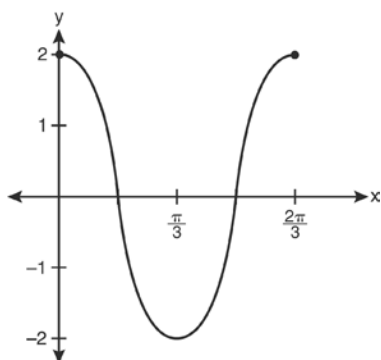


F.TF.B.5: Modeling Trigonometric Functions 2a

- 1 The equation $y - 2 \sin \theta = 3$ may be rewritten as

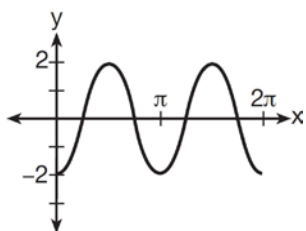
- 1) $f(y) = 2 \sin x + 3$
- 2) $f(y) = 2 \sin \theta + 3$
- 3) $f(x) = 2 \sin \theta + 3$
- 4) $f(\theta) = 2 \sin \theta + 3$

- 2 Which equation is represented by the graph below?



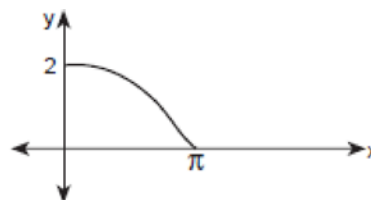
- 1) $y = 2 \cos 3x$
- 2) $y = 2 \sin 3x$
- 3) $y = 2 \cos \frac{2\pi}{3} x$
- 4) $y = 2 \sin \frac{2\pi}{3} x$

- 3 Which equation represents the graph below?



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

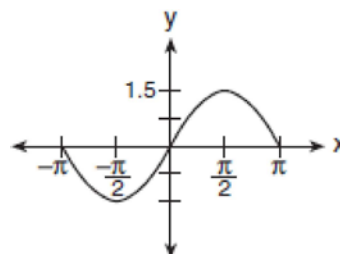
- 4 The accompanying diagram shows a section of a sound wave as displayed on an oscilloscope.



Which equation could represent this graph?

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

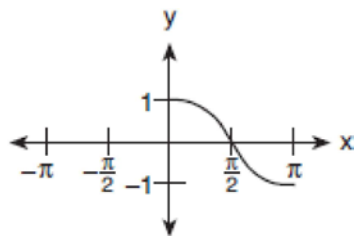
- 5 A radio transmitter sends a radio wave from the top of a 50-foot tower. The wave is represented by the accompanying graph.



What is the equation of this radio wave?

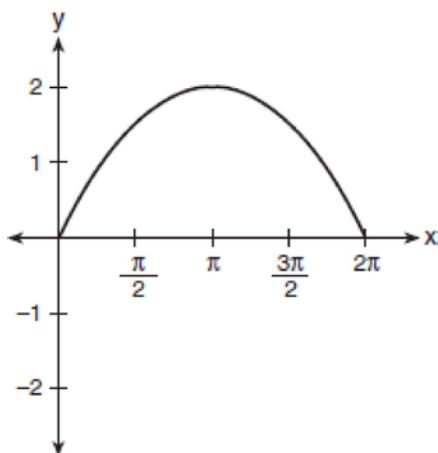
- 1) $y = \sin x$
- 2) $y = 1.5 \sin x$
- 3) $y = \sin 1.5x$
- 4) $y = 2 \sin x$

- 6 Which equation is represented by the accompanying graph?



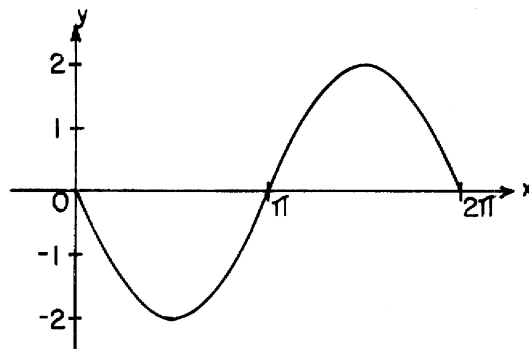
- 1) $y = \cos x$
- 2) $y = \cos \frac{1}{2}x$
- 3) $y = \cos 2x$
- 4) $y = \frac{1}{2} \cos x$

- 7 Which equation is represented by the accompanying graph?



