PRACTICE & PROBLEM SOLVING

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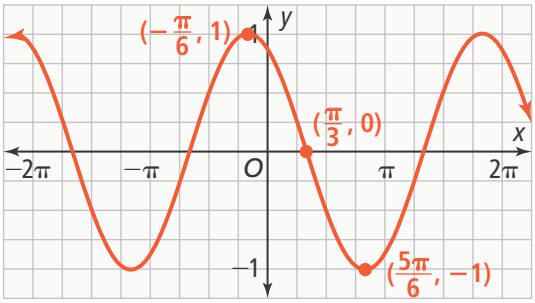
Practice Tutorial

Additional Exercises Available Online

UNDERSTAND

9. Use Structure Write a sine function and a cosine function for the graph.



10. Error Analysis Describe and correct the error a student made in finding the phase shift of the given function.

$y = \cos\left(3x + \frac{\pi}{2}\right)$

phase shift = $\frac{\pi}{2}$ units to the left

✗

11. Generalize Describe the phase shift and vertical shift of a function in the form $y = a \sin [b(x - c)] + d$.

12. Higher Order Thinking How are the domain and range of the function $y = \frac{1}{4}\cos\left[3\left(x - \frac{2\pi}{3}\right)\right] + 2$ related to the domain and range of the parent function $y = \cos x$? Explain your reasoning.

13. Generalize Write an equation for the midline of the function $y = a \cos [b(x - c)] + d$.

14. Reason How are the zeros of the function $y = \sin\left(x + \frac{\pi}{3}\right)$ related to the zeros of the parent function $y = \sin x$?

15. Mathematical Connections In the equation $y = a \sin [b(x - c)] + d$, which of the parameters a, b, c, and d can have an effect on the y-intercept of the graph? Explain.

PRACTICE

Sketch the graph of the function. SEE EXAMPLE 1

16. $y = \cos\left(x - \frac{\pi}{4}\right)$ **17.** $y = 2 \sin\left(x + \frac{3\pi}{4}\right)$

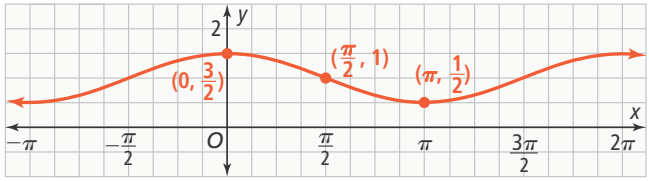
Sketch the graph of the function. SEE EXAMPLE 2

18. $y = \frac{1}{3}\cos\left(x + \frac{\pi}{2}\right) - 2$ **19.** $y = 3 \sin\left(x - \frac{\pi}{6}\right) + 1$

Identify the amplitude, period, phase shift, vertical shift, and the maximum and minimum values of the function. SEE EXAMPLE 3

20. $y = \frac{2}{3}\sin\left(x + \frac{\pi}{3}\right) + 3$ **21.** $y = \frac{1}{2}\cos\left[2\left(x - \frac{\pi}{4}\right)\right] - 1$

22. Write an equation for the function represented by the graph using the sine function. SEE EXAMPLE 4



23. The table shows the brightness of the moon at the end of eight consecutive weeks. How can you model this with a trigonometric function? How does the midline of the function compare with the average of the 8 visibility levels? SEE EXAMPLE 5

Week	Percent Visible	
1	50%	
2	0%	
3	48%	
4	100%	
5	67%	
6	5%	
7	34%	
8	95%	

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Mixed Review Available Online

APPLY

24. Model With Mathematics Alternating current is the flow of charge that periodically changes direction. Alternating current is used to deliver power. The function $V(t) = E\cos\left(wt + \frac{\pi}{2}\right)$ gives the voltage in amps for t seconds.

a. Edgar wants to find the voltage when $E = 40$ volts and $w = 188$ radians per second. Write a function to represent this situation.

b. Rewrite the function so that the coefficient of t is 1.

c. What is the amplitude of the function?

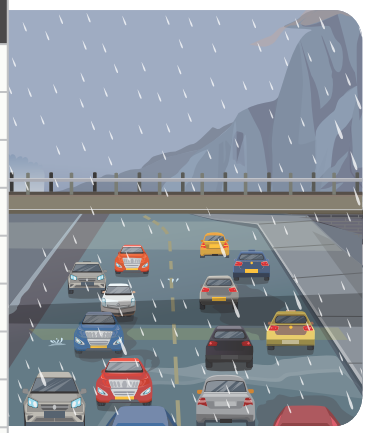
d. What is the period of the function?

e. What is the phase shift of the function?

f. Graph the function.

25. Make Sense and Persevere The table shows the average amount of rainfall in inches by month for Junction City, California.

Month	Rainfall (in.)
January	6.46
February	5.83
March	4.84
April	2.52
May	1.81
June	0.79
July	0.29
August	0.16
September	0.59
October	2.28
November	5.39
December	7.87



a. How can these rainfall amounts be modeled with a trigonometric graph?

b. How does the midline function value compare with the average of the 12 rainfall amounts?

c. Graph the function.

ASSESSMENT PRACTICE

26. Determine if each statement about the function $y = \frac{3}{4}\cos\left[3\left(x + \frac{\pi}{6}\right)\right] - 5$ is true. Write *yes* or *no*.

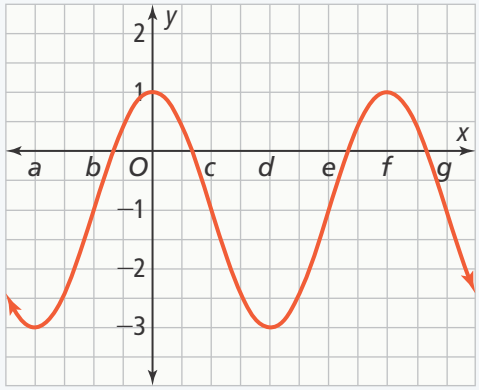
A. The amplitude is $\frac{3}{4}$.

B. The period is 3.

C. The phase shift is $\frac{\pi}{6}$ units to the right.

D. The vertical shift is 5 units down.

27. SAT/ACT Kathryn graphed the function $y = 2\sin\left(x + \frac{\pi}{2}\right) - 1$ but forgot to label the x-axis. What is the value of d on the x-axis?



Ⓐ $\frac{\pi}{2}$ Ⓑ π Ⓒ $\frac{3\pi}{2}$ Ⓓ 2π

28. Performance Task Micah is investigating phase shifts of the parent sine function, $y = \sin x$. He wants to map the sine function onto itself.

Part A Write an equation of a function that has an identical graph but includes a phase shift.

Part B Write an equation that will map the parent sine function onto itself by shifting the parent function to the right.

Part C What do the equations in part (a) and part (b) tell you about the period of the sine function?

Part D How many equations can you write to map the parent sine function onto itself? Explain.