

Section 1.1 : Functions and their Representations

MULTIPLE CHOICE

1. The number of research articles in *Physics Review* that were written by researchers in the U.S. from 1983 through 1999 can be approximated by $A(t) = -0.01t^2 + 0.24t + 3.4$ billion dollars (t is time in years since 1983).

Find an appropriate domain of A .

- a. $[0, 16]$
- b. $[1983, +\infty]$
- c. $[1983, 1999]$
- d. $[-\infty, 0]$
- e. $[-\infty, 16]$

ANS: A

PTS: 1

DIF: Medium

REF: 1.1.1

MSC: Application

2. Based on the following table, find $f(3)$.

x	-3	-2	-1	0	1	2	3
$f(x)$	2	4	5	-1	-1	0.2	0.85

- a. 0.2
- b. 2
- c. 0.85
- d. 5
- e. -1

ANS: C

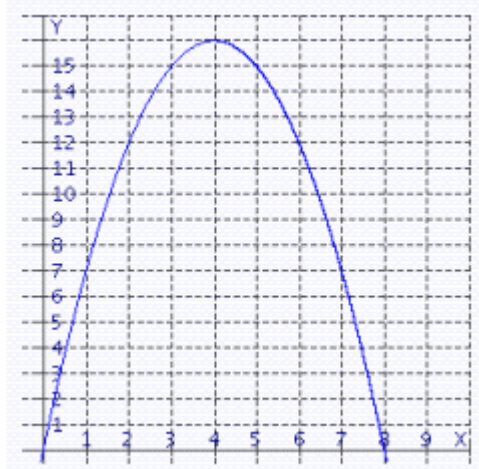
PTS: 1

DIF: Easy

REF: 1.1.3

MSC: Skill

3. Use the graph of the function f to find $f(3)$.



- a. 15
- b. 13
- c. 11
- d. 12
- e. 14

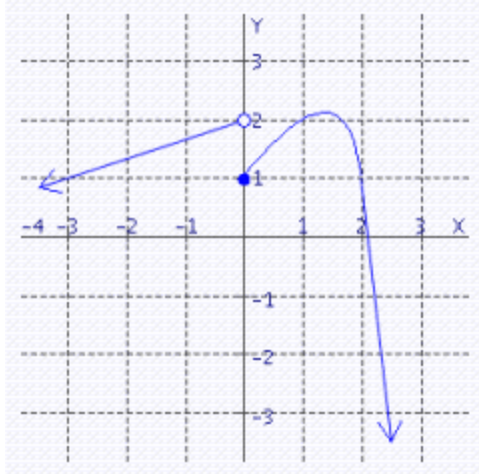
ANS: A
MSC: Concept

PTS: 1

DIF: Easy

REF: 1.1.7a

4. Use the graph of the function f to find $f(0)$.



- a. -1
- b. 1
- c. -0.5
- d. 0
- e. 2

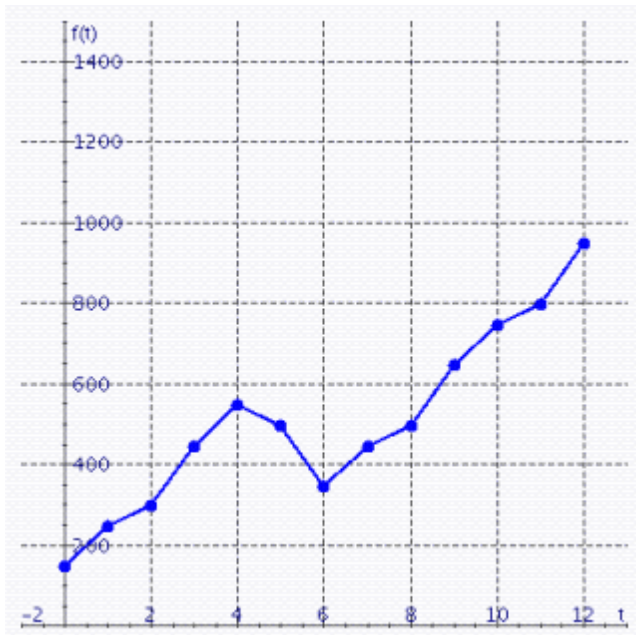
ANS: B
MSC: Concept

PTS: 1

DIF: Easy

REF: 1.1.7b

5. Graph shows the number of sports utility vehicles $f(t)$ sold in the United States. $f(t)$ represents sales in year t in thousands of vehicles. Find $f(9)$.



