# Ch. 2 Graphs of the Trigonometric Functions; Inverse Trigonometric Functions

## 2.1 Graphs of Sine and Cosine Functions

### 1 Understand the Graph of y = sin x

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Determine the amplitude or period as requested.**

1) Amplitude of $y = -2 \sin x$

A) 2 B) $-2\pi$ C) $\frac{\pi}{2}$ D) $2\pi$

2) Period of $y = -4 \sin x$

A) $2\pi$ B) $\pi$ C) $\frac{\pi}{4}$ D) 4

3) Amplitude of $y = -\frac{1}{3} \sin x$

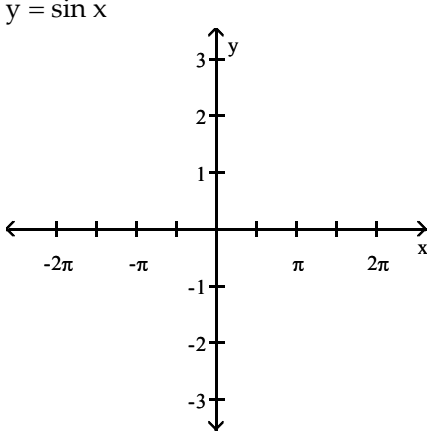
A) $\frac{1}{3}$ B) 3 C) $\frac{\pi}{3}$ D) $-\frac{1}{3}$

4) Period of $y = -\frac{1}{4} \sin x$

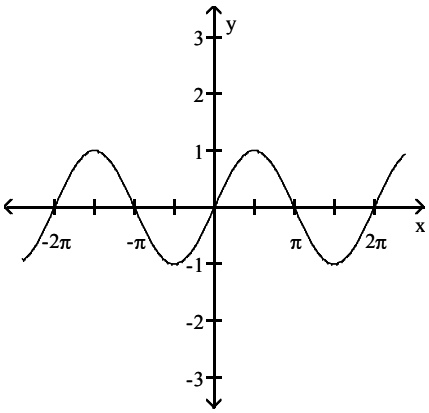
A) $2\pi$ B) $\pi$ C) $\frac{\pi}{4}$ D) $-\frac{1}{4}$

**Graph the function.**

5) $y = \sin x$




A)

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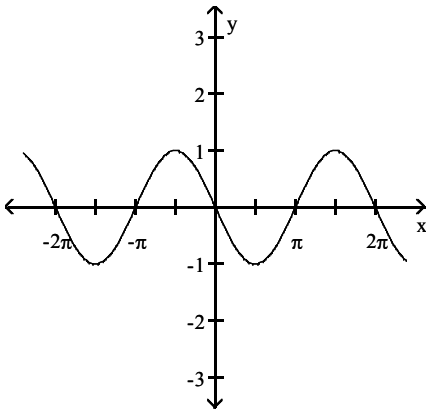


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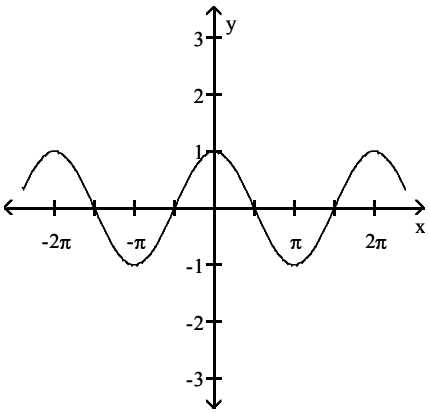


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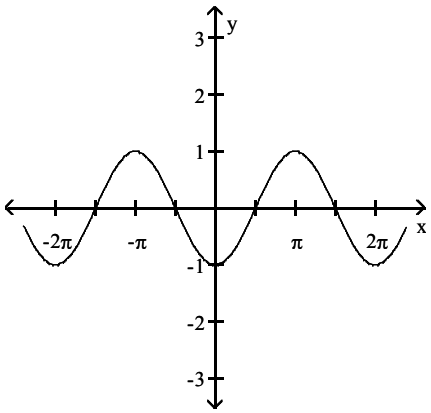
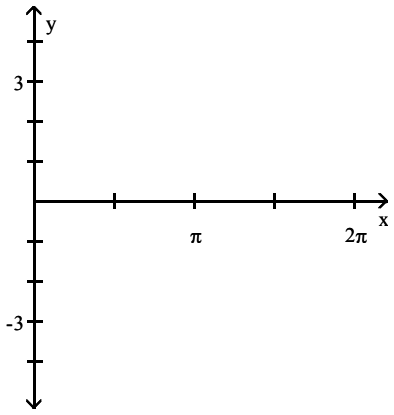


**Graph the function and y = sin x in the same rectangular system for $0 \le x \le 2\pi$.**

6) $y = \frac{1}{4} \sin x$

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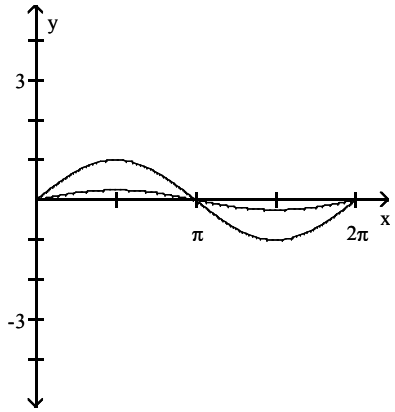


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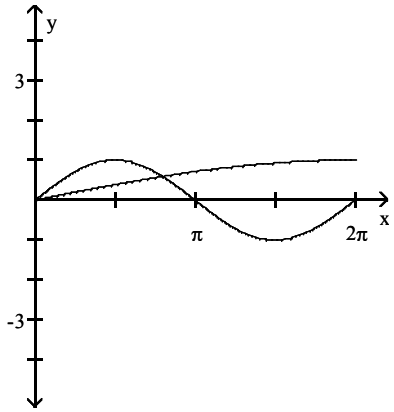


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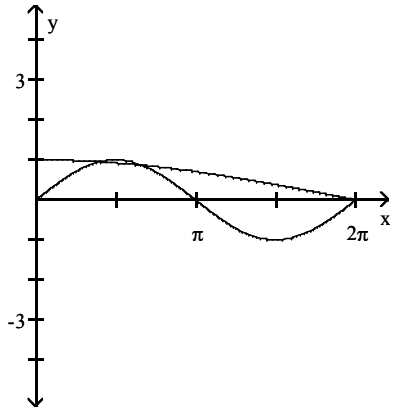


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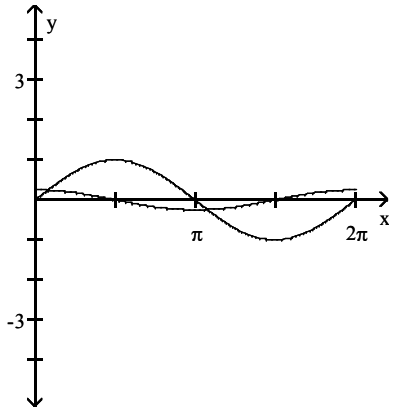



## 2 Graph Variations of y = sin x

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Determine the amplitude or period as requested.**

1) Amplitude of $y = -5 \sin \frac{1}{2}x$

A) 5 B) $\frac{5\pi}{2}$ C) $\frac{\pi}{5}$ D) $4\pi$

2) Amplitude of $y = -5 \sin 2x$

A) 5 B) $\frac{5}{2}$ C) $\frac{\pi}{5}$ D) $\frac{\pi}{2}$

3) Period of $y = \sin 5x$

A) $\frac{2\pi}{5}$ B) 5 C) $2\pi$ D) 1

4) Period of $y = -4 \cos \frac{1}{3}x$

A) $6\pi$ B) $-4$ C) $\frac{4\pi}{3}$ D) $\frac{\pi}{3}$

5) Period of $y = -5 \sin 4\pi x$

A) $\frac{1}{2}$ B) $\frac{\pi}{2}$ C) 2 D) $4\pi$

6) Period of $y = \frac{9}{4} \cos \frac{4\pi}{3}x$

A) $\frac{3}{2}$ B) $\frac{8\pi}{3}$ C) $\frac{9\pi}{2}$ D) $\frac{2}{9}$

7) Period of $y = 5 \sin\left(3x - \frac{\pi}{2}\right)$

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

8) Period of $y = -3 \sin (8\pi x + 4\pi)$

A) $\frac{1}{4}$ B) $\frac{\pi}{4}$ C) 4 D) $8\pi$

**Determine the phase shift of the function.**

9) $y = \frac{1}{4} \sin (4x + \pi)$

A) $\frac{\pi}{4}$ units to the left B) $\frac{\pi}{4}$ units to the right

C) $-\frac{\pi}{4}$ units to the left D) $\pi$ units to the left

10) $y = -4 \sin\left(x - \frac{\pi}{4}\right)$

A) $\frac{\pi}{4}$ units to the right B) $\frac{\pi}{4}$ units to the left

C) $-4$ units up D) $-4$ units down

11) $y = 5 \sin\left(4x - \frac{\pi}{2}\right)$

A) $\frac{\pi}{8}$ units to the right

B) $\frac{\pi}{2}$ units to the left

C) $5\pi$ units up

D) $4\pi$ units down

12) $y = 3 \sin\left(\frac{1}{2}x - \frac{\pi}{2}\right)$

A) $\pi$ units to the right

B) $\frac{\pi}{2}$ units to the right

C) $\frac{\pi}{4}$ units to the left

D) $\frac{\pi}{3}$ units to the left

13) $y = \frac{1}{2} \sin(\pi x + 3)$

A) $\frac{3}{\pi}$ units to the left

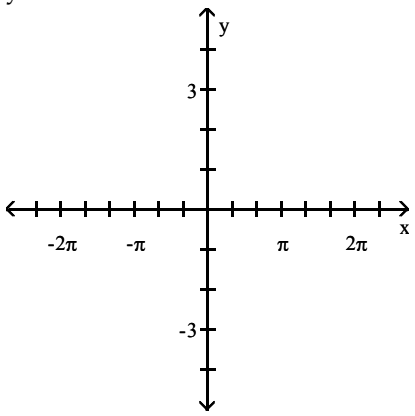
B) $\frac{\pi}{3}$ units to the right

C) $-\frac{\pi}{3}$ units to the left

D) 3 units to the left

**Graph the function.**

14) y = –2 sin 3x

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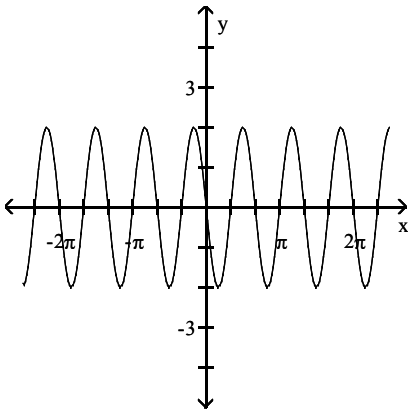


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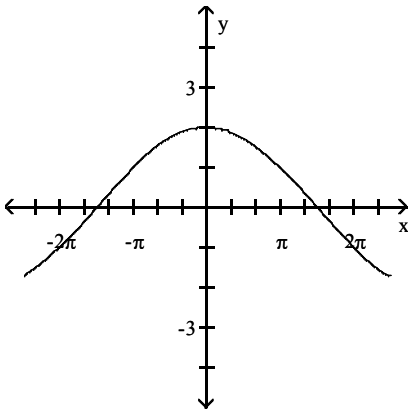


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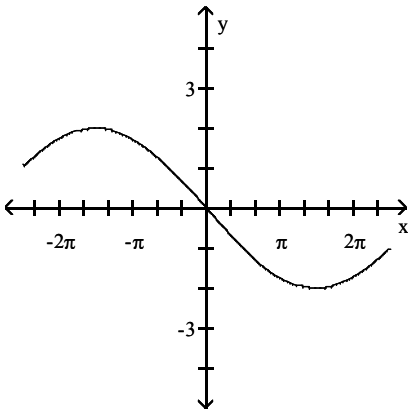


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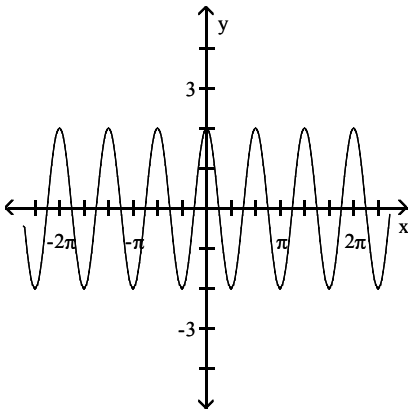
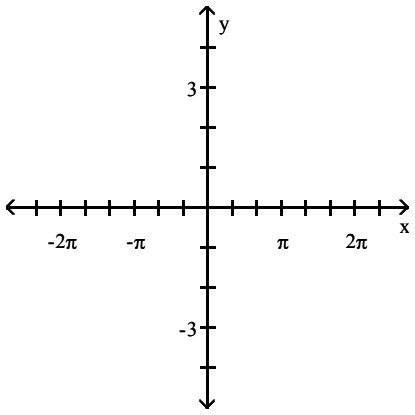


15) $y = -3 \sin \frac{1}{2}x$

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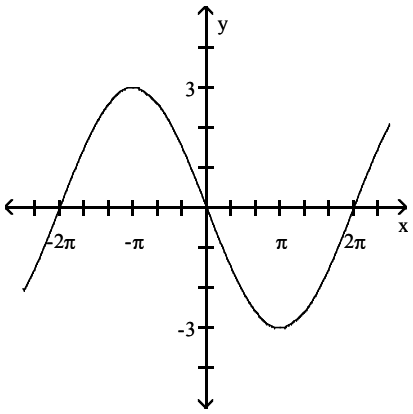


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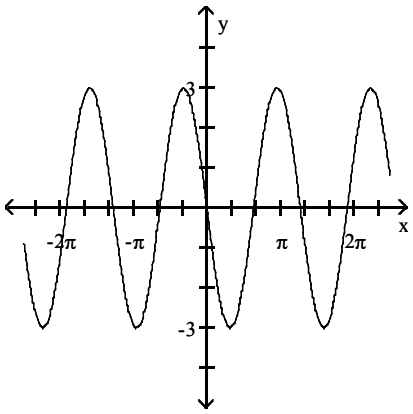


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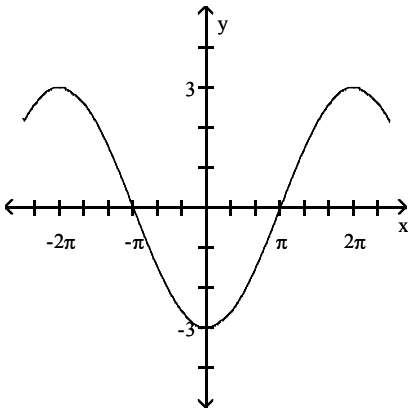


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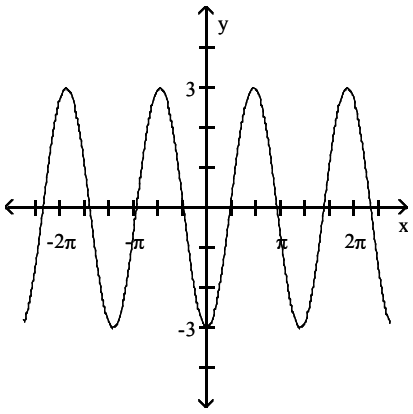
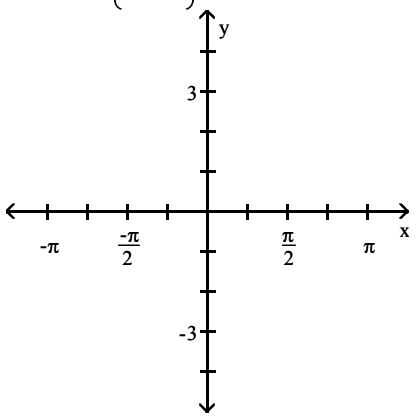


16) $y = 4 \sin\left(x + \frac{\pi}{2}\right)$

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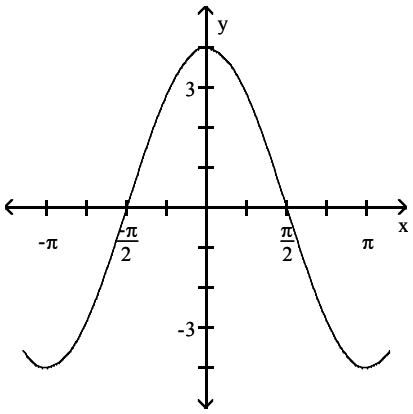


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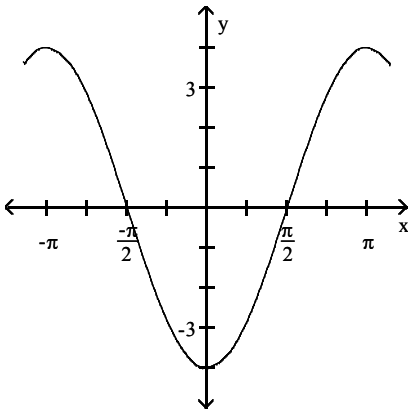


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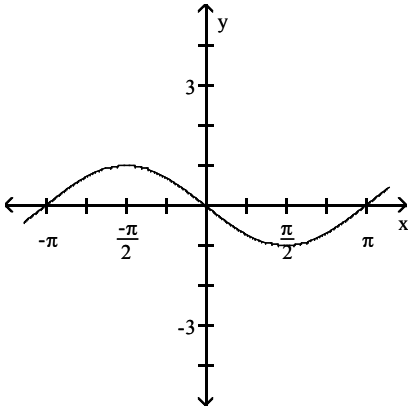


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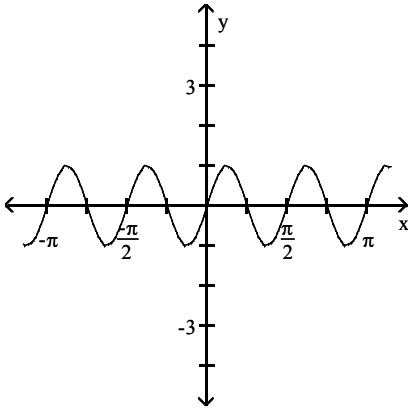
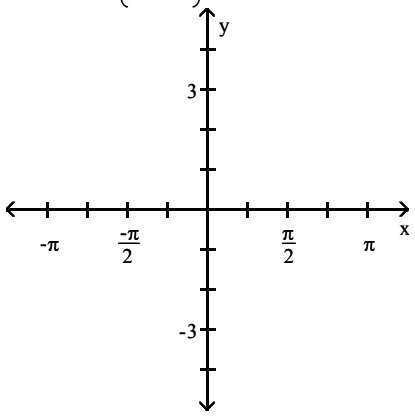


17) $y = \frac{3}{4}\sin\left(x + \frac{\pi}{3}\right)$

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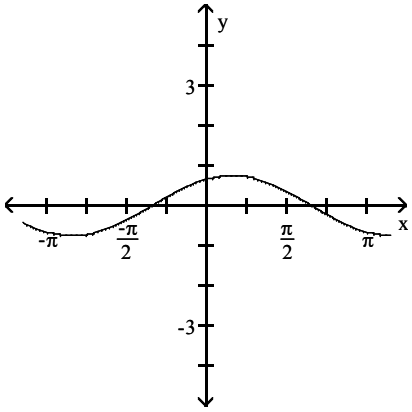


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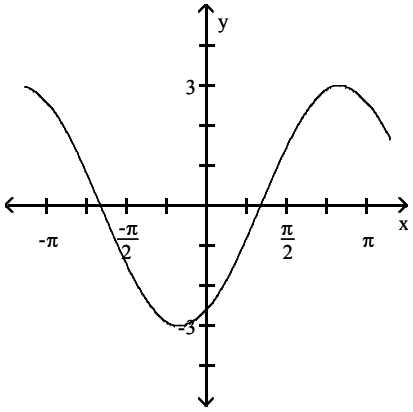


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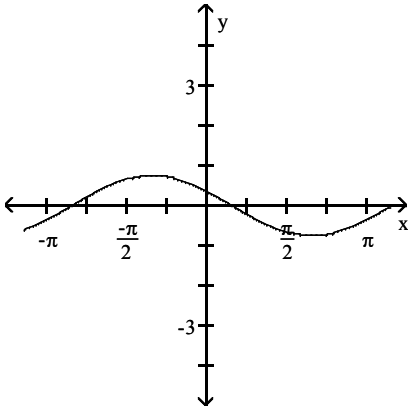


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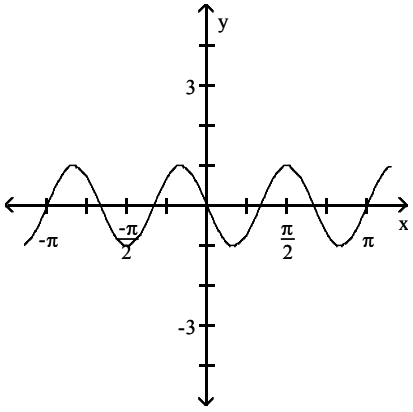
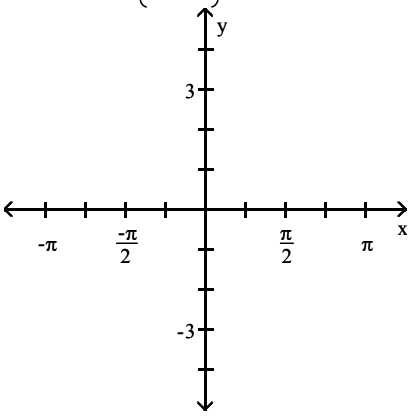


18) $y = -\frac{1}{4}\sin\left(x - \frac{\pi}{3}\right)$

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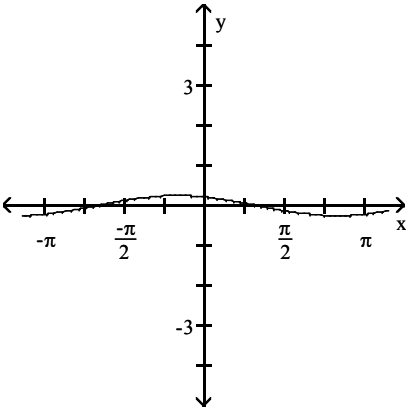


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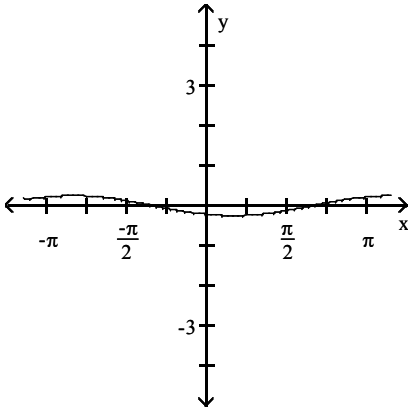


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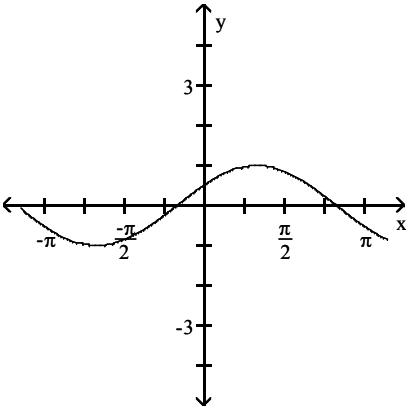


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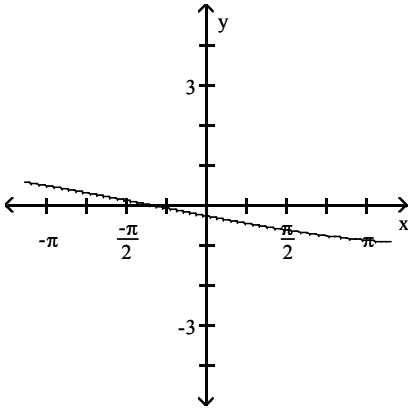
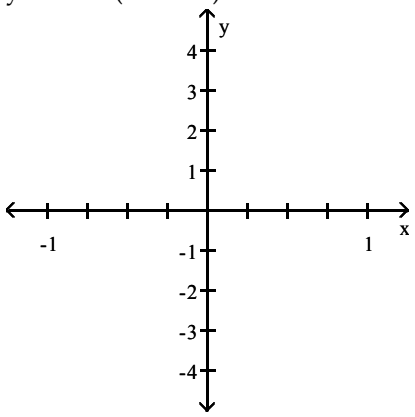


19) $y = 2 \sin (3\pi x + 2)$

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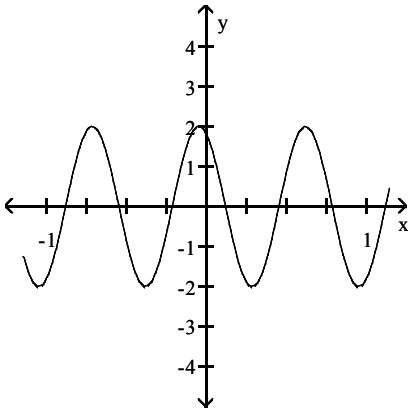


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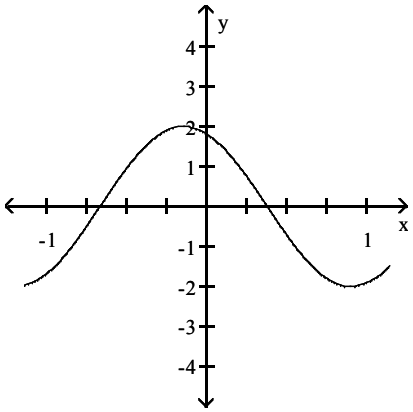


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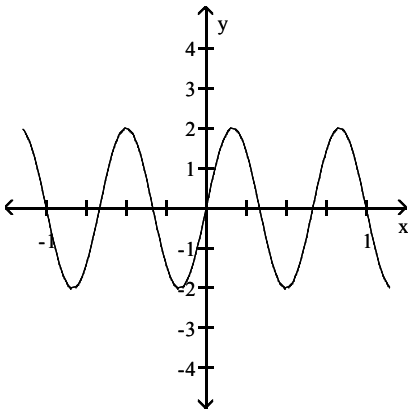


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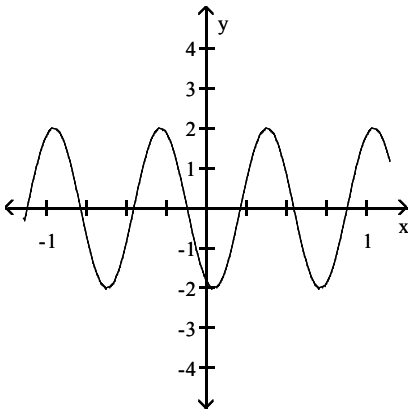
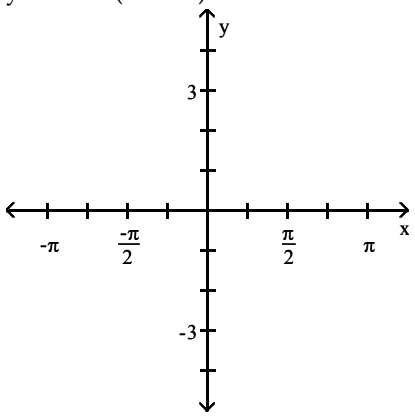


20) $y = 4 \sin (2x + \pi)$

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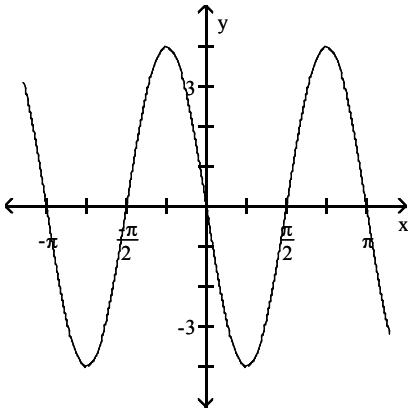


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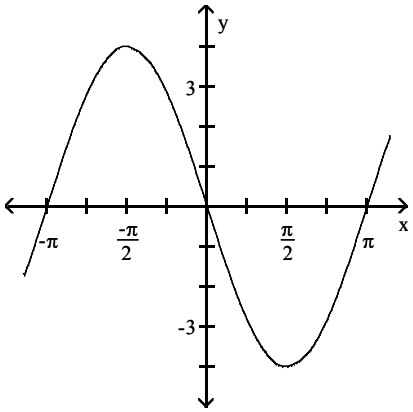


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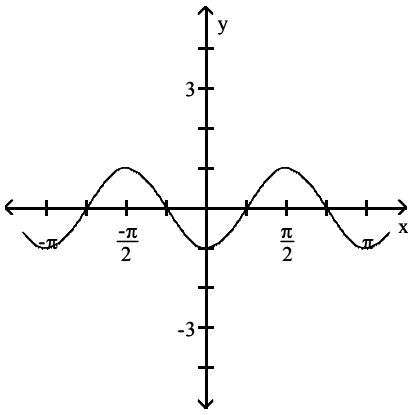


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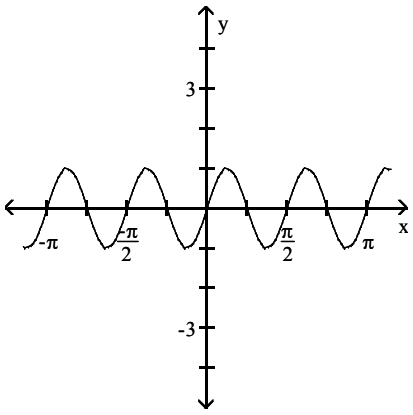
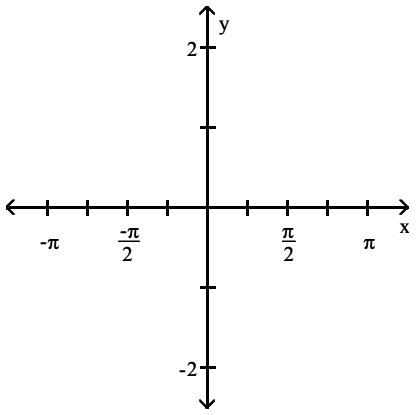


21) $y = \frac{1}{3}\sin(x - \pi)$

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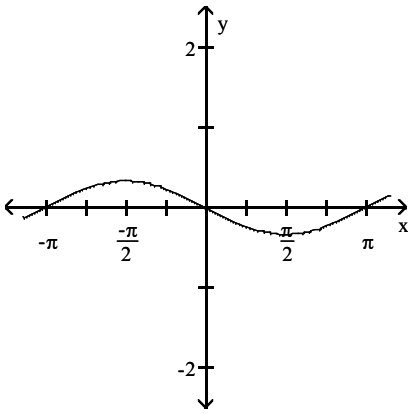


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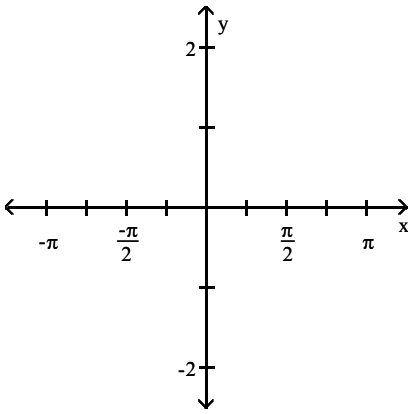


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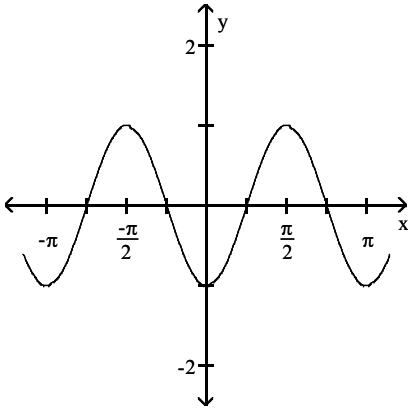


