Note: This study aid is intended to help you review for the midterm exam. It covers the primary concepts in the first half of the course. Although the midterm exam will be similar to the study aid, it will not be identical to it. You should also review notes, homework, tests, and other material given during the semester.

Midterm Exam Study Aid

1. Which of the following equations determine y as a function of x?

(1) $3x + 2y^3 = 10$ (2) $\sqrt{x-1} + y = 8$ (3) $2x - y^2 - 7 = 0$ (4) $3x^2 - xy = 1$

(A) All of them (B) 1 and 3 only (C) 1, 2 and 4 only
(D) 1 and 2 only (E) 1 and 4 only

2. Which of the following tables determine y as a function of x?

(1)

x	y
4	1
5	3
7	3
8	4

(2)

x	y
4	1
5	2
6	4
4	5

(3)

x	y
1	8
2	4
3	2
2	4

(A) 1 only (B) 2 only (C) 3 only
(D) 1 and 3 only (E) 2 and 3 only

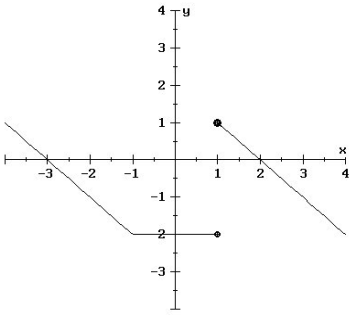
3. If $f(x) = 2^x + 3x$, find $f(-2)$.

(A) $-\frac{23}{4}$ (B) -10 (C) $-\frac{5}{4}$ (D) -4 (E) None of these

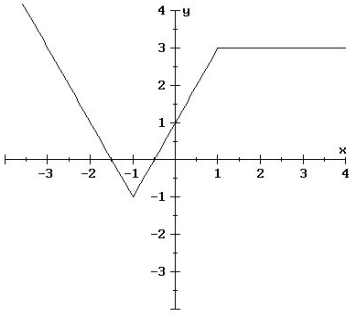
4. If $g(x) = \begin{cases} 1 - 3x & \text{for } x < -1 \\ 3 - x^2 & \text{for } x \geq -1 \end{cases}$, what is $g(-3)$?

(A) 12 (B) 10 (C) -8 (D) -6 (E) None of these

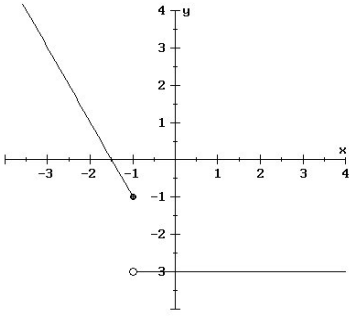
5. Which of the following graphs represent y as a function of x?



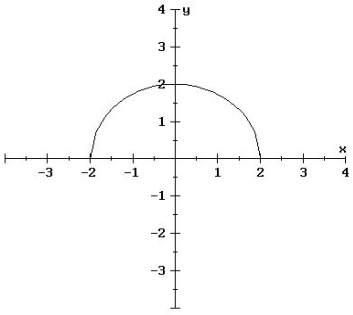
(1)



(2)



(3)



(4)

(A) All of them (B) None of them (C) 2, 3, and 4 only

(D) 2 and 3 only (E) 1 only

6. Consider the following table of values:

x	4	a	-2	5	1	0
y	3	2	0	4	2	-1

Which of the following values of a will make the table represent a function?

