F.TF.B.5: Modeling Trigonometric Functions 2b
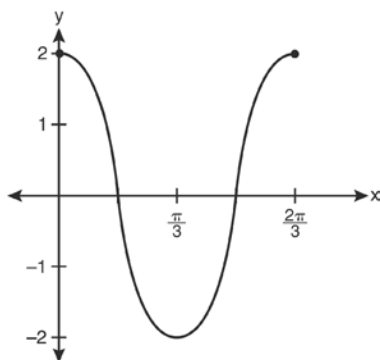
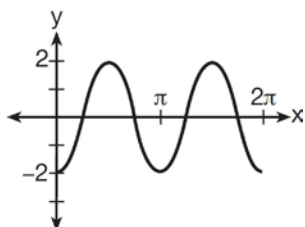1 The equation $y - 2\sin\theta = 3$ may be rewritten as
   1) $f(y) = 2\sin x + 3$
   2) $f(y) = 2\sin\theta + 3$
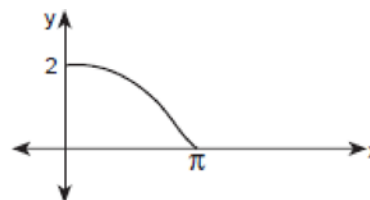   3) $f(x) = 2\sin\theta + 3$
   4) $f(\theta) = 2\sin\theta + 3$

2 Which equation is represented by the graph below?
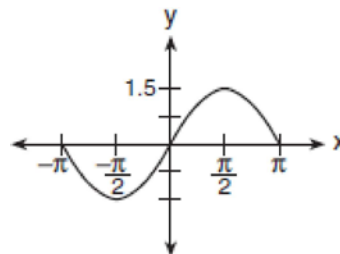

3 Which equation represents the graph below?

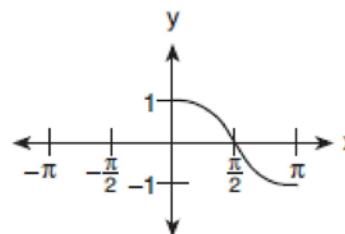4 The accompanying diagram shows a section of a sound wave as displayed on an oscilloscope.

Which equation could represent this graph?

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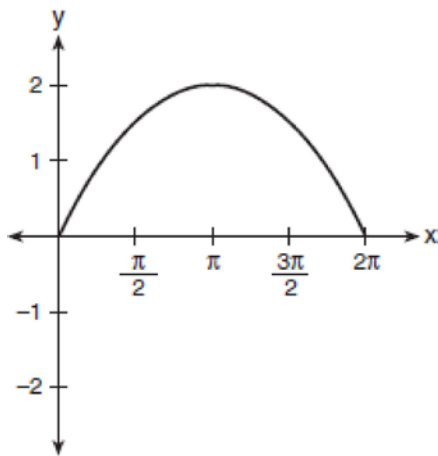

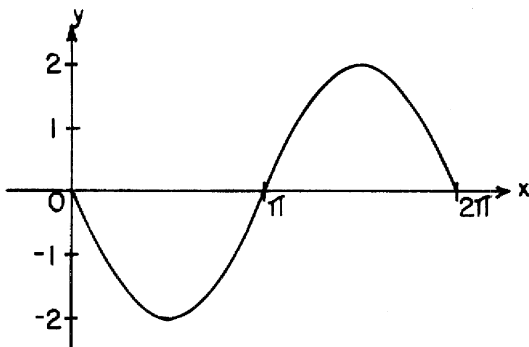What is the equation of this radio wave?

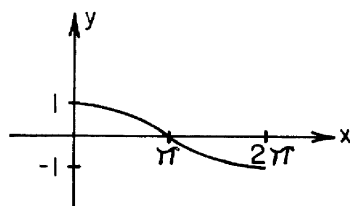6 Which equation is represented by the accompanying graph?

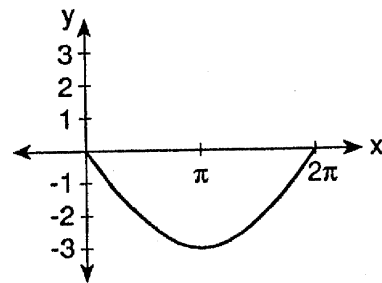7 Which equation is represented by the accompanying graph?