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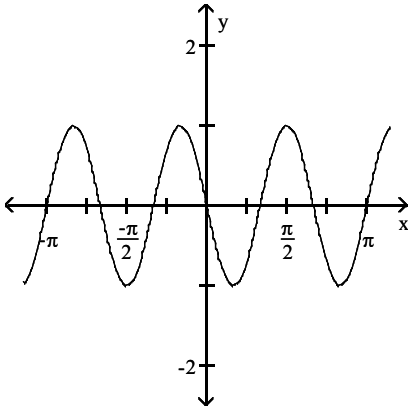
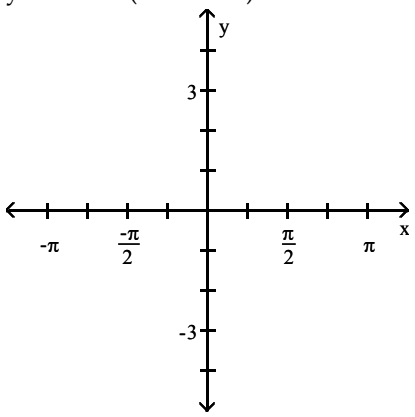
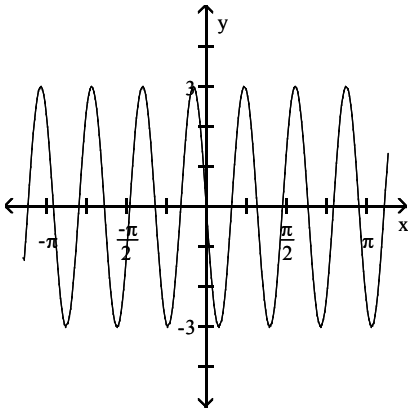


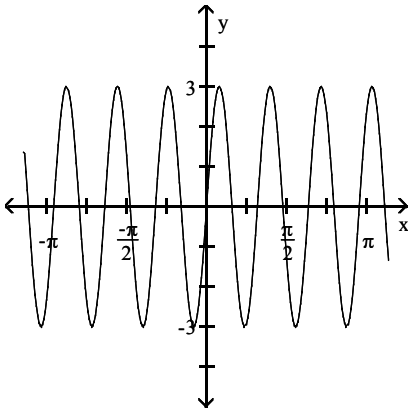
22) $y = -3 \sin(2\pi x + 2\pi)$



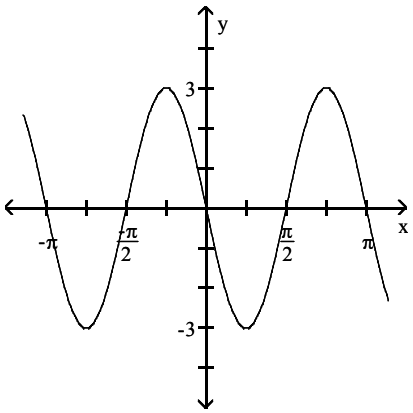

A)




B)




C)

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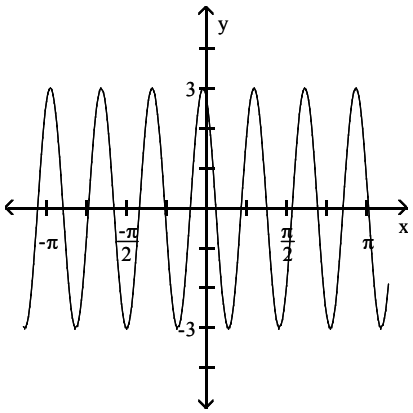
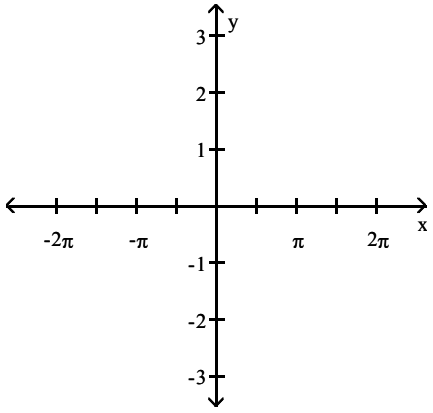


## 3 Understand the Graph of y = cos x

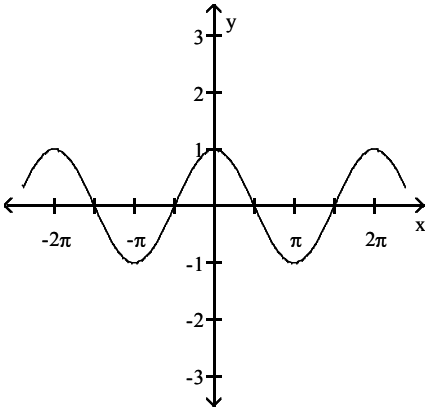
**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Graph the function.**

1) y = cos x




A)

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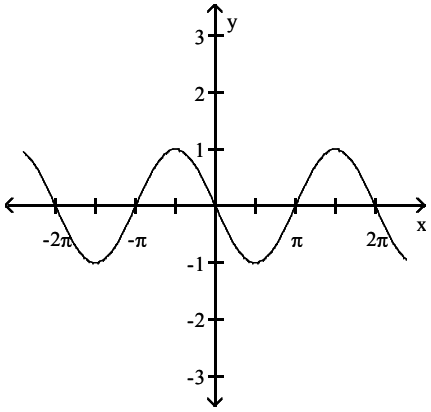


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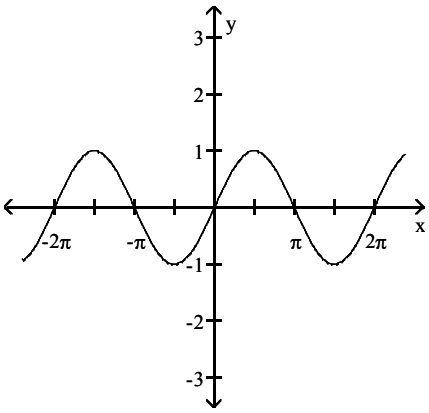
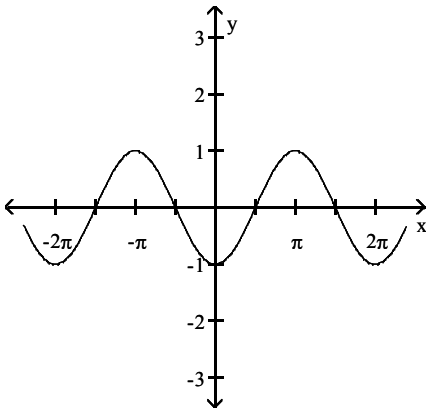
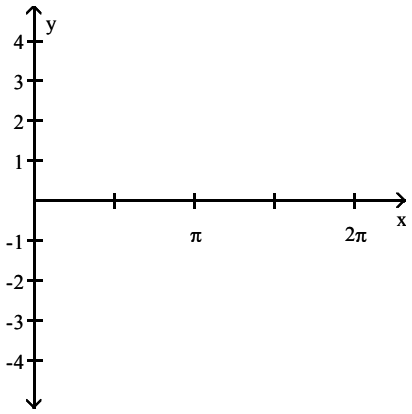



D)

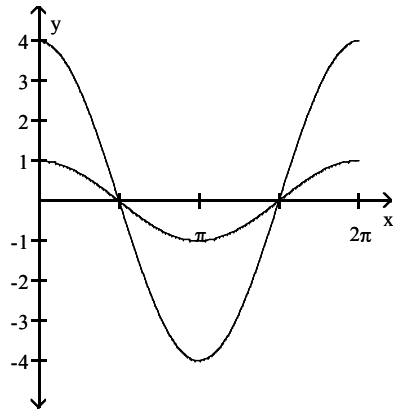


**Graph the function and y = cos x in the same rectangular system for $0 \le x \le 2\pi$.**

2) y = 4 cos x




A)

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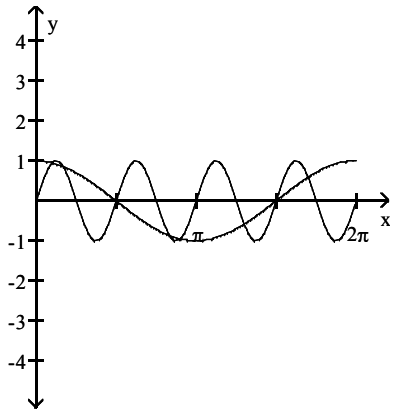


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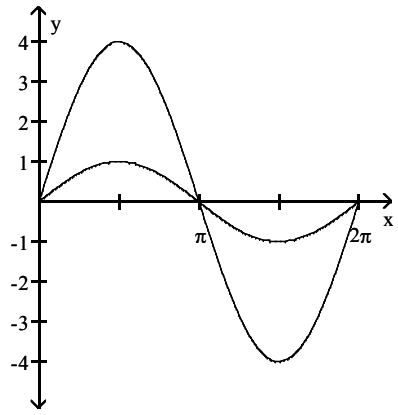


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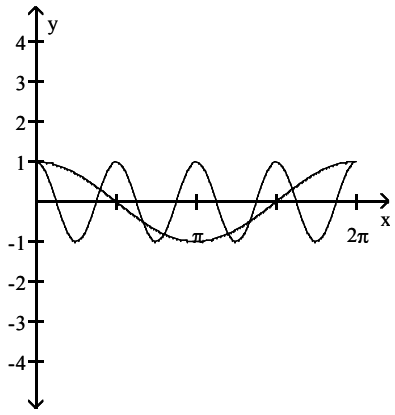
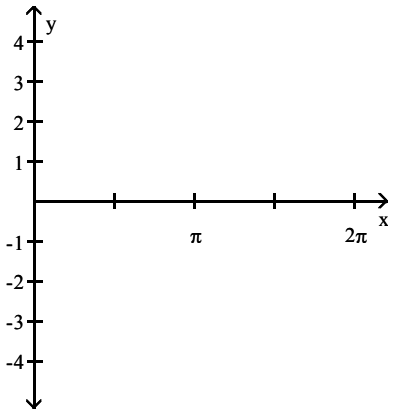
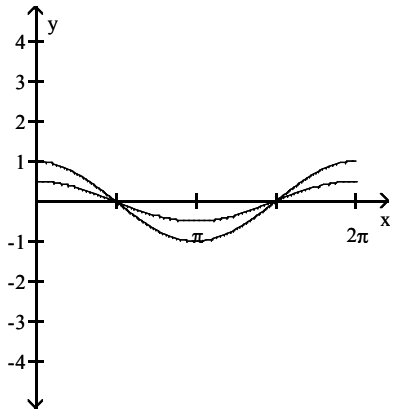


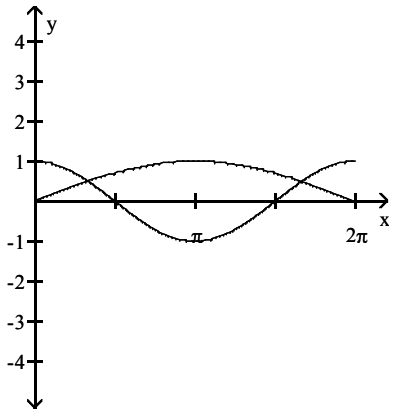
3) $y = \frac{1}{2}\cos x$




A)




B)

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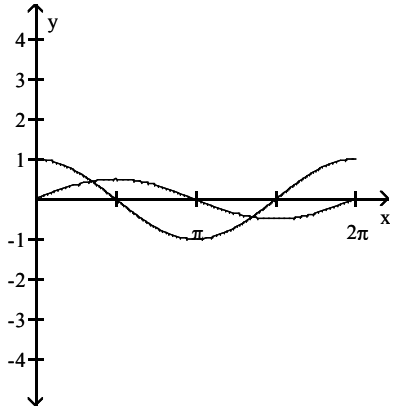
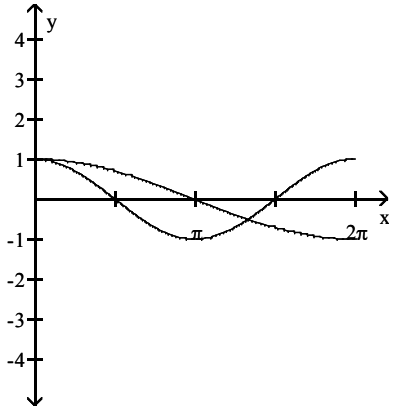



D)




## 4 Graph Variations of y = cos x

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Determine the amplitude or period as requested.**

1) Amplitude of $y = 2\cos\frac{1}{3}x$

A) 2 B) $\frac{2\pi}{3}$ C) $\frac{\pi}{2}$ D) $6\pi$

2) Amplitude of $y = \frac{1}{3}\cos 2x$

A) $\frac{1}{3}$ B) 2 C) $\frac{\pi}{2}$ D) $6\pi$

3) Period of $y = \cos 5x$

A) $\frac{2\pi}{5}$ B) 5 C) $2\pi$ D) 1

4) Period of $y = -5\cos\frac{1}{4}x$

A) $8\pi$ B) $-5$ C) $\frac{5\pi}{4}$ D) $\frac{\pi}{4}$

5) Period of $y = -2\cos x$

A) $2\pi$ B) 2 C) $\frac{\pi}{2}$ D) $\pi$

6) Period of $y = \frac{7}{8}\cos\left(-\frac{8\pi}{5}x\right)$

A) $\frac{5}{4}$ B) $\frac{16\pi}{5}$ C) $\frac{7\pi}{4}$ D) $\frac{4}{7}$

7) Amplitude of $y = \frac{9}{4}\sin\left(-\frac{8\pi}{5}x\right)$

A) $\frac{9}{4}$ B) $\frac{5}{4}$ C) $\frac{4\pi}{9}$ D) $\frac{8\pi}{5}$

8) Period of $y = 5\cos\left(7x - \frac{\pi}{2}\right)$

A) $\frac{2\pi}{7}$ B) $\frac{7\pi}{2}$ C) $\frac{2}{7}$ D) $\frac{7}{2}$

9) Period of $y = 5\cos(6\pi x + 3\pi)$

A) $\frac{1}{3}$ B) $\frac{\pi}{3}$ C) 3 D) $6\pi$

**Determine the phase shift of the function.**

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

A) $\frac{\pi}{2}$ units to the left B) $\frac{\pi}{2}$ units to the right

C) 3 units up D) 3 units down

11) $y = 2 \cos (8x + \pi)$

A) $\frac{\pi}{8}$ units to the left

B) $\frac{\pi}{2}$ units to the left

C) $2\pi$ units to the right

D) $8\pi$ units to the right

12) $y = 5 \cos\left(\frac{1}{4}x + \frac{\pi}{4}\right)$

A) $\pi$ units to the left

B) $\frac{\pi}{4}$ units to the left

C) $\frac{\pi}{16}$ units to the right

D) $5\pi$ units to the right

13) $y = 4 \sin (4\pi x + 3)$

A) $\frac{3}{4\pi}$ units to the left

B) $\frac{3}{4}$ units to the right

C) 3 units to the left

D) 3 units to the right

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

A) $\frac{\pi}{6}$ units to the right

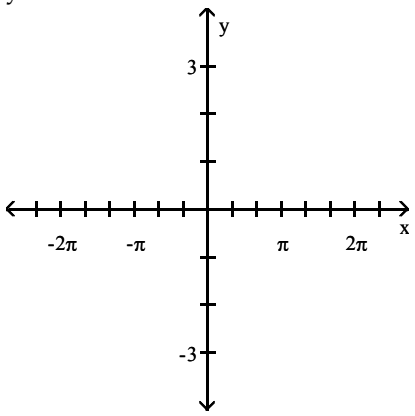
B) $\frac{\pi}{6}$ units to the left

C) $\frac{\pi}{3}$ units to the right

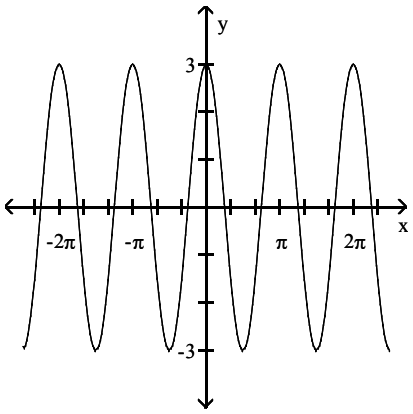
D) $\frac{\pi}{3}$ units to the left

**Graph the function.**

15) $y = 3 \cos 2x$




A)

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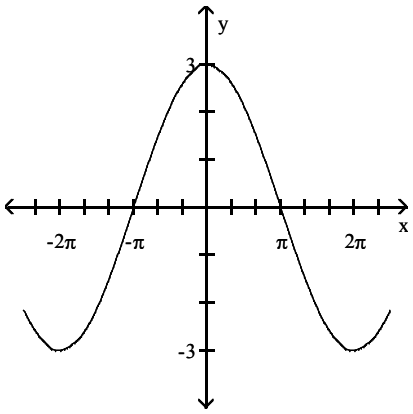


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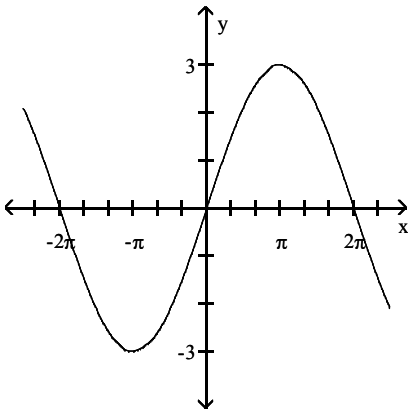
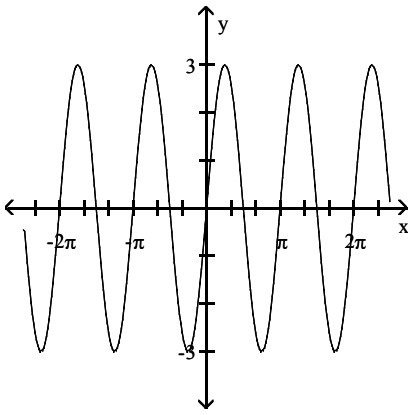
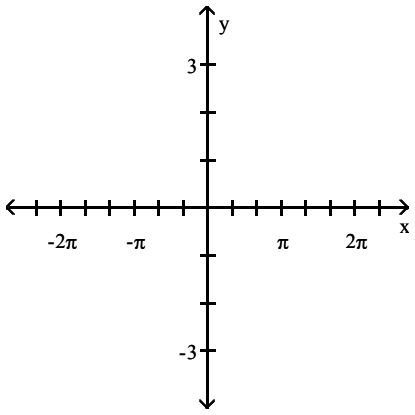


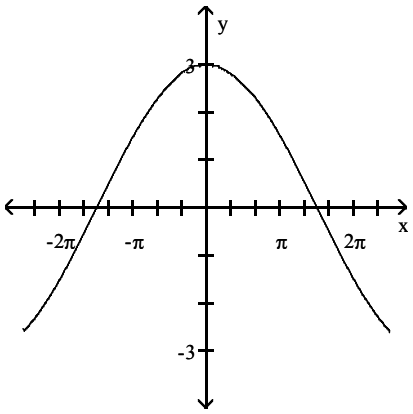

D)



16) $y = 3\cos\frac{1}{3}x$




A)

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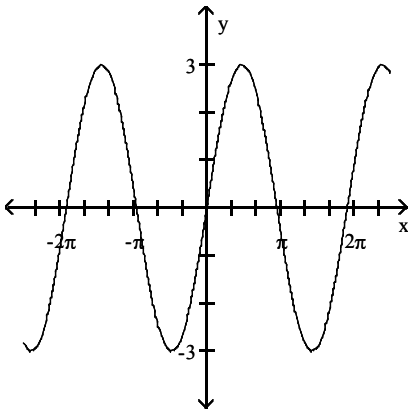
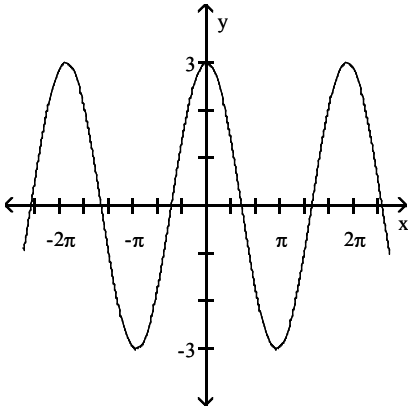



C)

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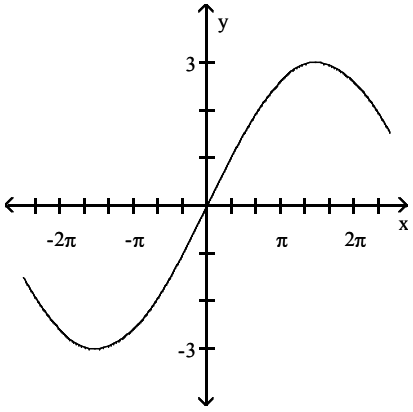
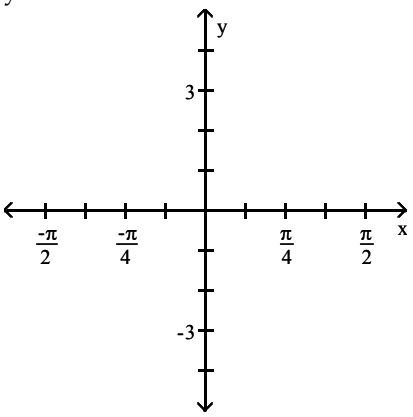
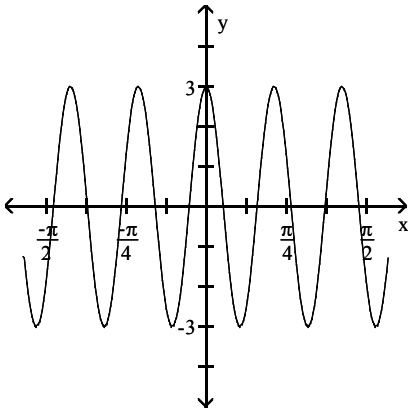


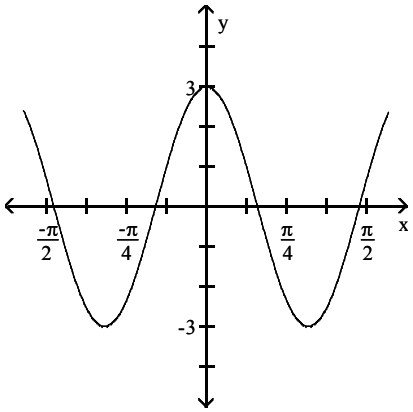
17) $y = 3 \cos 3\pi x$




A)




B)

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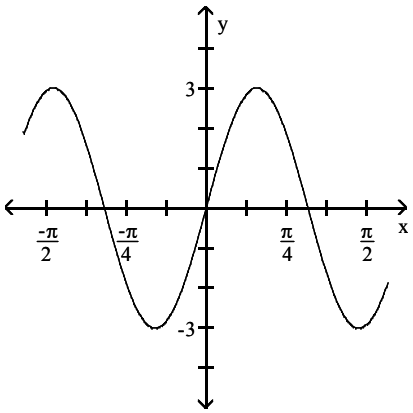


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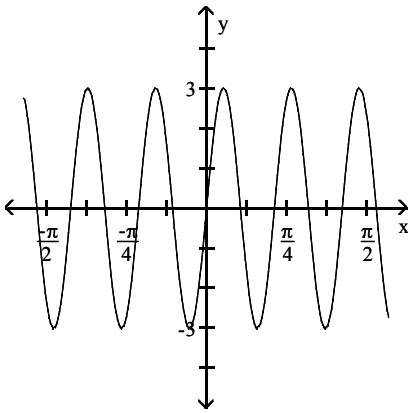
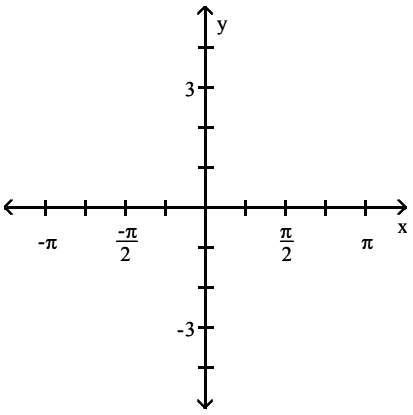
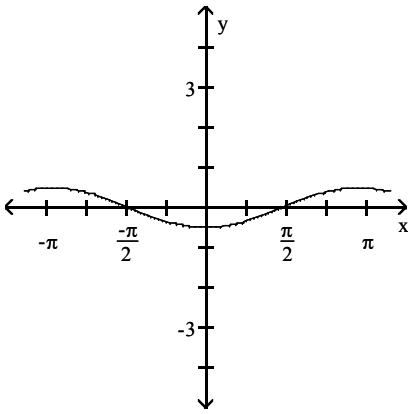


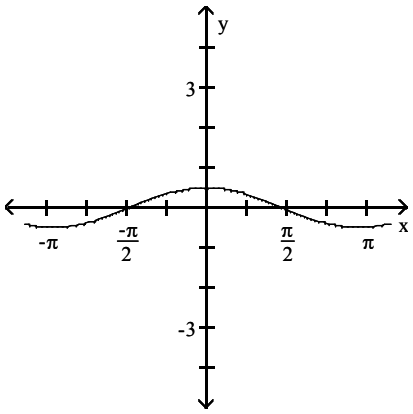
18) $y = -\frac{1}{2}\cos\frac{\pi}{3}x$




A)




B)

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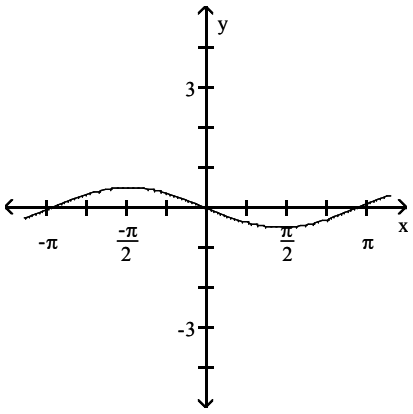


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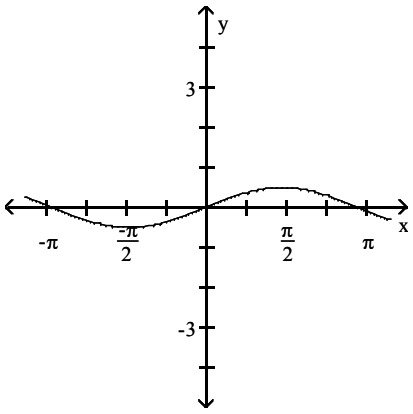
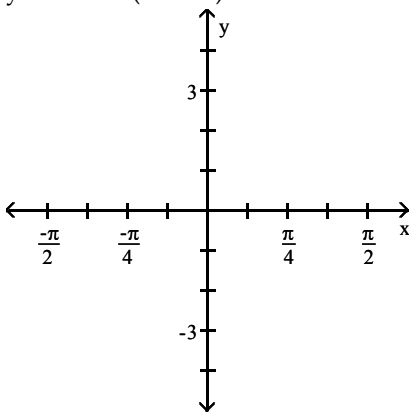
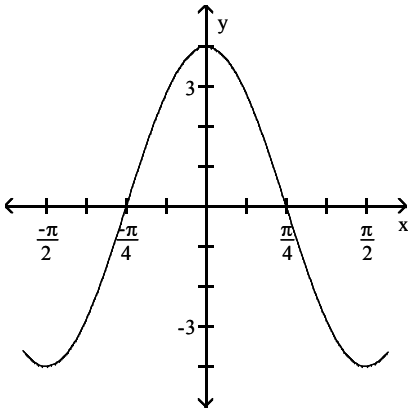


19) $y = -4\cos(2x - \pi)$




A)

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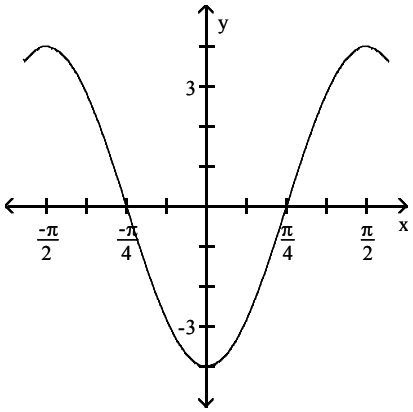


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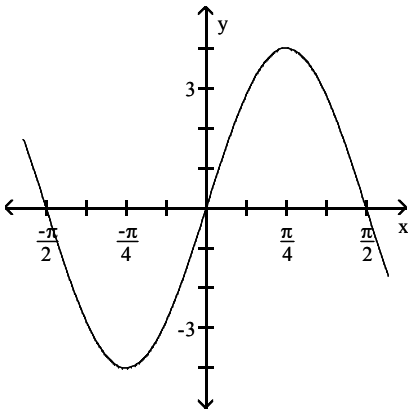


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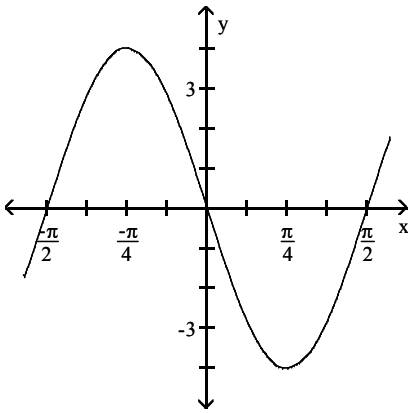
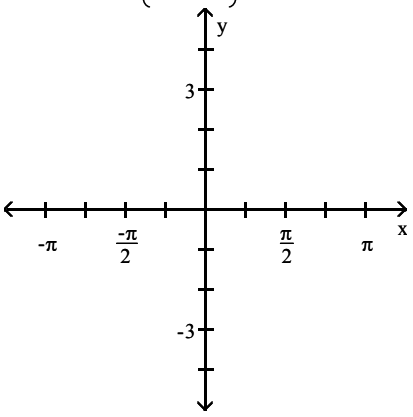
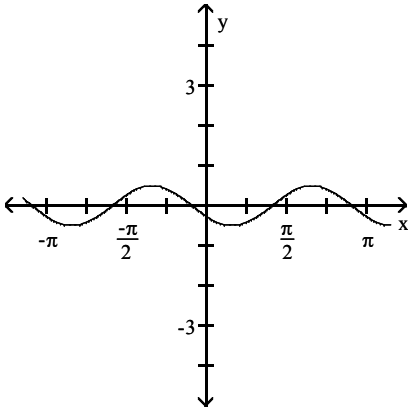


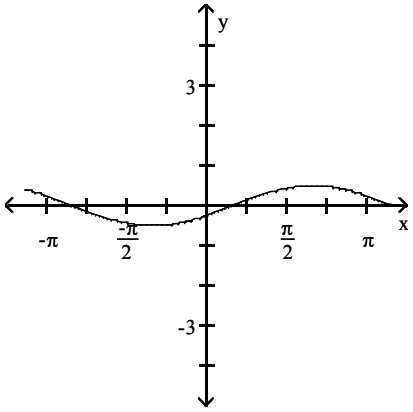
20) $y = -\frac{1}{2}\cos\left(2x - \frac{\pi}{3}\right)$




A)




B)

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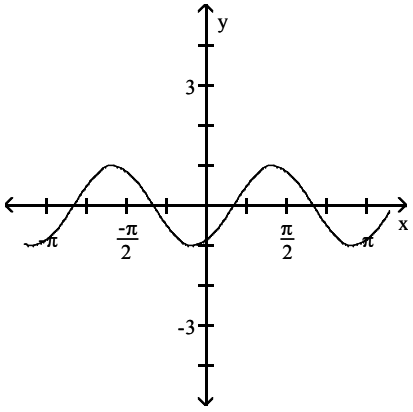
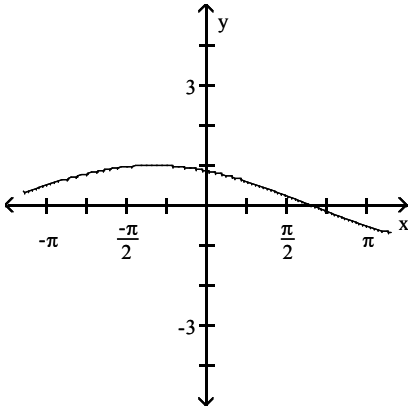
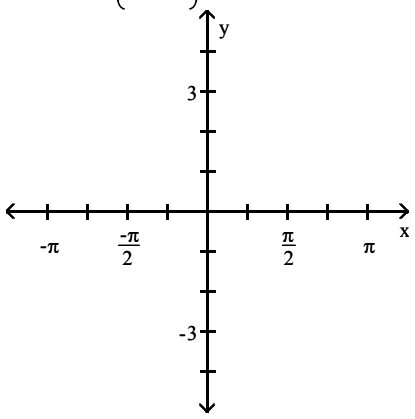