I. $a = -1$ II. $a = 0$ III. $a = 1$

(A) I only (B) II only (C) I and II only

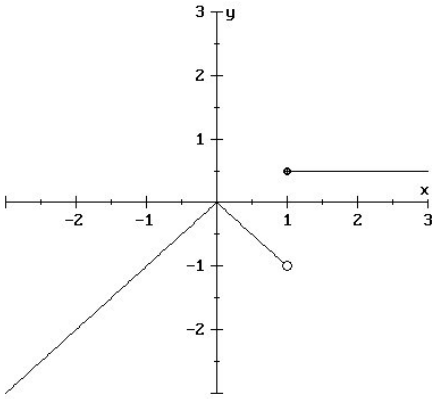
(D) I and III only (E) All of them

7. If $f(x) = 3x^2 - 2$, find $f(b-2)$.

(A) $3b^2 - 12b + 12$ (B) $3b^2 - 8$ (C) $3b^2 - 4b + 2$

(D) $3b^2 - 4$ (E) None of these

8. Which of the following is the piecewise equation for the graph below?

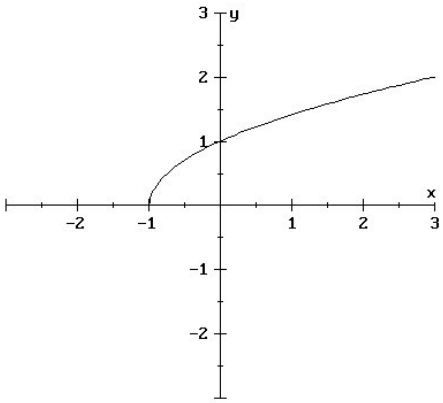


(A) $f(x) = \begin{cases} -x^2 \text{ for } x < 1 \\ 1/2 \text{ for } x \geq 1 \end{cases}$ (B) $f(x) = \begin{cases} 1/2 \text{ for } x > 1 \\ |x| \text{ for } x < 1 \end{cases}$

(C) $f(x) = \begin{cases} \text{-}|x| \text{ for } x < 1 \\ 1/2 \text{ for } x \geq 1 \end{cases}$ (D) $f(x) = \begin{cases} 1/2 \text{ for } x > 1 \\ -|x| \text{ for } x < 1 \end{cases}$

(E) None of these

9. What is the DOMAIN of the function represented by the graph below?



(A) $(-\infty, \infty)$ (B) $[0, \infty)$ (C) $[-1, \infty)$ (D) $(-\infty, -1]$ (E) None of these

10. Find the zeros of the function $g(x) = \dfrac{3x^2 - 5x + 2}{\sqrt{x+2}}$

(A) $\frac{2}{3}$, 1 and -2 only (B) $\frac{1}{3}$, 2, and -2 only (C) $-\frac{2}{3}$ and -1 only
(D) $\frac{1}{3}$ and 2 only (E) $\frac{2}{3}$ and 1 only

11. Which one(s) of the following has a domain of all real numbers except 18?

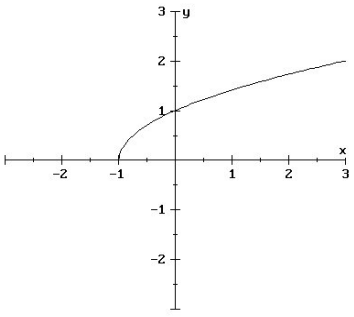
(1) $f(x) = \sqrt{x - 18}$ (2) $g(x) = \dfrac{2x}{x - 18}$ (3) $h(x) = \dfrac{1}{x^2 - 324}$

(A) 1 only (B) 2 only (C) 2 and 3 only (D) 1 and 2 only (E) All of them

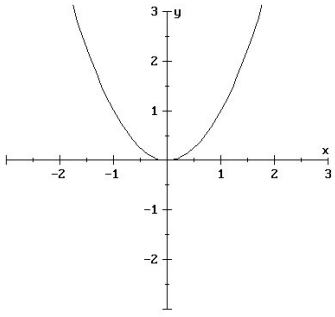
12. What is the DOMAIN of the function $f(x) = 12 - \sqrt{108 - 3x}$?

(A) $(-\infty, 36]$ (B) $[-108, 108]$ (C) $[36, \infty)$
(D) $(-\infty, 36) \cup (36, \infty)$ (E) None of these

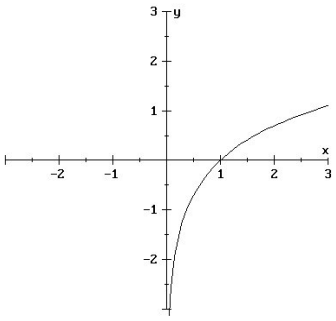
13. Which of the following have a RANGE of $[0, \infty)$?



(1)



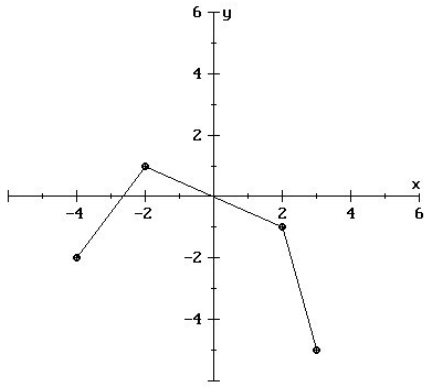
(2)



(3)

(A) 2 only (B) 1 and 3 only (C) 1 only
(D) 1 and 2 only (E) All of them

Use the graph of $g(x)$ shown below to answer the following THREE questions.