- a. 500
- b. 250

- c. 350
- d. 650
- e. 300

ANS: D PTS: 1 DIF: Medium REF: 1.1.8a
MSC: Concept

6. Let f be the function defined by $f(x) = 7x + 8$.

Find $f(6)$, $f(-6)$, $f(a)$, $f(-a)$, and $f(a + 6)$.

- a. $f(6) = 49$, $f(-6) = -33$, $f(a) = 7a + 8$, $f(-a) = -7a + 8$
- b. $f(6) = 50$, $f(-6) = -34$, $f(a) = 7a + 8$, $f(-a) = 1$, $f(a + 6) = 7a + 8$
- c. $f(6) = 50$, $f(-6) = -34$, $f(a) = a + 8$, $f(-a) = -a + 8$, $f(a + 6) = 7a + 34$
- d. $f(6) = 48$, $f(-6) = -32$, $f(a) = 15$, $f(-a) = 1$, $f(a + 6) = 7a + 50$
- e. $f(6) = 50$, $f(-6) = -34$, $f(a) = 7a + 8$, $f(-a) = -7a + 8$, $f(a + 6) = 7a + 50$

ANS: E PTS: 1 DIF: Medium REF: 1.1.23
MSC: Concept

7. Let f be the function defined by $f(x) = 2x + 7$.

Find $f(a + h)$, $f(-a)$, $f(a^2)$, $f(a - 3h)$, and $f(3a - h)$.

- a. $f(a + h) = 2a + 7$,
 $f(-a) = -2a + 7$,
 $f(a^2) = 2a^2 + 7$,
 $f(a - 3h) = 2a + 7$,
 $f(3a - h) = 6a + 7$
- b. $f(a + h) = 2a + 2h + 7$,
 $f(-a) = -2a$,
 $f(a^2) = 2a^2$,
 $f(a - 3h) = 2a - 6h + 7$,
 $f(3a - h) = 6a - 2h + 7$.
- c. $f(a + h) = 2a + 2h$,
 $f(-a) = -2a$,
 $f(a^2) = 2a^2$,
 $f(a - 3h) = 2a - 6h$,
 $f(3a - h) = 6a - 2h$
- d. $f(a + h) = 2a + 2h + 7$,
 $f(-a) = -2a + 7$,
 $f(a^2) = 2a^2 + 7$,
 $f(a - 3h) = 2a - 6h + 7$,
 $f(3a - h) = 6a - 2h + 7$
- e. $f(a + h) = 2a + 2h + 7$,
 $f(-a) = -2a + 7$,
 $f(a^2) = 2a^2 + 7$,
 $f(a - 3h) = 2a - 6h$,
 $f(3a - h) = 6a - 2h$.

ANS: D PTS: 1 DIF: Medium REF: 1.1.24
MSC: Concept

8. The value of U.S. trade with China from 1994 through 2000 can be approximated by $C(t) = 3t^2 - 7t + 50$ billion dollars (t is time in years since 1994).

Find an appropriate domain of $\mathcal{C}$.