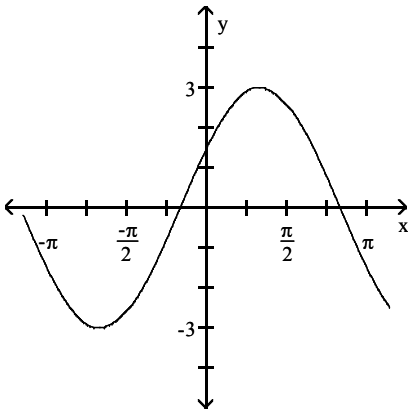

D)



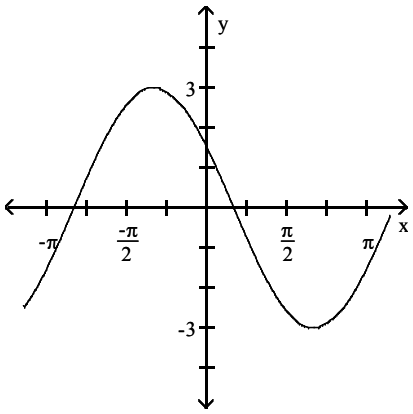
21) $y = 3\cos\left(x - \frac{\pi}{3}\right)$



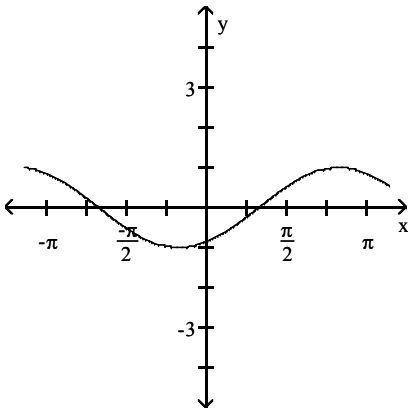

A)



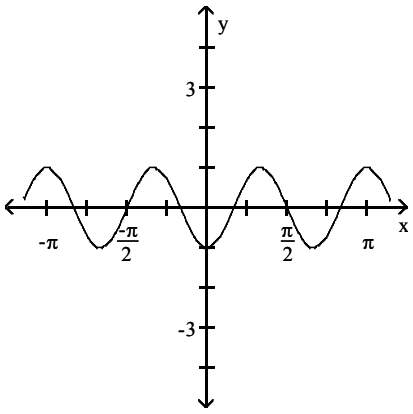

B)



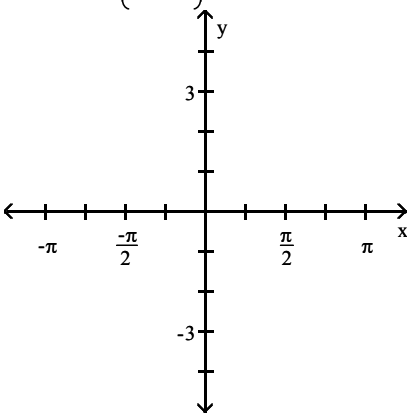

C)



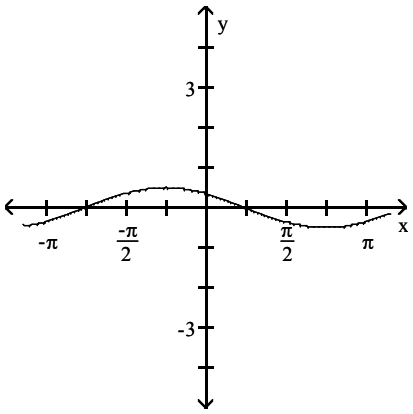

D)



22) $y = \frac{1}{2}\cos\left(x + \frac{\pi}{4}\right)$




A)

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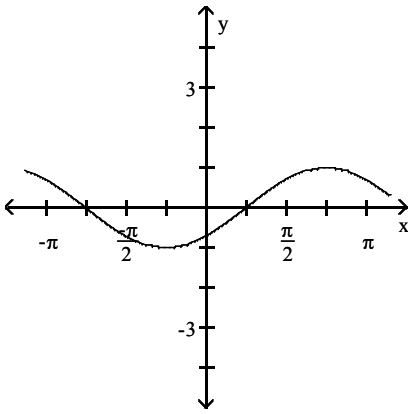


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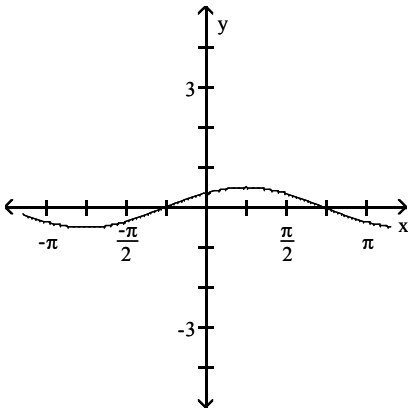
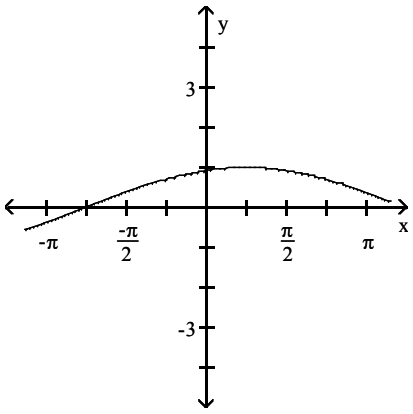
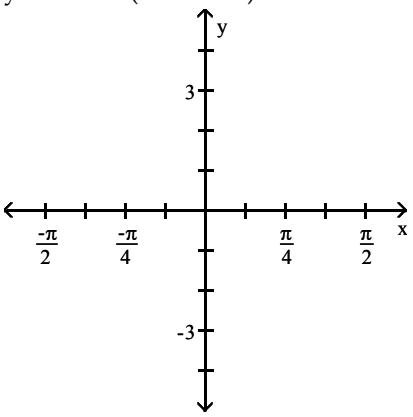


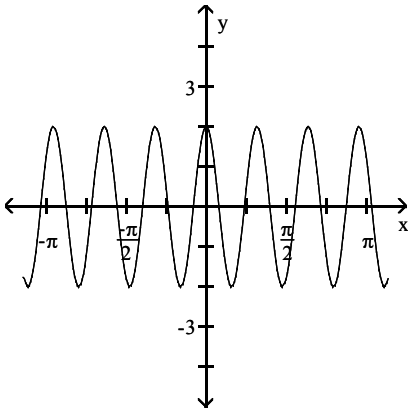

D)



23) $y = -2\cos(2\pi x + 3\pi)$




A)

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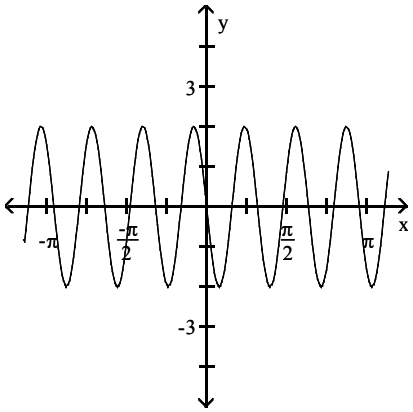


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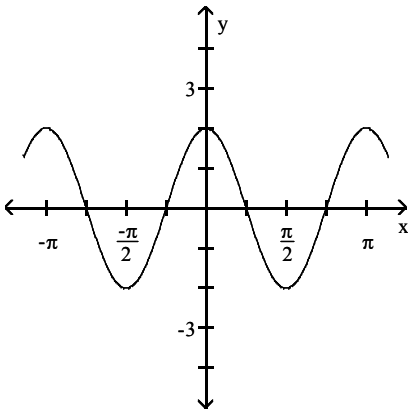


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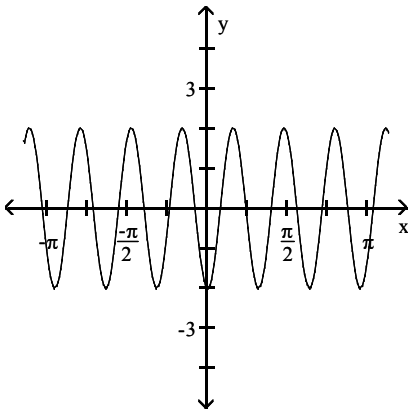
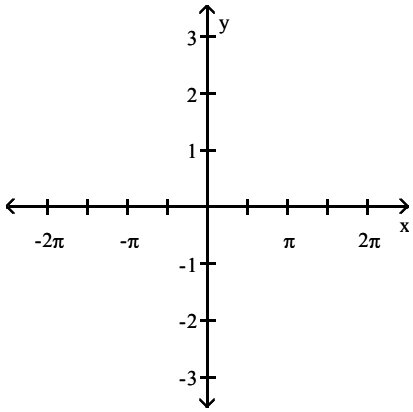


## 5 Use Vertical Shifts of Sine and Cosine Curves

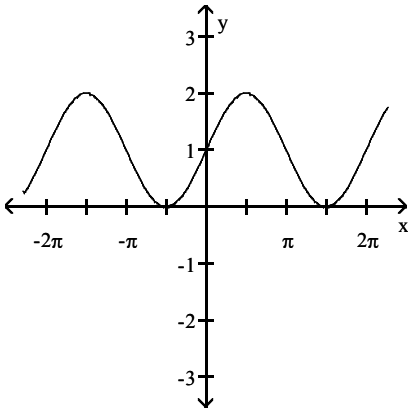
**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Use a vertical shift to graph the function.**

1) $y = 1 + \sin x$




A)

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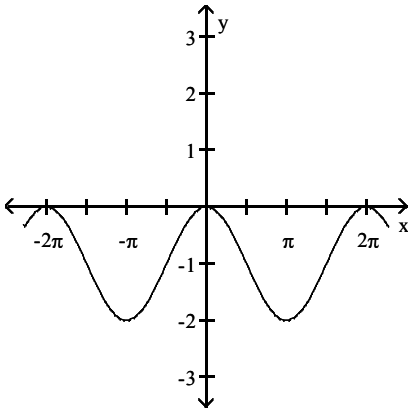
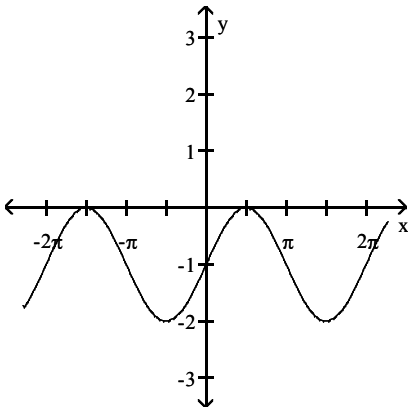
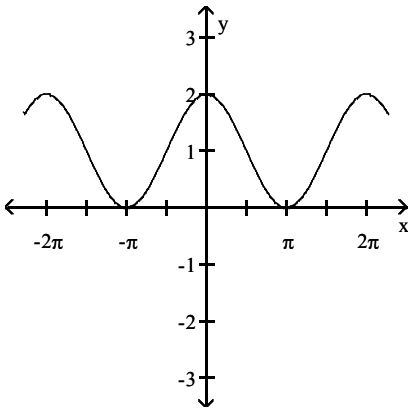


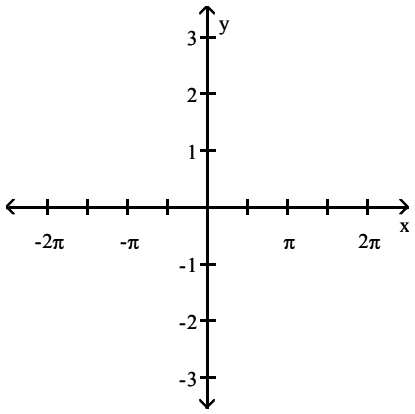

C)



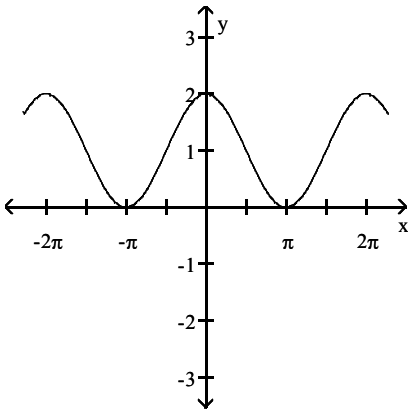

D)



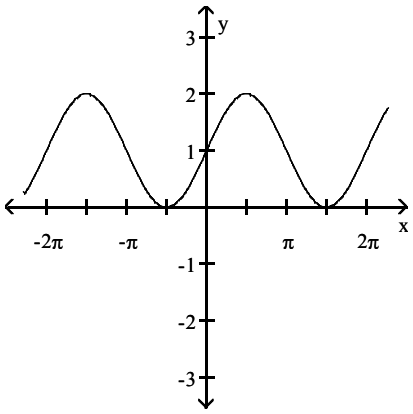
2) $y = 1 + \cos x$



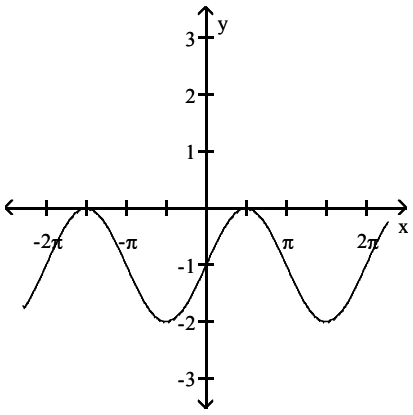

A)



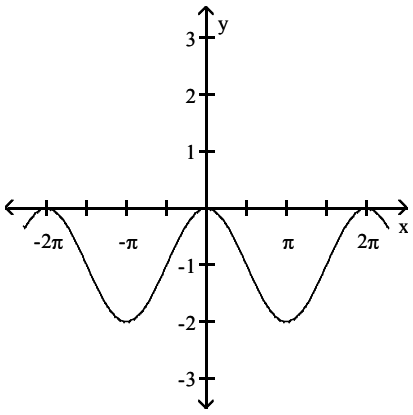

B)



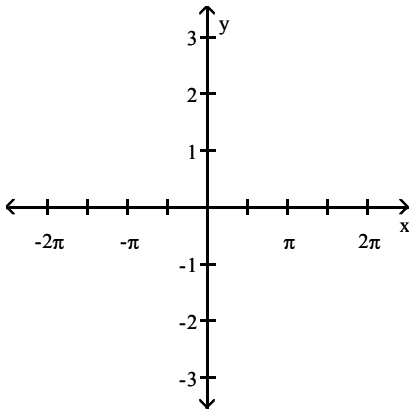

C)



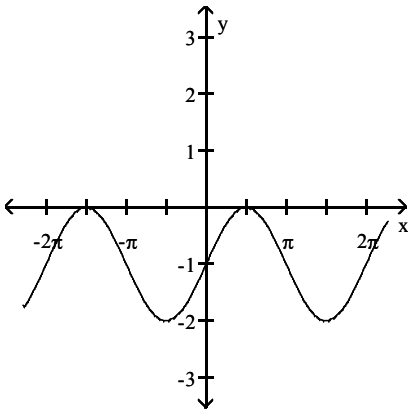

D)



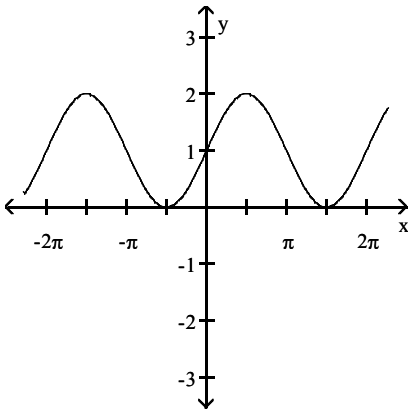
3) $y = \sin x - 1$




A)




B)

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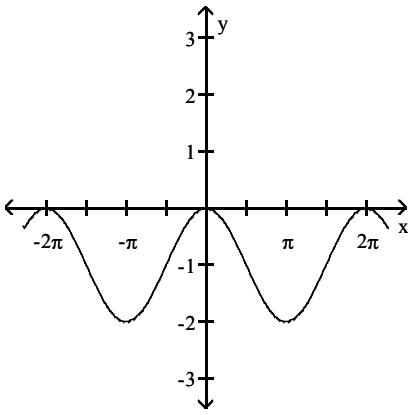


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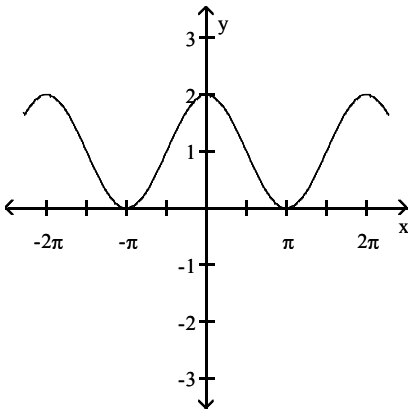
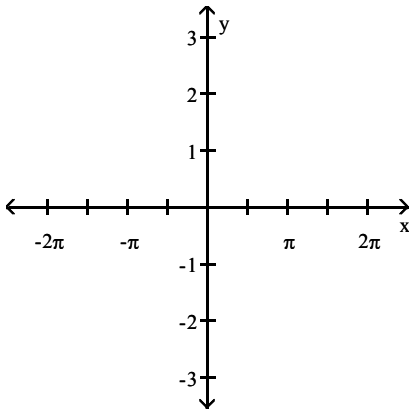
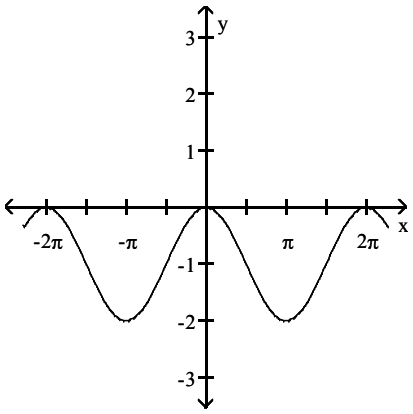


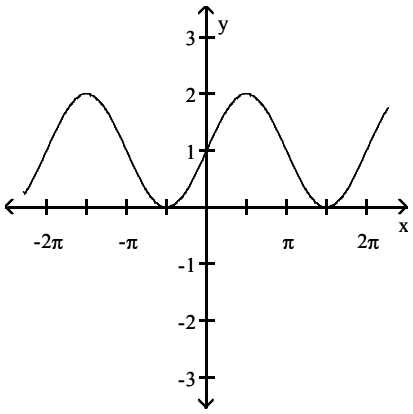
4) $y = \cos x - 1$




A)




B)

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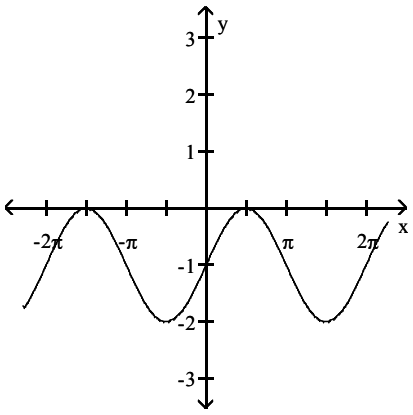
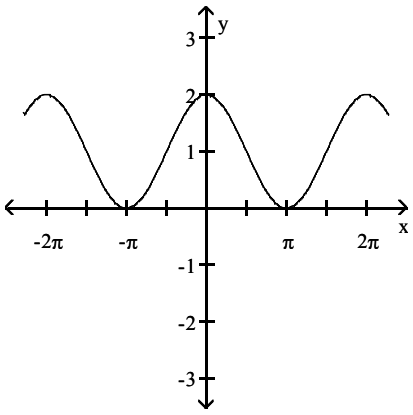
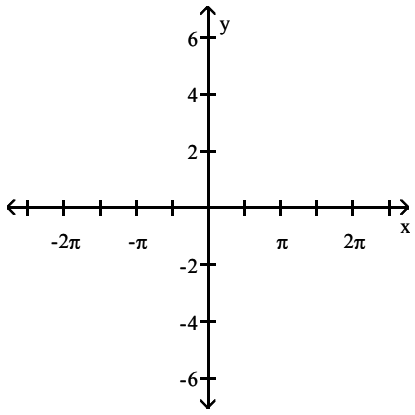


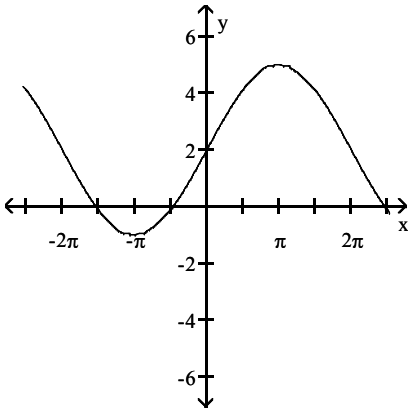

D)



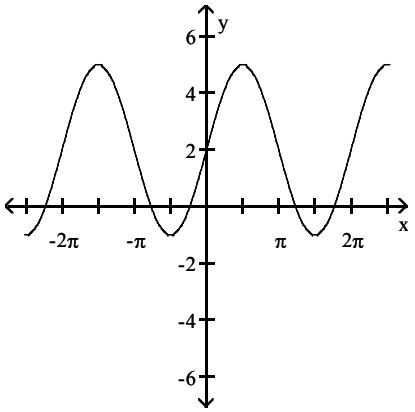
5) $y = 3 \sin \frac{1}{2}x + 2$



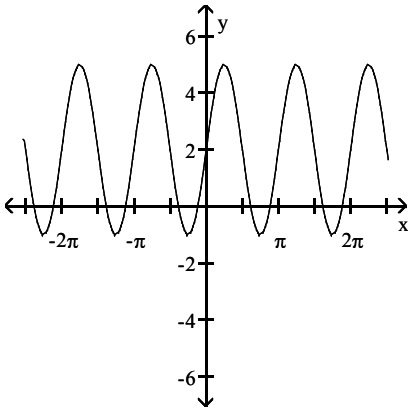

A)



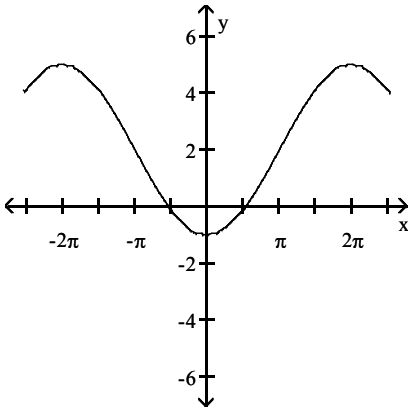

B)



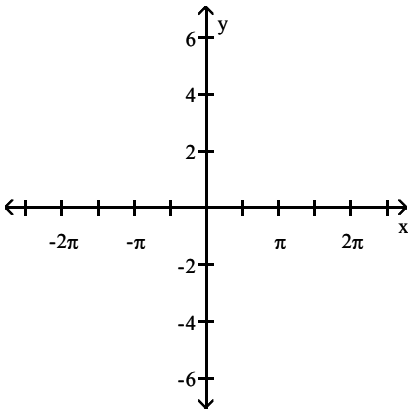

C)



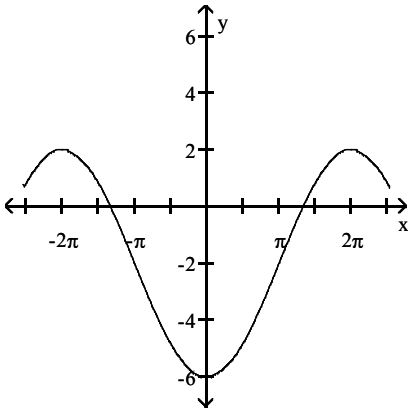

D)



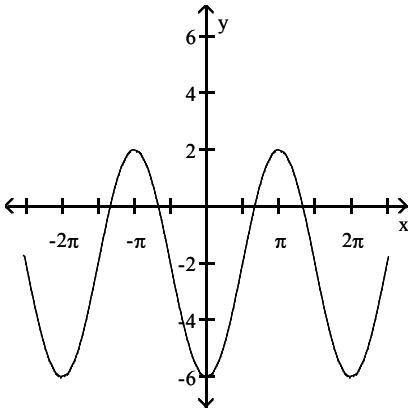
6) $y = -4 \cos \frac{1}{2}x - 2$



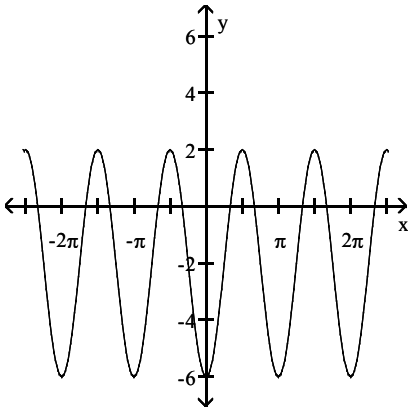

A)



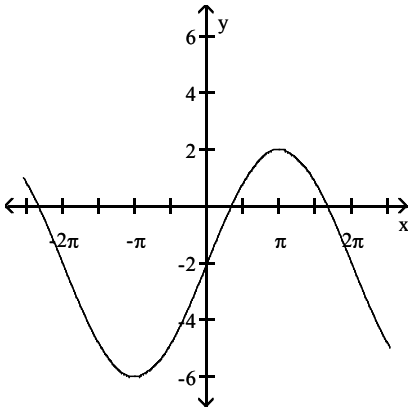

B)



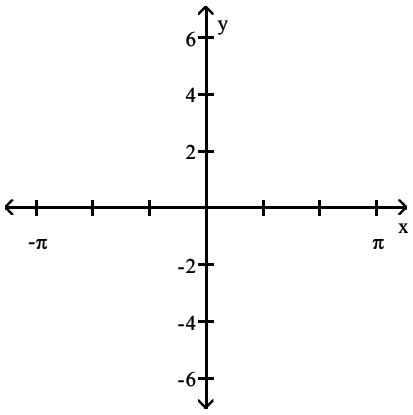

C)



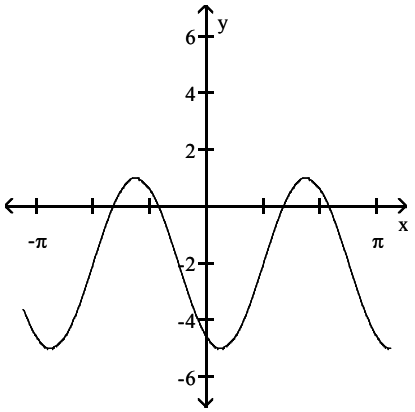

D)



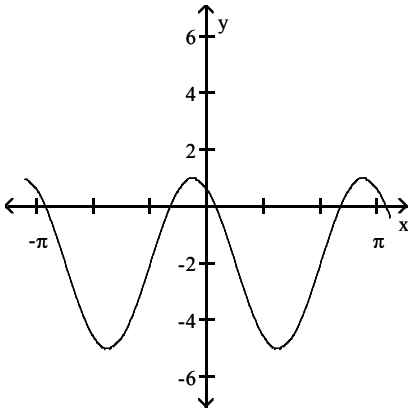
7) $y = -3 \sin\left(2x + \frac{\pi}{3}\right) - 2$



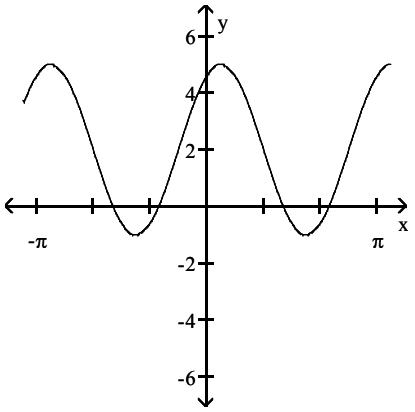

A)



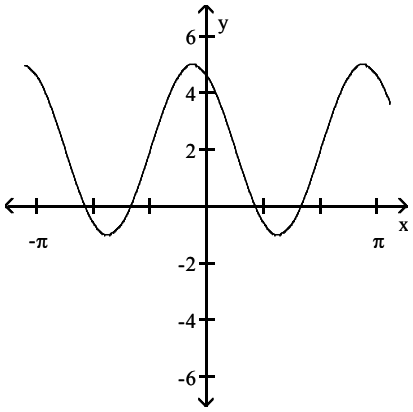

B)



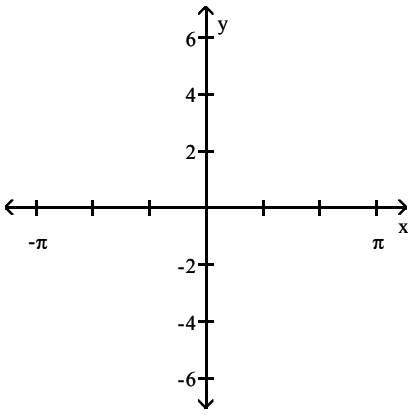

C)



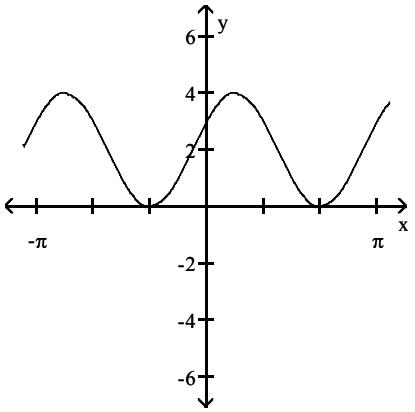

D)



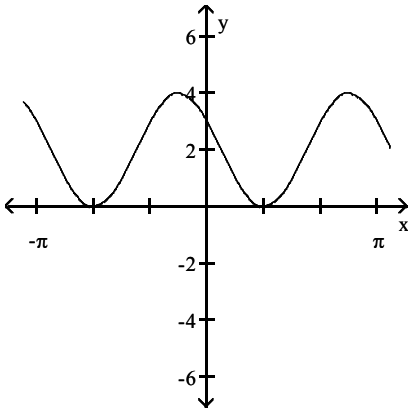
8) $y = 2\cos\left(2x - \frac{\pi}{3}\right) + 2$



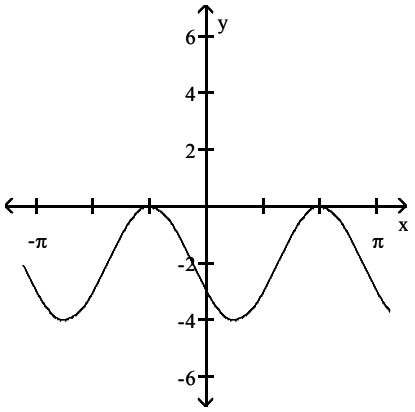

A)



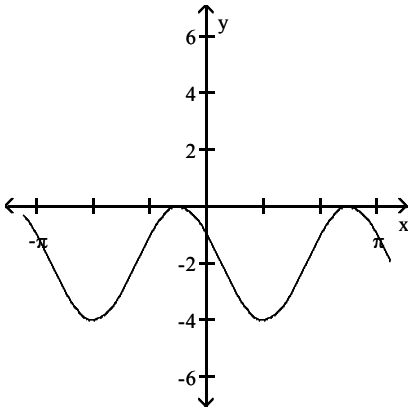

B)




C)




D)



## 6 Model Periodic Behavior

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Solve the problem.**

1) An experiment in a wind tunnel generates cyclic waves. The following data is collected for 60 seconds:

| Time (in seconds) | Wind speed (in feet per second) |
|---|---|
| 0 | 24 |
| 15 | 47 |
| 30 | 70 |
| 45 | 47 |
| 60 | 24 |

Let V represent the wind speed (velocity) in feet per second and let t represent the time in seconds. Write a sine equation that describes the wave.

A) $V = 23 \sin\left(\frac{\pi}{30} t - \frac{\pi}{2}\right) + 47$

B) $V = 70 \sin(60t - 30) + 24$

C) $V = 70 \sin\left(\frac{\pi}{30} t - \frac{\pi}{2}\right) + 24$

D) $V = 46 \sin(60t - 30) + 23$

2) The current I, in amperes, flowing through a particular ac (alternating current) circuit at time t seconds is

$$I = 240 \sin\left(25\pi t - \frac{\pi}{3}\right)$$

What is the period of the current?

A) $\frac{2}{25}$ second

B) $25\pi$ seconds

C) $\frac{1}{75}$ second

D) $\frac{\pi}{240}$ second

3) The total sales in dollars of some small businesses fluctuates according to the equation $S = A + B \sin \frac{\pi}{6}x$,

where x is the time in months, with x = 1 corresponding to January, A = 6100, and B = 3300. Determine the month with the greatest total sales and give the sales in that month.