This is the graph of $g(x)$

14. What is the RANGE of $g(x)$?

(A) $[-4, 3]$ (B) $[-5, -2]$ (C) $[-2, 3]$ (D) $[-5, 1]$ (E) None of these

15. On what interval(s) is $g(x)$ increasing?

(A) (-2,3) (B) (-4,-2) (C) (-2,1) (D) (-2.7,0) (E) (-4,0)

16. What is/are the x-coordinates of the turning point(s) of $g(x)$?

(A) -4 (B) -2 (C) -2 and 2 (D) -2.7 and 0 (E) 1

For the following TWO questions, use the partial table of values for the function $y = f(x)$ shown below:

x	$f(x)$
-3	9
-2	
-1	-6
1	
2	0
3	

17. Complete the table above so that $f(x)$ is an ODD function.

    The missing values, in order, are:

    (A) $0, 6, -9$ (B) $0, -6, 9$ (C) $0, -\frac{1}{6}, \frac{1}{9}$

    (D) $0, \frac{1}{6}, -\frac{1}{9}$ (E) Cannot be determined

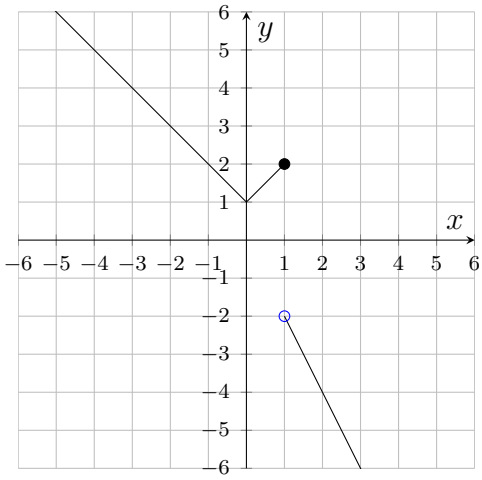
18. Complete the table above so that $f(x)$ is an EVEN function.

    The missing values, in order, are:

    (A) $0, 6, -9$ (B) $0, -6, 9$ (C) $0, -\frac{1}{6}, \frac{1}{9}$

    (D) $0, \frac{1}{6}, -\frac{1}{9}$ (E) Cannot be determined

19. Consider the graph of $f(x) = \begin{cases} |x| + 1 & \text{for } x \leq 1 \\ -2x & \text{for } x > 1 \end{cases}$ shown below.



Determine the domain and range of this function.

(A) Domain: $(-\infty, +\infty)$
Range: $(-\infty, -2) \cup [1, +\infty)$

(B) Domain: $(-\infty, +\infty)$
Range: $(-\infty, +\infty)$

(C) Domain: $(-1, 1)$
Range: $[1, +\infty)$

(D) Domain: $(-\infty, -1) \cup (1, +\infty)$
Range: $(-\infty, -2) \cup [1, +\infty)$

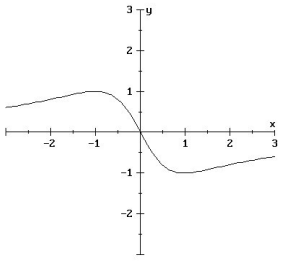
20. Which of the following functions are neither even nor odd?

(1) $f(x) = |15x|$

(2) $f(x) = \dfrac{2x}{x^2 + 15}$

(3) $f(x) = 217 - 3x - x^3$

(4)

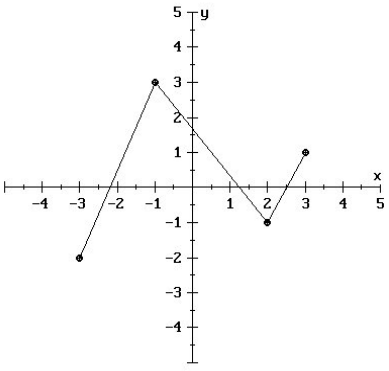


(A) All of them (B) None of them (C) 2 and 3 only (D) 3 only (E) 2 only

21. Suppose that $f(x)$ is an EVEN function, $g(x)$ is an ODD function, and $h(x) = g(f(x))$. If $f(-1) = 2$ and $g(-2) = 2$, find $h(1)$.