- a. $[0, 6]$
- b. $[6, +\infty]$
- c. $[0, +\infty]$
- d. $[1994, +\infty]$
- e. $[1994, 2000]$

ANS: A

PTS: 1

DIF: Medium

REF: 1.1.31

MSC: Application

9. Find the domain of the function.

$$f(x) = x^2 - x - 19$$

- a. $(-\infty, -19) \cup (-19, 19) \cup (19, \infty)$
- b. $[-19, 19]$
- c. $(-\infty, 19) \cup (19, \infty)$
- d. $(-19, 19)$
- e. $(-\infty, \infty)$

ANS: E

PTS: 1

DIF: Medium

REF: 1.1.32

MSC: Skill

10. Find the domain of the function.

$$f(x) = \frac{x}{x^2 - 49}$$

- a. $(-\infty, -7) \cup (-7, 7) \cup (7, \infty)$
- b. $[-7, 7]$
- c. $(-7, 7)$
- d. $(-\infty, 7) \cup (7, \infty)$
- e. $(-\infty, \infty)$

ANS: A

PTS: 1

DIF: Medium

REF: 1.1.33

MSC: Skill

11. Find the range of the function.

$$f(x) = 3x^2 + 1$$

- a. $(1, \infty)$
- b. $[-1, 1]$
- c. $(-1, 1)$
- d. (∞, ∞)
- e. $[1, \infty)$

ANS: E

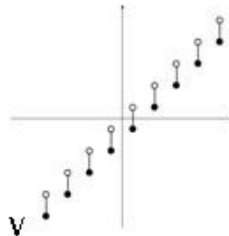
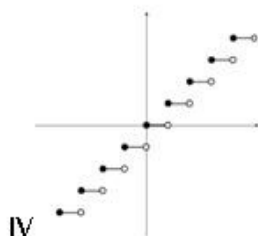
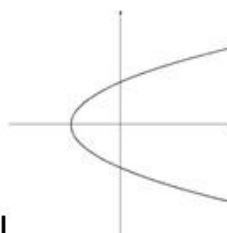
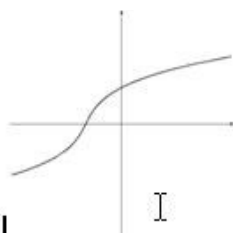
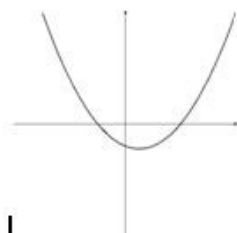
PTS: 1

DIF: Easy

REF: 1.1.34

MSC: Skill

12. Which of the following are graphs of functions?



- a. I, II, III only
- b. III only
- c. I and II only
- d. I, II, and IV only
- e. II only
- f. I and III only
- g. II and V only
- h. I only

ANS: D

PTS: 1

DIF: Difficult

REF: 1.1.37

MSC: Concept

13. Function f is
- $$f(x) = \begin{cases} 6x & \text{if } 0 \leq x < 8 \\ 5 & \text{if } 8 \leq x < 16 \end{cases}$$
- Find $f(9)$.

- a. 60
- b. 48
- c. 54
- d. 5
- e. 66

ANS: D

PTS: 1

DIF: Easy

REF: 1.1.41

MSC: Concept

14. Let f be the function defined by

$$f(x) = \begin{cases} 5 + \sqrt{16 - x} & \text{if } x \leq 16 \\ \frac{16}{16 - x} & \text{if } x > 16 \end{cases}$$

Find $f(0)$, $f(16)$, and $f(32)$.

- a. $f(0) = 21, f(16) = 5, f(32) = -1$
- b. $f(0) = 9, f(16) = \infty, f(32) = -16$
- c. $f(0) = 9, f(16) = 5, f(32) = -1$
- d. $f(0) = 21, f(16) = 5, f(32) = -16$
- e. $f(0) = 5, f(16) = \infty, f(32) = -1$

ANS: C

PTS: 1

DIF: Easy

REF: 1.1.42

MSC: Concept

$$f(x) = \begin{cases} -1 & \text{if } 0 \leq x < 10 \\ -5x & \text{if } 10 \leq x < 20 \end{cases}$$

15. Function f is

Find $f(5)$.