A) March; $9400

B) June; $6100

C) September; $2800

D) December; $9400

4) Tides go up and down in a 12.4–hour period. The average depth of a certain river is 10 m and ranges from 5 to 15 m. The variation can be approximated by a sine curve. Write an equation that gives the approximate variation y, if x is the number of hours after midnight and high tide occurs at 5:00 am.

A) $y = 5 \sin\left(\frac{\pi x}{6.2} - \frac{1.9\pi}{6.2}\right) + 10$

B) $y = 10 \sin\left(\frac{\pi x}{6.2} - 5\pi\right) + 5$

C) $y = 5 \sin\left(\frac{\pi x}{6.2} - \frac{5\pi}{6.2}\right) + 10$

D) $y = 10 \sin\left(\frac{\pi x}{6.2} - \frac{5\pi}{6.2}\right) + 5$

5) Suppose that the average monthly low temperatures for a small town are shown in the table.

| Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (°F) | 19 | 27 | 38 | 45 | 57 | 62 | 65 | 58 | 51 | 41 | 33 | 25 |

Model this data using f(x) = a sin(b(x – c)) + d. Use the sine regression feature to do this. Approximate all values to one decimal place.

A) f(x) = 22.5sin (0.5(x + 1.6)) + 40.7

B) f(x) = 25.7sin (0.5(x + 1.6)) + 32.5

C) f(x) = 22.5sin (0.5(x + 3.2)) + 40.7

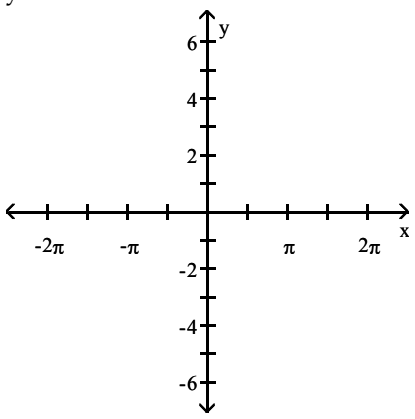
D) f(x) = 22.5sin (1.25(x + 1.6)) + 40.7

## 7 Graph the Sum of Two Trigonometric Functions

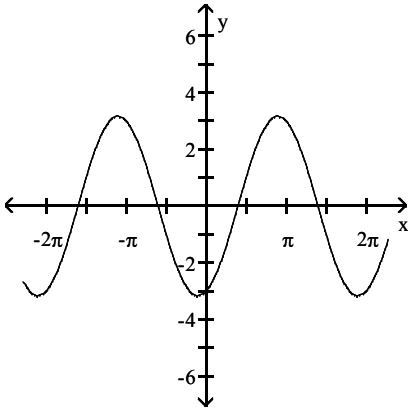
**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Graph the function.**

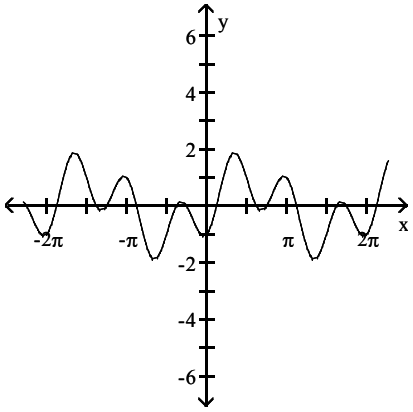
1) $y = \sin x - 3 \cos x$



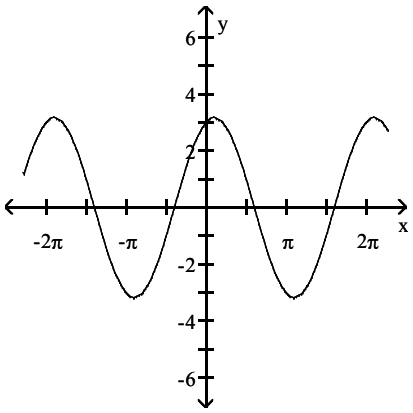

A)



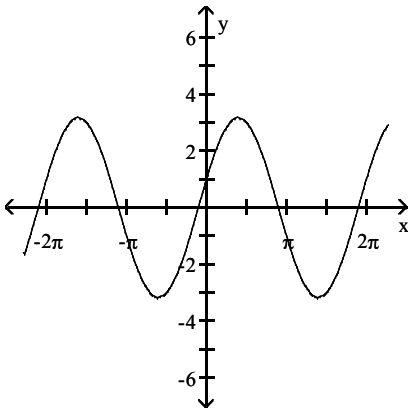

B)



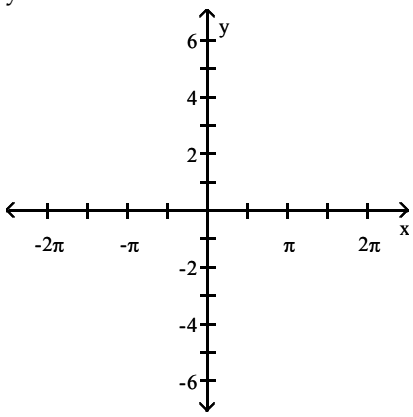

C)



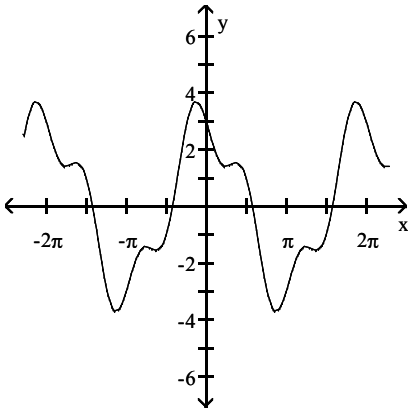

D)



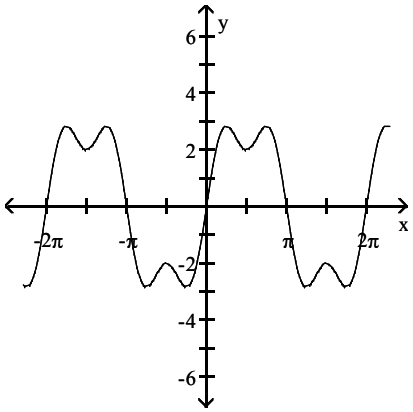
2) $y = 3\cos x - \sin 3x$



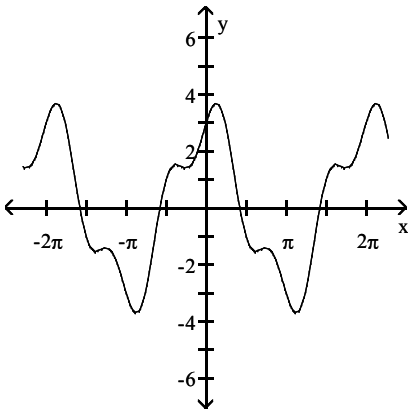

A)



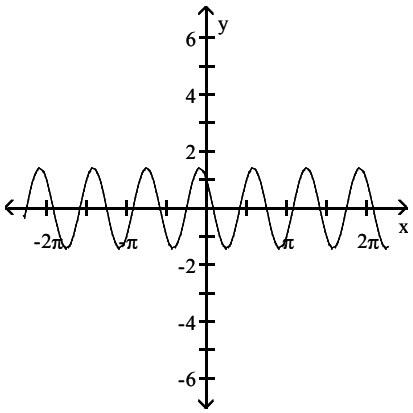

B)




C)

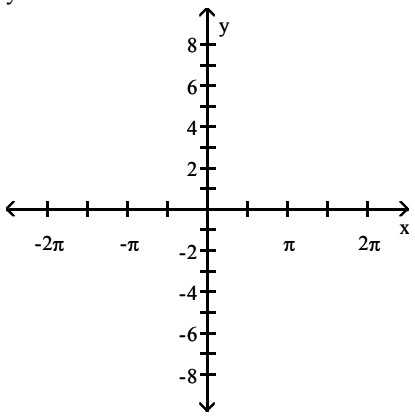



D)

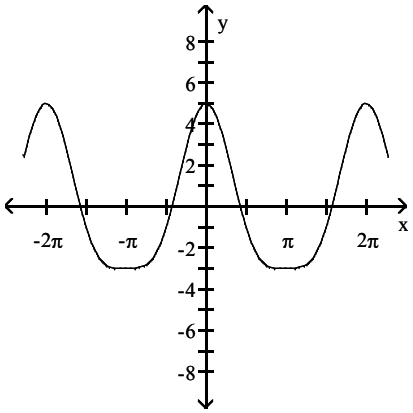


**Use the method of adding y–coordinates to graph the function.**

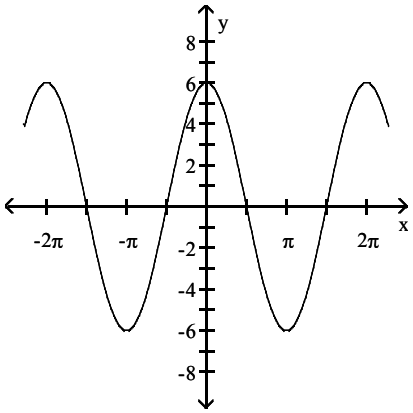
3) $y = 4 \cos x + \cos 2x$



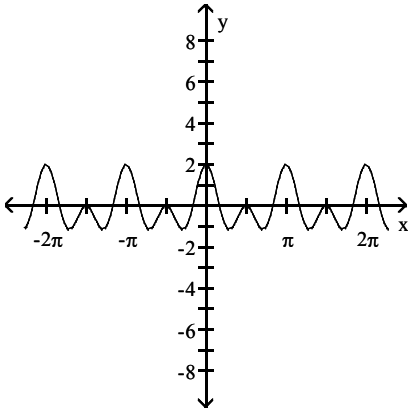

A)



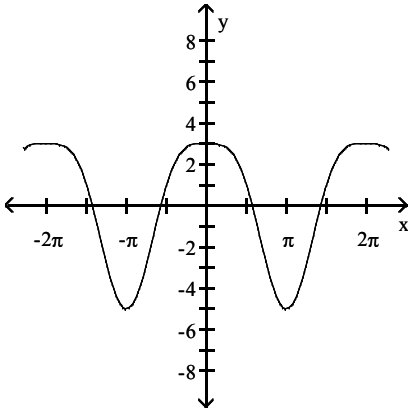

B)



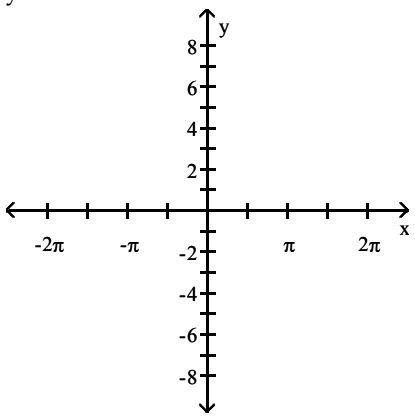

C)



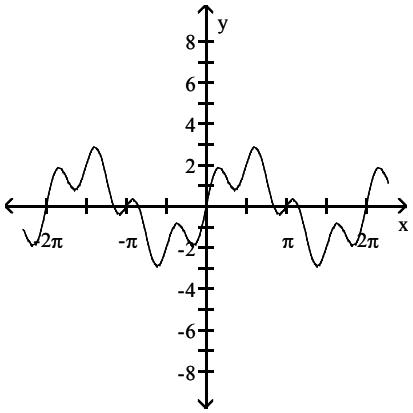

D)



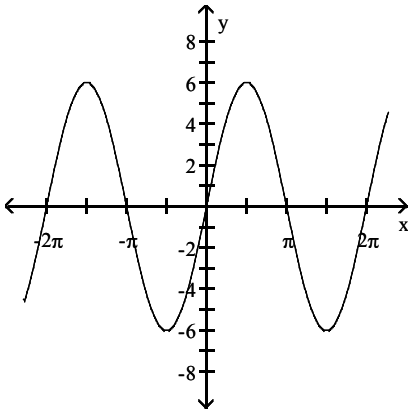
4) $y = 2 \sin x + \sin 4x$



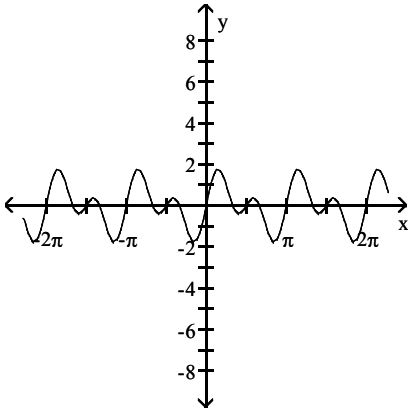

A)



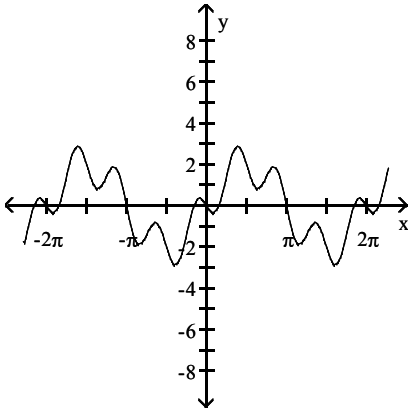

B)




C)




D)



## 8 Tech: Sine and Cosine Functions

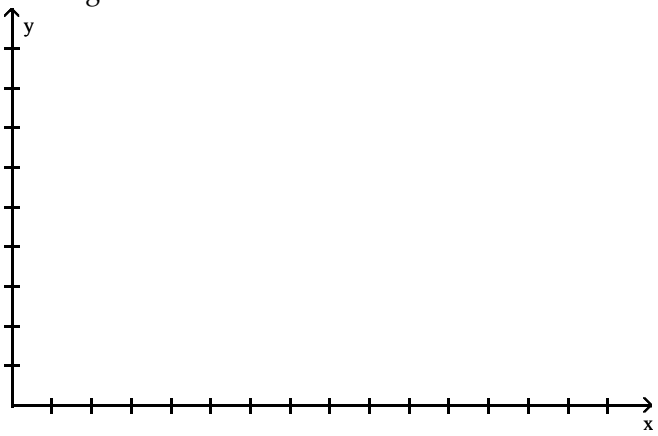
**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

**Solve the problem.**

1) The following data represents the normal monthly precipitation for a certain city.

| Month, x | Normal Monthly Precipitation, inches |
|---|---|
| January, 1 | 6.06 |
| February, 2 | 4.45 |
| March, 3 | 4.38 |
| April, 4 | 2.08 |
| May, 5 | 1.27 |
| June, 6 | 0.56 |
| July, 7 | 0.17 |
| August, 8 | 0.46 |
| September, 9 | 0.91 |
| October, 10 | 2.24 |
| November, 11 | 5.21 |
| December, 12 | 5.51 |

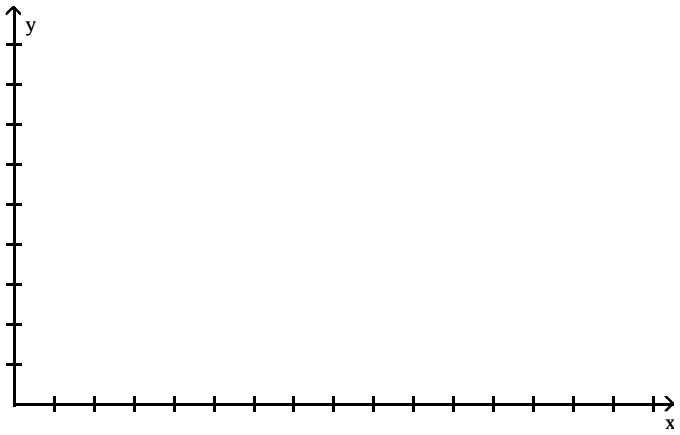
Draw a scatter diagram of the data for one period. Find a sinusoidal function of the form $y = A \sin(\omega x - \phi) + B$ that fits the data. Draw the sinusoidal function on the scatter diagram. Use a graphing utility to find the sinusoidal function of best fit. Draw the sinusoidal function of best fit on the scatter diagram.



2) The following data represents the normal monthly precipitation for a certain city.

| Month, x | Normal Monthly Precipitation, inches |
|---|---|
| January, 1 | 3.91 |
| February, 2 | 4.36 |
| March, 3 | 5.31 |
| April, 4 | 6.21 |
| May, 5 | 7.02 |
| June, 6 | 7.84 |
| July, 7 | 8.19 |
| August, 8 | 8.06 |
| September, 9 | 7.41 |
| October, 10 | 6.30 |
| November, 11 | 5.21 |
| December, 12 | 4.28 |

Draw a scatter diagram of the data for one period. Find the sinusoidal function of the form $y = A \sin(\omega x - \phi) + B$ that fits the data. Draw the sinusoidal function on the scatter diagram. Use a graphing utility to find the sinusoidal function of best fit. Draw the sinusoidal function of best fit on the scatter diagram.

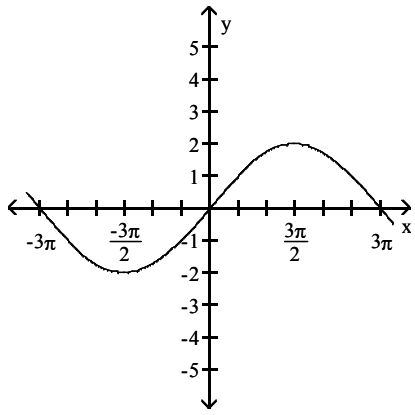


## 9 Additional Concepts

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

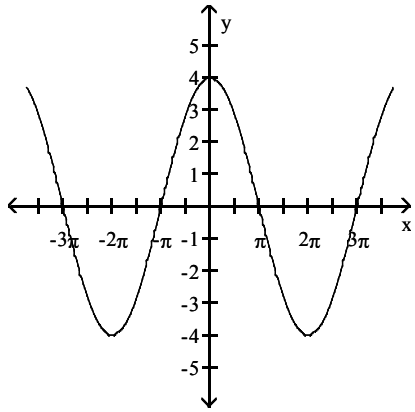
**Find an equation for the graph.**

1)



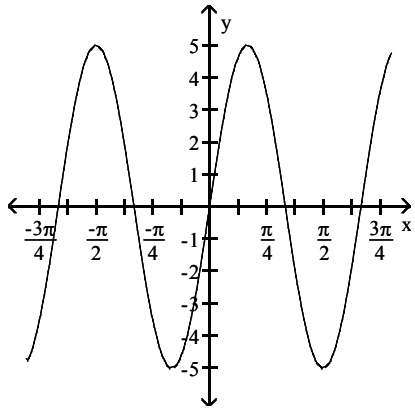

A) $y = 2 \sin \frac{1}{3}x$ B) $y = 2 \sin 3x$ C) $y = 3 \sin \frac{1}{2}x$ D) $y = 3 \sin 2x$

2)



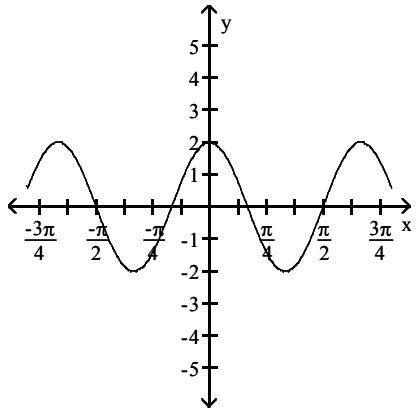

A) $y = 4 \cos \frac{1}{2}x$ B) $y = 4 \cos 2x$ C) $y = 2 \cos \frac{1}{4}x$ D) $y = 2 \cos 4x$

3)



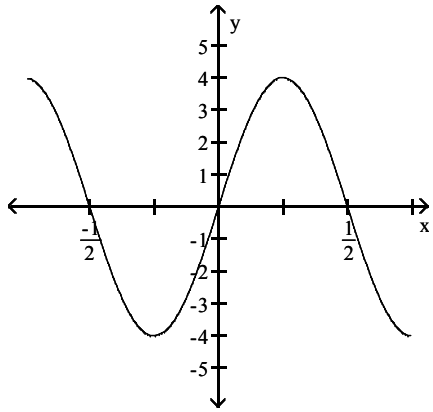

A) $y = 5 \sin 3x$ B) $y = 5 \sin \frac{1}{3}x$ C) $y = 3 \sin \frac{1}{5}x$ D) $y = 3 \sin 5x$

4)



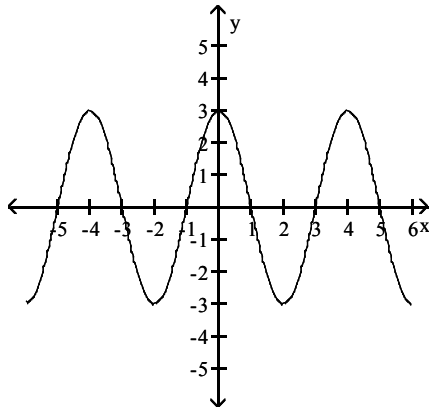

A) $y = 2 \cos 3x$ B) $y = 2 \cos \frac{1}{3}x$ C) $y = 3 \cos \frac{1}{2}x$ D) $y = 3 \cos 2x$

5)




A) $y = 4 \sin 2\pi x$ B) $y = 4 \sin \frac{\pi}{2}x$ C) $y = 2 \sin 4\pi x$ D) $y = 2 \sin \frac{\pi}{4}x$

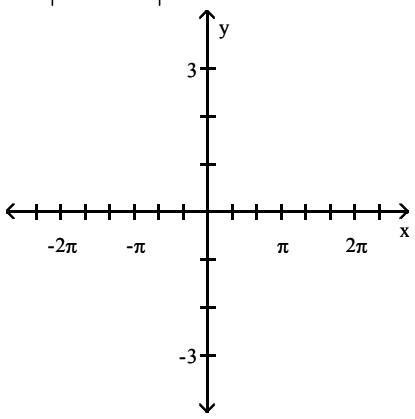
6)



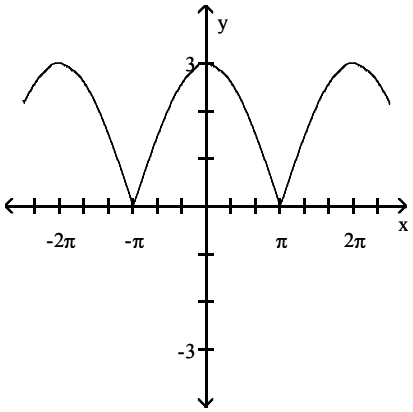

A) $y = 3 \cos \frac{\pi}{2}x$ B) $y = 3 \cos 2\pi x$ C) $y = 2 \cos 3\pi x$ D) $y = 2 \cos \frac{\pi}{3}x$

**Graph the function.**

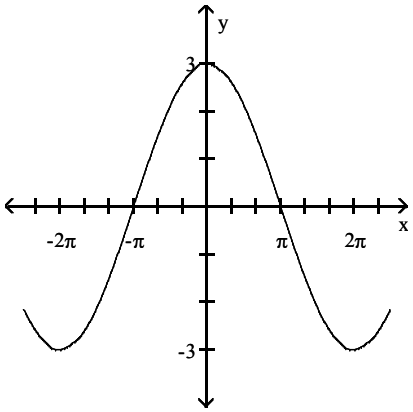
7) $y = \left|3 \cos \frac{1}{2}x\right|$



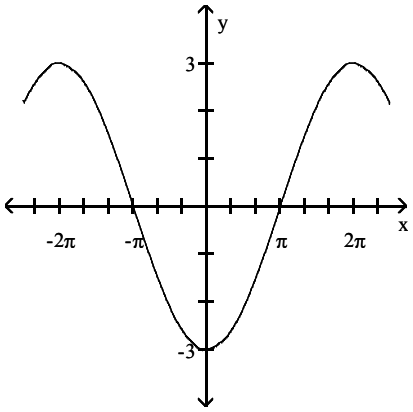

A)



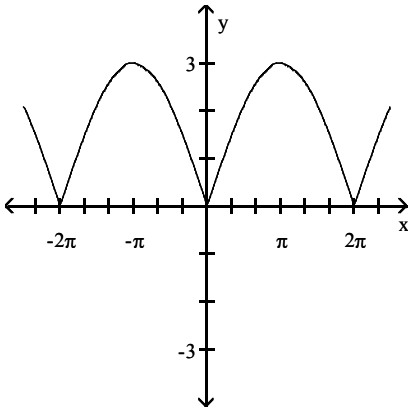

B)



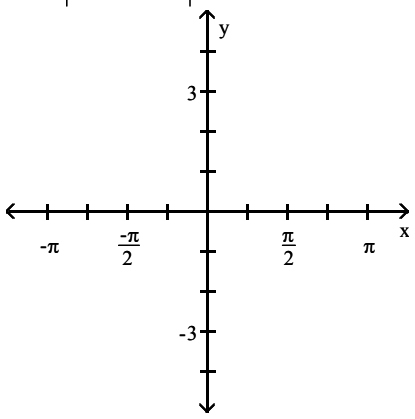

C)



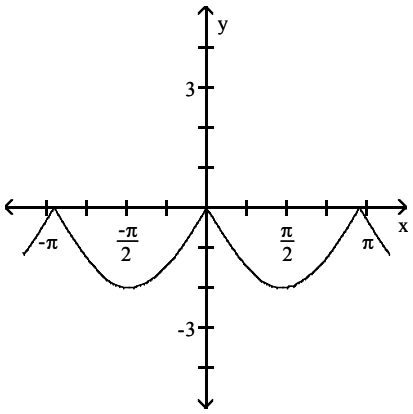

D)



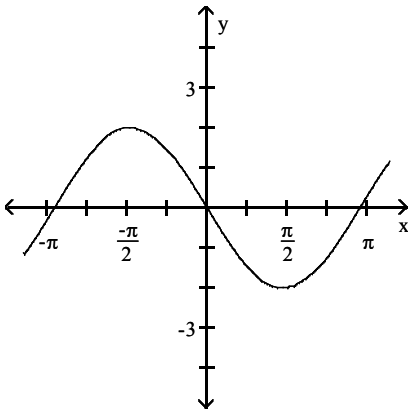
8) $y = -\left|-2 \sin \frac{\pi x}{3}\right|$



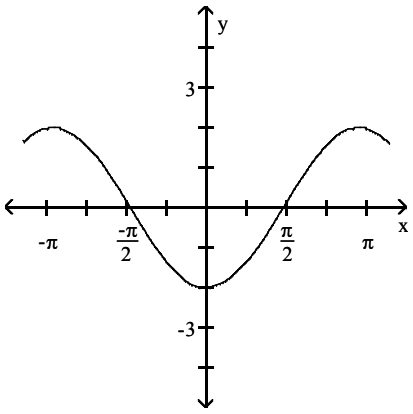

A)



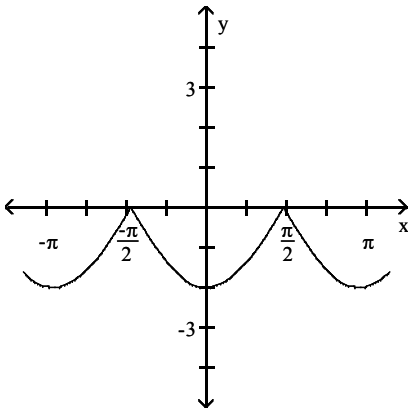

B)




C)




D)



## 2.2 Graphs of Other Trigonometric Functions

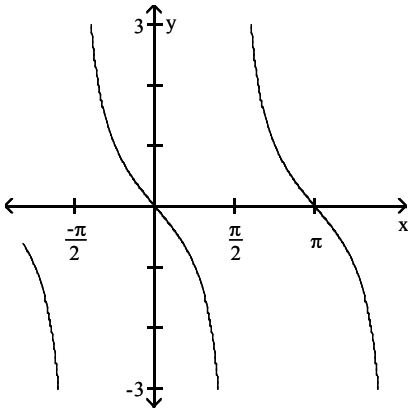
### 1 Understand the Graph of y = tan x

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

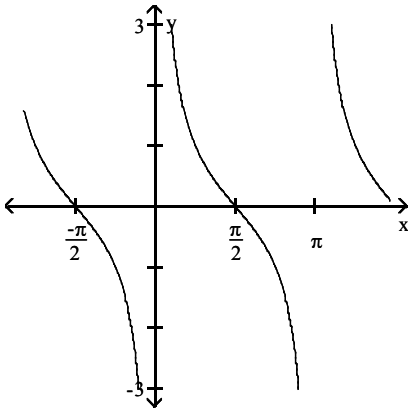
**Match the function to its graph.**

1) y = −tan x

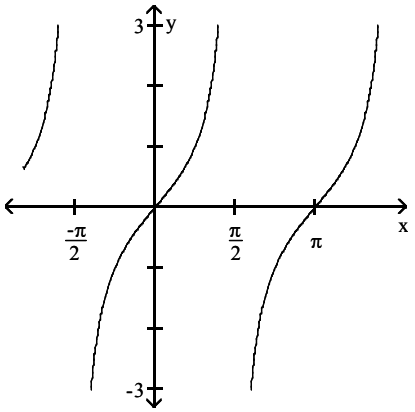
A)



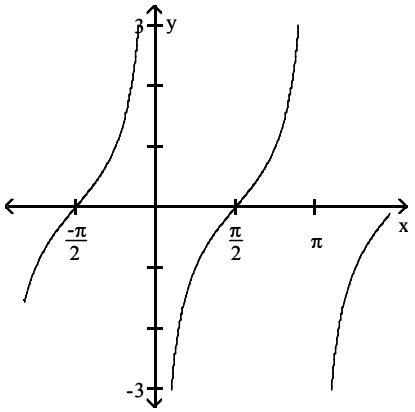

B)




C)

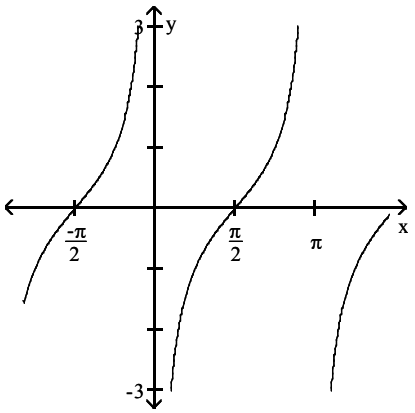



D)

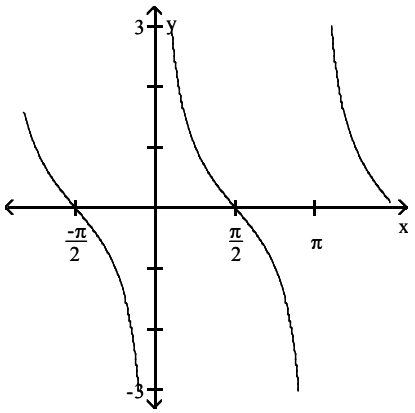


2) $y = \tan\left(x + \frac{\pi}{2}\right)$

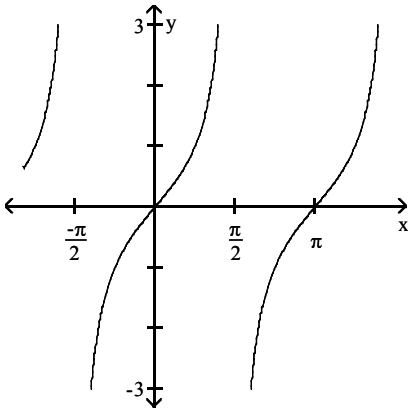
A)



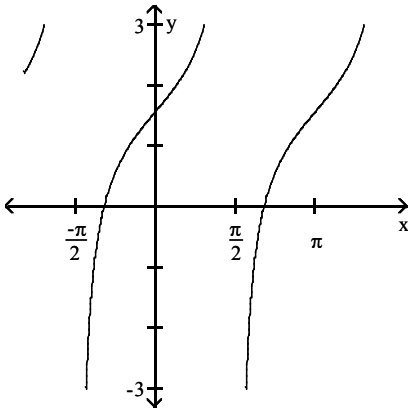

B)




C)