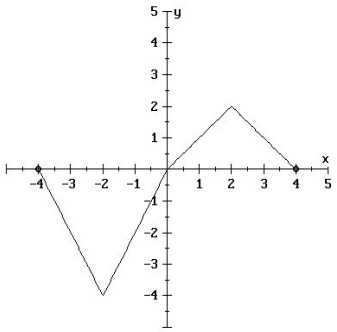
(A)1 (B) -1 (C) 2 (D) -2 (E) None of the choices A-D

22. Which of the following statements is TRUE about the function graphed below?



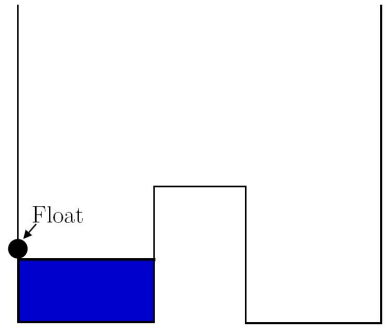
(A) The function is **increasing** on $(-2, 3)$; **decreasing** on $(-1, 3)$
(B) The function is **increasing** on $(-3, -1)$ and $(2, 3)$; **decreasing** on $(-1, 2)$
(C) The function is **increasing** on $(-1, 2)$; **decreasing** on $(-3, -1)$ and $(2, 3)$
(D) The function is **increasing** on $(-1, 1)$; **decreasing** on $(-1, 2)$
(E) The function is **increasing** on $(-3, 0)$ and $(1, 3)$; **decreasing** on $(0, 1)$

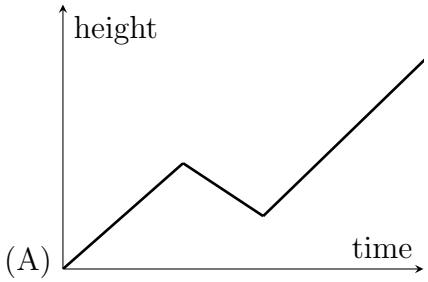
23. Determine the open interval(s) where the graph of the function $y = f(x)$ is both negative and decreasing.

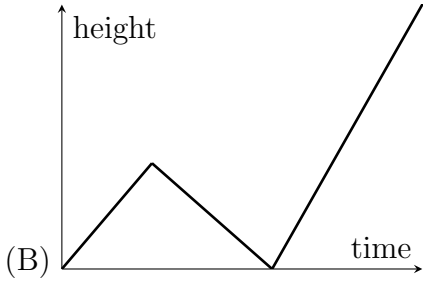


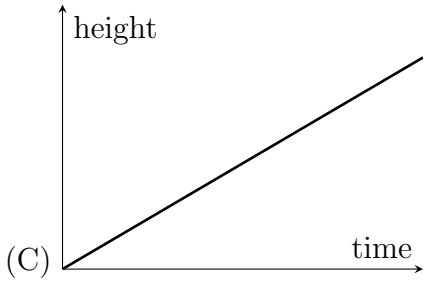
(A) $(-4, 0)$ (B) $(-4, -2)$ (C) $(-4, -2) \cup (2, 4)$
(D) $(2, 4)$ (E) $(-2, 0)$

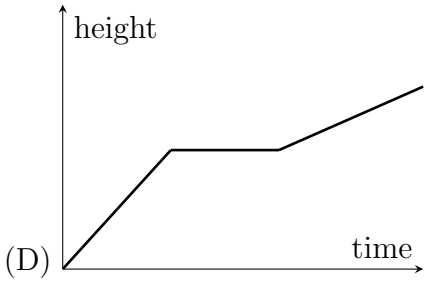
24. Water flows at a constant rate into the left side of the container shown below. A float is attached to the left side of the container. Which of the graphs shown best represents the height of the float as a function of time? The container begins empty and is filled to the top.

