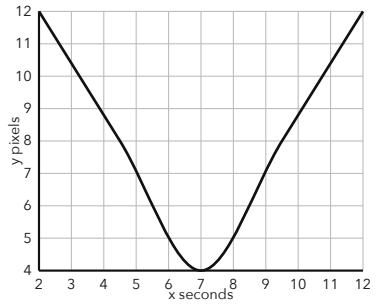
ANSWER _____

4 A repeating signal has maximum 12, minimum 4, period 10, and a maximum at x = 0. Write a cosine model.

ANSWER _____

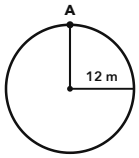
APPLY IT Show your work

1 A music visualizer's bar height y, in pixels, is shown for x seconds. Write a cosine model for the graph.



ANSWER _____

2 A Ferris wheel has radius 12 meters, and its center is 15 meters above the ground. At x = 0 seconds, a rider is at point A shown. One revolution takes 20 seconds. Write a cosine model for the rider's height y, in meters.



ANSWER _____

CHALLENGE One step up

A wave has maximum 14, minimum -4, period 14, and crosses its midline rising at x = 2. Write one sine model and one equivalent cosine model.

WORK SPACE AND ANSWER

ANSWER KEY

Wave Model Match

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write a cosine model with amplitude 2, period 2π, midline y = 4, and a maximum at x = 2.	**y = 2cos(x - 2) + 4**
2	Write a sine model with amplitude 5, period π, midline y = -2, and a rising midline crossing at x = 2.	**y = 5sin(2(x - 2)) - 2**
3	For y = -7cos(2(x + 4)) + 5, state the amplitude and period.	**amplitude 7; period π**
4	A repeating signal has maximum 12, minimum 4, period 10, and a maximum at x = 0. Write a cosine model.	**y = 4cos(πx/5) + 8**

PART 2 · APPLY IT

1. **y = 4cos((π/5)(x - 2)) + 8** The amplitude is 4, the midline is 8, and the period is 10. The graph has a maximum at x = 2, so use a cosine shift right 2.
2. **y = 12cos(πx/10) + 15** The radius gives amplitude 12 and the center height gives midline 15. Since the rider starts at the top, use cosine with period 20.

CHALLENGE

y = 9sin((π/7)(x - 2)) + 5; y = 9cos((π/7)(x - 11/2)) + 5

Accept equivalent sine or cosine models with phase shifts differing by whole periods. Accept algebraically equivalent forms of the angle expressions.