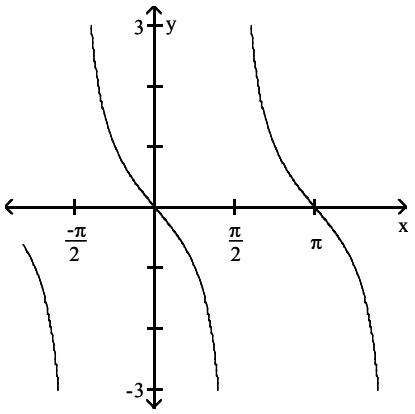



D)

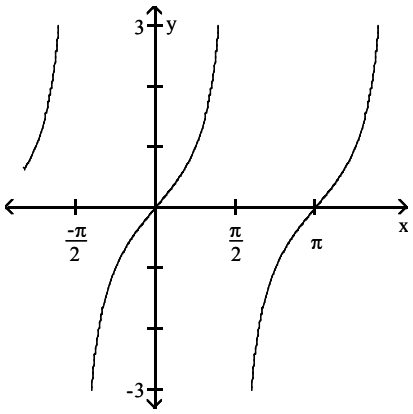


3) $y = -\tan(x + \pi)$

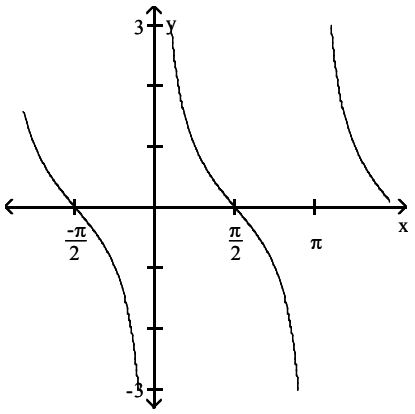
A)



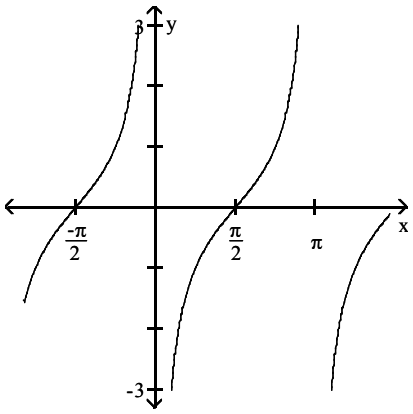

B)




C)

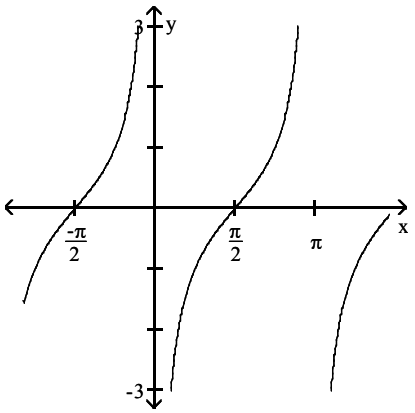



D)

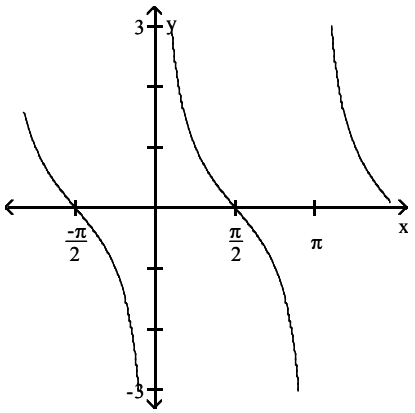


4) $y = \tan\left(x - \frac{\pi}{2}\right)$

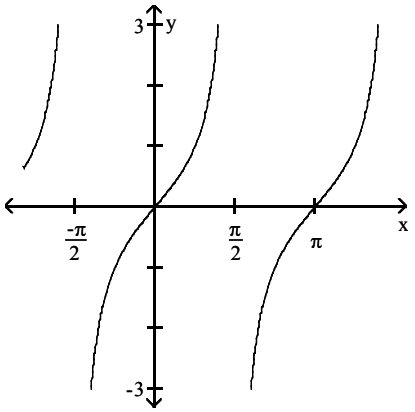
A)



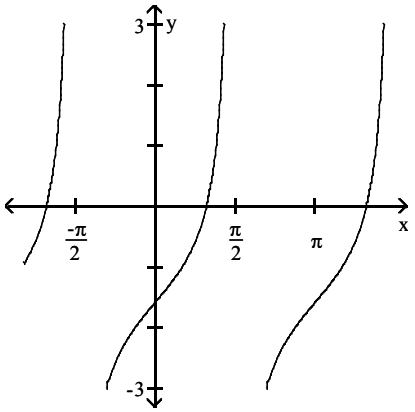

B)




C)




D)

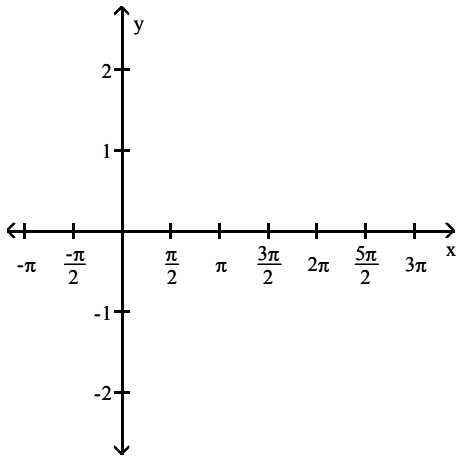


## 2 Graph Variations of y = tan x

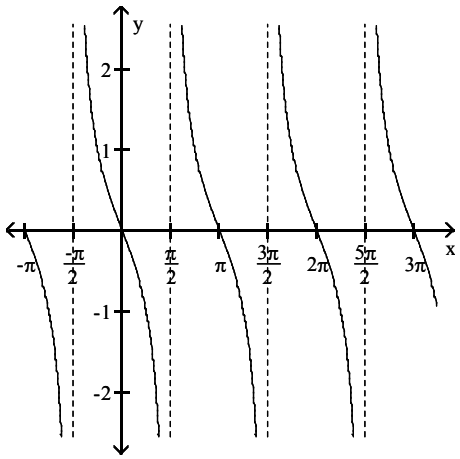
**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Graph the function.**

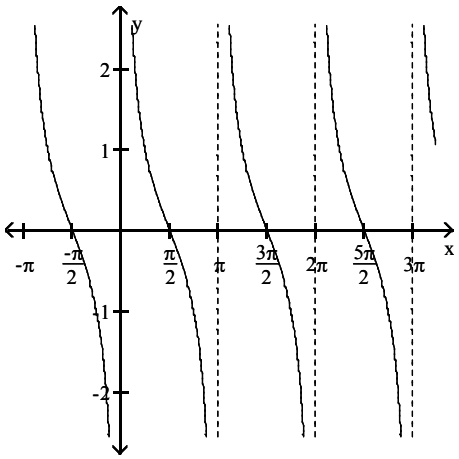
1) y = –tan x



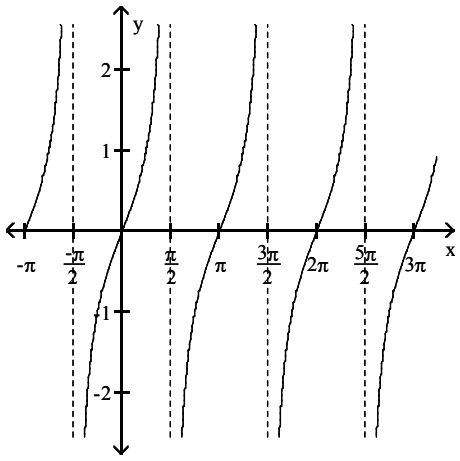

A)



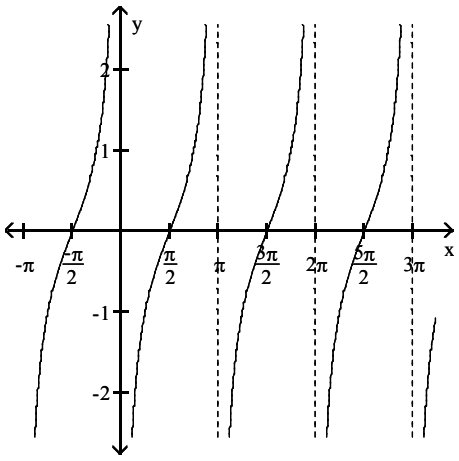

B)



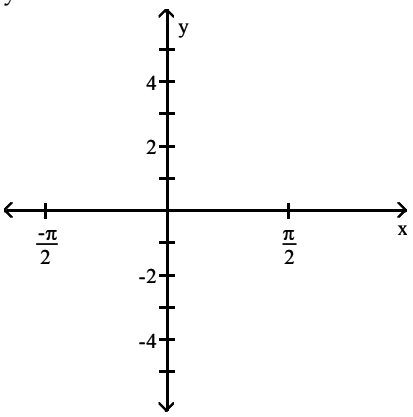

C)



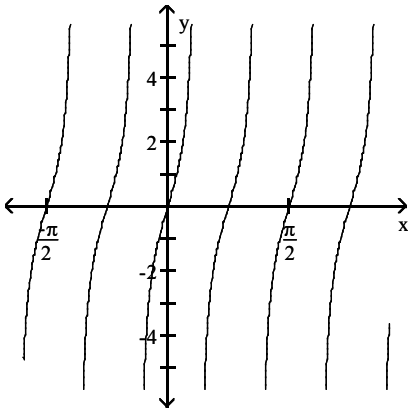

D)



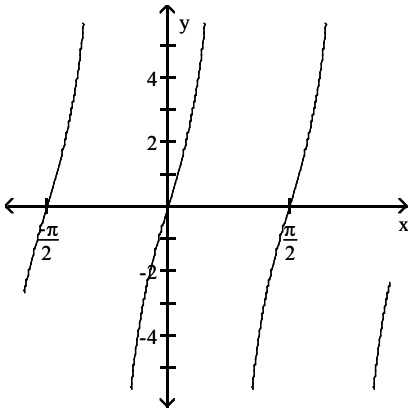
2) $y = 2 \tan 4x$



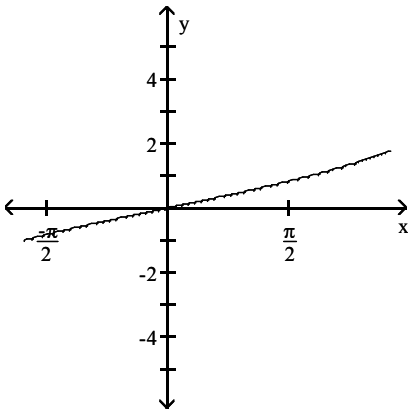

A)



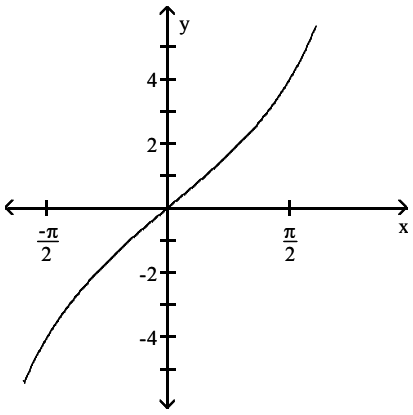

B)



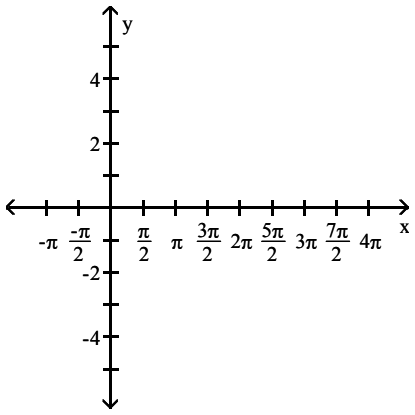

C)



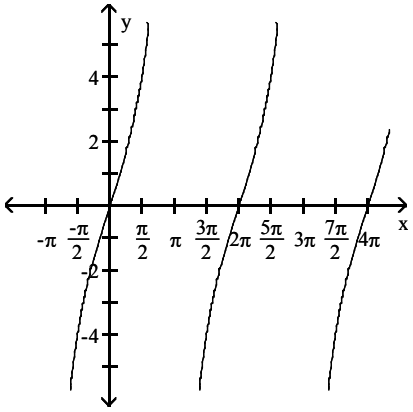

D)



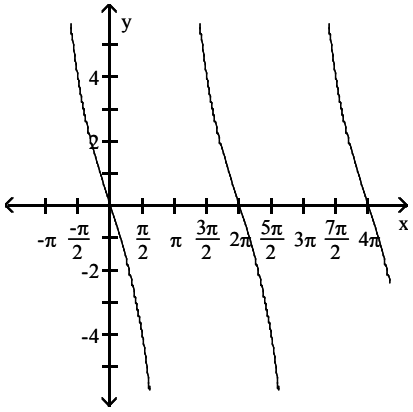
3) $y = 4 \tan \frac{x}{2}$



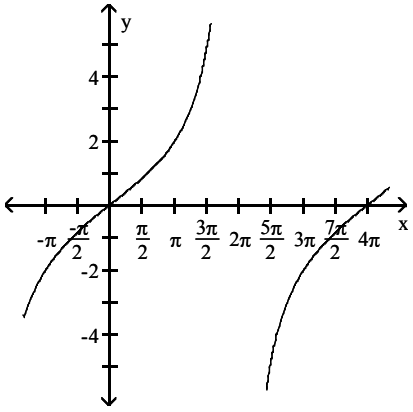

A)



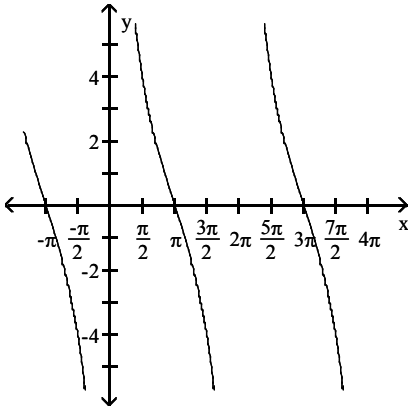

B)



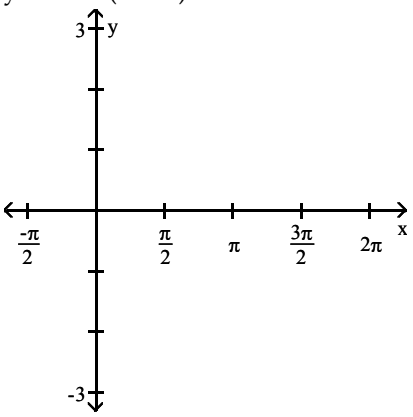

C)



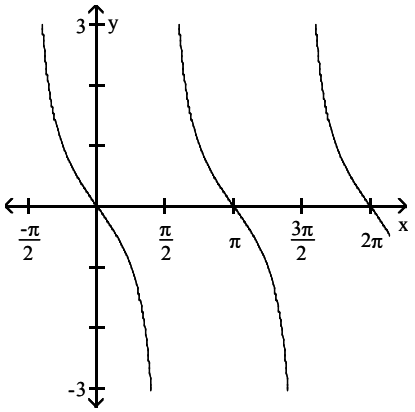

D)



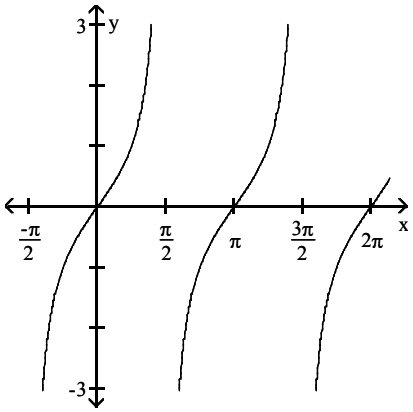
4) $y = -\tan(x - \pi)$



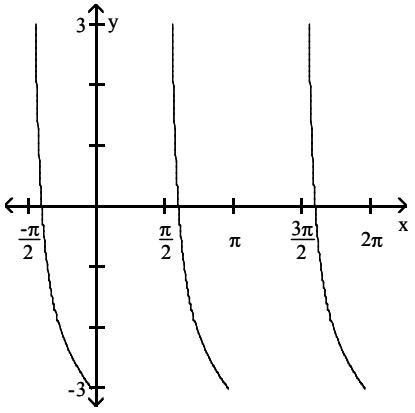

A)



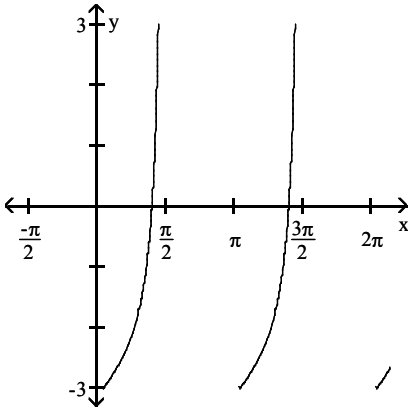

B)



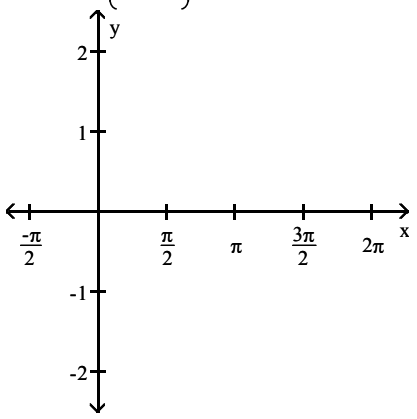

C)



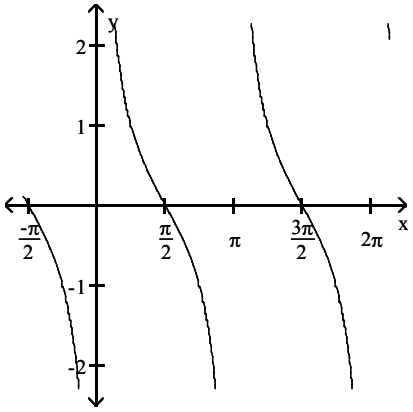

D)



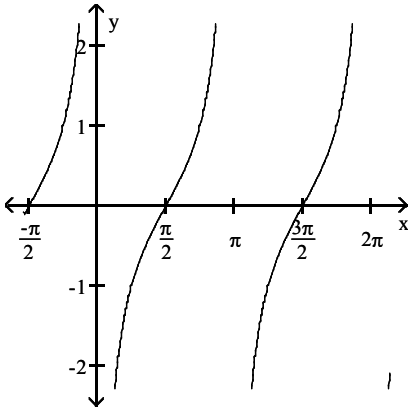
5) $y = -\tan\left(x + \frac{\pi}{2}\right)$



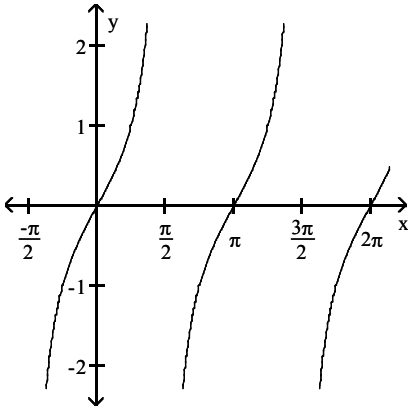

A)



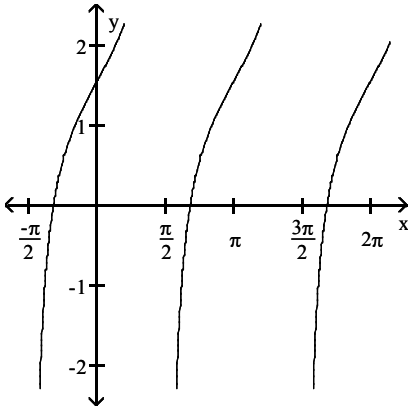

B)




C)




D)



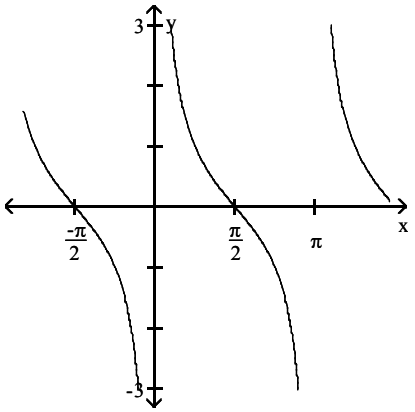
## 3 Understand the Graph of y = cot x

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

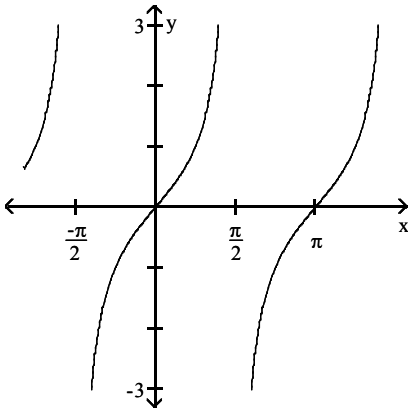
**Match the function to its graph.**

1) y = cot x

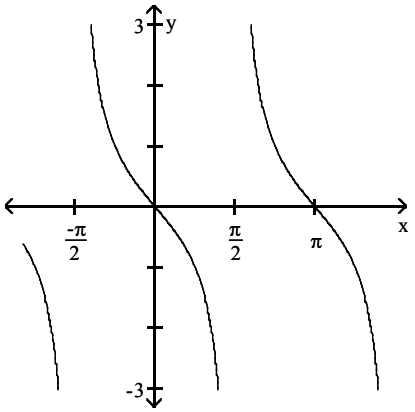
A)



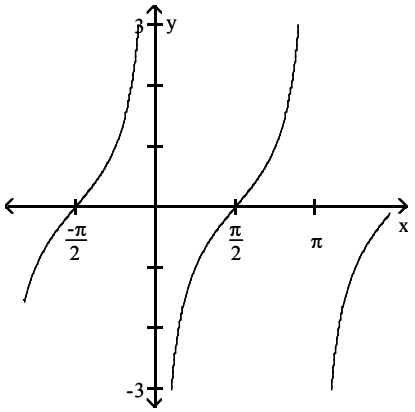

B)




C)

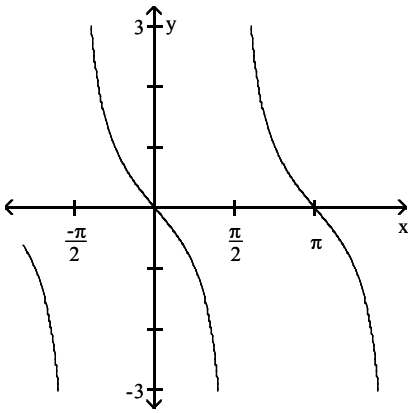



D)

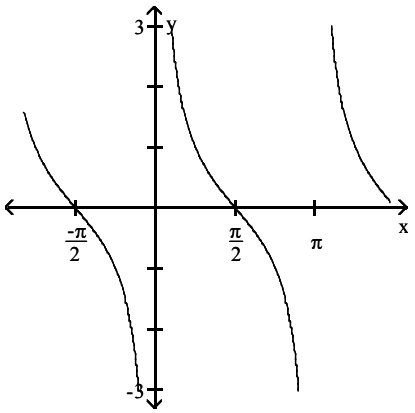


2) $y = \cot\left(x + \frac{\pi}{2}\right)$

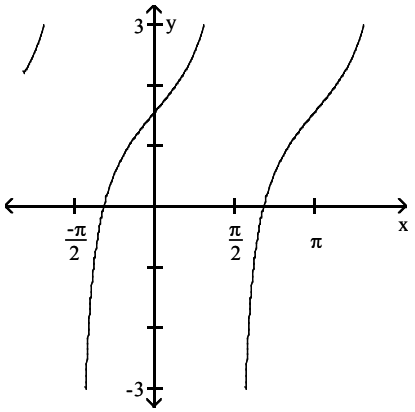
A)



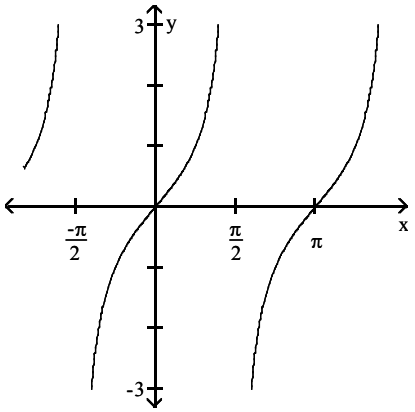

B)




C)

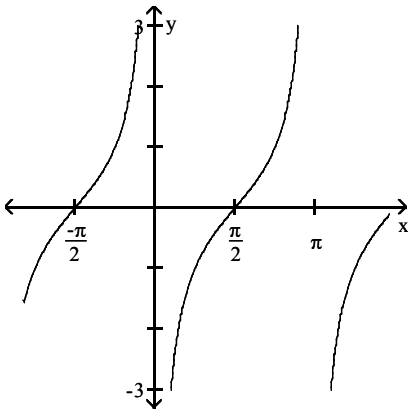



D)

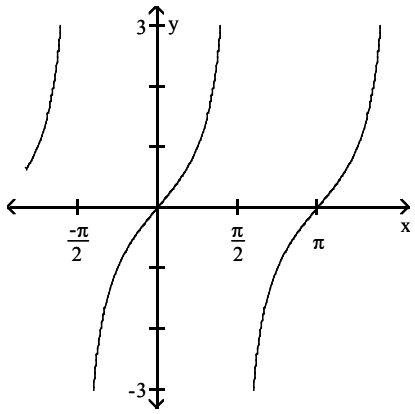


3) $y = -\cot(x + \pi)$

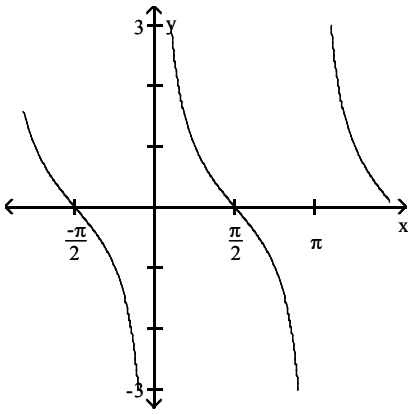
A)



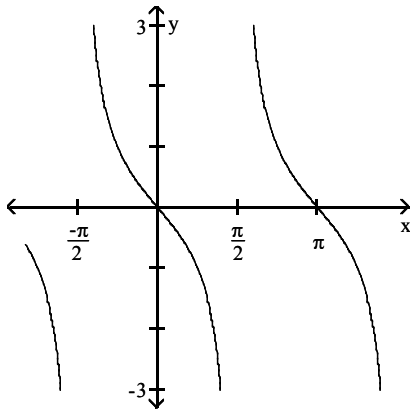

B)




C)

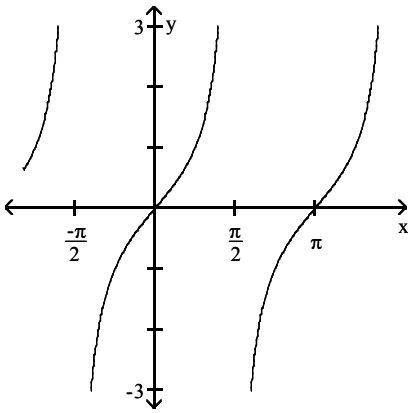



D)

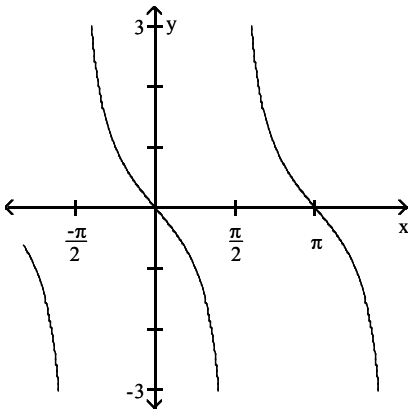


4) $y = -\cot\left(x - \frac{\pi}{2}\right)$

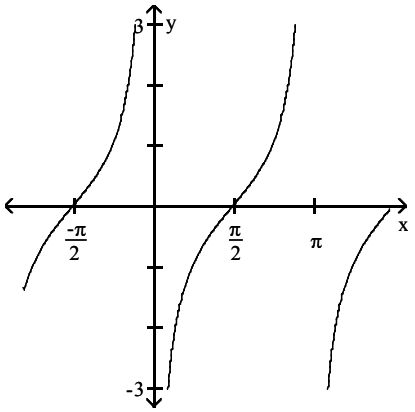
A)



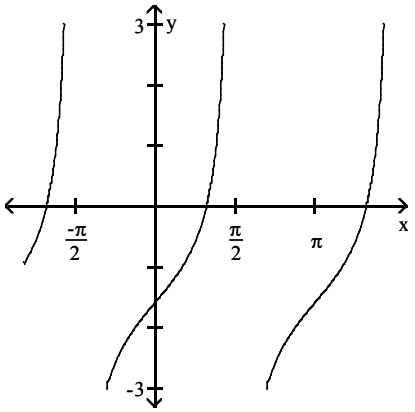

B)




C)




D)

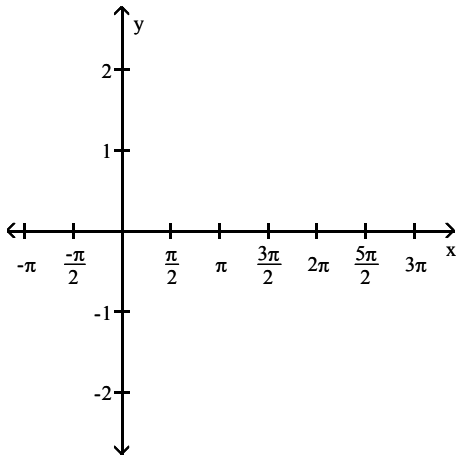


## 4 Graph Variations of y = cot x

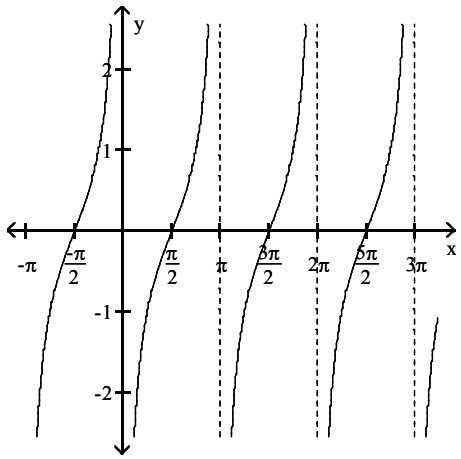
**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Graph the function.**

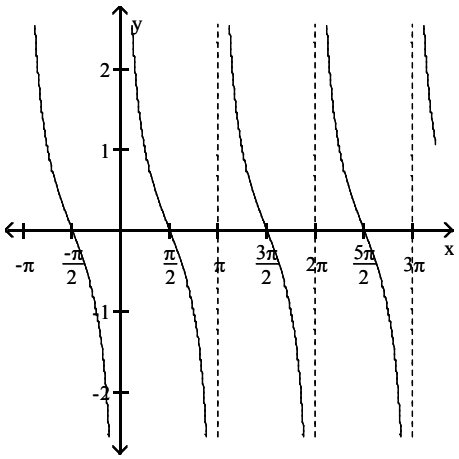
1) $y = -\cot x$



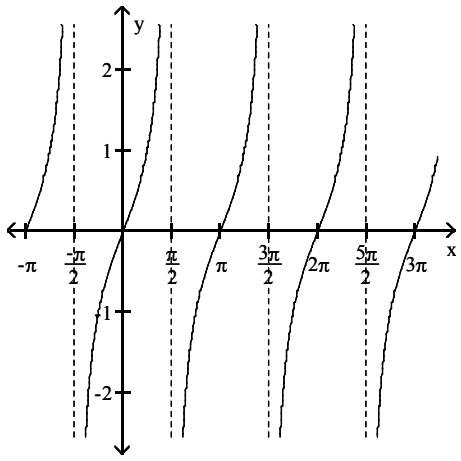

A)



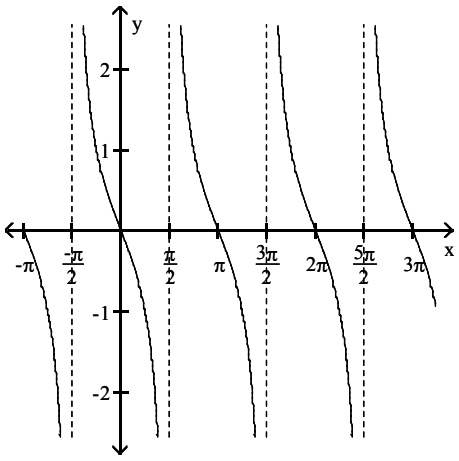

B)



