

Final Exam Study Aid

Note: This study aid is intended to help you review for the final exam. It covers the primary concepts in the course. Although the final exam will be similar to the study aid, it will not be identical to it. You should also review tests, notes, study aids and homework given during the semester. The formulas given below will be identical to the formulas given on the final exam.

FORMULAS

$$A = P \left(1 + \frac{r}{n}\right)^{nt} \qquad A = Pe^{rt}$$

1. 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

2. 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

3. 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

Use the function $h(x) = \begin{cases} 2x - 5 & \text{for } x \leq -1 \\ 5 & \text{for } -1 < x \leq 4 \\ -x^2 & \text{for } x > 4 \end{cases}$ to answer the next three questions.

4. Evaluate $h(-1)$

- (A) -7 (B) 5 (C) -3 (D) -1 (E) None of these

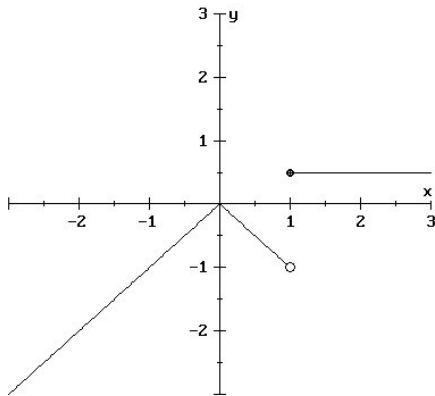
5. Evaluate $h(3) + h(6)$

- (A) 41 (B) -81 (C) -21 (D) -31 (E) 51

6. Evaluate $h(h(2))$

- (A) 25 (B) 5 (C) -25 (D) 100 (E) -100

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

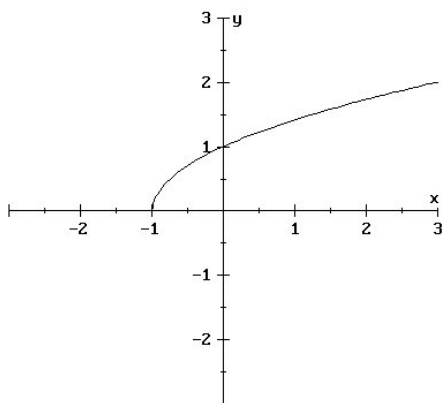


(A) $f(x) = \begin{cases} -x^2 & \text{for } x < 1 \\ 1/2 & \text{for } x \geq 1 \end{cases}$ (B) $f(x) = \begin{cases} 1/2 & \text{for } x > 1 \\ |x| & \text{for } x < 1 \end{cases}$

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

(E) None of these

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

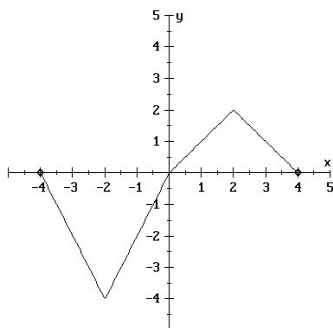


- (A) $(-\infty, \infty)$ (B) $[0, \infty)$ (C) $[-1, \infty)$ (D) $(-\infty, -1]$ (E) None of these

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

- (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

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

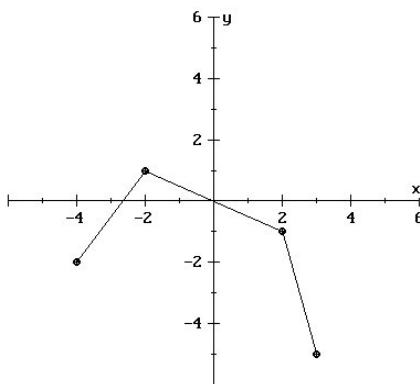


- (A) $(-4, 0)$ (B) $(-4, -2)$ (C) $(-4, -2) \cup (2, 4)$
 (D) $(2, 4)$ (E) $(-2, 0)$

11. 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

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



This is the graph of $g(x)$

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

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

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

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

14. What is/are the x -coordinate(s) 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	

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

The missing values, in order, are:

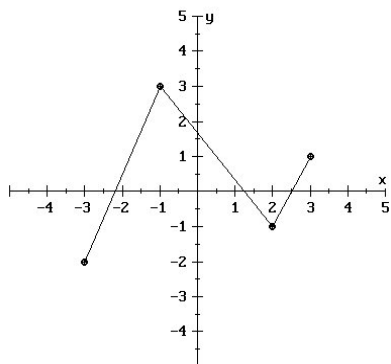
- (A) 0, 6, -9 (B) 0, -6, 9 (C) $0, -\frac{1}{6}, \frac{1}{9}$
 (D) $0, \frac{1}{6}, -\frac{1}{9}$ (E) Cannot be determined

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

The missing values, in order, are:

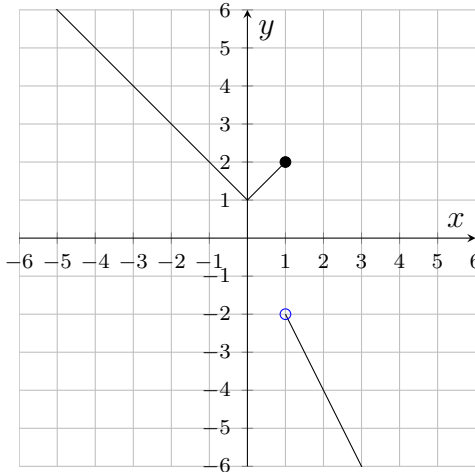
- (A) 0, 6, -9 (B) 0, -6, 9 (C) $0, -\frac{1}{6}, \frac{1}{9}$
 (D) $0, \frac{1}{6}, -\frac{1}{9}$ (E) Cannot be determined