- a. -1
- b. -26
- c. -25
- d. 20
- e. 25

ANS: A

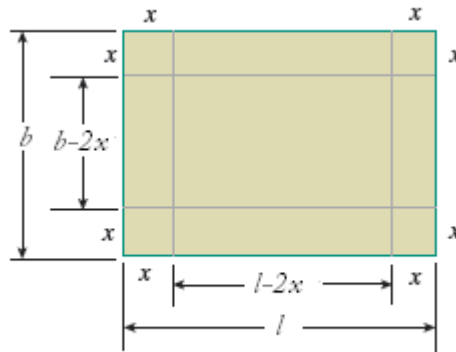
PTS: 1

DIF: Easy

REF: 1.1.44

MSC: Concept

16. By cutting away identical squares from each corner of a rectangular piece of cardboard and folding up the resulting flaps, an open box can be made. If the cardboard is 17 in. long and 7 in. wide and the square cutaways have dimensions of x in. by x in., find a function giving the volume of the resulting box.



- a. $f = (17 + 2x)(7 + 2x)x$
- b. $f = (17 - 2x)(7 - 2x)x$
- c. $f = (17 - 2x)(7 + 2x)x$
- d. $f = (217 + x)(27 + x)x$
- e. $f = (17 + 2x)(7 - 2x)x$

ANS: B

PTS: 1

DIF: Medium

REF: 1.1.49

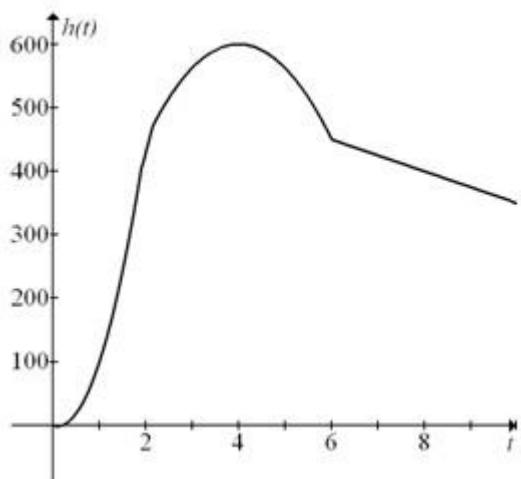
MSC: Concept

SHORT ANSWER

1. A small model rocket is launched vertically upward on a calm day. The engine delivers its thrust at a constant rate for 2 seconds, at which point the engine burns out. The rocket continues until it begins to fall from its maximum height of 600 feet. Six seconds into the flight a parachute is automatically deployed and the rocket descends at a constant rate of 30 feet per second. Sketch a possible graph of the altitude, $h(t)$, of the rocket at time t for the first 10 seconds of the flight.

ANS:

Answers will vary. One possible graph



PTS: 1

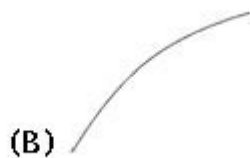
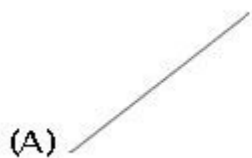
DIF: Medium

REF: 1.1.20a

MSC: Application

2. Each of the functions in the table below is increasing, but each increases in a different way. Select the graph from those given below which best fits each function:

t	1	2	3	4	5	6
$f(t)$	26	34	41	46	48	49
$g(t)$	16	24	32	40	48	56
$h(t)$	36	44	53	64	77	93



ANS:

$f(t)$: (B)

$g(t)$: (A)

$h(t)$: (C)

PTS: 1

DIF: Medium

REF: 1.1.21

MSC: Application

3. Each of the functions in the table below is decreasing, but each decreases in a different way. Select the graph from those given below which best fits each function:

t	1	2	3	4	5	6
$f(t)$	98	91	81	69	54	35
$g(t)$	80	71	63	57	53	52
$h(t)$	78	69	60	51	42	33

(A)



(B)



(C)



ANS:

$f(t)$: (B)

$g(t)$: (C)

$h(t)$: (A)

PTS: 1

DIF: Medium

REF: 1.1.22

MSC: Application

4. Let $f(x) = 4 - x^2$. Find

(a) the domain of f .