8 Which is an equation of the graph shown below?
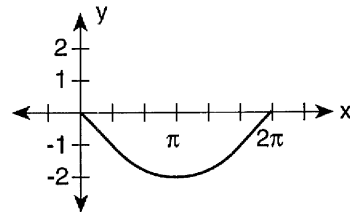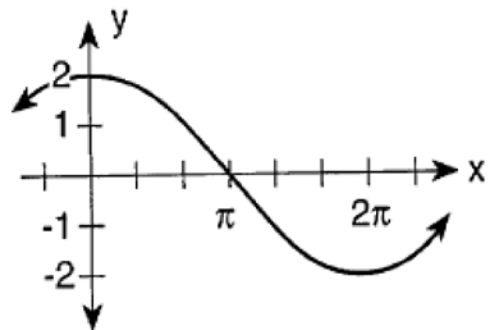

9 Which is an equation of the graph shown below?

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

11 Which equation is represented by the graph below?

12 Which equation is represented in the graph below?

2

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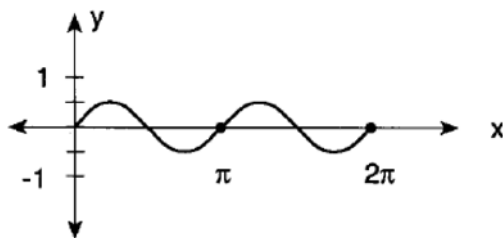
16 Which equation is represented by the graph in the accompanying diagram?

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

17 Which equation is represented on the graph shown below?
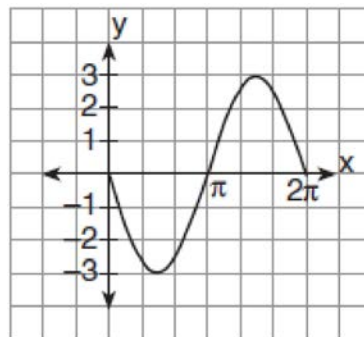
18 Which equation could be represented by the graph below?

15 Which trigonometric function is shown in the graph below?

3
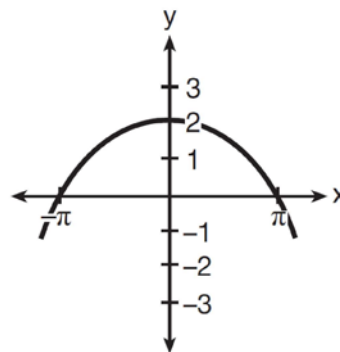
19 In physics class, Eva noticed the pattern shown in the accompanying diagram on an oscilloscope.
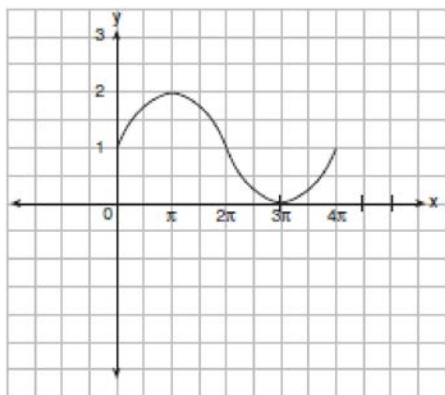
Which equation best represents the pattern shown on this oscilloscope?

20 The accompanying graph represents a portion of a sound wave.
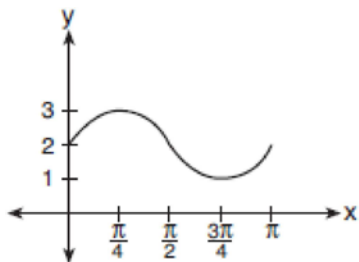
Which equation best represents this graph?