17. 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 $(0, 1)$

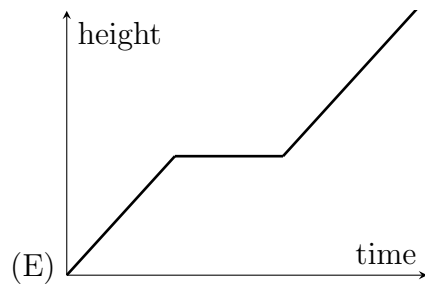
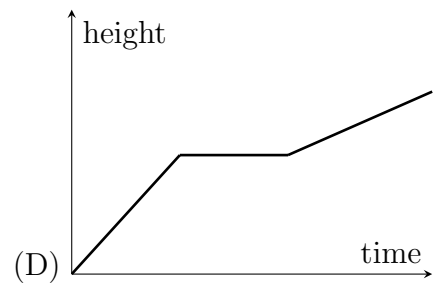
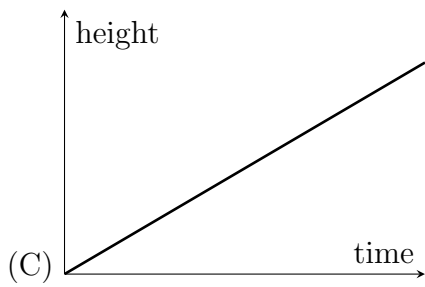
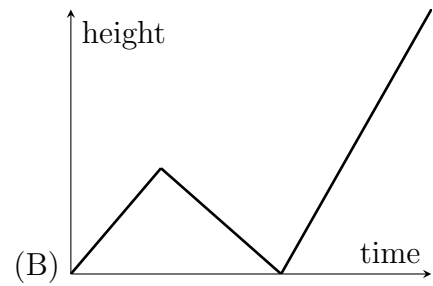
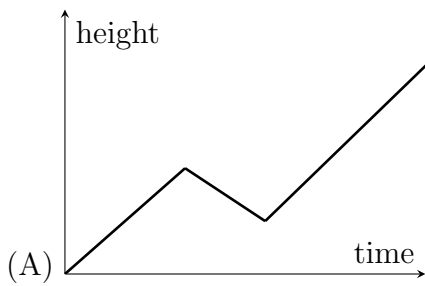
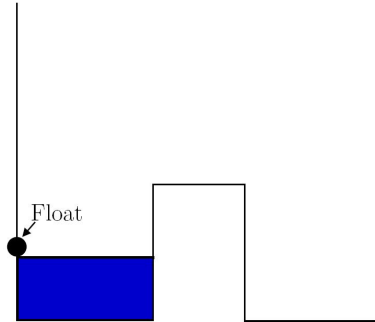
18. Consider the graph of $f(x) = \begin{cases} |x| + 1 & \text{for } x \leq 1 \\ -2x & \text{for } x > 1 \end{cases}$ shown below.



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: $(-\infty, -2) \cup [1, +\infty)$
19. 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

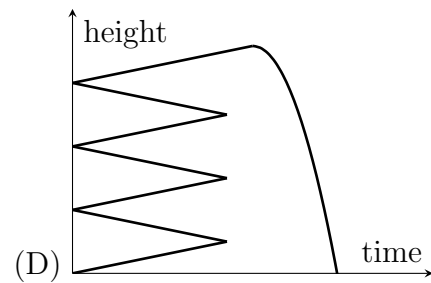
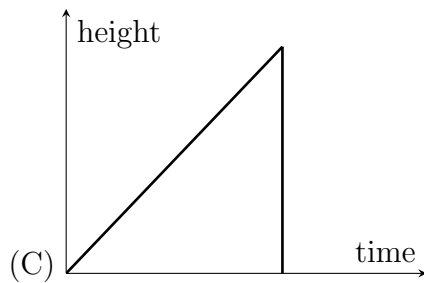
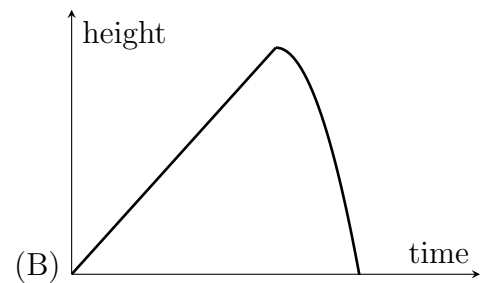
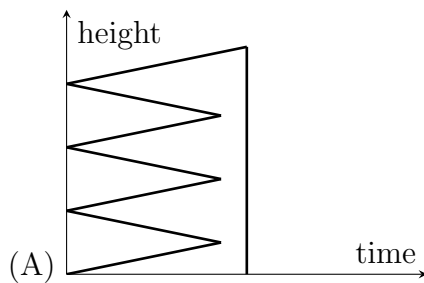
20. Water flows at a constant rate into the left side of the container shown below. A float is attached to the left side of the container. Which of the graphs shown best represents the height of the float as a function of time? The container begins empty and is filled to the top.



21. 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



22. 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

23. 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.

24. 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) $S(h) = 28h^2$

25. 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

26. 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

27. A couple invests \$3500 to build a rose garden. On the average, it costs them \$0.35 to grow each rose. If each rose can be sold for \$1.75, how many roses must they sell to break even?

(A) 2,000 (B) 2,500 (C) 10,000 (D) 8,250 (E) None of these

28. A certain class has 9 quizzes throughout the semester. A student has an average of A on the first six quizzes. If the student then has an average of B on the last three quizzes, determine the students average on all 9 quizzes.

(A) $\frac{A+B}{2}$ (B) $\frac{6A+3B}{2}$ (C) $\frac{A+B}{9}$ (D) $\frac{6A+3B}{9}$ (E) None of these

29. The conversion rate between kilograms and pounds is about 2.2 pounds per kilogram. That is, if a person weighs 100 kilograms, they would weigh about 220 pounds. Let k represent the weight of an object in kilograms, and let p represent the weight in pounds. Express k as a function of p .

(A) $k(p) = 2.2 + p$ (B) $p(k) = \frac{k}{2.2}$ (C) $k(p) = 2.2p$
(D) $p(k) = 2.2k$ (E) $k(p) = \frac{p}{2.2}$

Consider the following problem: In 2000 Joe bought a BMW for \$40,000; it depreciates \$4,000 each year. Tom bought a classic '57 Chevy for \$10,000 and it appreciates \$1,000 each year. Use this information to answer the next TWO questions.

30. Write a system of equations for the values (V) of these cars in terms of the number of years (t). [$t = 0$ is 2000]

(A) BMW : $V = 40,000 - 4000t$ (B) BMW: $V = 40,000 + 4000t$
Chevy: $V = 10,000 + 1000t$ Chevy: $V = 10,000 - 1000t$
(C) BMW : $V = 40,000 - t$ (D) BMW: $V = t + 40,000$
Chevy: $V = 10,000 + t$ Chevy: $V = t + 10,000$
(E) None of these

31. How many years must pass before the values of both cars are equal? The answer is a number:

(A) between 1 and 5 (B) between 5 and 10 (C) more than 10
(D) never equal (E) None of these

32. An above ground pool is in the shape of a circular cylinder with a radius of 12 feet. A hose begins filling the pool at a rate of 2 cubic feet per minute. Express the height of the water in the pool as a function of time t , in minutes.

(A) $h(t) = \frac{12t}{\pi}$ (B) $h(t) = \frac{t}{72\pi}$ (C) $h(t) = \frac{t}{144\pi}$ (D) $h(t) = \frac{2t}{\pi}$ (E) $h(t) = 144\pi t$

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

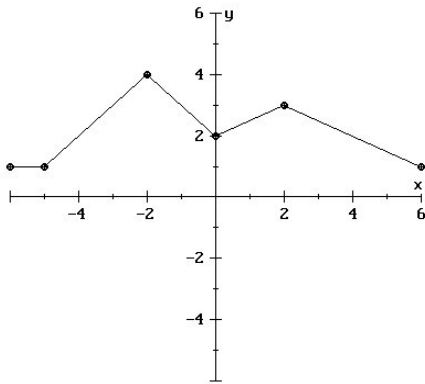
34. Suppose that a function $f(x)$ has a domain of $[-10, 10]$ and a range of $[-4, 6]$. Which of the following would be the domain and range of $g(x) = f(2x) - 5$.