(b) the range of f .

ANS:

(a) $(-\infty, \infty)$

(b) $(-\infty, 4]$

PTS: 1

DIF: Medium

REF: 1.1.38

MSC: Concept

5. Let $f(x) = \sqrt{2x+5}$. Find

(a) the domain of f .

(b) the range of f .

ANS:

(a) $[-\frac{5}{2}, \infty)$

(b) $[0, \infty)$

PTS: 1

DIF: Medium

REF: 1.1.39

MSC: Skill

6. Let $f(x) = \sqrt{16 - x^2}$. Find

(a) the domain of f .

(b) the range of f .

ANS:

(a) $[-4, 4]$

(b) $[0, 4]$

PTS: 1

DIF: Medium

REF: 1.1.40

MSC: Skill

7. Let f be the function defined by

$$f(x) = \begin{cases} 1 + \sqrt{4-x} & \text{if } x \leq 4 \\ \frac{4}{4-x} & \text{if } x > 4 \end{cases}$$

Find $f(0)$, $f(4)$, and $f(8)$.

$$f(0) = \underline{\hspace{2cm}}$$

$$f(4) = \underline{\hspace{2cm}}$$

$$f(8) = \underline{\hspace{2cm}}$$

ANS:

3; 1; -1

PTS: 1

DIF: Medium

REF: 1.1.43

MSC: Concept

8. Express the area A of a circle as a function of its circumference C .

ANS:

$$A = \frac{C^2}{4\pi}$$

PTS: 1

DIF: Easy

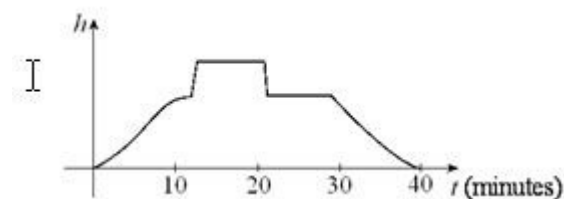
REF: 1.1.45

MSC: Concept

9. Suppose a pet owner decides to wash her dog in the laundry tub. She fills the laundry tub with warm water, puts the dog into the tub and shampoos it, removes the dog from the tub to towel it, then pulls the plug to drain the tub. Let t be the time in minutes, beginning when she starts to fill the tub, and let $h(t)$ be the water level in the tub at time t . If the total time for filling and draining the tub and washing the dog was 40 minutes, sketch a possible graph of $h(t)$.

ANS:

(One possible answer — answers will vary.)



PTS: 1

DIF: Difficult

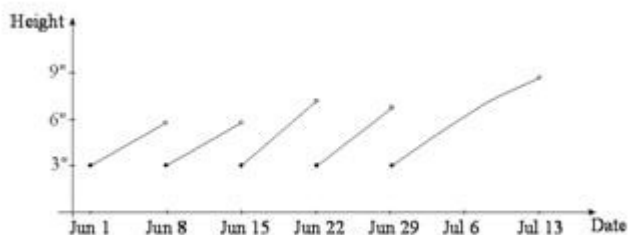
REF: 1.1.50

MSC: Application

10. A homeowner mowed her lawn on June 1, cutting it to a uniform height of 3". She mowed the lawn at one-week intervals after that until she left for a vacation on June 30. A local lawn service put fertilizer on her lawn shortly after she mowed on June 15, causing the grass to grow more rapidly. She returned from her vacation on July 13 to find that the neighborhood boy whom she had hired to mow the lawn while she was away had indeed mowed on June 22 and on June 29, but had forgotten to mow on July 6. Sketch a possible graph of the height of the grass as a function of time over the time period from June 1 through July 13.

ANS:

(One possible answer — answers will vary.)