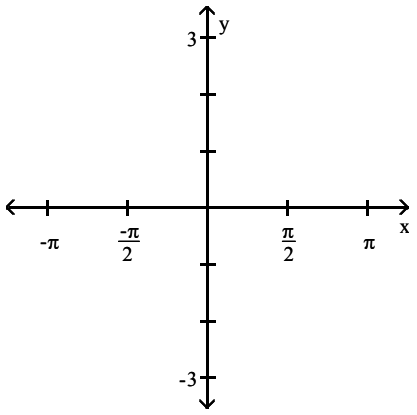

C)



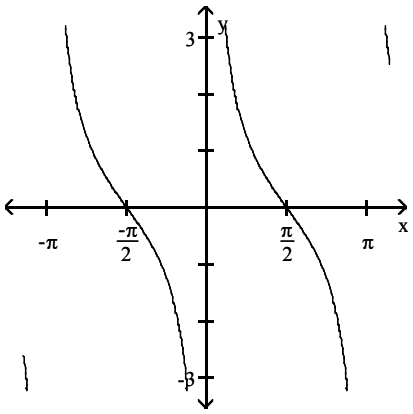

D)



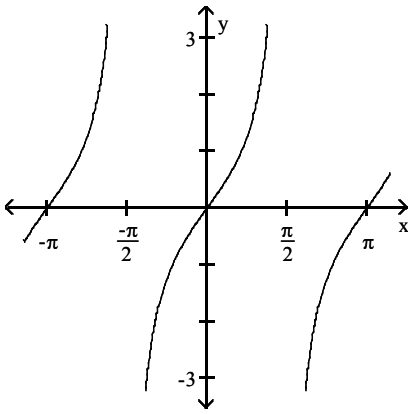
2) $y = \frac{5}{4}\cot x$



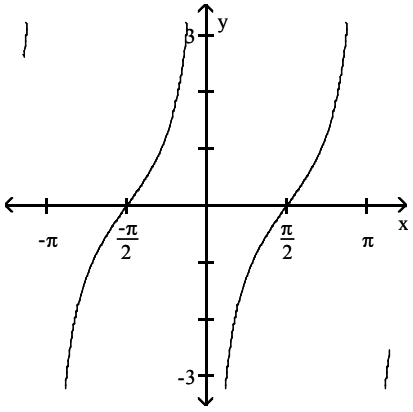

A)



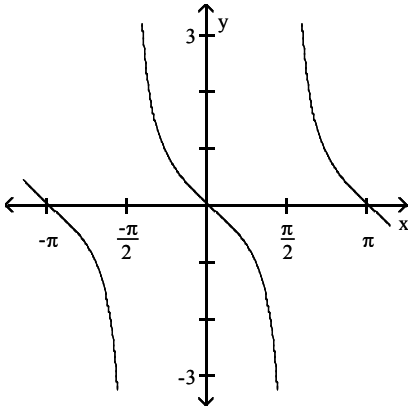

B)



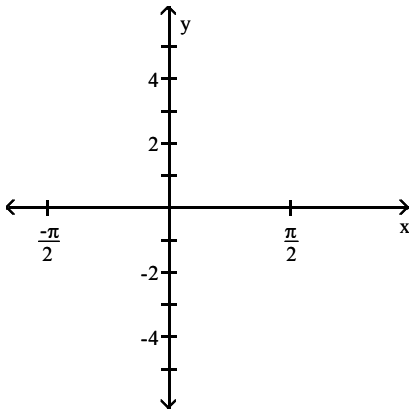

C)



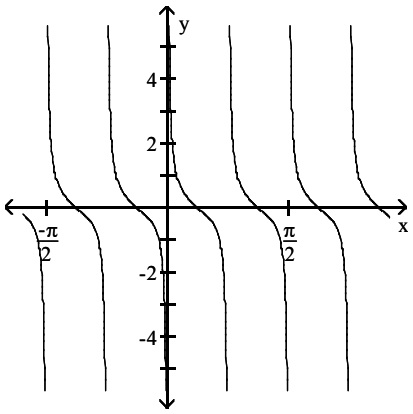

D)



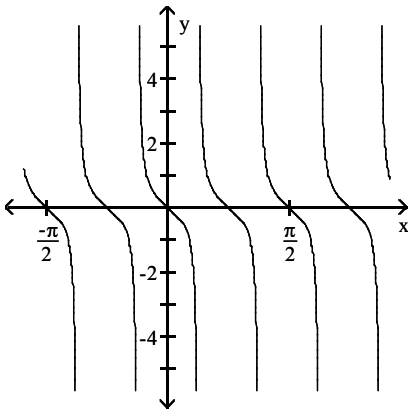
3) $y = \frac{1}{2}\cot 4x$



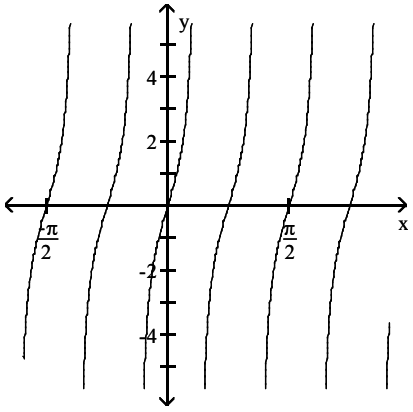

A)



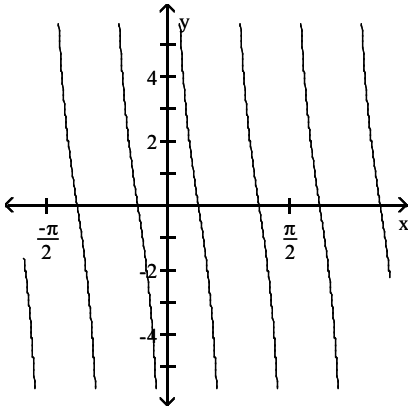

B)



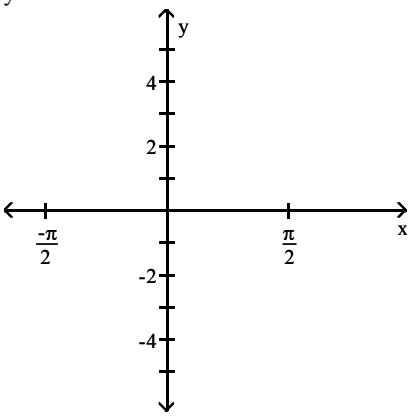

C)



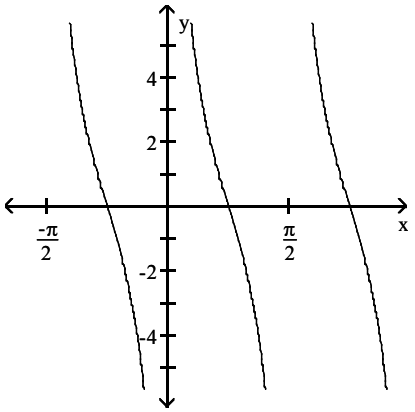

D)



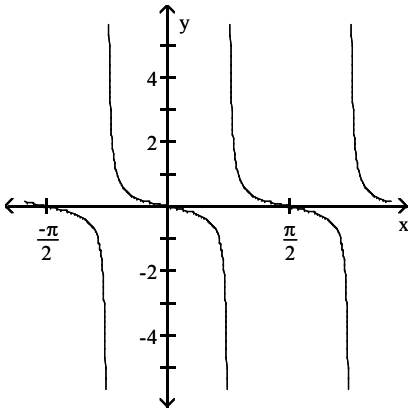
4) $y = 4 \cot 2x$



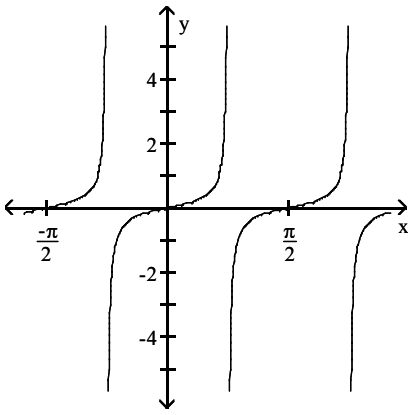

A)



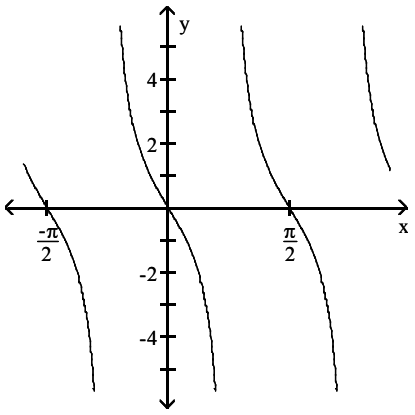

B)



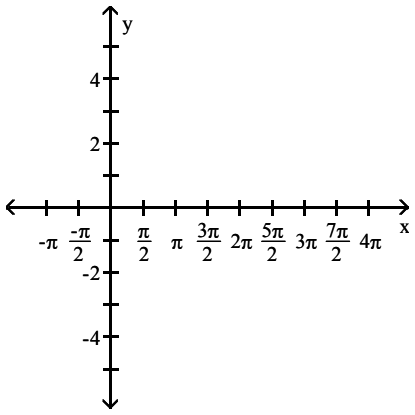

C)



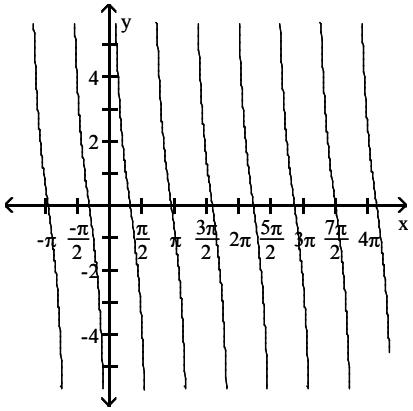

D)



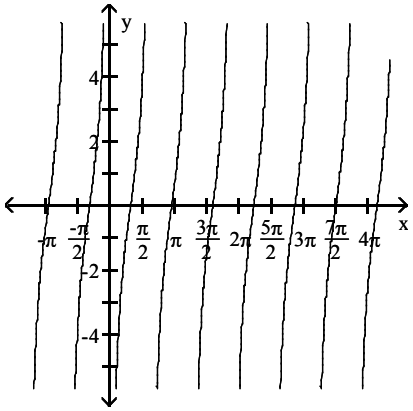
5) $y = 3 \cot \frac{\pi}{2}x$



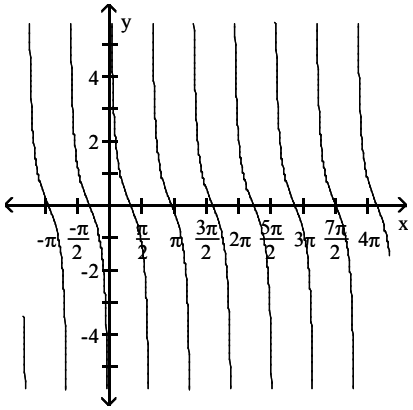

A)



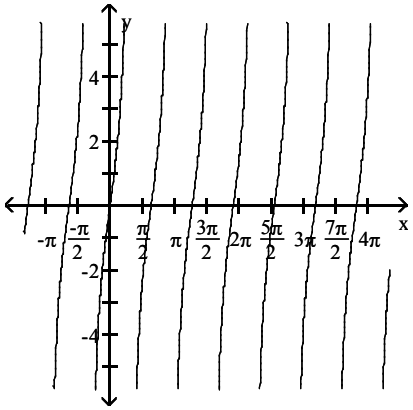

B)



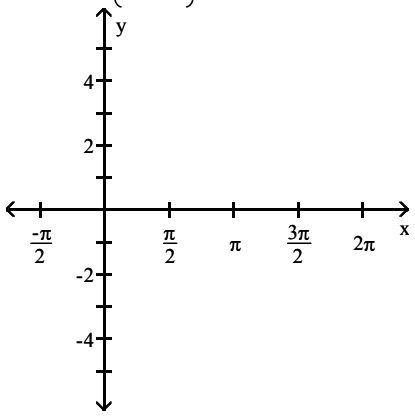

C)



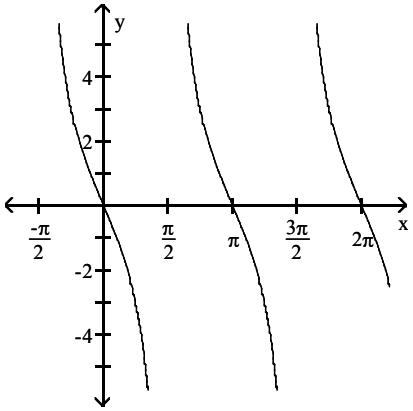

D)



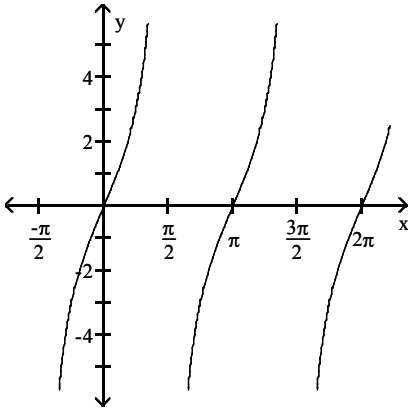
6) $y = 3\cot\left(x + \frac{\pi}{2}\right)$



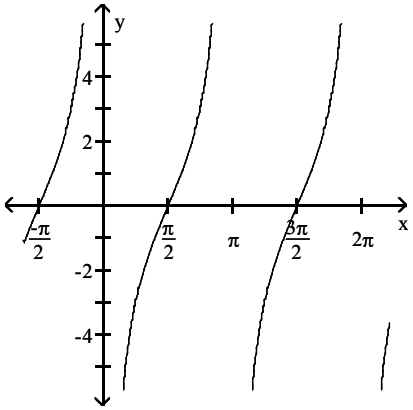

A)



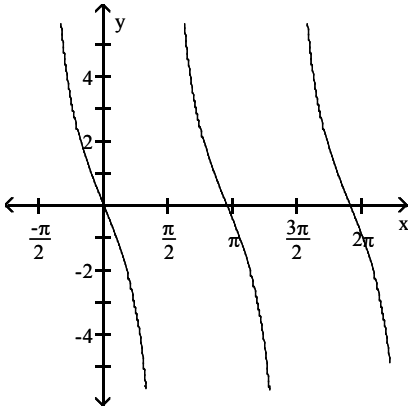

B)




C)




D)

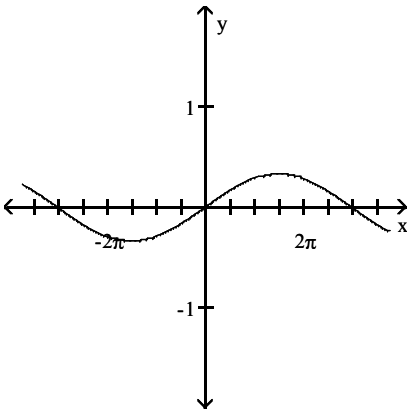


## 5 Understand the Graphs of y = csc x and y = sec x

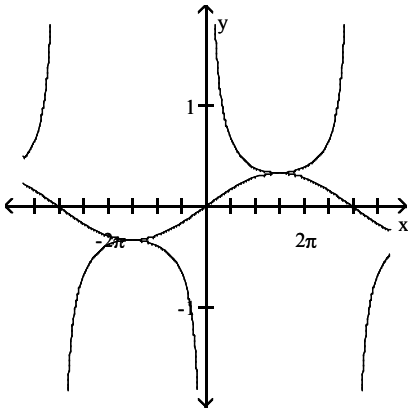
**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Use the graph to obtain the graph of the reciprocal function. Give the equation of the function for the graph that you obtain.**

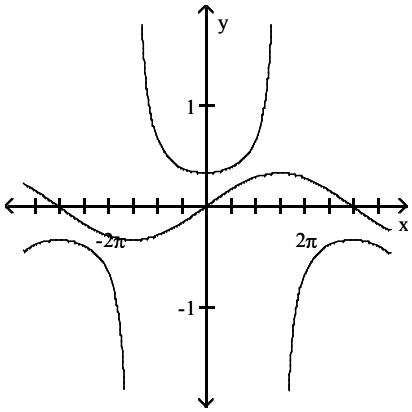
1) $y = \frac{1}{3}\sin\frac{1}{3}x$



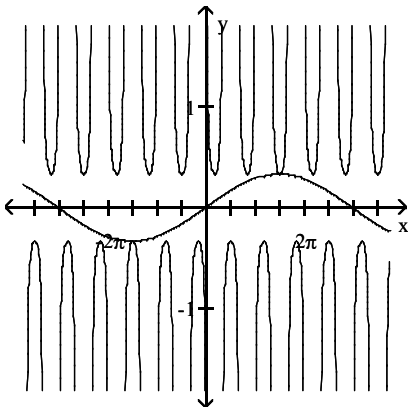

A) $y = \frac{1}{3}\csc\frac{1}{3}x$



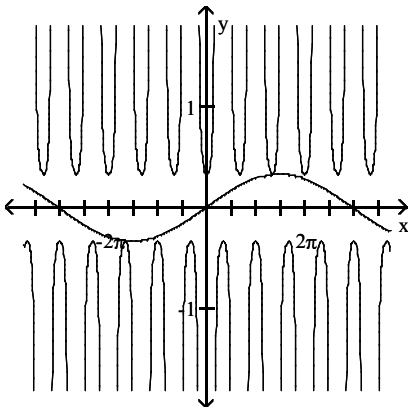

B) $y = \frac{1}{3}\sec\frac{1}{3}x$



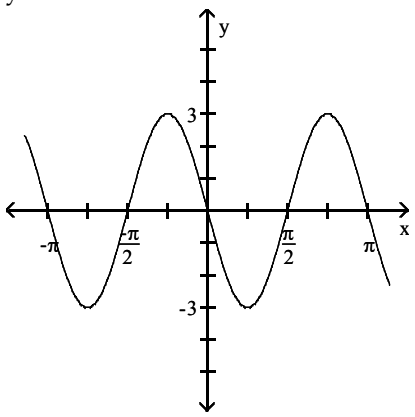

C) $y = \frac{1}{3}\csc 3x$



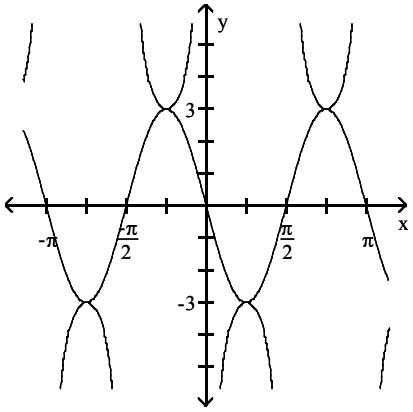

D) $y = \frac{1}{3}\sec 3x$



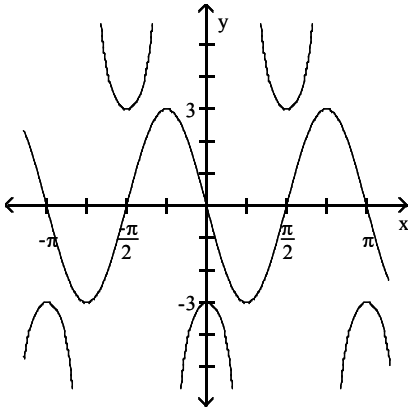
2) $y = -3 \sin 2x$



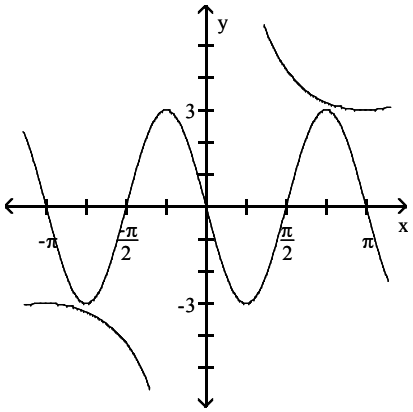

A) $y = -3 \csc 2x$



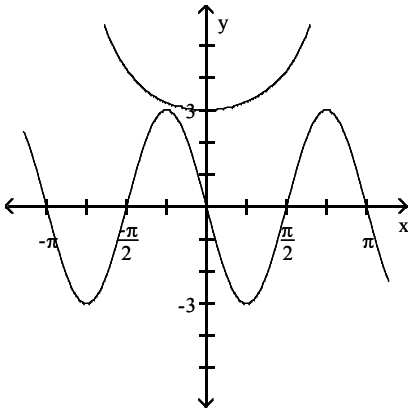

B) $y = -3 \sec 2x$



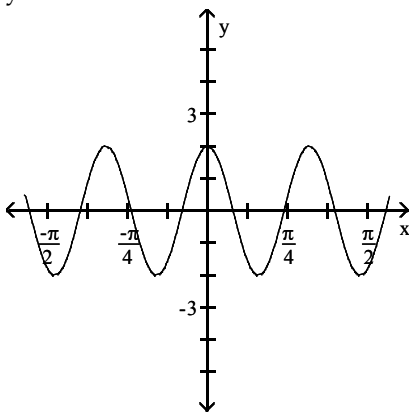

C) $y = 3 \csc \frac{x}{2}$



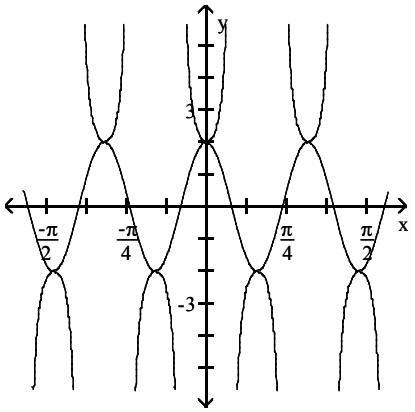

D) $y = 3 \sec \frac{x}{2}$



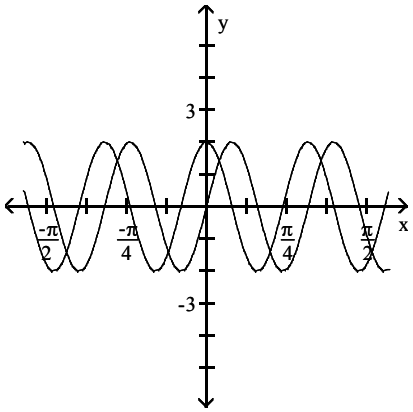
3) $y = 2 \cos 2\pi x$



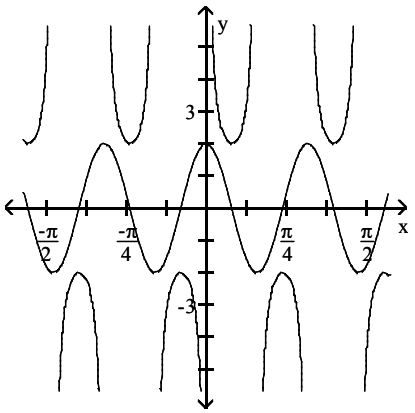

A) $y = 2 \sec 2\pi x$



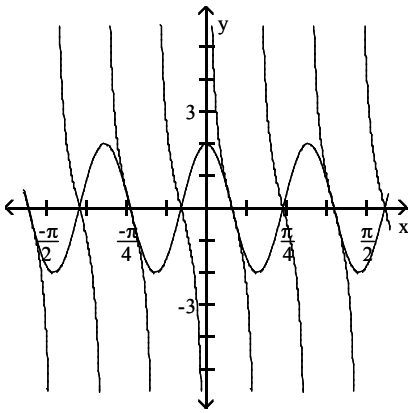

B) $y = 2 \sin 2\pi x$



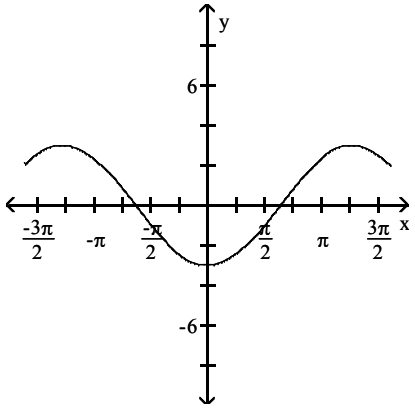

C) $y = 2 \csc 2\pi x$



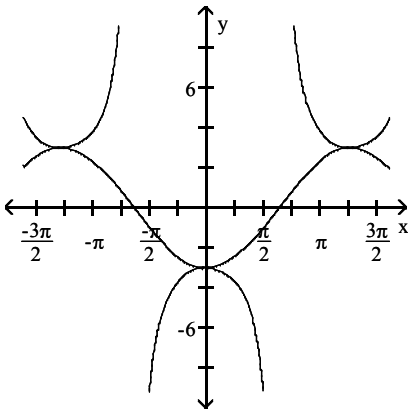

D) $y = 2 \cot 2\pi x$



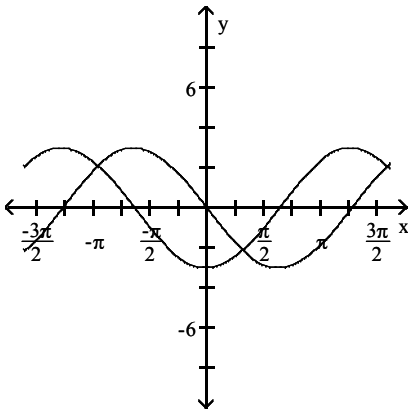

4) $y = -3 \cos \frac{\pi}{4} x$



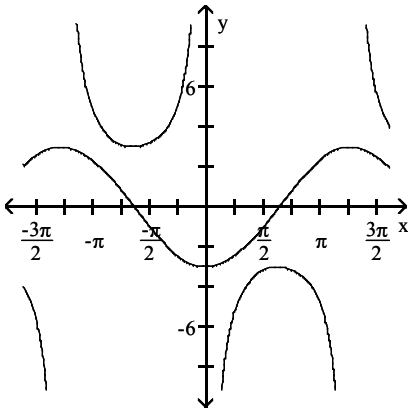
A) $y = -3 \sec \frac{\pi}{4}x$



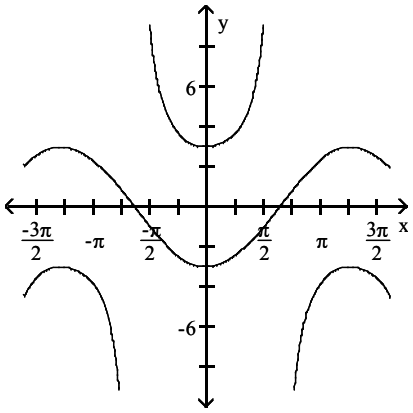

B) $y = -3 \sin \frac{\pi}{4}x$




C) $y = -3 \csc \frac{\pi}{4}x$




D) $y = 3 \sec \frac{\pi}{4}x$

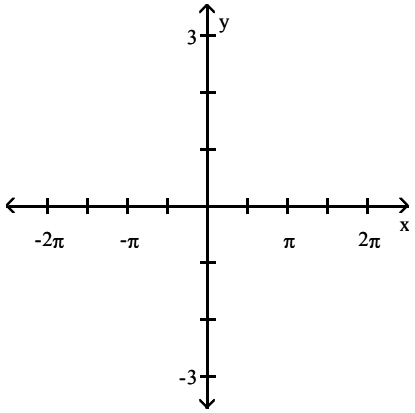


## 6 Graph Variations of y = csc x and y = sec x

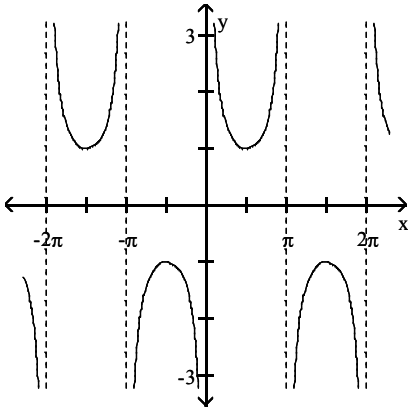
**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Graph the function.**

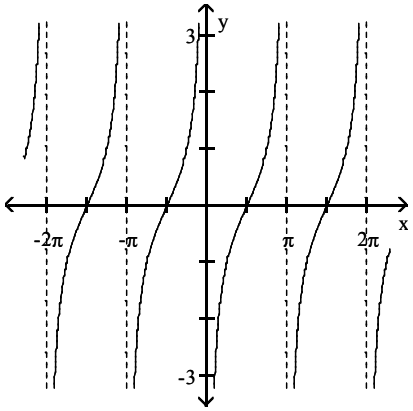
1) y = csc x



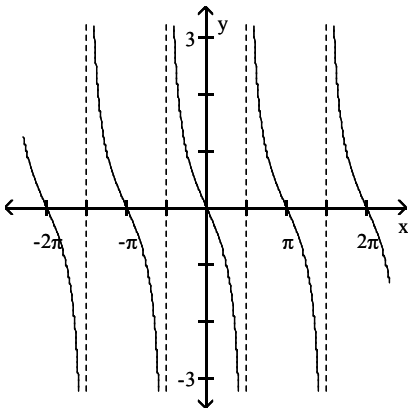

A)



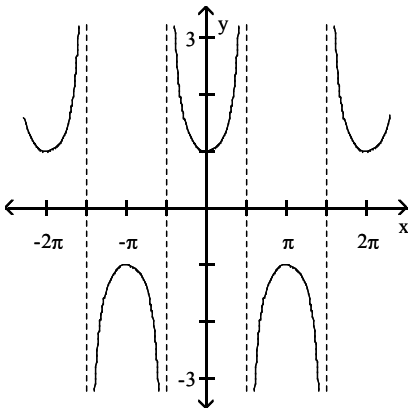

B)



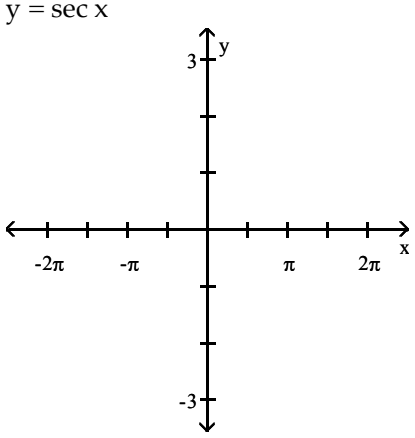

C)



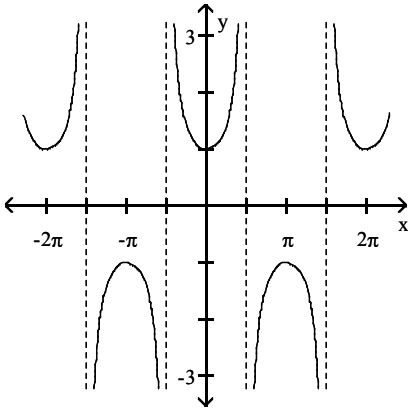

D)



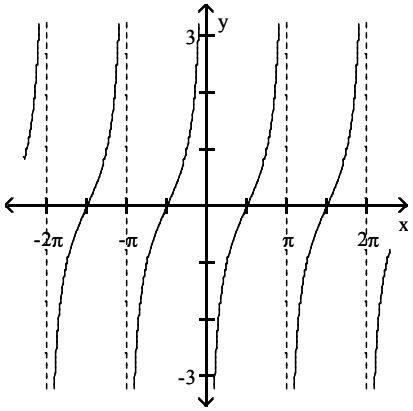
2) y = sec x



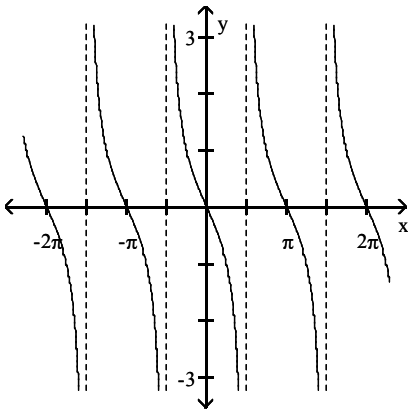

A)