(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

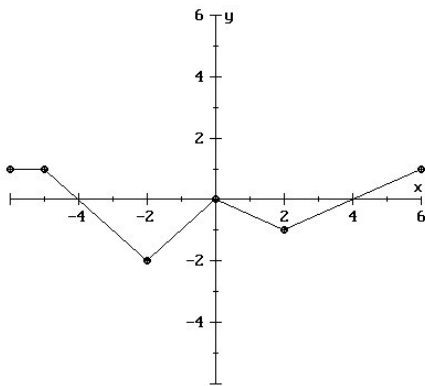
35. The graph of $y = -g(x + 5)$ can be produced by transforming the graph of $y = g(x)$ in which of the following ways?

- (A) Horizontally shifting to the right 5 units and reflecting across the x -axis.
(B) Horizontally shifting to the left 5 units and reflecting across the y -axis.
(C) Horizontally shifting to the right 5 units and reflecting across the y -axis.
(D) Horizontally shifting to the left 5 units and reflecting across the x -axis.
(E) None of these

36. 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) $y = f(-x + 2)$

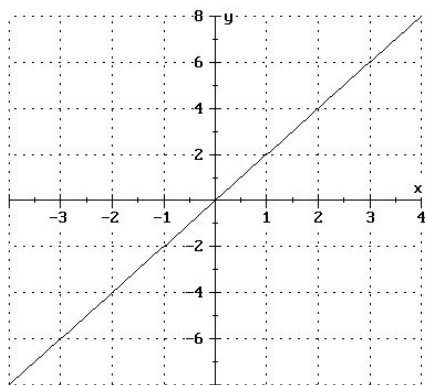
37. You can get the graph of $y = -f(2x)$ by transforming the graph of $y = f(x)$ in the following way:

- (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

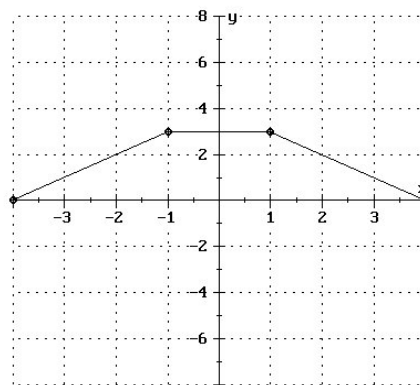
38. If $(5, -6)$ is a point on the graph of $y = g(x)$, which of the following must be a point on the graph of $y = -g(x) + 1$?

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

Use the graphs below to answer the next TWO questions.



This is the graph of $f(x)$



This is the graph of $g(x)$

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

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

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

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

41. The domain of $f(x)$ is $[-5, 4]$ and the domain of $g(x)$ is $[-2, 6]$. The function $g(x)$ has zeroes at $x = 1$ and $x = 5$. What is the domain of $\left(\frac{f}{g}\right)(x)$?

- (A) $\left[-\frac{5}{2}, \frac{2}{3}\right]$ (B) $[-5, 6]$ (C) $[-2, 4]$
 (D) $[-2, 1) \cup (1, 4]$ (E) $[-5, 1) \cup (1, 5) \cup (5, 6]$

42. 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

43. 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

44. 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

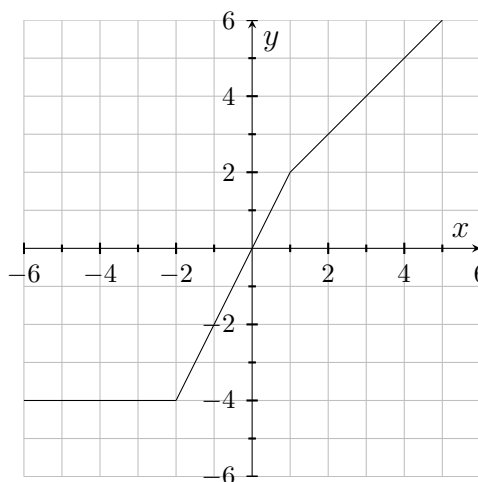
- (A) $w(x) = f(x) - 2$ (B) $w(x) = f(x + 2)$ (C) $w(x) = f(x - 2)$
(D) $w(x) = f(x) + 2$ (E) None of these

45. 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) $g(x) = 2x^2 - 4x - 2$

For the next TWO questions, use the graph of $f(x)$ and the table of values for $g(x)$ below.

x	1	2	3	4	5
$g(x)$	4	-3	5	2	1



The graph of $f(x)$

46. Find $(f \circ g \circ f)(1)$.

- (A) -4 (B) 5 (C) 16 (D) -3 (E) None of these

47. Find $(g^{-1} \circ f \circ g)(1)$.

- (A) 2 (B) 3 (C) 1 (D) 4 (E) None of these

48. If $(2, -5)$ is a point on the graph of $r(x)$, which of the following points MUST be on the graph of $y = \frac{1}{3}r(x+1)$?

- (A) $\left(\frac{2}{3}, -4\right)$ (B) $(1, -5)$ (C) $\left(3, -\frac{5}{3}\right)$ (D) $\left(\frac{1}{3}, -5\right)$ (E) $\left(1, -\frac{5}{3}\right)$

49. Given $f(x) = \log_4(-8x)$ and $h(x) = x - 3$, find $(h \circ f)(-2)$.

- (A) 1 (B) 10 (C) -1 (D) 0 (E) None of these

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

(A) $f(3) = \frac{40}{x^2 + 1}$

(B) $f(3) = 5$

(C) $f(3) = \frac{1}{4}$

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

(E) $f(3) = 4$

51. 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

52. 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) $P = 2d + 50$

53. 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

54. 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.
55. Using the information in the table above, 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

56. 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 | |

57. 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

58. 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.

59. 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.

60. A train that is traveling 52 mph leaves the station and goes west. Another train leaves the station on a parallel track one hour later traveling west at 65 mph. How long will it take the fast train to catch up with the slower train?

(A) 5 hours

(B) 4 hours

(C) 1.25 hours

(D) 6 hours

(E) None of these

61. 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) $y = -2x + 5$

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

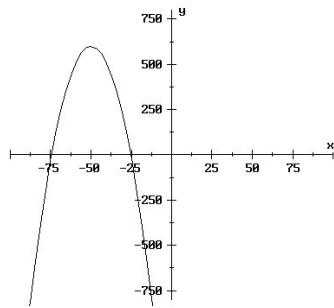
- (A) $y = -2x + 2$ (B) $y = -\frac{1}{2}x + 4$ (C) $y = -\frac{1}{2}x$ (D) $x = 2$ (E) $y = 3$

63. 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:

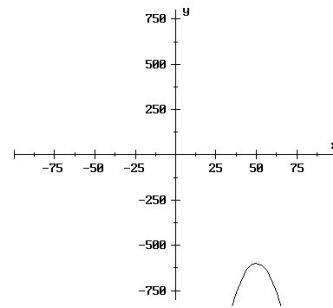
- (A) 3 (B) $\frac{5}{2}$ (C) -2 (D) 1 (E) $\frac{1}{2}$