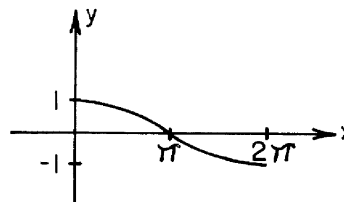
- 1) $y = 2 \sin \frac{1}{2}x$
- 2) $y = 2 \sin x$
- 3) $y = \sin \frac{1}{2}x$
- 4) $y = \sin 2x$

- 8 Which is an equation of the graph shown below?



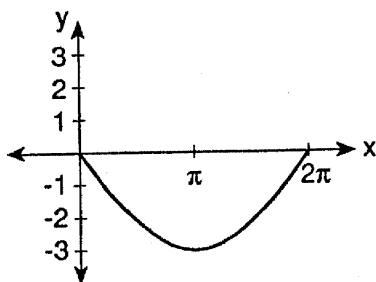
- 1) $y = \sin 2x$
- 2) $y = -\sin 2x$
- 3) $y = -2 \sin x$
- 4) $y = 2 \sin x$

- 9 Which is an equation of the graph shown below?



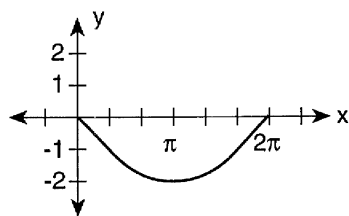
- 1) $y = \cos \frac{1}{2}x$
- 2) $y = \cos 2x$
- 3) $y = \sin \frac{1}{2}x$
- 4) $y = \sin 2x$

- 10 Which equation is represented by the graph in the diagram below?



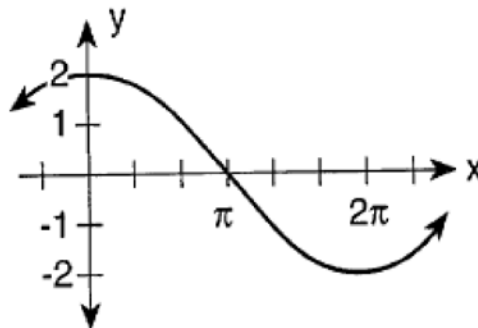
- 1) $y = 3 \sin 2x$
- 2) $y = 3 \sin \frac{1}{2}x$
- 3) $y = -3 \sin 3x$
- 4) $y = -3 \sin \frac{1}{2}x$

- 11 Which equation is represented by the graph below?



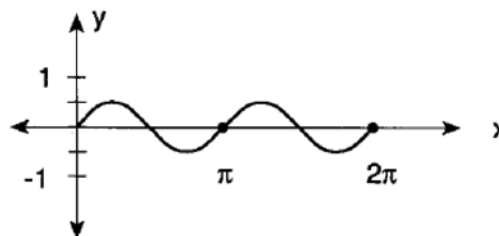
- 1) $y = -2 \sin \frac{1}{2}x$
- 2) $y = -\frac{1}{2} \sin 2x$
- 3) $y = \frac{1}{2} \sin 2x$
- 4) $y = 2 \sin \frac{1}{2}x$

- 12 Which equation is represented in the graph below?



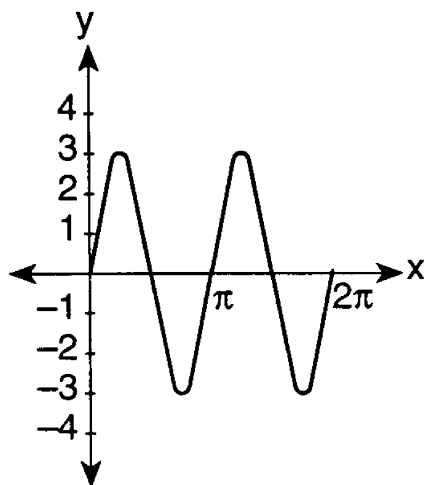
- 1) $y = 2 \cos 2x$
- 2) $y = \frac{1}{2} \cos 2x$
- 3) $y = 2 \cos \frac{1}{2}x$
- 4) $y = \frac{1}{2} \cos \frac{1}{2}x$

- 13 Which equation is represented in the accompanying graph?