21 Which equation is graphed in the diagram below?
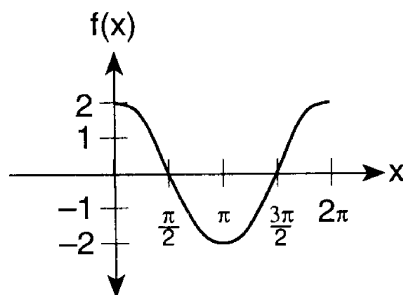

22 Which equation is represented by the graph below?

23 Which equation is sketched in the diagram below?

4

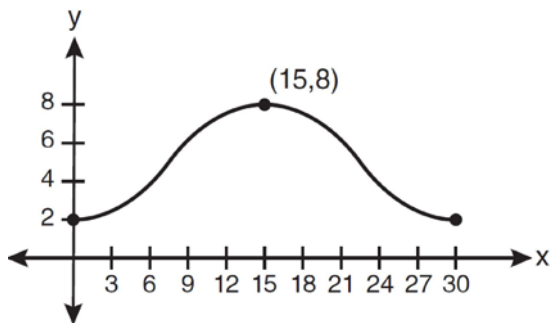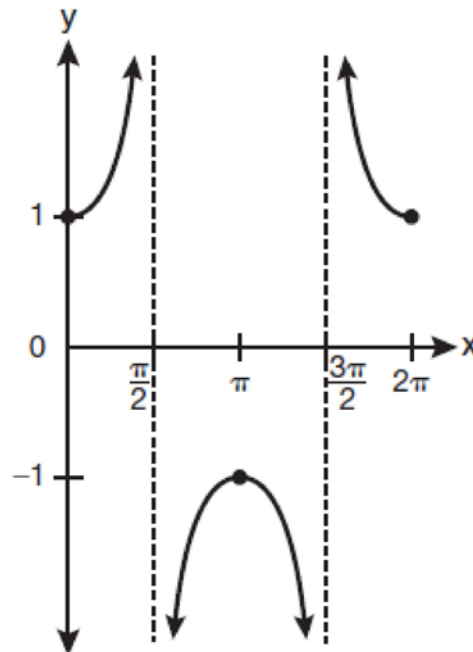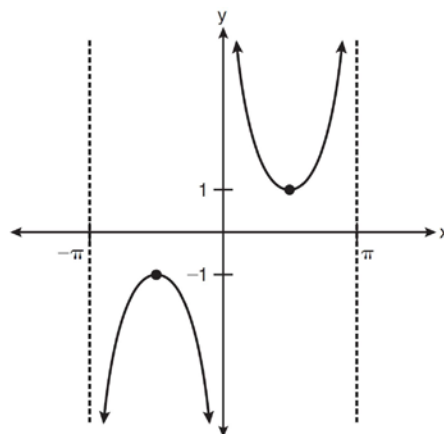24 Write an equation for the graph of the trigonometric function shown below.
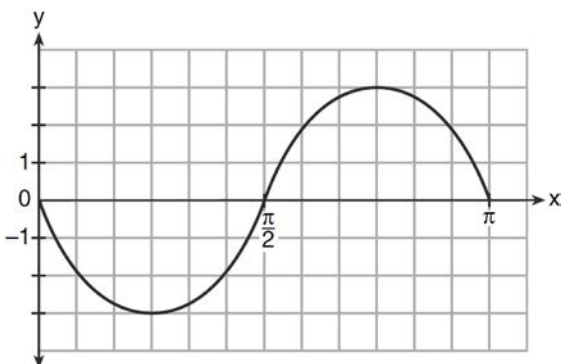
25 The accompanying graph shows a trigonometric function. State an equation of this function.
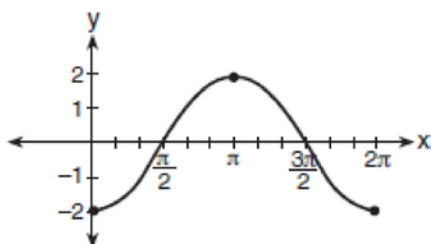
26 A student attaches one end of a rope to a wall at a fixed point 3 feet above the ground, as shown in the accompanying diagram, and moves the other end of the rope up and down, producing a wave described by the equation $y = a \sin bx + c$. The range of the rope's height above the ground is between 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.
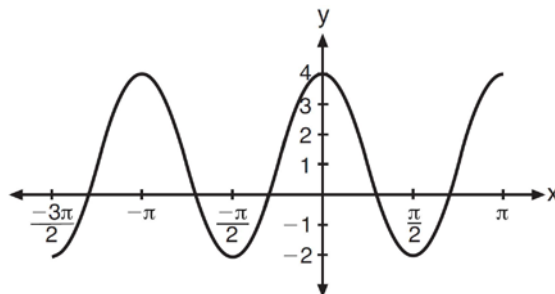
State the values of a, b, and c, and write an equation for the graph.

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.