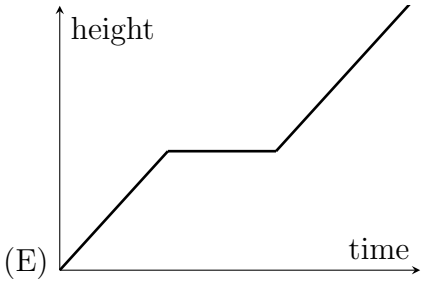






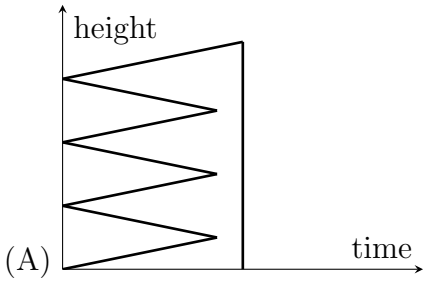




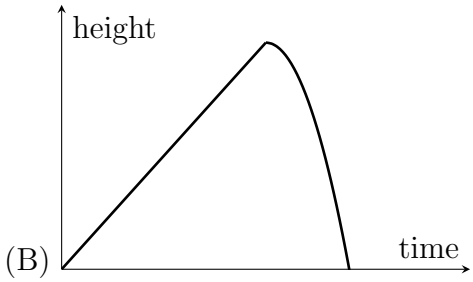


25. Rob walks up the stairs of the Sixth Street Parking Garage at a constant rate. The time he spends traversing the landings is negligible. Once he reaches the top of the stairs, he drops a ball. Which of the following best represents the height of the ball t seconds since he began his ascent?

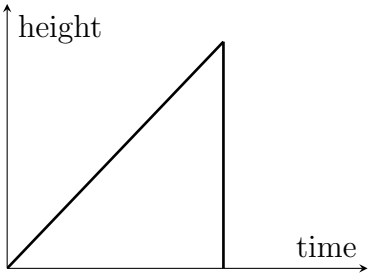
Sixth Street Parking Structure



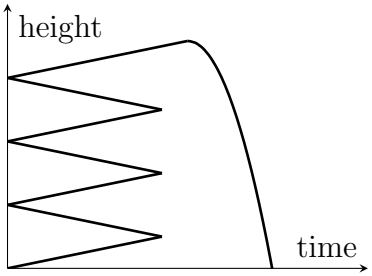
(A)



(B)



(C)



(D)

26. The number of miles per gallon, M, for an experimental engine is given by

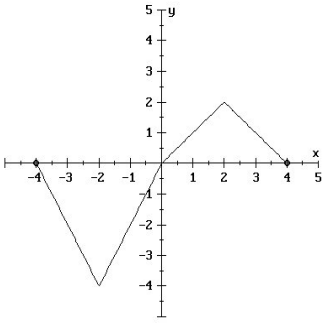
$$M = \frac{2000x}{1000 + x^2} + 5$$

where x is the speed of the car in miles per hour, $10 \leq x \leq 60$. Using your calculator, determine the speed that yields the greatest number of miles per gallon.

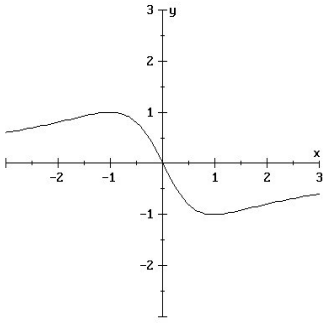
(A) about 60 mph (B) about 10 mph (C) about 37 mph

(D) about 32 mph (E) there is no maximum

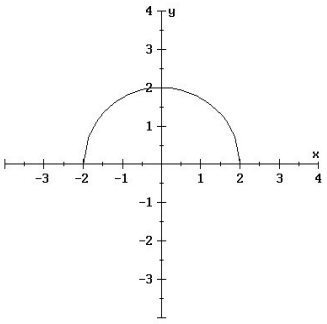
27. Which of the graphs below represent odd functions?



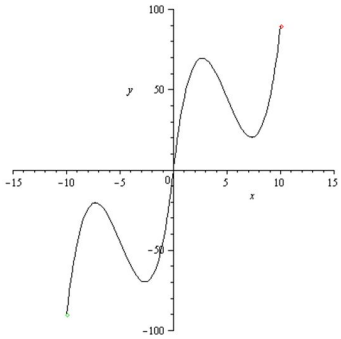
(1)



(2)



(3)



(4)

(A) (2) only (B) (1) and (2) only (C) (3) only

(D) (2) and (4) only (E) (1), (3) and (4) only

28. Express the area of a rectangle AS A FUNCTION OF ITS WIDTH if the width is 25% of its length. Let L and W represent length and width, respectively.

(A) $A = (0.25W)(W)$ (B) $A = (0.75W)(W)$ (C) $A = (4W)(W)$

(D) $A = 4LW$ (E) None of these

For the next three questions consider the following situation: Chad is designing a rectangular cereal box. His boss says that the box should be half as wide as it is tall, and the depth should be one half of the width.