64. Which of the following graphs best represents: $f(x) = 600 - (x - 50)^2$

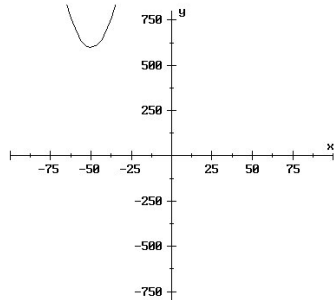
(A)



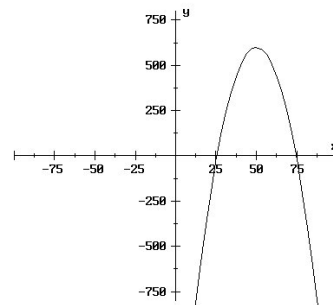
(B)



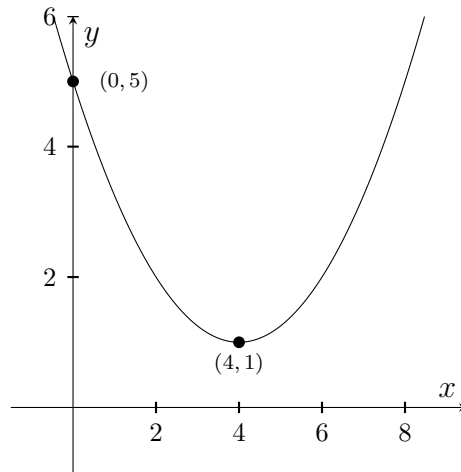
(C)



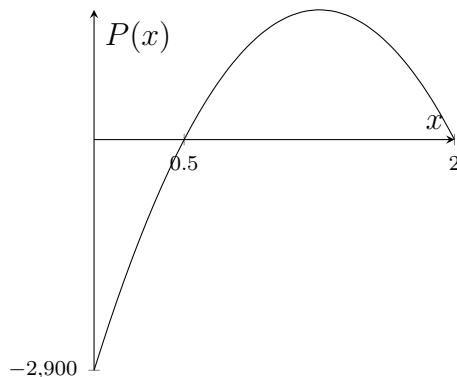
(D)



65. Determine a function in standard form for the quadratic function whose graph is shown below.



- (A) $f(x) = -\frac{1}{4}(x - 1)^2 + 4$ (B) $f(x) = \frac{1}{4}(x + 4)^2 + 1$
 (C) $f(x) = 4(x - 4)^2 + 1$ (D) $f(x) = \frac{1}{4}(x - 4)^2 + 1$
 (E) $f(x) = -(x - 4)^2 + 1$
66. An espresso stand finds that its weekly profit (in dollars), $P(x)$, is a quadratic function of the price, x , it charges per cup (in dollars). A graph of $P(x)$ is shown below:



The graph of $P(x)$

What price should the espresso stand charge to maximize its weekly profits?

- (A) \$0.50 per cup (B) \$1.25 per cup (C) \$1.65 per cup (D) \$2.00 per cup

67. Write $f(x) = 3x^2 + 60x - 1$ in standard form. The SUM of the x and y coordinates of the vertex is:

- (A) 291 (B) -311 (C) 311 (D) -291 (E) None of these

68. Find the vertex of the quadratic function $y = x^2 + 2ax + b$. The y -coordinate of the vertex is:

- (A) b (B) $-b$ (C) $\frac{b^2}{4a^2} - b$ (D) $-a^2 + b$ (E) $3a^2 + b$

69. How many x -intercepts does the graph of the function $k(x) = x^2 - 24x + 159$ have?

- (A) Zero (B) One (C) Two (D) Three

70. Find the vertex of the quadratic function $f(t) = \frac{4}{7}t^2 - \frac{16}{7}t + 3$.

The y -coordinate of the vertex is:

- (A) $\frac{1}{2}$ (B) $\frac{5}{7}$ (C) $\frac{6}{7}$ (D) 1 (E) None of these

71. Find the equation of the parabola that has a vertex of $(3, -1)$ and passes through the point $(4, 1)$. The coefficient of x^2 is a number:

- (A) between -2 and -0.5 (B) between -0.5 and 1.5
(C) between 1.5 and 3 (D) between 3 and 4.5
(E) None of these

72. Find the vertex of the quadratic function

$$f(x) = 3x^2 + 7x + 4.$$

The vertex is located:

- (A) Above the x -axis (B) Below the x -axis
(C) At the origin (D) On the x -axis but not at the origin
(E) None of these
73. A skydiver jumps out of a plane from a height of 13000 feet. Her height (in feet) above the ground t seconds after she jumps is given by the function

$$h(t) = -16t^2 - 24t + 13000.$$

If she plans to open her parachute at a height of 3000 feet, how long after she jumps should she open her parachute? Round your answer to one decimal place.

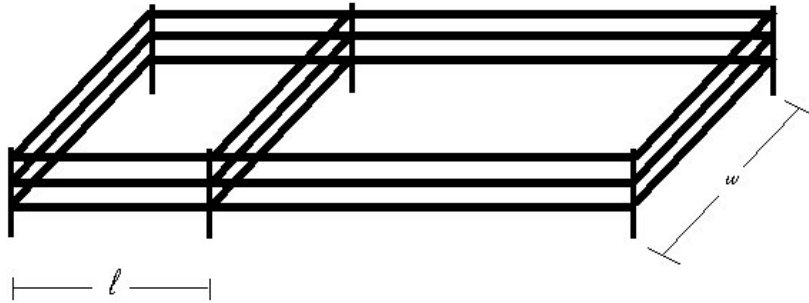
- (A) 25.8 seconds (B) 27.8 seconds (C) 24.3 seconds
(D) 30.9 seconds (E) 48.6 seconds
74. A horticulturist has determined that the number of inches a young oak tree grows in one year is a function of the annual rainfall, r , given by $g(r) = -0.01r^2 + 0.1r + 2$. What is the maximum number of inches a young oak can grow in a year? The maximum number of inches is:
- (A) less than 1 (B) between 1 and 2 (C) between 2 and 3
(D) between 3 and 4 (E) between 4 and 5

75. For the years 1975 through 1990, the average price, p (in dollars per million British thermal units), of fuel used to generate electricity in the U.S. can be modeled by the function

$$p(t) = -0.021t^2 + 0.50t - 1.04$$

where t is time in years since 1970. Estimate the maximum average price, p , of fuel used according to this model.

- (A) \$11.9 per million *Btu* (B) \$1.94 per million *Btu* (C) \$2.1 per billion *Btu*
 (D) \$10.2 per million *Btu* (E) None of these
76. A rancher wishes to enclose two adjacent rectangular corrals such that the right-hand corral has twice the length of the left hand (see diagram). She has 900 feet of fencing. What is the maximum area she can enclose?