5
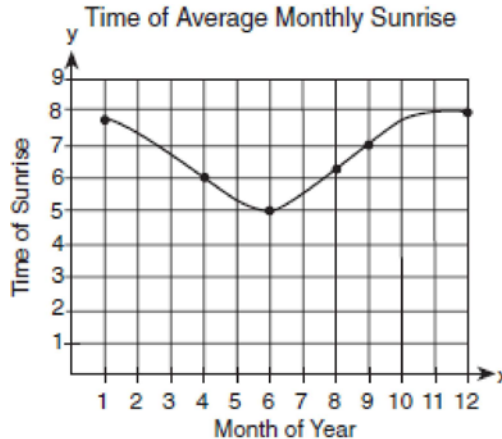
F.TF.B.5: Modeling Trigonometric Functions 2b
Answer Section

1   ANS: 4
$y - 2\sin\theta = 3$

$y = 2\sin\theta + 3$

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

REF: fall0927a2

2   ANS:
$y = 2\cos 3x$

REF: 011320a2

3   ANS:
$y = -2\cos 2x$

REF: 061306a2

4   ANS:

$y = 2\cos\dfrac{x}{2}$

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 $\dfrac{1}{4}$ complete, so the period is 4π.

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

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

REF: 010214b

5   ANS:
$y = 1.5\sin x$
The maximum and minimum of this sine function indicates the amplitude is 1.5.

REF: 060608b

6   ANS:
$y = \cos x$

REF: 060711b

7   ANS:

$y = 2\sin\dfrac{1}{2}x$

REF: 010419siii

8 ANS:
$y = -2\sin x$

REF: 068633siii

9 ANS:
$y = \cos \frac{1}{2} x$

REF: 018917siii

10 ANS:
$y = -3\sin \frac{1}{2} x$

REF: 089522siii

11 ANS:
$y = -2\sin \frac{1}{2} x$

REF: 069721siii

12 ANS:
$y = 2\cos \frac{1}{2} x$

REF: 089725siii

13 ANS:
$y = \frac{1}{2} \sin 2x$

REF: 019822siii

14 ANS:
$y = 3\sin 2x$

REF: 089820siii

15 ANS:
$f(x) = 2\cos x$

REF: 010019siii

16 ANS:
$y = 3\sin \frac{1}{2} x$

REF: 010119siii

17 ANS:
$y = -3\sin x$

REF: 080121siii

18 ANS:

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

REF: 081607a2

19 ANS:

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

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:

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

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:

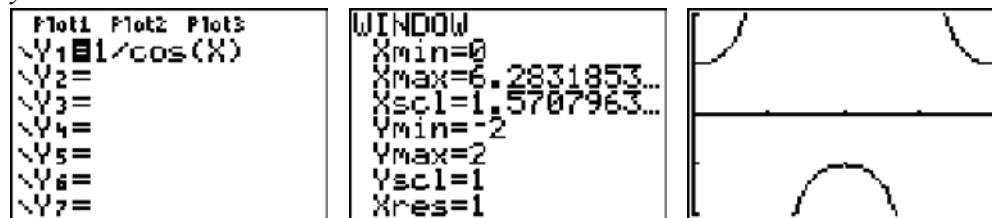$$y = -3\cos\left(\frac{\pi}{15}x\right) + 5$$

$$\frac{2\pi}{b} = 30$$
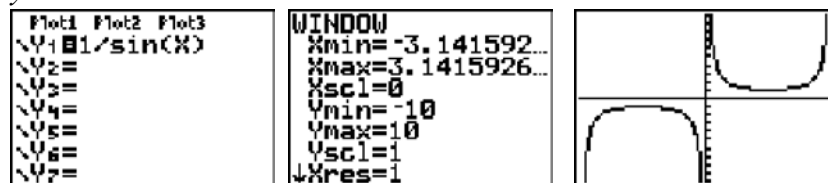
$$b = \frac{\pi}{15}$$

REF: 011227a2

22 ANS:

$y = \sec x$

REF: 061020a2

23 ANS:

$y = \csc x$

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:

$y = 2\sin\dfrac{1}{2}x + 3$. The range of the function is from a minimum of 1 to a maximum of 5. To compute c, average these values: $c = \dfrac{1+5}{2} = 3$. To compute a, the amplitude, find the distance from c to the minimum or maximum.

$a = |5-3| = |1-3| = 2$. 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: 080330b

27 ANS:

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

REF: 011538a2

4

28 ANS:

1.5, $\dfrac{1}{2}$, 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: $D = \dfrac{5+8}{2} = 6.5$. 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,

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

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

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

REF: 080127b