29. Determine a model which gives the surface area, S, of the cereal box in terms of its height, h.

(A) $S(h) = \frac{17}{4}h^2$ (B) $S(h) = \frac{h^3}{8}$ (C) $S(h) = \frac{7}{4}h^2$

(D) $S(h) = \frac{7}{8}h^2$ (E) $S(h) = 28h^2$

30. Determine a model for the volume of the cereal box in terms of its depth, d.

(A) $V(d) = d^3$ (B) $V(d) = \frac{d^3}{8}$ (C) $V(d) = 2d^2$

(D) $V(d) = 8d^3$ (E) None of these

31. Determine a model for the surface area of the cereal box in terms of its width, w.

(A) $S(w) = 8w^2$ (B) $S(w) = 7w^2$ (C) $S(w) = w^2$

(D) $S(w) = 4w^2$ (E) None of these

32. Search and Rescue teams are used in remote areas in the West to find lost people. Experience has shown the team's chance of finding an individual is a function of the distance by which team members are separated. The percentage found for various separation distances is shown in the table below.

Separation distance (ft)	Percent found
20	90
40	80
60	70
80	60
100	50

Find an equation to express the percent found, P, as a function of the separation distance, d,of the team members.

(A) $P = 0.5d + 100$ (B) $P = 290 - 0.5d$ (C) $P = 100 - 0.5d$

(D) $P = 90 - 5d$ (E) $P = 2d + 50$

33. The relation that vertically compresses the graph of $y = \sqrt{x}$ and shifts the graph up twenty units is:

(A) $y = \frac{5}{3}\sqrt{x} + 20$ (B) $y = \sqrt{\frac{7}{2}x + 20}$ (C) $y = \frac{3}{4}\sqrt{x} + 20$

(D) $y = 2\sqrt{x + 20}$ (E) None of these

34. Suppose that a function $f(x)$ has a domain of $[-10, 10]$ and a range of $[-4, 6]$. Which of the following would be the domain and range of $g(x) = f(2x) - 5$.

(A) Domain: $[-10, 10]$
Range: $[-8, 12]$

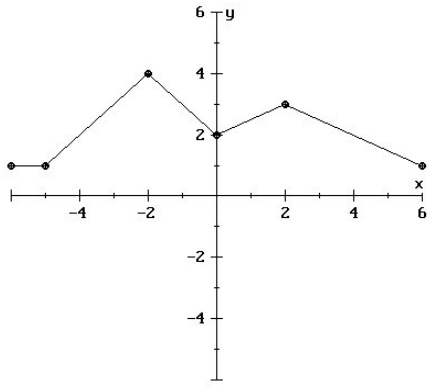
(B) Domain: $[-20, 20]$
Range: $[-9, 1]$

(C) Domain: $[-15, 5]$
Range: $[-8, 12]$

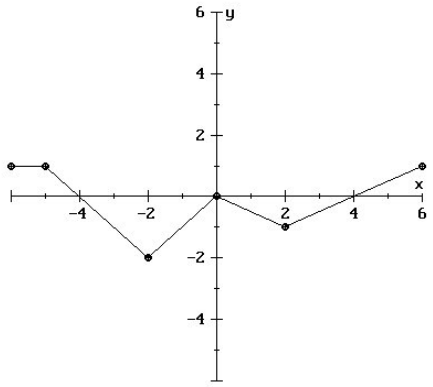
(D) Domain: $[-5, 5]$
Range: $[-9, 1]$

(E) None of these

35. The graph of $y = f(x)$ is shown below



The graph below is a transformation of the graph of $y = f(x)$. Which of the following is the formula for the function graphed below?



(A) $y = f(-x) - 2$ (B) $y = -f(x) - 2$ (C) $y = -f(x + 2)$

(D) $y = -f(x) + 2$ (E) $y = f(-x + 2)$

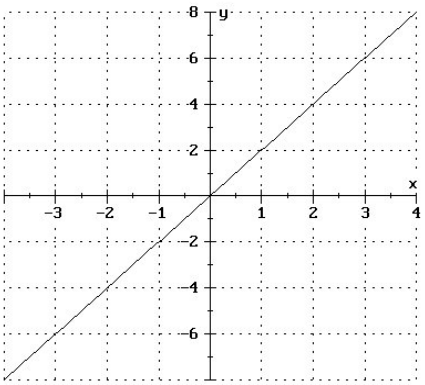
36. You can get the graph of $y = -f(2x)$ by transforming the graph of $y = f(x)$ in the following way:

(A) Compress horizontally and reflect across the x-axis
(B) Compress horizontally and reflect across the y-axis
(C) Expand vertically and reflect across the x-axis
(D) Expand vertically and reflect across the y-axis
(E) None of these

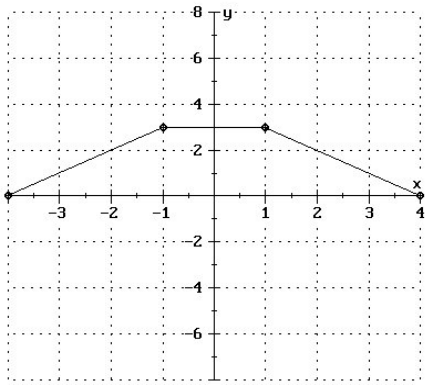
37. If $(5, -6)$ is a point on the graph of $y = g(x)$, which of the following must be a point on the graph of $y = -g(x) + 1$?