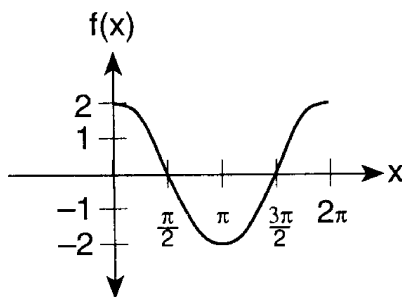
- 1) $y = 2 \sin 2x$
- 2) $y = \frac{1}{2} \sin \frac{1}{2}x$
- 3) $y = 2 \sin \frac{1}{2}x$
- 4) $y = \frac{1}{2} \sin 2x$

- 14 Which equation is represented by the graph in the accompanying diagram?



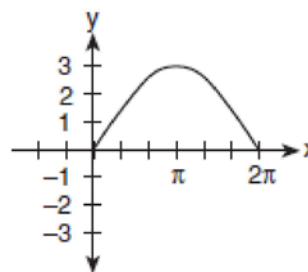
- 1) $y = 3 \sin 2x$
- 2) $y = 2 \sin 3x$
- 3) $y = 3 \sin x$
- 4) $y = 2 \sin 4x$

- 15 Which trigonometric function is shown in the graph below?



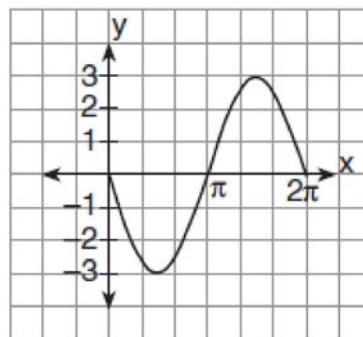
- 1) $f(x) = 2 \sin x$
- 2) $f(x) = 2 \cos x$
- 3) $f(x) = \cos 2x$
- 4) $f(x) = \sin 2x$

- 16 Which equation is represented by the graph in the accompanying diagram?



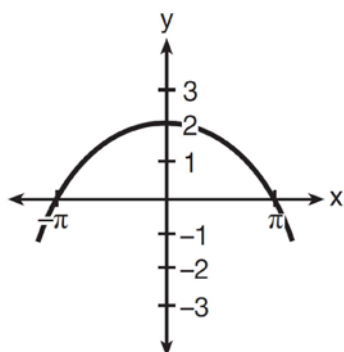
- 1) $y = 3 \sin 2x$
- 2) $y = 3 \sin \frac{1}{2}x$
- 3) $y = 2 \sin 3x$
- 4) $y = \frac{1}{2} \sin 3x$

- 17 Which equation is represented on the graph shown below?



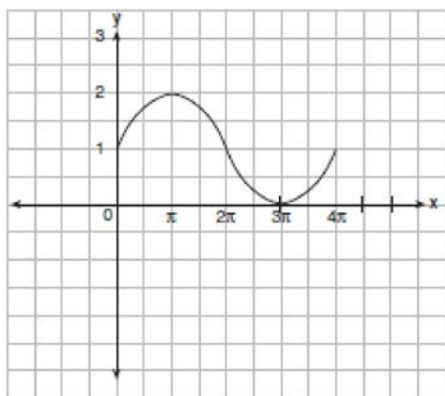
- 1) $y = 3 \sin x$
- 2) $y = -3 \sin x$
- 3) $y = 3 \cos x$
- 4) $y = -\sin 3x$

- 18 Which equation could be represented by the graph below?