- (A) 22,500 sq. ft. (B) 50,625 sq. ft. (C) 62,500 sq. ft.
 (D) 67,500 sq. ft. (E) None of these
77. Find the following sum: $\sum_{k=3}^5 (4k - 7)$
- (A) -1 (B) 18 (C) 25 (D) 27 (E) None of these
78. Find the following sum: $\sum_{k=1}^4 (kx + 3)$
- (A) 11 (B) 22 (C) $4x + 3$ (D) $5x + 6$ (E) $10x + 12$

79. What is the degree and leading coefficient of

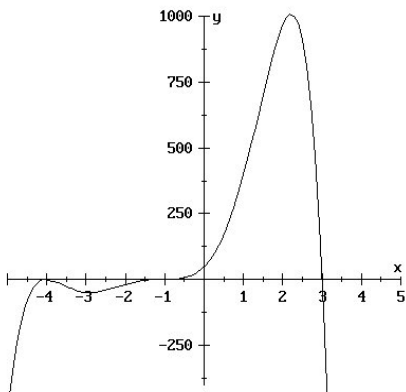
$$f(x) = -3x^2 + 6x^4 - 4x^5 + 7?$$

- (A) degree is 2, leading coefficient is -3
- (B) degree is 11, leading coefficient is -4
- (C) degree is 5, leading coefficient is -4
- (D) degree is 5, leading coefficient is 4
- (E) None of these

80. For the graph of $y = -3x^4 + 37x^3 + 28x^2 + 42$, which of the following is correct?

- (A) $y \rightarrow -\infty$ as $x \rightarrow -\infty$
 $y \rightarrow \infty$ as $x \rightarrow \infty$
- (B) $y \rightarrow -\infty$ as $x \rightarrow -\infty$
 $y \rightarrow -\infty$ as $x \rightarrow \infty$
- (C) $y \rightarrow \infty$ as $x \rightarrow -\infty$
 $y \rightarrow \infty$ as $x \rightarrow \infty$
- (D) $y \rightarrow \infty$ as $x \rightarrow -\infty$
 $y \rightarrow -\infty$ as $x \rightarrow \infty$

81. Which of the following could be the equation of the polynomial $P(x)$ graphed below?



- (A) $P(x) = (x - 4)^2(x + 3)^2(x - 1)$
- (B) $P(x) = (x + 4)^3(x - 3)(x + 1)$
- (C) $P(x) = -(x + 4)^2(x - 3)(x + 1)^3$
- (D) $P(x) = (x - 4)^2(x + 3)(x + 1)$
- (E) $P(x) = -(x - 4)^2(x + 3)(x - 1)^3$

82. Find all the real zeros of $f(x) = x^3 + 5x^2 + 7x + 2$. The LARGEST real zero is:

- (A) $\frac{-3 + \sqrt{5}}{2}$ (B) -0.5 (C) $\frac{-3 + \sqrt{13}}{2}$
(D) $\frac{-3 + \sqrt{7}}{2}$ (E) -2

83. Find all rational zeros of $p(x) = x^4 - 4x^3 + 2x^2 + 5x - 2$. The SUM of all the RATIONAL zeros is:

- (A) 1 (B) 2 (C) -1 (D) 0 (E) There are no rational zeros

84. Find the value of 'b' so that $x + 2$ is a factor of $P(x) = x^4 - (b + 1)x^2 - 5bx - 9b$.

- (A) $b = -2$ (B) $b = 4$ (C) $b = 2$ (D) $b = -4$ (E) None of these

85. Find all real zeros of $f(x) = 3x^4 - 36x^2 + 60$. The SMALLEST real zero of $f(x)$ is:

- (A) $-\sqrt{2}$ (B) $\frac{7}{5}$ (C) $-\frac{16}{5}$ (D) $-\sqrt{10}$ (E) $\sqrt{2}$

86. Factor $T(x) = x^3 + x^2 + 13x + 30$. One of the factors is:

- (A) $x + 3$ (B) $x - 5$ (C) $x + 2$ (D) $x - 10$ (E) None of these

87. If 3 is a zero of $f(x) = 18x^3 - 111x^2 + 161x + 30$, what are the other real zeros of $f(x)$? The SMALLEST real zero is:

- (A) $-\frac{16}{5}$ (B) $\frac{16}{5}$ (C) $-\frac{1}{6}$ (D) $-\frac{1}{5}$ (E) 0

88. What is the remainder when $p(x) = x^4 + x^3 - x^2 - 2$ is divided by $x + 3$?
- (A) -26 (B) 43 (C) -17 (D) 0 (E) None of these
89. Find a polynomial of lowest degree that has -3 , $-\sqrt{2}$, and $\sqrt{2}$ as its zeros.
- (A) $x^3 + 3x^2 - 2x - 6$ (B) $x^2 + (-3 - \sqrt{2})x - 6$
(C) $x^3 + 3x^2 - 4x - 12$ (D) $x^2 - 2\sqrt{2}x + 3$
(E) None of these
90. What is the remainder when $5x^3 - 6x^2 + 3$ is divided by $x^2 - x + 4$?
- (A) $-21x + 7$ (B) 7 (C) $21x - 7$
(D) $-14x$ (E) None of these
91. Find a polynomial of lowest degree having zeros $-2, 1, 0$ (a zero of multiplicity 2), and -4 (a zero of multiplicity 3).
- (A) $f(x) = x^2(x + 2)(x - 1)(x + 4)^3$ (B) $f(x) = x^2(x - 2)(x + 1)(x - 4)^3$
(C) $f(x) = 2x(x + 2)(x - 1)(x + 4)^3$ (D) $f(x) = (x + 2)(x - 1)(x + 4)^3$
(E) None of these
92. Find the vertical asymptote(s), if any, for $f(x) = \frac{x + 1}{4x^2 - 1}$.
- (A) $x = \frac{1}{4}$ (B) $x = \frac{1}{2}$ (C) $x = -\frac{1}{2}, x = \frac{1}{2}$
(D) $x = -\frac{1}{4}, x = \frac{1}{4}$ (E) $x = -1$

93. Find the value of the parameter a so that the rational function $g(x) = \frac{ax^2 + 3x + 7}{x + 1}$ has the slant asymptote $y = 2x + 1$.

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

94. Which ONE of the following statements is true about the rational function

$$g(x) = \frac{3x^2 - x}{3x^2 + x} ?$$

- (A) The graph of g has a zero at $x = 0$.
(B) The graph of g has a vertical asymptote at $x = 0$.
(C) The graph of g has a hole at $x = 0$.
(D) The graph of g has a horizontal asymptote at $y = 0$.
(E) The graph of g has no horizontal asymptote.

95. Find all the asymptotes of the rational function $y = \frac{2x^2 + 1}{2x + 3}$

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

96. Determine the behavior of the function $f(x) = \frac{2x + 1}{1 - 18x}$ as $x \rightarrow \infty$.

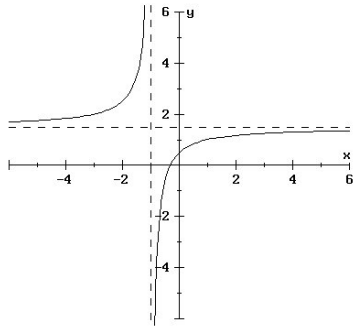
- (A) $y \rightarrow -\frac{1}{9}$ (B) $y \rightarrow 2$ (C) $y \rightarrow 0$ (D) $y \rightarrow \infty$
(E) $y \rightarrow \frac{1}{18}$

97. The graph of a particular rational function has one vertical asymptote at $x = 2$, a horizontal asymptote at $y = 1$, and passes through the point $(4, 5)$. What is the x -intercept?