(A) $(-5, -6)$ (B) $(-5, 7)$ (C) $(5, 6)$ (D) $(5, 7)$ (E) $(-6, 6)$

Use the graphs below to answer the next THREE questions.



This is the graph of $f(x)$



This is the graph of $g(x)$

38. Using the previous graphs, find $(f - g)(3)$.

(A) 3 (B) 5 (C) 15 (D) 6 (E) None of these

39. Using the previous graphs, find $(f \circ g)(1)$.

(A) 6 (B) 2 (C) 1 (D) 3 (E) None of these

40. For which of the following value(s) of x is/are $g(f(x)) = 0$?

(I) $x = 2$ (II) $x = 4$ (III) $x = -4$ (IV) $x = 3$

(A) (II) and (III) only (B) (I) only (C) (IV) only

(D) (II) only (E) None of them

41. Given $f(x) = 4x + 1$ and $g(x) = |5x + 2|$, find $\left(\frac{f}{g}\right)(-4)$.

(A) $-\frac{15}{22}$ (B) $\frac{17}{22}$ (C) $-\frac{5}{6}$ (D) -4 (E) None of these

42. Given $f(x) = \sqrt{-2x}$ and $h(x) = x - 3$, find $(h \circ f)(-2)$.

(A) 1 (B) $\sqrt{10}$ (C) -1 (D) -10 (E) $(h \circ f)(-2)$ is undefined

43. Given the table of values for $f(x)$ and $w(x)$ below, determine an equation for $w(x)$ in terms of $f(x)$.

x	0	1	2	3	4	5	6	7
$f(x)$	0	0.3	2	2.3	3	3.3	4	4.3

x	-2	-1	0	1	2	3	4	5
$w(x)$	0	0.3	2	2.3	3	3.3	4	4.3

(A) $w(x) = f(x) - 2$ (B) $w(x) = f(x + 2)$ (C) $w(x) = f(x - 2)$
(D) $w(x) = f(x) + 2$ (E) None of these

44. Given $(f + g)(x) = 3x^2 - 2x + 5$ and $f(x) = x^2 - 2x + 7$, determine $g(x)$.

(A) $g(x) = 2x^2 - 4x + 12$ (B) $g(x) = 2x^2 - 2$
(C) $g(x) = 4x^2 - 4x + 12$ (D) $g(x) = -2x^2 + 2$
(E) $g(x) = 2x^2 - 4x - 2$

45. Given $(fg)(3) = 20$ and $g(x) = \dfrac{x^2+1}{2}$, find $f(3)$.

(A) $f(3) = \dfrac{40}{x^2+1}$ (B) $f(3) = 5$ (C) $f(3) = \dfrac{1}{4}$

(D) $f(3) = 10(x^2+1)$ (E) $f(3) = 4$

46. Given $f(x) = 3 + 2x$ and $h(x) = \sqrt{x}$, find $(f \circ h)(x)$.

(A) $\sqrt{3+2x}$ (B) $3 + 2\sqrt{x}$ (C) $\sqrt{3} + \sqrt{2x}$

(D) $3\sqrt{x} + 2x\sqrt{x}$ (E) None of these

47. True or False: Let $f(x) = 2x - 5$ and $g(x) = \sqrt{x-3}$. Then $(f \circ g)(7) = 18$.

(A) True (B) False

48. Suppose that $h(x) = (f \circ g)(x)$. If $h(x) = \dfrac{1}{(x+3)^2}$, which of the following is NOT a possible choice for $f(x)$ and $g(x)$?