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

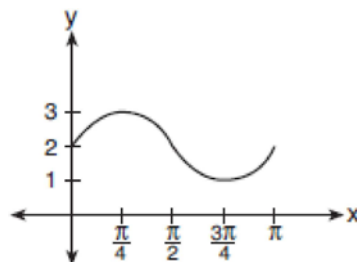
- 19 In physics class, Eva noticed the pattern shown in the accompanying diagram on an oscilloscope.



Which equation best represents the pattern shown on this oscilloscope?

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

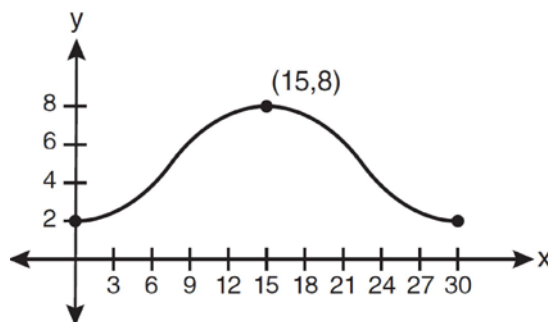
- 20 The accompanying graph represents a portion of a sound wave.



Which equation best represents this graph?

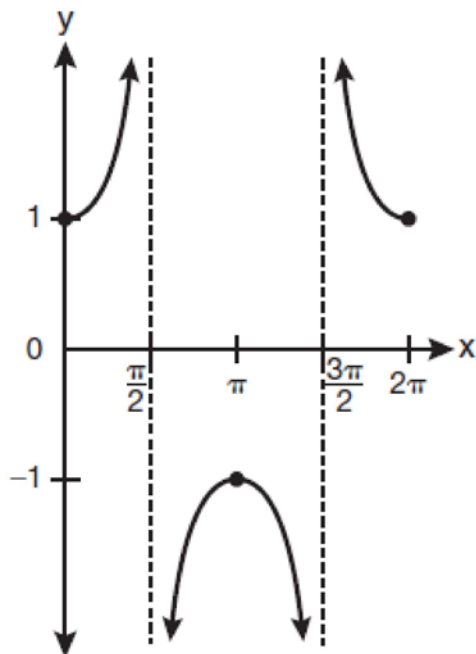
- 1) $y = 2 \sin \frac{1}{2}x$
- 2) $y = \sin \frac{1}{2}x + 2$
- 3) $y = \sin 2x$
- 4) $y = \sin 2x + 2$

- 21 Which equation is graphed in the diagram below?



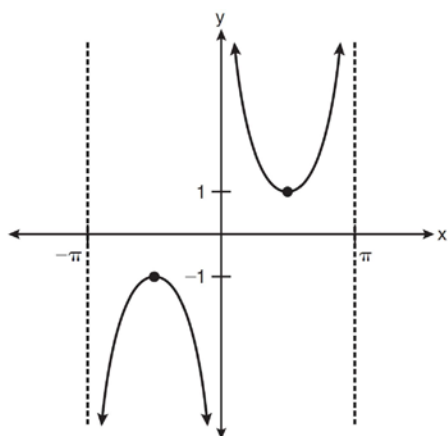
- 1) $y = 3 \cos \left(\frac{\pi}{30}x \right) + 8$
- 2) $y = 3 \cos \left(\frac{\pi}{15}x \right) + 5$
- 3) $y = -3 \cos \left(\frac{\pi}{30}x \right) + 8$
- 4) $y = -3 \cos \left(\frac{\pi}{15}x \right) + 5$

22 Which equation is represented by the graph below?



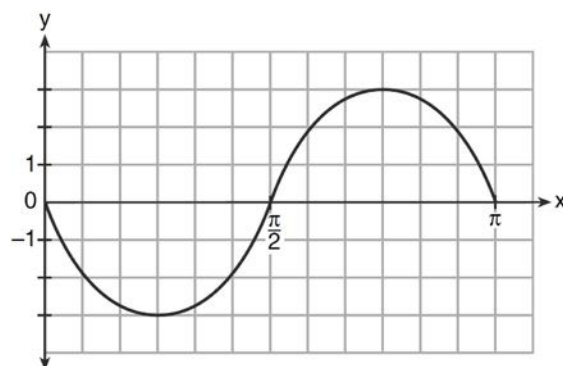
- 1) $y = \cot x$
- 2) $y = \csc x$
- 3) $y = \sec x$
- 4) $y = \tan x$