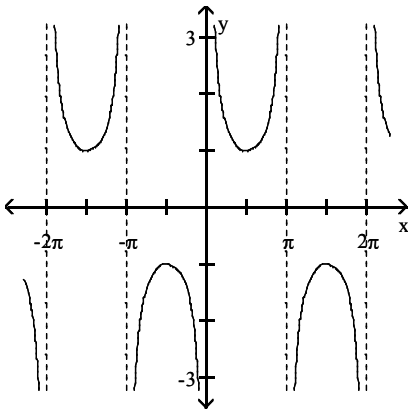

B)



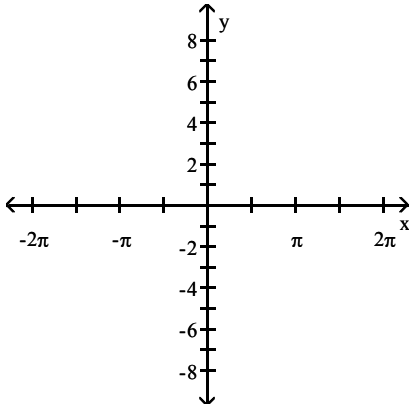

C)



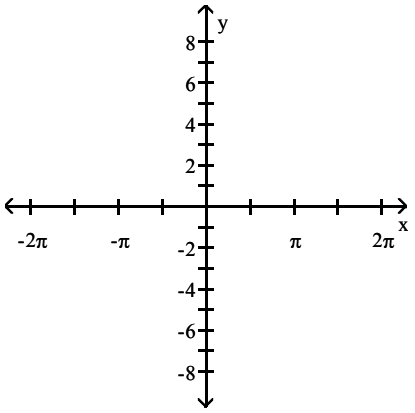

D)



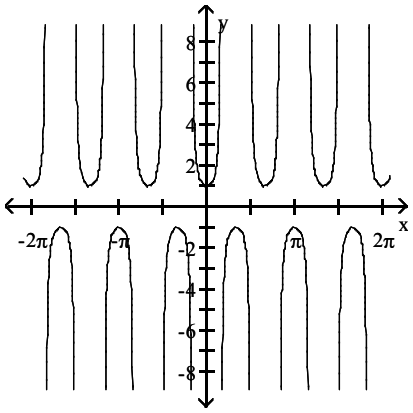

3) y = 3 csc x



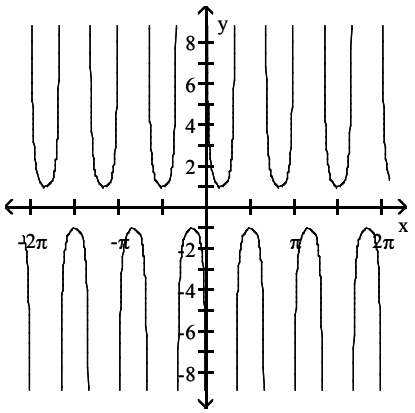
A)


y
x
8
6
4
2
-2
-4
-6
-8
-2π
-π
π
2π

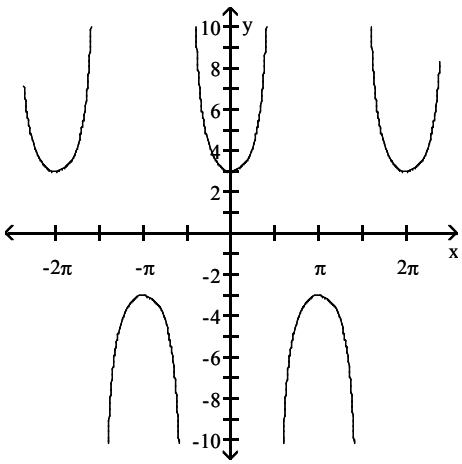
B)


y
x
8
6
4
2
-2
-4
-6
-8
-2π
-π
π
2π

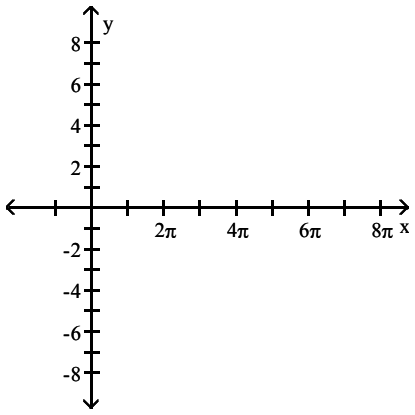
C)


y
x
8
6
4
2
-2
-4
-6
-8
-2π
-π
π
2π

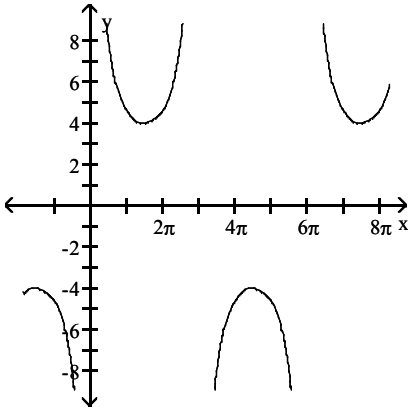
D)


y
x
10
8
6
4
2
-2
-4
-6
-8
-10
-2π
-π
π
2π

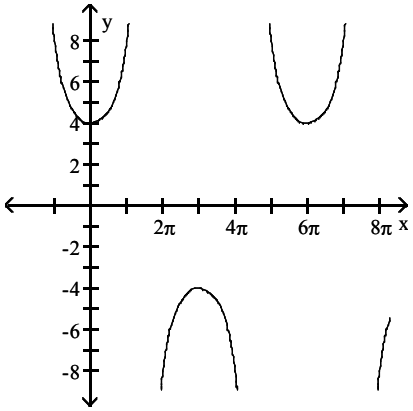
4) $y = 4 \csc \frac{x}{3}$



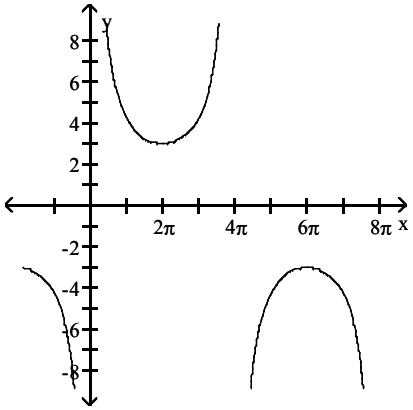

A)



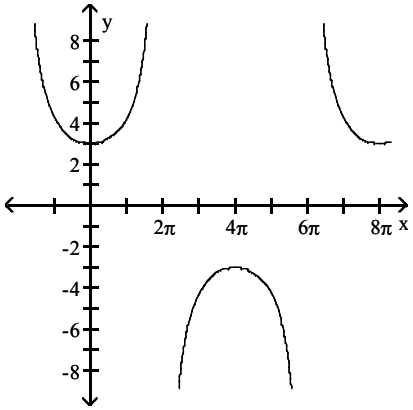

B)



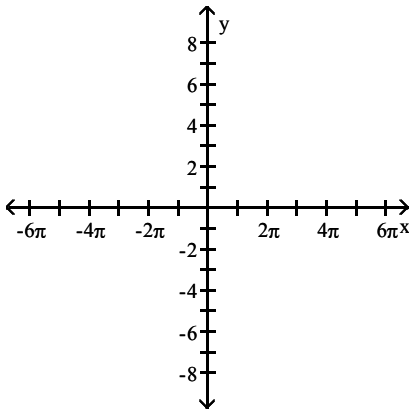

C)



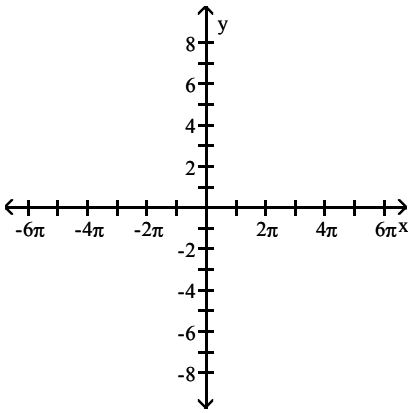

D)



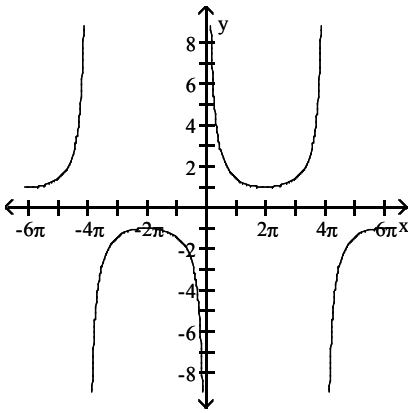
5) $y = \sec \frac{x}{3}$




A)




B)

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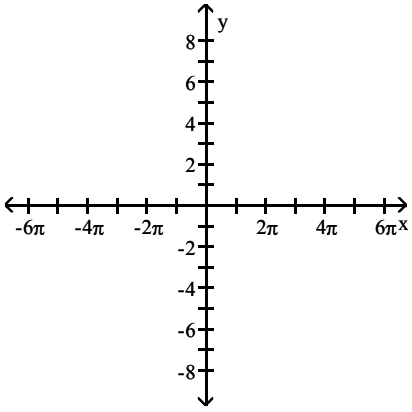


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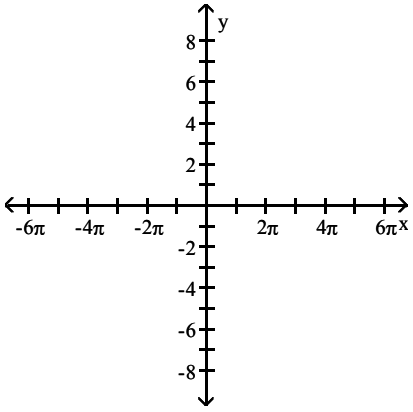
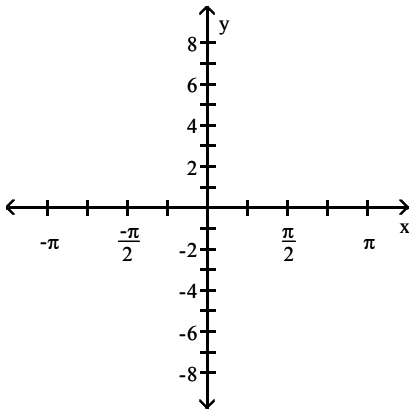
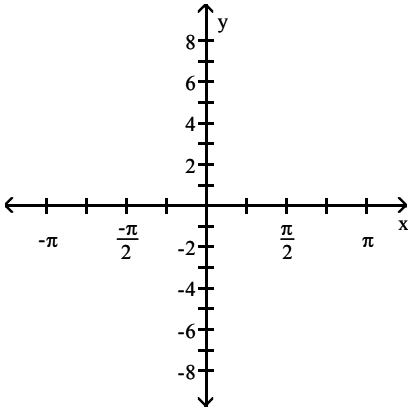


6) $y = -\frac{1}{2}\csc \pi x$




A)

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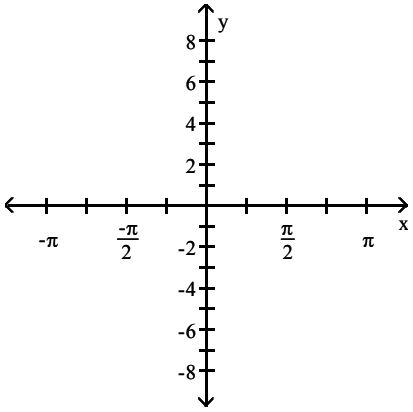


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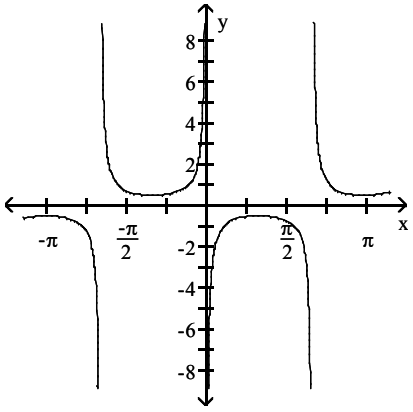
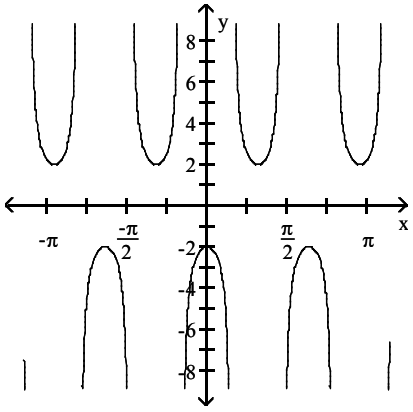
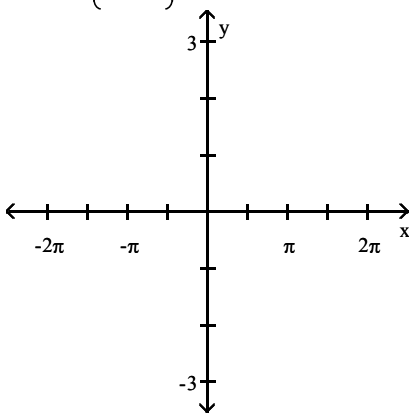


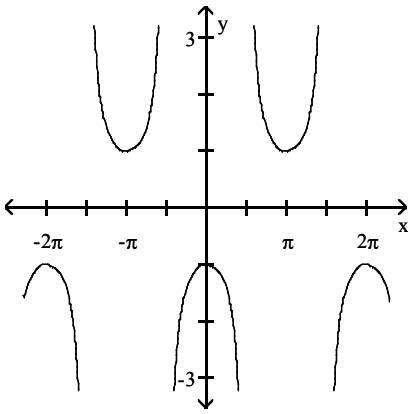

D)



7) $y = \csc\left(x - \frac{\pi}{2}\right)$




A)

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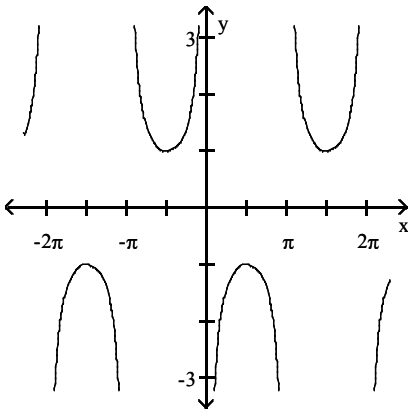


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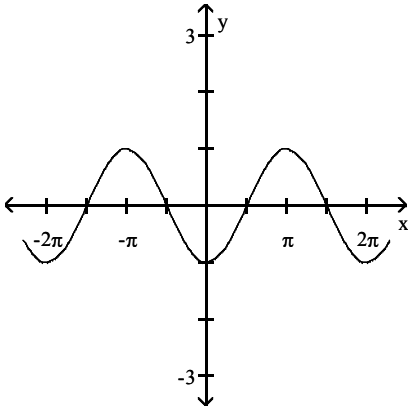


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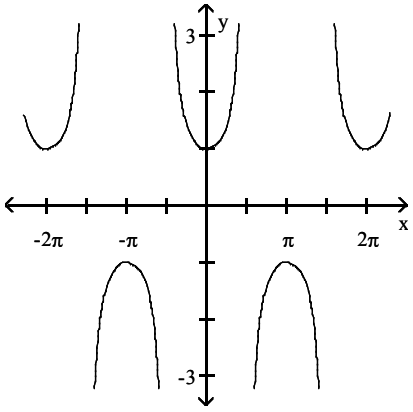
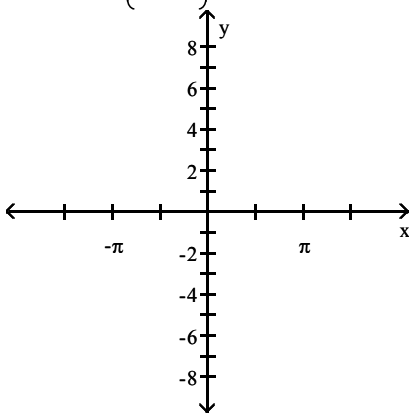
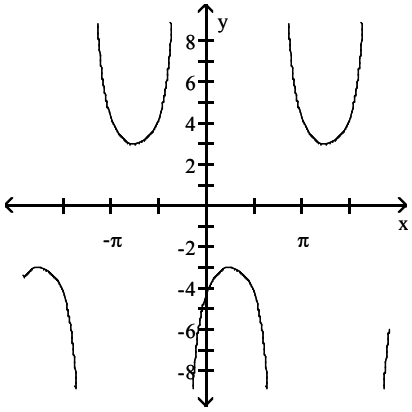


8) $y = -3 \csc\left(x + \frac{\pi}{4}\right)$




A)

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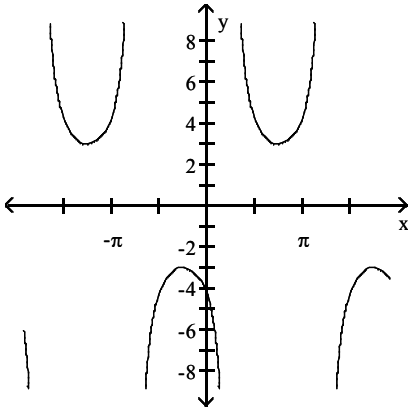
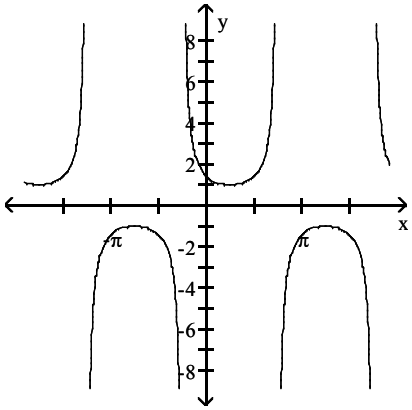
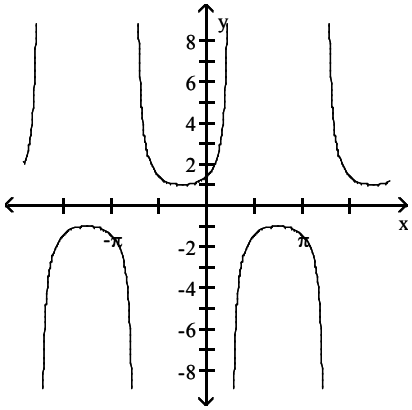



C)




D)




## 7 Solve Apps: Other Trigonometric Functions

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Solve the problem.**

1) A rotating beacon is located 8 ft from a wall. If the distance from the beacon to the point on the wall where the beacon is aimed is given by $a = 8\left|\sec 2\pi t\right|$, where t is in seconds, find a when t = 0.33 seconds. Round your answer to the nearest hundredth.

A) 16.61 feet B) 15.72 feet C) 16.16 feet D) −16.61 feet

2) The angle of elevation from the top of a house to a plane flying 6300 meters above the house is x radians. If d represents the horizontal distance, in meters, of the plane from the house, express d in terms of a trigonometric function of x.

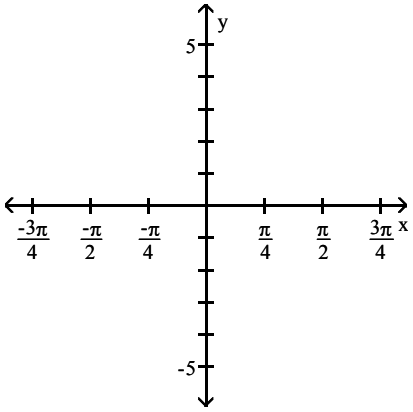
A) $d = 6300 \cot x$ B) $d = \dfrac{6300}{\cot x}$ C) $d = 6300 \tan x$ D) $d = 6300 \sec x$

## 8 Additional Concepts

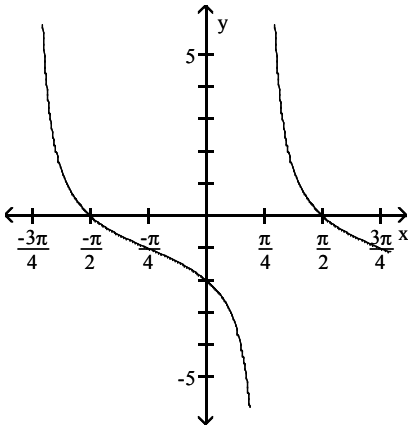
**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Graph the function.**

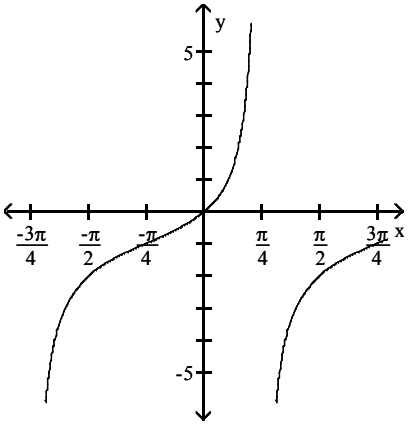
1) $y = -1 - \tan\left(x + \dfrac{\pi}{4}\right)$



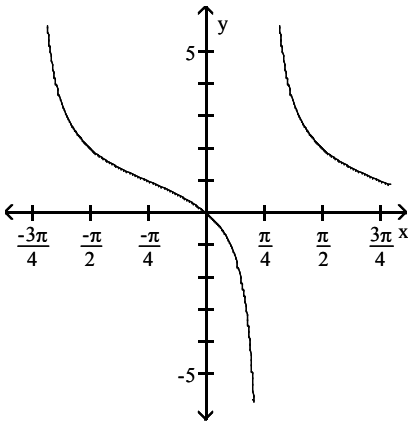

A)



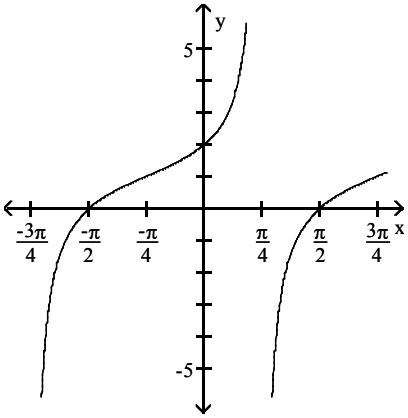

B)



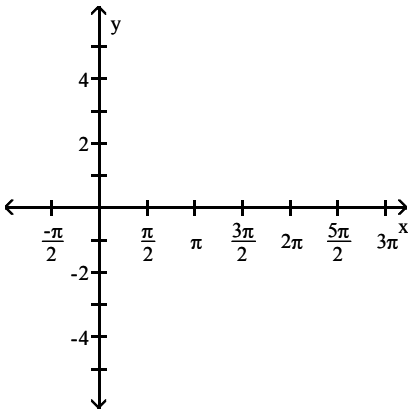

C)



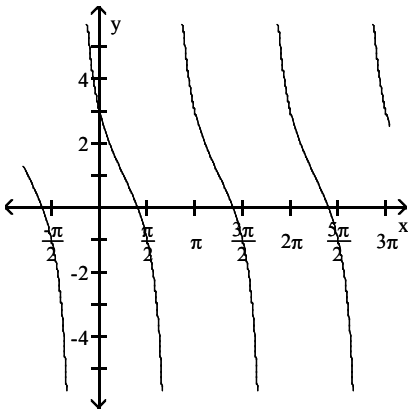

D)



2) $y = 2\cot\left(x + \frac{\pi}{4}\right) + 1$




A)

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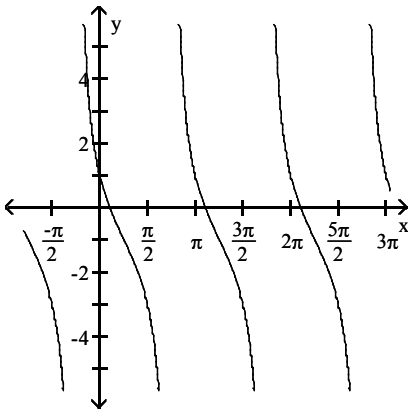
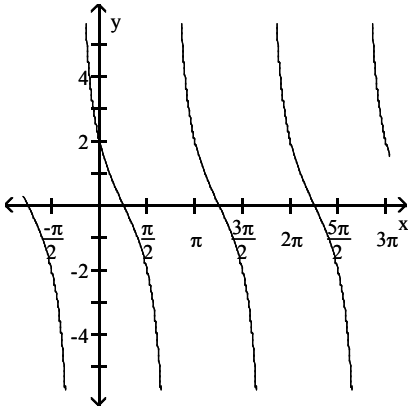
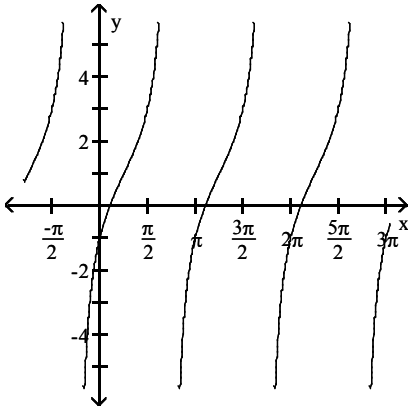


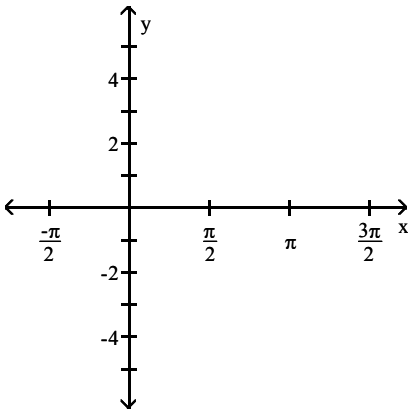

C)



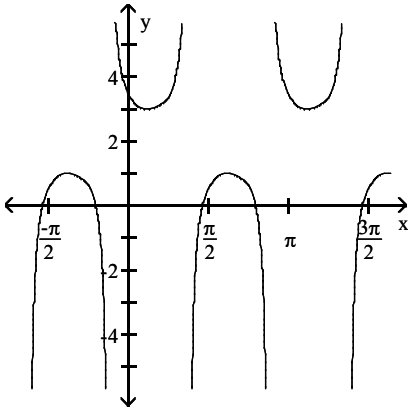

D)



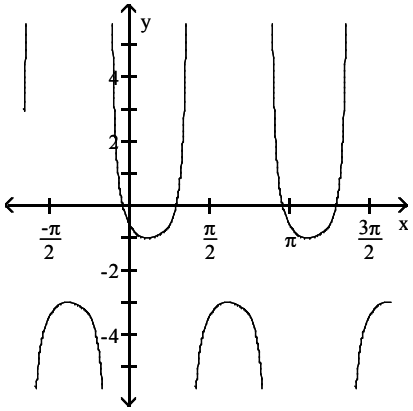
3) $y = \sec\left(2x - \frac{\pi}{4}\right) + 2$



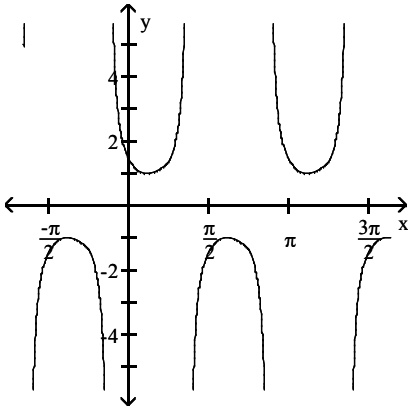

A)



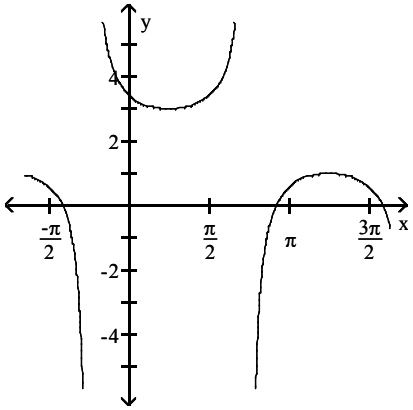

B)



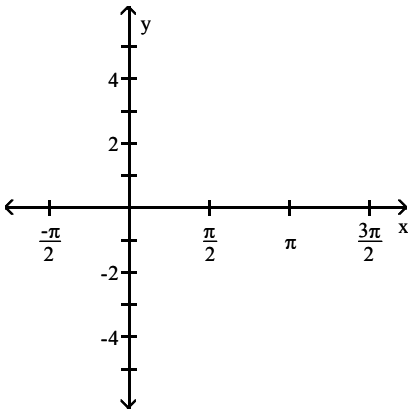

C)



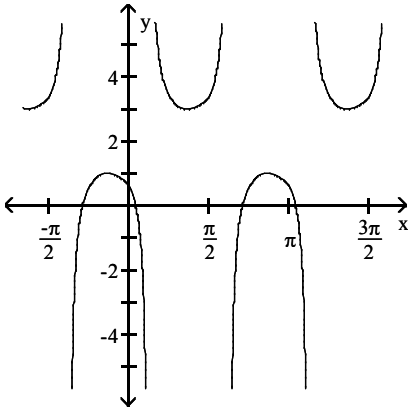

D)



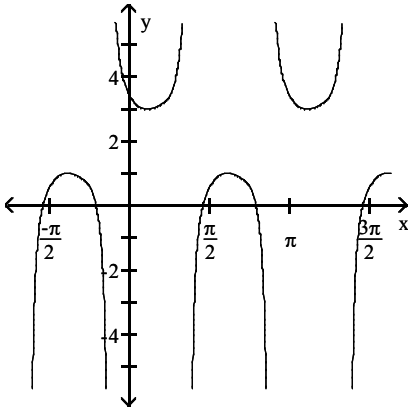
4) $y = \csc\left(2x - \frac{\pi}{4}\right) + 2$




A)




B)

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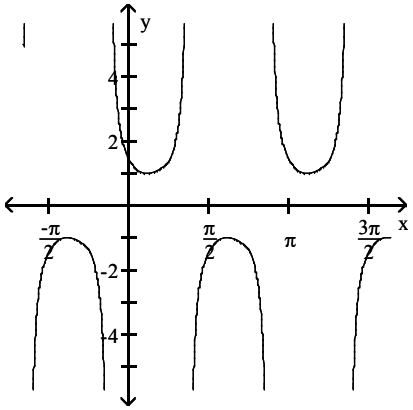
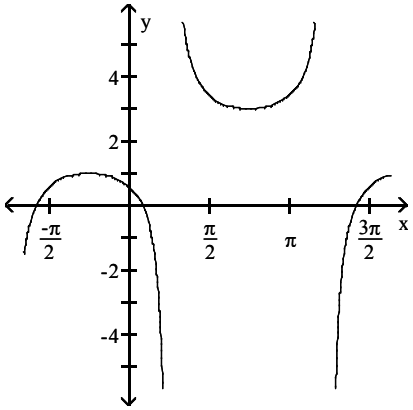
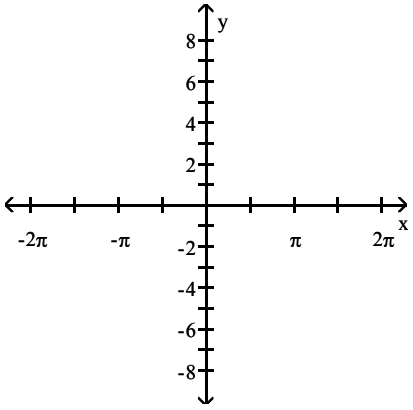


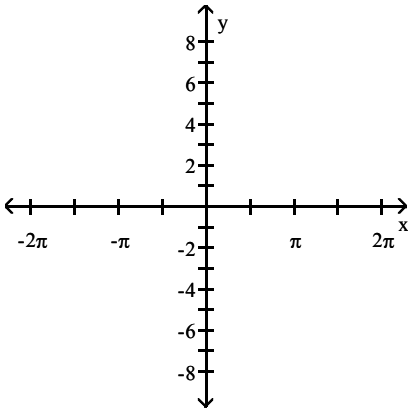

D)