(A) $f(x) = \dfrac{1}{x^2}$ and $g(x) = x + 3$ (B) $f(x) = \dfrac{1}{x}$ and $g(x) = (x+3)^2$

(C) $f(x) = x + 3$ and $g(x) = \dfrac{1}{x^2}$ (D) $f(x) = x$ and $g(x) = (x+3)^{-2}$

49. Find the equation of the line passing through the points $(2, 1)$ and $(4, 7)$.

The slope and y-intercept are:

	slope	y-intercept
(A)	3	(0,7)
(B)	$\frac{1}{3}$	$(0,\frac{1}{3})$
(C)	$\frac{1}{3}$	$(0,\frac{5}{3})$
(D)	3	(0,−5)

(E) None of these

50. What is the equation of the line PERPENDICULAR to $3y + 2x - 3 = 0$, passing through the point $(4, -1)$?

(A) $2y - 3x + 14 = 0$ (B) $2y + 3x - 10 = 0$ (C) $3y + 2x - 5 = 0$

(D) $3y + 2x + 11 = 0$ (E) None of these

51. The table below shows a person's monthly payment, P, as a *linear* function of the amount of money borrowed, b, in thousand of dollars, for a home loan at an interest rate of 5%.

P (monthly payment)	\$5.37	\$10.74	\$16.11	\$21.48	\$26.85
b (amount borrowed in 1000s)	1	2	3	4	5

Find the slope of this linear function and give a practical interpretation.

(A) Slope = 5.37 ; Every 1 thousand dollars you borrow raises your monthly payment by \$5.37.

(B) Slope = 5.37 ; Every dollar your monthly payment goes up, the amount borrowed increases by \$5370.

(C) Slope = 0.19 ; Every 1 thousand dollars you borrow raises your monthly payment by \$0.19.

(D) Slope = 0.19 ; Every dollar your monthly payment goes up, the amount borrowed increases by \$190.

(E) Slope = 5.37 ; Every 1 dollar you borrow raises your monthly payment by \$5.37.

52. Approximately how much would your monthly payment be if you borrowed \$250,000?

(A) \$1,342,500 (B) \$1,342.50 (C) \$47,500 (D) \$47.50

(E) None of the choices A-D

53. Which of the following lines is PARALLEL to $3x - 4y = 7$?

(A) $y = 3x - 7$

(B) $y = -\frac{3}{4}x + 8$

(C) $y = -\frac{4}{3}x - 2$

(D) $y = -\frac{4}{3}x - 3$

(E) None of these

54. True or False: The lines $2x - 5y = 7$ and $-6x + 15y = 0$ are parallel.

(A) True (B) False

55. Which of these lines has zero slope?

(1) $x = 0$ (2) $y + 3 = 5x + 20$ (3) $y - 5 = 0$

(A) 1 only (B) 2 only (C) 3 only (D) 1 and 3 only (E) None of these

56. Find a value for c so that $cy + 2x = 3$ and $8y + cx = 5$ are parallel.

(A) $c = 8$ (B) $c = 16$ (C) $c = 0$ (D) $c = 4$

(E) There are no values of c that make the lines parallel.

57. Find a value for c so that $cy + 2x = 3$ and $8y + cx = 5$ are perpendicular.

(A) $c = 8$ (B) $c = 16$ (C) $c = 0$ (D) $c = 4$

(E) There are no values of c that make the lines parallel.

58. Given the line $x = 2$, determine the equation of the line parallel to this line and containing the point $(5, 7)$.

(A) $y = 2x + 7$ (B) $y = -\frac{5}{7}x + \frac{2}{7}$ (C) $y = 7$ (D) $x = 5$ (E) $y = -2x + 5$

59. Given the line $x = 2$, determine the equation of the line perpendicular to this line and containing the point $(2, 3)$.

(A) $y = -2x + 2$ (B) $y = -\frac{1}{2}x + 4$ (C) $y = -\frac{1}{2}x$ (D) $x = 2$ (E) $y = 3$

60. Determine the equation of the line perpendicular to $2x - y = 3$ and containing the point $(1, 3)$. The sum of the slope and the y-intercept is:

(A) 3 (B) $\frac{5}{2}$ (C) -2 (D) 1 (E) $\frac{1}{2}$

Answers

1. C
2. D
3. A
4. B
5. C
6. D
7. E
8. C
9. C
10. E
11. B
12. A
13. D
14. D
15. B
16. B
17. A
18. B
19. A
20. D
21. D
22. B
23. B
24. D
25. B
26. D
27. D
28. C
29. C
30. D
31. B
32. C
33. C
34. D
35. D
36. A
37. D
38. B
39. A
40. B
41. C
42. C
43. B
44. B
45. E
46. B
47. B
48. C
49. D
50. A
51. A
52. B
53. E
54. A
55. C
56. D
57. C
58. D
59. E
60. A