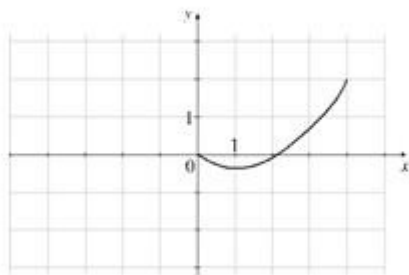
PTS: 1

DIF: Difficult

REF: 1.1.51a

MSC: Application

11. A function has a domain $[-4, 4]$ and a portion of its graph is shown.

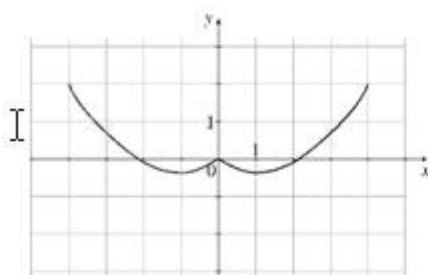


(a) Complete the graph of f if it is known that f is an even function.

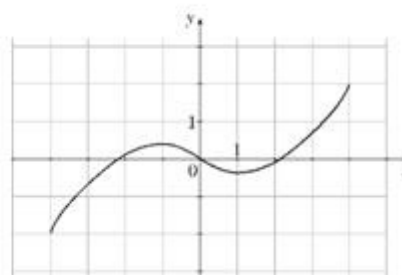
(b) Complete the graph of f if it is known that f is an odd function.

ANS:

(a)



(b)



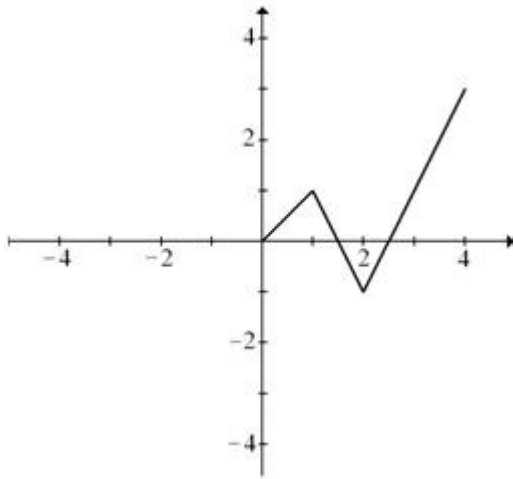
PTS: 1

DIF: Medium

REF: 1.1.56

MSC: Concept

12. A function has a domain $[-4, 4]$ and a portion of its graph is shown.

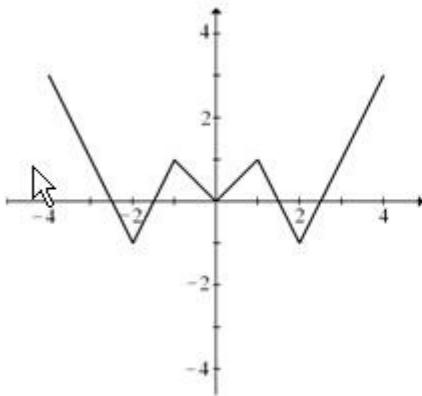


(a) Complete the graph of f if it is known that f is an even function.

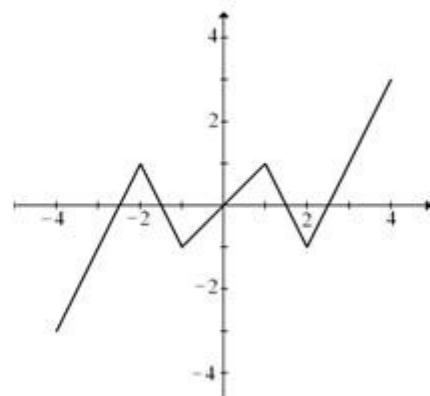
(b) Complete the graph of f if it is known that f is an odd function.

ANS:

(a)



(b)



PTS: 1

DIF: Medium

REF: 1.1.63

MSC: Concept