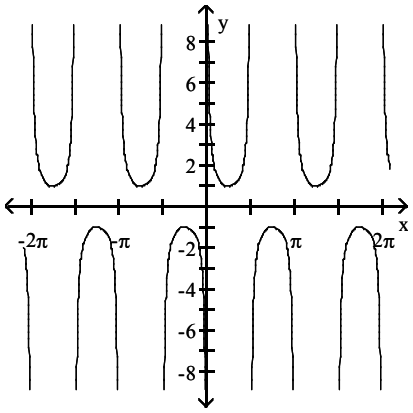

5) $y = 2 \sec|x|$



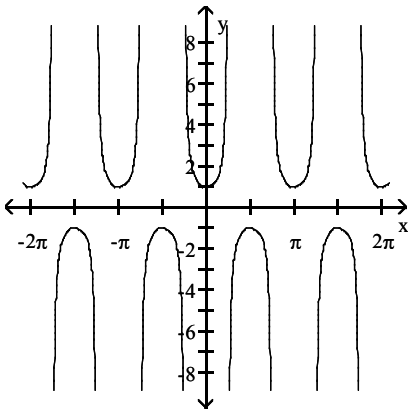
A)


y
8
6
4
2
-2π
-π
-2
π
2π
x
-4
-6
-8

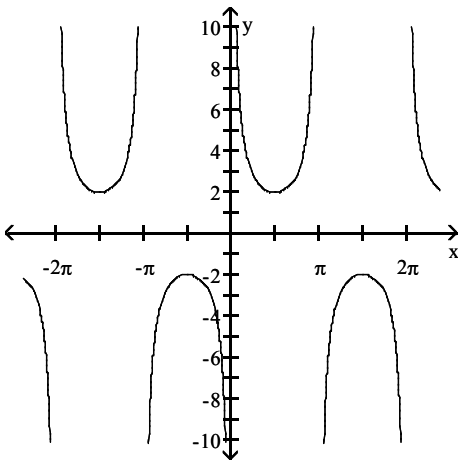
B)


y
8
6
4
2
-2π
-π
-2
π
2π
x
-4
-6
-8

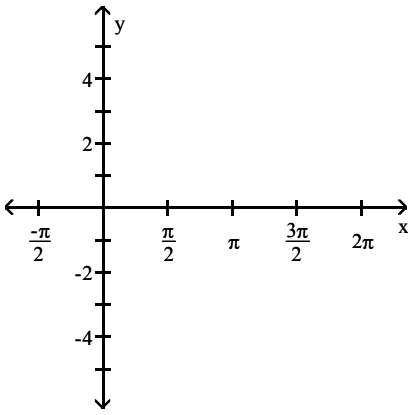
C)


y
8
6
4
2
-2π
-π
-2
π
2π
x
-4
-6
-8

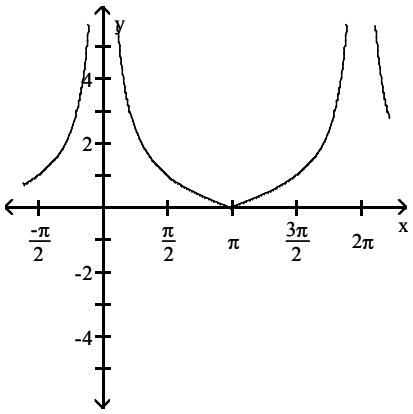
D)


10
y
8
6
4
2
-2π
-π
-2
π
2π
x
-4
-6
-8
-10

6) $y = |\cot \frac{x}{2}|$




A)

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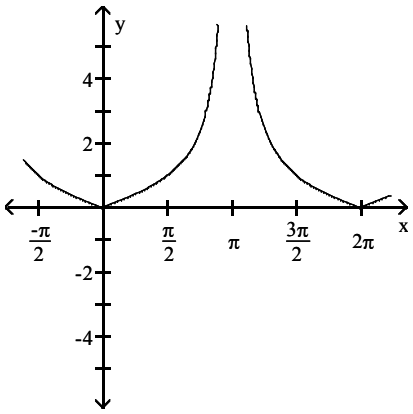
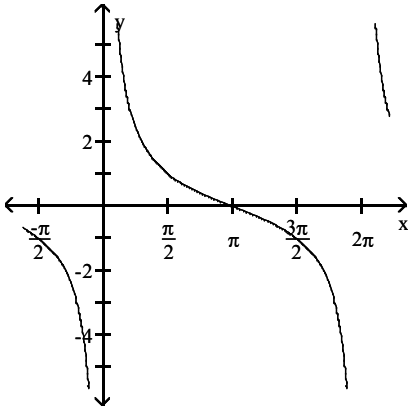
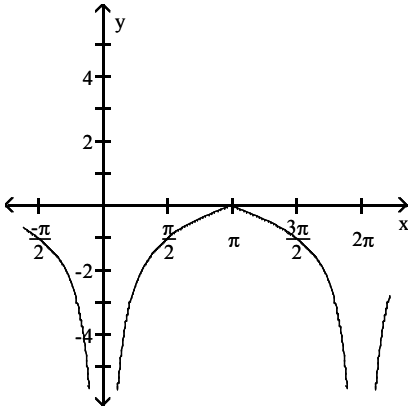



C)




D)




**Solve the equation for $-2\pi \le x \le 2\pi$.**

7) $\sec x = 1$

A) $-2\pi, 0, 2\pi$ B) $-\frac{3\pi}{2}, \frac{\pi}{2}$ C) $-\pi, \pi$ D) none

8) $\csc x = 1$

A) $-\frac{3\pi}{2}, \frac{\pi}{2}$ B) $-2\pi, 0, 2\pi$ C) $-\pi, \pi$ D) none

## 2.3 Inverse Trigonometric Functions

### 1 Understand and Use the Inverse Sine Function

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Find the exact value of the expression.**

1) $\sin^{-1}\frac{\sqrt{2}}{2}$

A) $\frac{\pi}{4}$ B) $\frac{3\pi}{4}$ C) $\frac{\pi}{3}$ D) $\frac{2\pi}{3}$

2) $\sin^{-1}(0.5)$

A) $\frac{\pi}{6}$ B) $\frac{7\pi}{6}$ C) $\frac{7\pi}{3}$ D) $\frac{\pi}{3}$

3) $\sin^{-1}(1)$

A) $\frac{\pi}{2}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{3}$ D) $\pi$

### 2 Understand and Use the Inverse Cosine Function

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Find the exact value of the expression.**

1) $\cos^{-1}\frac{\sqrt{3}}{2}$

A) $\frac{\pi}{6}$ B) $\frac{11\pi}{6}$ C) $\frac{\pi}{4}$ D) $\frac{7\pi}{4}$

2) $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

A) $\frac{5\pi}{6}$ B) $\frac{\pi}{6}$ C) $\frac{\pi}{3}$ D) $\frac{2\pi}{3}$

3) $\cos^{-1}(-1)$

A) $\pi$ B) 0 C) $\frac{\pi}{2}$ D) $2\pi$

### 3 Understand and Use the Inverse Tangent Function

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Find the exact value of the expression.**

1) $\tan^{-1}\frac{\sqrt{3}}{3}$

A) $\frac{\pi}{6}$ B) $\frac{\pi}{3}$ C) $\frac{5\pi}{4}$ D) $\frac{5\pi}{6}$

2) $\tan^{-1}(-1)$

A) $-\frac{\pi}{4}$ B) $\frac{\pi}{4}$ C) $\frac{5\pi}{4}$ D) $\frac{7\pi}{4}$

3) $\tan^{-1} 0$

A) 0 B) $2\pi$ C) $\pi$ D) $\frac{\pi}{2}$

## 4 Use a Calculator to Evaluate Inverse Trigonometric Functions

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Use a calculator to find the value of the expression rounded to two decimal places.**

1) $\tan^{-1}(-2.5)$

A) −1.19 B) −68.20 C) −0.38 D) −21.80

2) $\sin^{-1}\left(\frac{2}{7}\right)$

A) 0.29 B) 16.60 C) 1.28 D) 73.40

3) $\cos^{-1}\left(-\frac{1}{7}\right)$

A) 1.71 B) 98.21 C) −0.14 D) −8.21

4) $\sin^{-1}(-0.9)$

A) −1.12 B) −64.16 C) 2.69 D) 154.16

5) $\sin^{-1}\left(\frac{\sqrt{6}}{5}\right)$

A) 0.51 B) 29.33 C) 1.06 D) 60.67

6) $\cos^{-1}\left(-\frac{\sqrt{6}}{3}\right)$

A) 2.53 B) 144.74 C) −0.96 D) −54.74

## 5 Find Exact Values of Composite Functions with Inverse Trigonometric Functions

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Find the exact value of the expression, if possible. Do not use a calculator.**

1) $\sin^{-1}\left[\sin\left(\frac{6\pi}{7}\right)\right]$

A) $\frac{\pi}{7}$ B) $\frac{6\pi}{7}$ C) $\frac{7}{6\pi}$ D) $\frac{7}{\pi}$

2) $\tan^{-1}\left[\tan\left(\frac{4\pi}{5}\right)\right]$

A) $-\frac{\pi}{5}$ B) $\frac{4\pi}{5}$ C) $-\frac{4\pi}{5}$ D) $\frac{\pi}{5}$

3) $\cos^{-1}(\cos \pi)$

A) $\pi$ B) 0 C) $\frac{\pi}{2}$ D) $\frac{\pi}{3}$

4) $\cos^{-1}\left[\cos\left(-\frac{\pi}{3}\right)\right]$

A) $\frac{\pi}{3}$ B) $\frac{2\pi}{3}$ C) $-\frac{\pi}{3}$ D) $\frac{4\pi}{3}$

5) $\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$

A) $-\frac{\pi}{4}$ B) $\frac{3\pi}{4}$ C) $\frac{5\pi}{4}$ D) $-\frac{5\pi}{4}$

6) $\cos(\cos^{-1} 0.3)$

A) 0.3 B) 2.8 C) 3.4 D) 1

7) $\tan(\tan^{-1}(-9.2))$

A) −9.2 B) 9.2 C) 12.3 D) −6.1

**Use a sketch to find the exact value of the expression.**

8) $\cos\left(\sin^{-1}\frac{4}{5}\right)$

A) $\frac{3}{5}$ B) $\frac{1}{5}$ C) $-\frac{4}{5}$ D) $-\frac{3}{5}$

9) $\cos\left(\tan^{-1}\frac{1}{9}\right)$

A) $\frac{9\sqrt{82}}{82}$ B) $\frac{\sqrt{82}}{9}$ C) $\frac{9}{82}$ D) $\frac{1}{9}$

10) $\cot\left(\sin^{-1}\frac{7\sqrt{113}}{113}\right)$

A) $\frac{8}{7}$ B) $\frac{\sqrt{113}}{7}$ C) $\frac{7}{113}$ D) $-\frac{8}{7}$

11) $\sec\left(\tan^{-1}\frac{\sqrt{3}}{3}\right)$

A) $\frac{2\sqrt{3}}{3}$ B) 2 C) $\sqrt{3}$ D) $\frac{1}{2}$

12) $\tan\left(\sin^{-1}\frac{\sqrt{2}}{2}\right)$

A) 1 B) $\sqrt{2}$ C) $\frac{\sqrt{2}}{2}$ D) 2

**Use a right triangle to write the expression as an algebraic expression. Assume that x is positive and in the domain of the given inverse trigonometric function.**

13) $\sin(\tan^{-1} x)$

A) $\frac{x\sqrt{x^2+1}}{x^2+1}$ B) $\frac{x\sqrt{x^2-1}}{x^2-1}$ C) $x\sqrt{x^2+1}$ D) $\frac{\sqrt{x^2+1}}{x^2+1}$

14) $\cos(\tan^{-1} x)$

A) $\frac{\sqrt{x^2+1}}{x^2+1}$ B) $\frac{\sqrt{x^2-1}}{x^2-1}$ C) $x\sqrt{x^2+1}$ D) $\frac{x\sqrt{x^2+1}}{x^2+1}$

15) $\cos(\sin^{-1} x)$

A) $\sqrt{1-x^2}$ B) $\sqrt{x^2+1}$ C) $\sqrt{x^2-1}$ D) $\frac{\sqrt{x^2+1}}{x}$

16) $\sin(\tan^{-1} \frac{x}{\sqrt{3}})$

A) $\frac{x\sqrt{x^2+3}}{x^2+3}$ B) $\frac{x\sqrt{x^2-3}}{x^2-3}$ C) $x\sqrt{x^2+3}$ D) $\frac{\sqrt{x^2+3}}{x^2+3}$

17) $\sin(\sin^{-1} \frac{x}{\sqrt{2}})$

A) $\frac{x\sqrt{2}}{2}$ B) $\frac{x\sqrt{x^2-2}}{x^2-2}$ C) $x\sqrt{2}$ D) $\frac{\sqrt{x^2+2}}{x^2+2}$

18) $\tan(\sec^{-1} \frac{\sqrt{x^2+4}}{x})$

A) $\frac{2}{x}$ B) $\frac{x\sqrt{x^2+4}}{x^2+4}$ C) $2x$ D) $\frac{\sqrt{x^2+2}}{x^2+2}$

19) $\sin(\sec^{-1} \frac{\sqrt{x^2+25}}{x})$

A) $\frac{5\sqrt{x^2+25}}{x^2+25}$ B) $\frac{x\sqrt{x^2+5}}{x^2+5}$ C) $x\sqrt{5}$ D) $\frac{\sqrt{x^2+5}}{x^2+5}$

## 6 Solve Apps: Inverse Trigonometric Functions

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Solve the problem.**

1) The equation $\theta_2 = \tan^{-1}(\omega C/G)$ gives the phase angle of impedance in the parallel portion of a distributed constant circuit. Find $\theta_2$ if $\omega = 390$ radians per second, $C = 0.07$ μF per kilometer, and $G = 1.56$ μsiemens per kilometer.

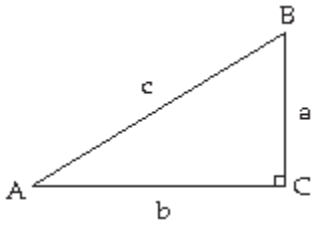
A) 85.9° B) 88.5° C) 1.5° D) 89.7°

## 2.4 Applications of Trigonometric Functions

### 1 Solve a Right Triangle

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Solve the right triangle shown in the figure. Round lengths to one decimal place and express angles to the nearest tenth of a degree.**




1) A = 36°, b = 51.2
A) B = 54°, a = 37.2, c = 63.3
B) B = 54°, a = 70.5, c = 87.1
C) B = 36°, a = 41.4, c = 37.2
D) B = 36°, a = 70.5, c = 41.4

2) A = 53.3°, c = 50.2
A) B = 36.7°, a = 40.2, b = 30
B) B = 36.7°, a = 30, b = 40.2
C) B = 53.3°, a = 40.2, b = 30
D) B = 53.3°, a = 30, b = 40.2

3) B = 37°, b = 49.7
A) A = 53°, a = 66, c = 82.6
B) A = 53°, a = 66, c = 62.2
C) A = 37°, a = 37.5, c = 82.6
D) A = 37°, a = 37.5, c = 39.7

4) b = 150, c = 430
A) A = 69.6°, B = 20.4°, a = 403
B) A = 69.6°, B = 20.4°, a = 455.4
C) A = 70.8°, B = 19.2°, a = 455.4
D) A = 19.2°, B = 70.8°, a = 403

5) a = 17.1, c = 26.8
A) A = 39.6°, B = 50.4°, b = 20.6
B) A = 39.6°, B = 50.4°, b = 31.8
C) A = 57.5°, B = 32.5°, b = 31.8
D) A = 39.6°, B = 39.6°, b = 20.6

6) a = 1.5 cm, b = 1.2 cm
A) A = 51.3°, B = 38.7°, c = 1.9 cm
B) A = 38.7°, B = 51.3°, c = 1.9 cm
C) A = 53.1°, B = 36.9°, c = 2.7 cm
D) A = 46.8°, B = 43.2°, c = 1.9 cm

7) a = 1.5 m, B = 40.9°
A) A = 49.1°, b = 1.3 m, c = 2.0 m
B) A = 49.1°, b = 0.2 m, c = 1.5 m
C) A = 49.1°, b = 2.4 m, c = 2.8 m
D) A = 49.1°, b = 2.4 m, c = 2.0 m

8) a = 2.1 in, A = 52.7°
A) b = 1.6 in, B = 37.3°, c = 2.6 in
B) b = 0.5 in, B = 37.3°, c = 2.2 in
C) b = 3.0 in, B = 37.3°, c = 3.7 in
D) b = 3.0 in, B = 37.3°, c = 2.6 in

9) B = 27.4°, c = 3.0 mm
A) a = 2.7 mm, A = 62.6°, b = 1.4 mm
B) a = 1.4 mm, A = 62.6°, b = 2.7 mm
C) a = 1.9 mm, A = 62.6°, b = 2.3 mm
D) a = 2.7 mm, A = 62.6°, b = 1.9 mm

**Solve the problem.**

10) From a boat on the lake, the angle of elevation to the top of a cliff is 32°55'. If the base of the cliff is 90 feet from the boat, how high is the cliff (to the nearest foot)?
A) 58 feet B) 61 feet C) 68 feet D) 71 feet

11) From a boat on the river below a dam, the angle of elevation to the top of the dam is 28°48'. If the dam is 1200 feet above the level of the river, how far is the boat from the base of the dam (to the nearest foot)?
A) 2183 feet B) 2173 feet C) 2163 feet D) 2153 feet

12) A surveyor is measuring the distance across a small lake. He has set up his transit on one side of the lake 130 feet from a piling that is directly across from a pier on the other side of the lake. From his transit, the angle between the piling and the pier is 60°. What is the distance between the piling and the pier to the nearest foot?
A) 225 feet B) 113 feet C) 65 feet D) 75 feet

13) A building 230 feet tall casts a 30 foot long shadow. If a person stands at the end of the shadow and looks up to the top of the building, what is the angle of the person's eyes to the top of the building (to the nearest hundredth of a degree)? (Assume the person's eyes are 6 feet above ground level.)
A) 82.37° B) 82.57° C) 82.30° D) 7.70°

14) A building 220 feet tall casts a 70 foot long shadow. If a person looks down from the top of the building, what is the measure of the angle between the end of the shadow and the vertical side of the building (to the nearest degree)? (Assume the person's eyes are level with the top of the building.)
A) 18° B) 72° C) 71° D) 19°

15) A radio transmission tower is 110 feet tall. How long should a guy wire be if it is to be attached 12 feet from the top and is to make an angle of 25° with the ground? Give your answer to the nearest tenth of a foot.
A) 231.9 feet B) 260.3 feet C) 108.1 feet D) 121.4 feet

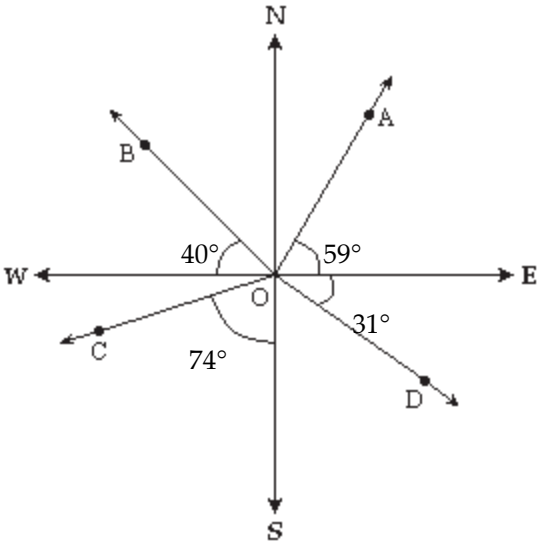
16) A straight trail with a uniform inclination of 17° leads from a lodge at an elevation of 800 feet to a mountain lake at an elevation of 5300 feet. What is the length of the trail (to the nearest foot)?
A) 15,391 feet B) 18,128 feet C) 4706 feet D) 5542 feet

## 2 Solve Problems Involving Bearings

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

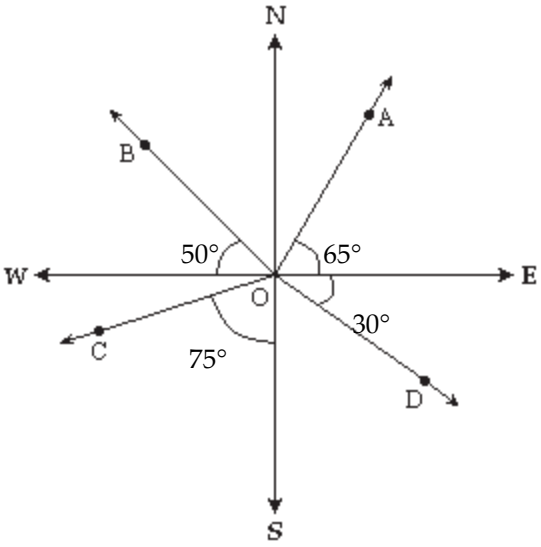
**Use the given figure to solve the problem.**

1) Find the bearing from O to A.



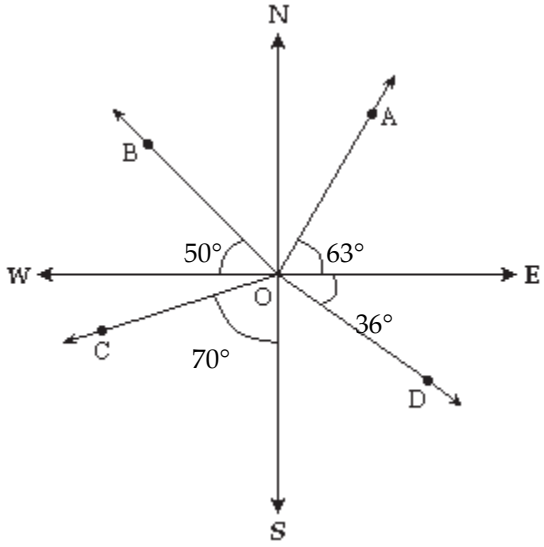

A) N 31° E B) N 59° E C) S 90° E D) N 149° E

2) Find the bearing from O to B.



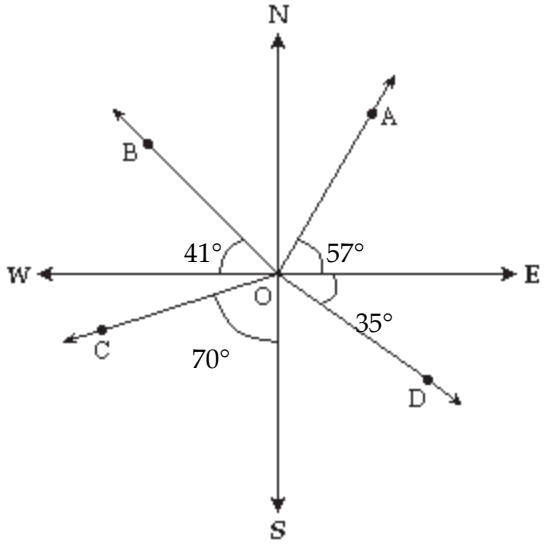

A) N 40° W B) S 140° W C) N 40° E D) N 50° W

3) Find the bearing from O to C.




A) S 70° W B) S 20° W C) N 153° W D) S 36° E

4) Find the bearing from O to D.




A) S 55° E B) S 55° W C) N 147° E D) N 125° W

**Using a calculator, solve the following problems. Round your answers to the nearest tenth.**

5) A boat leaves the entrance of a harbor and travels 86 miles on a bearing of N 58° E. How many miles north and how many miles east from the harbor has the boat traveled?

A) 45.6 miles north and 72.9 miles east B) 53.7 miles north and 137.6 miles east
C) 72.9 miles north and 45.6 miles east D) 86 miles north and 86 miles east

6) A ship is 6 miles west and 46 miles south of a harbor. What bearing should the captain set to sail directly to harbor?

A) N 7.4° E B) N 82.6° E C) N 97.4° E D) N 127.6° E

7) A ship leaves port with a bearing of N 34° W. After traveling 26 miles, the ship then turns 90° and travels on a bearing of S 56° W for 8 miles. At that time, what is the bearing of the ship from port?

A) N 51.1° W B) N 17.1° W C) N 73.1° W D) N 16.9° W

## 3 Model Simple Harmonic Motion

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**An object is attached to a coiled spring. The object is pulled down (negative direction from the rest position) and then released. Write an equation for the distance of the object from its rest position after t seconds.**

1) amplitude = 9 cm; period = 3 seconds

A) $d = -9 \cos \frac{2}{3} \pi t$ B) $d = -3 \cos \frac{2}{9} \pi t$ C) $d = -9 \sin \frac{2}{3} \pi t$ D) $d = -9 \cos \frac{\pi}{3} t$

2) amplitude = 13 in.; period = 8 seconds

A) $d = -13 \cos \frac{1}{4} \pi t$ B) $d = -8 \cos \frac{2}{13} \pi t$ C) $d = -13 \sin \frac{1}{4} \pi t$ D) $d = -13 \cos \frac{\pi}{8} t$

3) amplitude = 12 cm; period = 4π seconds

A) $d = -12 \cos \frac{1}{2} t$ B) $d = -4 \cos \frac{1}{6} t$ C) $d = -12 \sin \frac{1}{2} \pi t$ D) $d = -12 \cos \frac{1}{2} \pi t$

**An object moves in simple harmonic motion described by the given equation, where t is measured in seconds and d in meters . Find the maximum displacement, the frequency, and the time required for one cycle.**

4) d = 6 sin 3t meters

A) displacement = 6 meters; period = $\frac{2}{3} \pi$ seconds; f = $\frac{3}{2\pi}$ oscillations/second

B) displacement = 6 meters; period = $\frac{3}{2\pi}$ seconds; f = $\frac{2}{3} \pi$ oscillations/second

C) displacement = −6 meters; period = $\frac{2}{3} \pi$ seconds; f = $\frac{3}{2\pi}$ oscillations/second

D) displacement = 6 meters; period = 3 π seconds; f = $\frac{3}{\pi}$ oscillations/second

5) d = −6 sin 5t meters

A) displacement = 6 meters; period = $\frac{2}{5} \pi$ seconds; f = $\frac{5}{2\pi}$ oscillations/second

B) displacement = 6 meters; period = $\frac{5}{2\pi}$ seconds; f = $\frac{2}{5} \pi$ oscillations/second

C) displacement = −6 meters; period = $\frac{2}{5} \pi$ seconds; f = $\frac{5}{2\pi}$ oscillations/second

D) displacement = −6 meters; period = 5 π seconds; f = $\frac{5}{\pi}$ oscillations/second

6) $d = 4 \cos 5t$ meters

A) displacement = 4 meters; period = $\frac{2}{5}\pi$ seconds; f = $\frac{5}{2\pi}$ oscillations/second

B) displacement = 4 meters; period = $\frac{5}{2\pi}$ seconds; f = $\frac{2}{5}\pi$ oscillations/second

C) displacement = −4 meters; period = $\frac{2}{5}\pi$ seconds; f = $\frac{5}{2\pi}$ oscillations/second

D) displacement = 4 meters; period = $5\pi$ seconds; f = $\frac{5}{\pi}$ oscillations/second

7) $d = 2 \cos 5\pi t$ meters

A) displacement = 2 meters; period = $\frac{2}{5}$ seconds; f = $\frac{5}{2}$ oscillations/second

B) displacement = 2 meters; period = $\frac{5}{2}$ seconds; f = $\frac{2}{5}$ oscillations/second

C) displacement = 2 meters; period = $\frac{2}{5}\pi$ seconds; f = $\frac{5}{2\pi}$ oscillations/second

D) displacement = −2 meters; period = $\frac{5}{2}$ seconds; f = $\frac{2}{5}$ oscillations/second

8) $d = 4 + 3 \cos 5\pi t$ meters

A) displacement = 3 meters; period = $\frac{2}{5}$ seconds; f = $\frac{5}{2}$ oscillations/second

B) displacement = 3 meters; period = $\frac{5}{2}$ seconds; f = $\frac{2}{5}$ oscillations/second

C) displacement = 7 meters; period = $\frac{2}{5}\pi$ seconds; f = $\frac{5}{2\pi}$ oscillations/second

D) displacement = 7 meters; period = $\frac{2}{5}$ seconds; f = $\frac{5}{2}$ oscillations/second

**Solve the problem.**

9) An object in simple harmonic motion has a frequency of $\frac{3}{2}$ oscillations per second and an amplitude of 6 feet. Write an equation in the form $d = a \sin \omega t$ for the object's simple harmonic motion.

A) $d = 6 \sin 3\pi t$ B) $d = 6 \sin \frac{3\pi t}{2}$ C) $d = 6 \sin \frac{3t}{2\pi}$ D) $d = 6 \sin \frac{2t}{3}$

10) An object has a frequency of 5 vibrations per second. Write an equation in the form $d = \sin \omega t$ for the object's simple harmonic motion.

A) $d = \sin 10\pi t$ B) $d = \sin 10t$ C) $d = \sin \frac{5}{\pi}t$ D) $d = \sin \frac{5}{2}\pi t$

11) A weight attached to a spring is pulled down 3 inches below the equilibrium position. Assuming that the frequency of the system is $\frac{8}{\pi}$ cycles per second, determine a trigonometric model that gives the position of the weight at time t seconds.

A) $y = -3 \cos 16t$ B) $y = 3 \cos 16t$ C) $y = -3 \cos \frac{8}{\pi}t$ D) $y = 3\pi \cos 8t$

# Ch. 2 Graphs of the Trigonometric Functions; Inverse Trigonometric Functions Answer Key

## 2.1 Graphs of Sine and Cosine Functions

### 1 Understand the Graph of y = sin x

1) A
2) A
3) A
4) A
5) A
6) A

### 2 Graph Variations of y = sin x

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A
15) A
16) A
17) A
18) A
19) A
20) A
21) A
22) A

### 3 Understand the Graph of y = cos x

1) A
2) A
3) A

### 4 Graph Variations of y = cos x

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A

15) A
16) A
17) A
18) A
19) A
20) A
21) A
22) A
23) A

## 5 Use Vertical Shifts of Sine and Cosine Curves

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A

## 6 Model Periodic Behavior

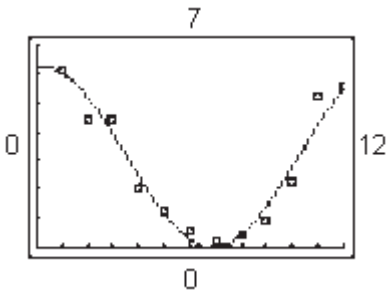
1) A
2) A
3) A
4) A
5) A

## 7 Graph the Sum of Two Trigonometric Functions

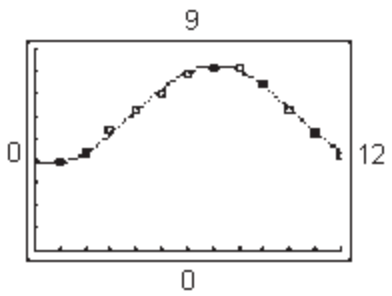
1) A
2) A
3) A
4) A

## 8 Tech: Sine and Cosine Functions

1) y = 3.14 sin(0.46x + 1.53) + 3.16;




2) y = 2.17 sin(0.49x − 1.88) + 6.02;



### 9 Additional Concepts

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A

## 2.2 Graphs of Other Trigonometric Functions

### 1 Understand the Graph of y = tan x

1) A
2) A
3) A
4) A

### 2 Graph Variations of y = tan x

1) A
2) A
3) A
4) A
5) A

### 3 Understand the Graph of y = cot x

1) A
2) A
3) A
4) A

### 4 Graph Variations of y = cot x

1) A
2) A
3) A
4) A
5) A
6) A

### 5 Understand the Graphs of y = csc x and y = sec x

1) A
2) A
3) A
4) A

### 6 Graph Variations of y = csc x and y = sec x

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A

### 7 Solve Apps: Other Trigonometric Functions

1) A
2) A

### 8 Additional Concepts

1) A

2) A
3) A
4) A
5) A
6) A
7) A
8) A

## 2.3 Inverse Trigonometric Functions

### 1 Understand and Use the Inverse Sine Function

1) A
2) A
3) A

### 2 Understand and Use the Inverse Cosine Function

1) A
2) A
3) A

### 3 Understand and Use the Inverse Tangent Function

1) A
2) A
3) A

### 4 Use a Calculator to Evaluate Inverse Trigonometric Functions

1) A
2) A
3) A
4) A
5) A
6) A

### 5 Find Exact Values of Composite Functions with Inverse Trigonometric Functions

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A
15) A
16) A
17) A
18) A
19) A

### 6 Solve Apps: Inverse Trigonometric Functions

1) A

## 2.4 Applications of Trigonometric Functions

### 1 Solve a Right Triangle

1) A

2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A
15) A
16) A

## 2 Solve Problems Involving Bearings

1) A
2) A
3) A
4) A
5) A
6) A
7) A

## 3 Model Simple Harmonic Motion

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A