23 Which equation is sketched in the diagram below?

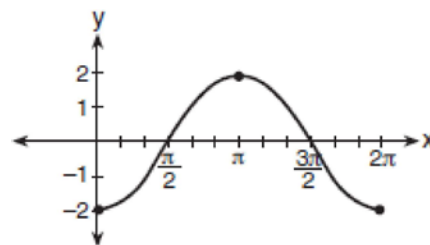


- 1) $y = \csc x$
- 2) $y = \sec x$
- 3) $y = \cot x$
- 4) $y = \tan x$

24 Write an equation for the graph of the trigonometric function shown below.



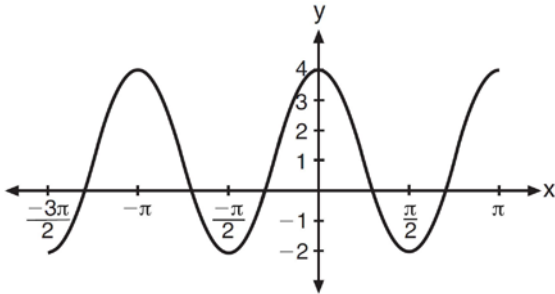
25 The accompanying graph shows a trigonometric function. State an equation of this function.



26 A student attaches one end of a rope to a wall at a fixed point 3 feet above the ground, as shown in the accompanying diagram, and moves the other end of the rope up and down, producing a wave described by the equation $y = a \sin bx + c$. The range of the rope's height above the ground is between 1 and 5 feet. The period of the wave is 4π . Write the equation that represents this wave.

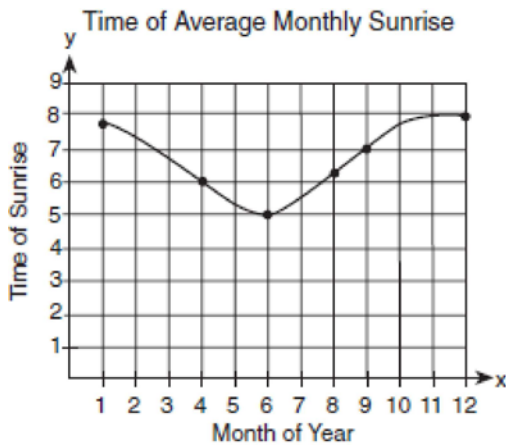


- 27 The periodic graph below can be represented by the trigonometric equation $y = a \cos bx + c$ where a , b , and c are real numbers.



State the values of a , b , and c , and write an equation for the graph.

- 28 The times of average monthly sunrise, as shown in the accompanying diagram, over the course of a 12-month interval can be modeled by the equation $y = A \cos(Bx) + D$. Determine the values of A , B , and D , and explain how you arrived at your values.



F.TF.B.5: Modeling Trigonometric Functions 2a

Answer Section

1 ANS: 4

$$y - 2 \sin \theta = 3$$

$$y = 2 \sin \theta + 3$$

$$f(\theta) = 2 \sin \theta + 3$$

REF: fall0927a2

2 ANS: 1

REF: 011320a2

3 ANS: 3

REF: 061306a2

4 ANS: 1

Since none of the answers has a translation, the point (0,2) must result from a dilation of 2 of the cosine function.

$$\text{period} = \frac{2\pi}{b}$$

$$4\pi = \frac{2\pi}{b}$$

At $x = \pi$, the function is $\frac{1}{4}$ complete, so the period is 4π .

$$b = \frac{2\pi}{4\pi}$$

$$b = \frac{1}{2}$$

REF: 010214b

5 ANS: 2

The maximum and minimum of this sine function indicates the amplitude is 1.5.