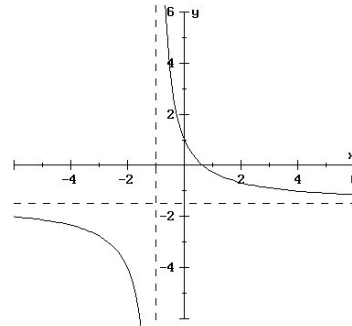
- (A) $(-6, 0)$ (B) $(-7, 0)$ (C) $(2, 0)$ (D) $(1, 0)$

98. Which of the following is the graph of $y = \frac{2x + 1}{2x - 3}$

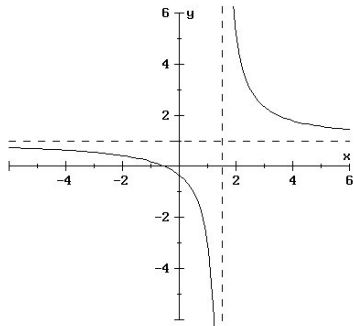
(A)



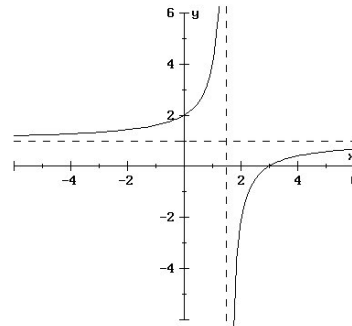
(B)



(C)

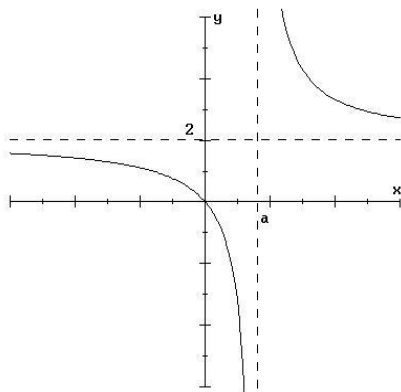


(D)



(E) None of these

99. Find a formula for the rational function show below.



(A) $y = \frac{2}{x - a}$

(B) $y = \frac{2x}{x + a}$

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

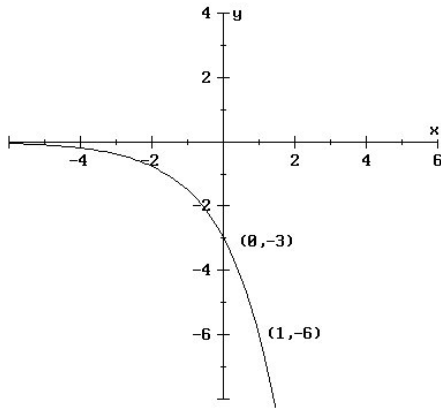
(D) $y = \frac{x + 2}{x - a}$

(E) $y = \frac{x - a}{2x}$

100. Find the domain and range of the function $H(x) = 3^{x+2} - 4$.

- (A) Domain: $(-2, \infty)$ Range: $(-4, \infty)$
 (B) Domain: $(-\infty, \infty)$ Range: $(-4, \infty)$
 (C) Domain: $(-\infty, \infty)$ Range: $(0, \infty)$
 (D) Domain: $(2, \infty)$ Range: $(4, \infty)$
 (E) Domain: $(-2, \infty)$ Range: $(4, \infty)$

101. The graph below represents $y = C(a)^x$. Find the values of C and a .



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

102. How much MORE money will you earn in an account that compounds interest continually than in an account that compounds interest quarterly if you invest \$3000 for 7 years at an interest rate of 11%?

- (A) \$67.02 (B) \$59.37 (C) \$101.16 (D) \$32.52 (E) None of these

103. Find the x -intercept of the graph of $y = \ln(x - a) + 2$

- (A) $(\ln(-a) + 2, 0)$ (B) $(-2 + \ln a, 0)$ (C) $(e^{-2+\ln(a)}, 0)$
 (D) $(e^{-2} + a, 0)$ (E) None of these

104. The given table lists the day, y , that there were x bacteria (in thousands).

x	1	10	100	1,000	10,000
y	1	3	5	7	9

Find the values of a and b so that $f(x) = a + b \log(x)$ models the data exactly.

- (A) $a = 1, b = 2$ (B) $a = 2, b = 2$ (C) $a = 1, b = 1$
(D) $a = 2, b = 1$ (E) None of these

105. If $f(x)$ is a one-to-one function, and $f(2) = 7$, then which of the following CANNOT be true?

- (A) $f(7) = 2$ (B) $f^{-1}(7) = 2$ (C) $f^{-1}(5) = 3$
(D) $f(-2) = 4$ (E) $f(-2) = 7$

106. If $h(x) = 20x - 62$, what is $h(h^{-1}(6))$?

- (A) 2 (B) 58 (C) -6 (D) 6 (E) None of these

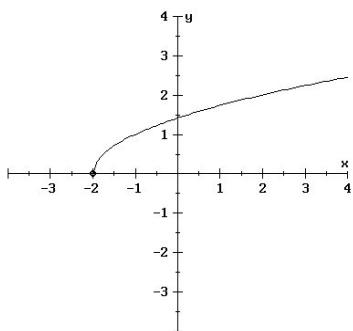
107. If $G(x) = \sqrt[3]{4 - x}$, what is $G^{-1}(x)$?

- (A) $G^{-1}(x) = \frac{1}{\sqrt[3]{4 - x}}$ (B) $G^{-1}(x) = -\sqrt[3]{4 - x}$ (C) $G^{-1}(x) = 4 - x^3$
(D) $G^{-1}(x) = x^3 + 4$ (E) None of these

108. If the point $(2, 6)$ is on the graph of $f(x)$, which of the following points must be on the graph of $f^{-1}(x)$?

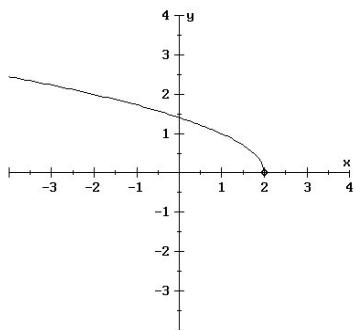
- (A) $(-2, -6)$ (B) $\left(2, \frac{1}{6}\right)$ (C) $(6, 2)$ (D) $(2, -6)$ (E) None of these

109. If the graph of $S(x)$ is:

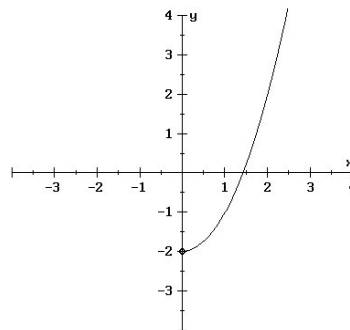


Then the graph of $S^{-1}(x)$ is:

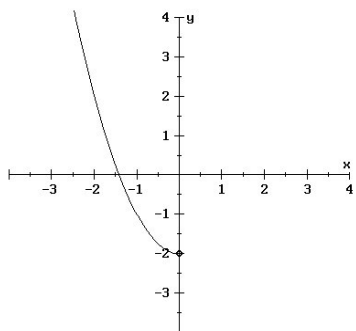
(A)



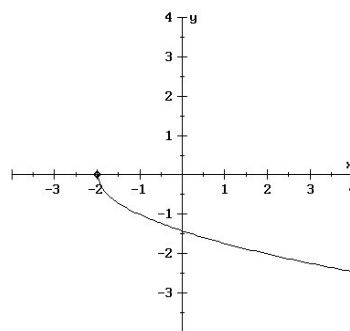
(B)



(C)



(D)



(E) None of these

110. Find $R^{-1}(x)$ if $R(x) = \frac{C}{3x-1}$ (C is a real number)

- (A) $R^{-1}(x) = \frac{C}{3}x + C$ (B) $R^{-1}(x) = \frac{3x-1}{C}$
 (C) $R^{-1}(x) = \frac{C+x}{3x}, x \neq 0$ (D) $R^{-1}(x) = \frac{C-3x}{x}, x \neq 0$
 (E) None of these

111. Suppose $g(x)$ is the inverse of the function $f(x)$. Which of the following tables would be correct for $g(2x)$ if $f(x)$ is given in the table below.

x	-2	-1	0	1	2
$f(x)$	1	3	5	7	9

(A)

x	1	3	5	7	9
$g(2x)$	-4	-2	0	2	4

(B)

x	1	3	5	7	9
$g(2x)$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1

(C)

x	2	6	10	14	18
$g(2x)$	-2	-1	0	1	2

(D)

x	$\frac{1}{2}$	$\frac{3}{2}$	$\frac{5}{2}$	$\frac{7}{2}$	$\frac{9}{2}$
$g(2x)$	-2	-1	0	1	2

112. What is the domain of $y = 10 - \log_7(5n - 230)$?

- (A) $(-\infty, 230]$ (B) $[46, \infty)$ (C) $(46, \infty)$
 (D) $(230, \infty)$ (E) $(-\infty, 48)$

113. Let $f(x) = \frac{e^x + 1}{e^x - 1}$. Find $f^{-1}(x)$.

- (A) $f^{-1}(x) = \ln\left(\frac{e^x + 1}{e^x - 1}\right)$ (B) $f^{-1}(x) = \frac{\ln(e^x + 1)}{\ln(e^x - 1)}$ (C) $f^{-1}(x) = \ln\left(\frac{x + 1}{x - 1}\right)$
 (D) $f^{-1}(x) = \frac{\ln(x + 1)}{\ln(x - 1)}$ (E) $f^{-1}(x) = \frac{\ln(x - 1)}{\ln(x + 1)}$

114. Let f be a function with values given in the table below.

x	0	$1/5$	2	3	4	5
$f(x)$	4	1	36	25	9	16

Find $h^{-1}\left(\frac{1}{5}\right)$ for $h(x) = \frac{1}{\sqrt{f(x)}}$.

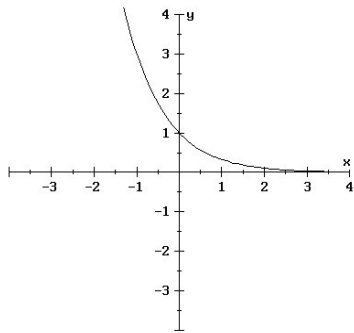
- (A) 25 (B) 16 (C) 3 (D) 1 (E) $1/4$

115. Find the x -intercept of the graph of $M(x) = \log_6(2x + 3)$.

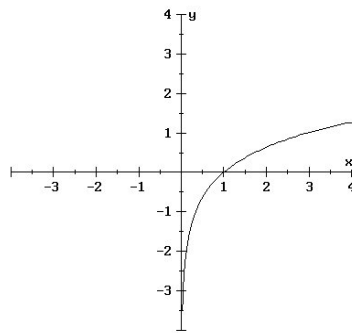
- (A) $(1.5, 0)$ (B) $(0, 0)$ (C) $(-3, 0)$
 (D) $(0.5, 0)$ (E) $(-1, 0)$

116. Which of the following is a graph of the INVERSE of $y = \log_3 x$?

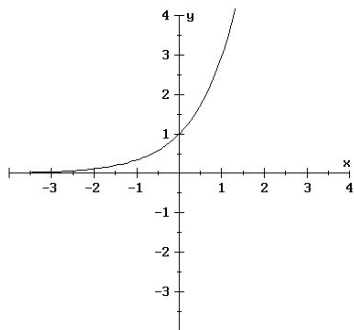
(A)



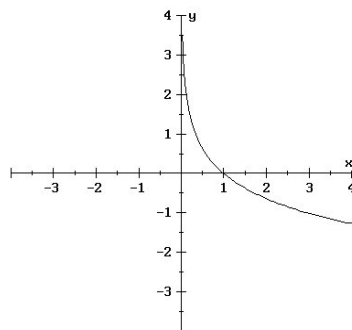
(B)



(C)



(D)



(E) None of these

117. Rewrite $23^b = a$ in logarithmic form.

- (A) $\log_a b = 23$ (B) $\log_{23} a = b$ (C) $\log_{23} b = a$
(D) $\log_b 23 = a$ (E) None of these

118. Find the exact value of $\ln \left[\sqrt[4]{e^5} \right]$.

- (A) 0.8 (B) 1.25 (C) e (D) $0.8e$ (E) None of these

119. Solve $\log_5 x = 2$ and $\log_2 32 = w$. The two solutions are:

- (A) $x = \sqrt{5}$ and $w = \sqrt{32}$ (B) $x = 25$ and $w = 5$ (C) $x = 32$ and $w = 16$
(D) $x = 25$ and $w = 16$ (E) None of these

120. Express as a single logarithm and simplify if possible:

$$\frac{1}{3} \log_a x + 4 \log_a y - 2 \log_a z$$

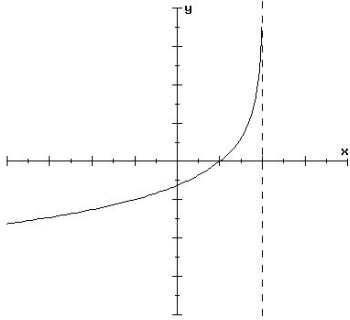
- (A) $\log_a [x^{1/3} + y^4 - z^2]$ (B) $\log_a \left[\frac{1}{3}x + 4y - 2z \right]$ (C) $\frac{7}{3} \log_a \left[\frac{xy}{z} \right]$
(D) $\log_a \left[\frac{x^{1/3}y^4}{z^2} \right]$ (E) None of these