REF: 060608b

6 ANS: 1

REF: 060711b

7 ANS: 1

REF: 010419siii

8 ANS: 3

REF: 068633siii

9 ANS: 1

REF: 018917siii

10 ANS: 4

REF: 089522siii

11 ANS: 1

REF: 069721siii

12 ANS: 3

REF: 089725siii

13 ANS: 4

REF: 019822siii

14 ANS: 1

REF: 089820siii

15 ANS: 2

REF: 010019siii

16 ANS: 2

REF: 010119siii

17 ANS: 2

REF: 080121siii

18 ANS: 2

REF: 081607a2

19 ANS: 1

The sine function has been translated +1. Since the maximum is 2 and the minimum is 0, the amplitude is 1.

$$\text{period} = \frac{2\pi}{b}$$

$$4\pi = \frac{2\pi}{b}$$

$$b = \frac{2\pi}{4\pi}$$

$$b = \frac{1}{2}$$

REF: 010612b

20 ANS: 4

The sine function has been translated +2. Since the maximum is 3 and the minimum is 1, the amplitude is 1.

$$\text{period} = \frac{2\pi}{b}$$

$$\pi = \frac{2\pi}{b}$$

$$b = 2$$

REF: 080717b

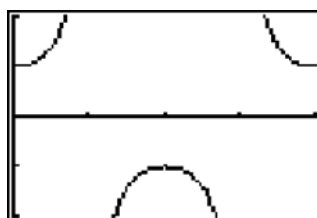
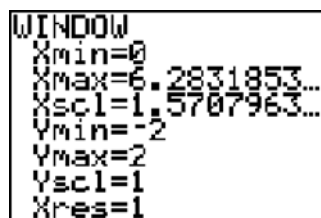
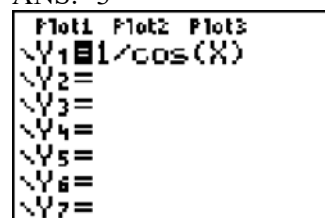
21 ANS: 4

$$\frac{2\pi}{b} = 30$$

$$b = \frac{\pi}{15}$$

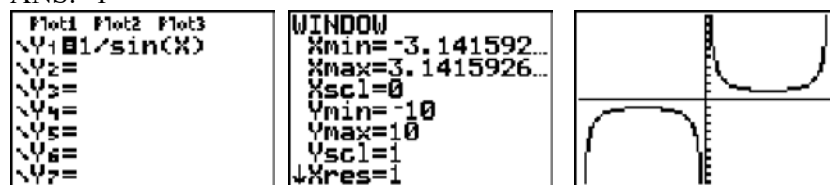
REF: 011227a2

22 ANS: 3



REF: 061020a2

23 ANS: 1



REF: 011123a2

24 ANS:

$y = -3\sin 2x$. The period of the function is π , the amplitude is 3 and it is reflected over the x -axis.

REF: 061235a2

25 ANS:

$y = -2\cos x$. The period of the function is 2π , the amplitude is 2 and it is reflected over the x -axis.

REF: 080926b

26 ANS:

$y = 2\sin \frac{1}{2}x + 3$. The range of the function is from a minimum of 1 to a maximum of 5. To compute c , average

these values: $c = \frac{1+5}{2} = 3$. To compute a , the amplitude, find the distance from c to the minimum or maximum.

$$\text{period} = \frac{2\pi}{b}$$

$a = |5 - 3| = |1 - 3| = 2$. The period of the function is 4π . To compute b ,

$$4\pi = \frac{2\pi}{b}$$

$$b = \frac{2\pi}{4\pi} = \frac{1}{2}$$

REF: 080330b

27 ANS:

$a = 3, b = 2, c = 1$ $y = 3\cos 2x + 1$.

REF: 011538a2

28 ANS:

1.5, $\frac{1}{2}$, 6.5. The range of the function is from a minimum of 5 to a maximum of 8. To compute D , the translation of the function, average these values: $D = \frac{5+8}{2} = 6.5$. To compute A , the amplitude, find the distance from D to the minimum or maximum. $A = |8 - 6.5| = |5 - 6.5| = 1.5$. The period of the function is 4π . To compute B ,

$$\text{period} = \frac{2\pi}{b}$$

$$4\pi = \frac{2\pi}{B}$$

$$B = \frac{2\pi}{4\pi} = \frac{1}{2}$$

REF: 080127b