121. Express as a sum or difference of the natural logarithms of x , y , and z : $\ln \sqrt{\frac{x^3y}{z^4}}$

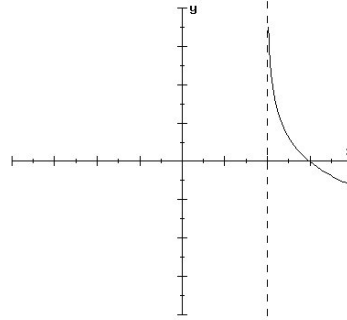
- (A) $\frac{(3 \ln x)(\ln y)}{4 \ln z}$ (B) $\frac{3}{2} \ln x + \ln y - 4 \ln z$
(C) $\frac{3}{2} \ln x + \frac{1}{2} \ln y - 2 \ln z$ (D) $6 \ln x + 2 \ln y - 4 \ln z$
(E) None of these

122. Which of the following most resembles the graph of $y = -\log_3(x - a)$, where a is a positive constant?

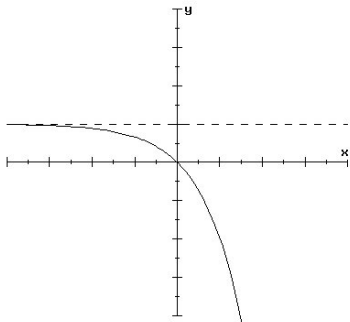
(A)



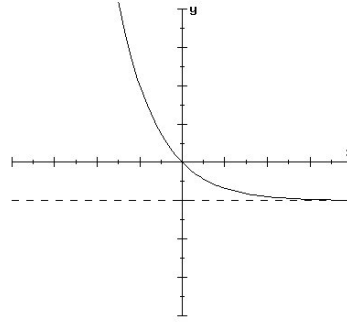
(B)



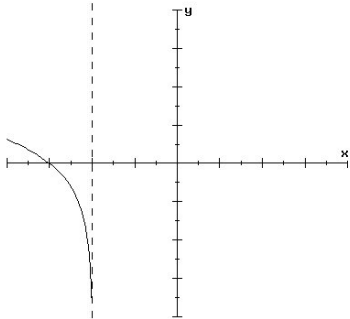
(C)



(D)



(E)



123. Use natural logarithms to solve for x : $3 + 6e^{2x} = 5$

(A) $x = \frac{1}{2} \ln 3$ (B) $x = 2 \ln 3$ (C) $x = \frac{1}{2} \ln \left(\frac{1}{3} \right)$

(D) $x = \ln 3 - 2$ (E) None of these

124. Determine the domain of the logarithmic function $f(x) = \log_7(x - 4)$.

- (A) $(-\infty, 4)$ (B) $(-\infty, 4]$ (C) $(-\infty, 1)$ (D) $[4, \infty)$ (E) $(4, \infty)$

125. Solve for x : $3^{2x} = 27^{2x-1}$

The answer is a number:

- (A) between 0.5 and 1 (B) between 0 and 0.5 (C) between -0.5 and 0
(D) between 1 and 2 (E) None of these

126. Solve for x : $3^x = 5^{x-1}$

The solution is a number:

- (A) between 2 and 4 (B) between -5 and -3 (C) between -1 and 0
(D) between -3 and -1 (E) None of these

127. Solve for x : $\ln(2x - 1) = 2$

- (A) $x = \frac{e^2}{2}$ (B) $x = \frac{e^2 + 1}{2}$ (C) $x = e^2 + \frac{1}{2}$ (D) $x = \frac{e^4}{2}$
(E) None of these

128. Solve for x : $\log_2(-4 - x) + \log_2(3 - x) = 3$

The solution is a number:

- (A) between -9 and -6 (B) between -6 and -4
(C) between -4 and -1 (D) between -1 and 2
(E) between 2 and 5

129. Solve for x : $\log_3 x - \log_3(x - 1) = 2$
- (A) $\frac{1}{8}$ (B) $\frac{9}{8}$ (C) $\frac{10}{9}$ (D) $\frac{100}{99}$ (E) None of these
130. The number of California gray whales is growing according to the formula $A = Pe^{0.015t}$, where t is measured in years. How long will it take the number of whales to double?
- (A) less than 40 years (B) between 40 and 50 years
(C) between 50 and 60 years (D) between 60 and 70 years
(E) more than 70 years
131. In 1980, the population of the United States was approximately 226.5 million people. In 1990, the population had grown to approximately 246.7 million. Assuming an exponential growth model $A = Pe^{rt}$, what is the projected population of the U.S. in the year 2000?
- (A) Less than 260 million
(B) Between 260 million and 265 million
(C) Between 265 million and 270 million
(D) Between 270 million and 275 million
(E) More than 275 million
132. Mr. Smart decided to invest \$20,000 in a savings account. At what annual percentage rate, compounded monthly, did he invest his money in order to have \$36,500 at the end of 10 years?
- The interest rate is:
- (A) less than 6.1% (B) between 6.1% and 6.3%
(C) between 6.3% and 6.5% (D) between 6.5% and 6.7%
(E) greater than 6.7%

133. An object which is initially at a temperature of 100°F is placed in a room which is at a constant temperature of 60°F . Given that the rate of change is $r = -0.05$ when t is measured in minutes, determine how long it will take the object to cool to a temperature of 70°F .

Recall that Newton's Law of Cooling is $A(t) = C + (A_0 - C)e^{rt}$.

- (A) 61.2 minutes (B) 1.4 minutes (C) 26.3 minutes
- (D) 27.7 minutes (E) None of these
134. The release of fluorocarbons used in household sprays destroys the ozone layer in the upper atmosphere. Suppose the amount of ozone is given by $P = Ce^{-0.0025t}$ where t is measured in years. How long will it take for 70% of the ozone to disappear? (Round to the nearest yr.)
- (A) About 143 yrs. (B) About 1699 yrs. (C) About 1360 yrs.
(D) About 482 yrs. (E) None of these

Answers

1. A	29. E	57. E	85. D	113. C
2. B	30. A	58. D	86. C	114. C
3. E	31. B	59. C	87. C	115. E
4. A	32. B	60. B	88. B	116. C
5. D	33. C	61. D	89. A	117. B
6. C	34. D	62. E	90. A	118. B
7. C	35. D	63. A	91. A	119. B
8. C	36. D	64. D	92. C	120. D
9. E	37. A	65. D	93. B	121. C
10. B	38. D	66. B	94. C	122. B
11. A	39. B	67. B	95. A	123. C
12. D	40. A	68. D	96. A	124. E
13. B	41. D	69. A	97. A	125. A
14. B	42. C	70. B	98. C	126. A
15. A	43. C	71. C	99. C	127. B
16. B	44. B	72. B	100. B	128. B
17. B	45. B	73. C	101. A	129. B
18. A	46. A	74. C	102. A	130. B
19. D	47. B	75. B	103. D	131. C
20. D	48. E	76. E	104. A	132. A
21. B	49. C	77. D	105. E	133. D
22. D	50. E	78. E	106. D	134. D
23. C	51. B	79. C	107. C	
24. C	52. C	80. B	108. C	
25. D	53. A	81. C	109. B	
26. B	54. A	82. A	110. C	
27. B	55. B	83. A	111. D	
28. D	56. D	84. B	112. C	