

Select the correct response.

1. If $f(x) = -x^2 - 3x + 4$, calculate $f(-2)$.
A. -6 B. 0 C. 2 D. 6 E. 14
2. If $f(x) = 2x^2 - x + 1$, find and simplify $f(x+2)$.
A. $2x^2 - x + 3$ B. $2x^2 + 7x + 7$ C. $2x^2 - x + 7$
D. $2x^2 + 7x + 11$ E. $2x^2 - x + 11$
3. Simplify: $(3x-7)(2x+4) - 4(x-3)$
A. $6x^2 - 11x - 16$ B. $6x^2 - 6x - 40$ C. $6x^2 - 4x - 16$
D. $6x^2 - 11x - 40$ E. $6x^2 - 6x - 16$
4. At 6 AM a snowplow, traveling at a constant speed, begins to clear a street. At 8 AM a car begins traveling that street from the snowplow's starting point, at a speed of 30 miles per hour. Half an hour later, the car reaches the snowplow. Find the speed of the snowplow.
A. 6 mph B. 7.5 mph C. 7.6 mph D. 12.2 mph E. 30 mph
5. A box with a square base and no top is to be made from a square piece of tin by cutting out a 3-inch square from each corner and folding up the sides. If the box must hold 48 in^3 , which equation can be used to find the length of the side of the piece of tin?
A. $3(x-3)(x-3) = 48$ B. $x(x-3)(x-3) = 48$ C. $3(x-6)(x-6) = 48$
D. $x(x-6)(x-3) = 48$ E. $3(x-6)(x-3) = 48$
6. Find the slope of the line containing the points $(-2, 4)$ and $(6, -3)$.
A. 4 B. $-\frac{7}{8}$ C. $\frac{1}{4}$ D. $-\frac{8}{7}$ E. $-\frac{1}{2}$
7. Suppose 280 tons of corn were harvested in 5 days and 940 tons in 20 days. If the relationship between tons T and days d is linear, express T as a function of d .
A. $T(d) = 5d + 280$ B. $T(d) = -44d + 500$ C. $T(d) = 60d + 280$
D. $T(d) = 60d + 44$ E. $T(d) = 44d + 60$
8. If $f(x) = \sqrt{x+1}$ and $g(x) = x^2 + 7$, then $(f \circ g)(-1) = ?$
A. 3 B. $\sqrt{7}$ C. 0 D. 7 E. $\sqrt{3}$
9. $\lim_{x \rightarrow 1} \frac{x^2 + 4x - 5}{x^2 - 1} =$
A. -3 B. 0 C. 3 D. 5 E. Limit does not exist.

10. $\lim_{x \rightarrow \infty} \frac{x^3 - x^2}{2x^2 - 3x + 1} =$
 A. -1 B. 0 C. $\frac{1}{2}$ D. 1 E. Limit does not exist.
11. $\lim_{h \rightarrow 0} \frac{(x+h)^2 - 3(x+h) - (x^2 - 3x)}{h} =$
 A. $-4x + 3$ B. 3 C. $-4x$ D. $2x - 3$ E. -3
12. Find y' if $y = 9x^2 + \frac{1}{4x^3} - \sqrt{x} + 1$.
 A. $18x - \frac{3}{4x^4} + \frac{1}{2x^{3/2}}$ B. $18x - \frac{12}{x^4} - \frac{1}{2x^{1/2}}$ C. $18x - \frac{3}{4x^4} - \frac{1}{2x^{1/2}}$
 D. $18x - \frac{12}{x^4} + \frac{1}{2x^{3/2}}$ E. $18x - \frac{3}{4x^2} - \frac{1}{2x^{1/2}}$
13. The derivative of $(7x+4)(x^2-3x)$ is:
 A. $21x^2 - 13x$ B. $21x^2 - 34x - 12$ C. $14x - 21$
 D. $7x^3 - 17x^2 - 12x$ E. $7x^2 + 8x - 12$
14. The derivative of $\frac{x^2+1}{x+5}$ is:
 A. $\frac{x^2+10x-1}{(x+5)^2}$ B. $2x$ C. $\frac{2x^2+10x}{(x^2+1)^2}$ D. $\frac{3x^2+10x+1}{(x+5)^2}$ E. $\frac{-x^2-10x+1}{(x+5)^2}$
15. If $y = (3-x^2)^3$, then $y'' =$
 A. $-6x(3-x^2)^2$ B. $6(3-x^2)(5x^2-3)$ C. $6(3-x^2)$
 D. $24x^2(3-x^2)$ E. $18(x^2-1)$
16. The line tangent to the graph of $f(x) = x - \frac{1}{x}$ at $x = 2$ has slope:
 A. $\frac{1}{4}$ B. $\frac{3}{4}$ C. $\frac{3}{2}$ D. 0 E. $\frac{5}{4}$
17. A cost function is given by $C(x) = 1000\sqrt{x^2+2}$. Use the marginal cost function to estimate the cost of the 11th unit. Round your answer to the nearest cent.
 A. \$499.15 B. \$99.01 C. \$10,099.50 D. \$49.51 E. \$990.15

18. Suppose the distance (in feet) covered by a car moving along a straight road t seconds after starting from rest is given by the function $f(t) = 2t^2$ ($0 \leq t \leq 30$). Find the average velocity of the car over the time interval $[22, 22.1]$.
- A. 88.2 ft/sec B. 88.4 ft/sec C. 88.6 ft/sec
D. 95.2 ft/sec E. 97.7 ft/sec
19. Find all values of x for which the function $f(x) = 2x^3 - 3x^2 - 12x + 12$ is increasing.
- A. $(-1, 2)$ B. $(-\infty, -1)$ C. $(2, \infty)$ D. $(-\infty, -1) \cup (2, \infty)$ E. $(-1, 2) \cup (2, \infty)$
20. For what value of a does the function $f(x) = x^2 + ax$ have a relative minimum at $x = 1$?
- A. -2 B. 0 C. 2 D. -1 E. 1
21. If the concentration $C(t)$ of a certain drug remaining in the bloodstream t minutes after it is injected is given by $C(t) = \frac{t}{5t^2 + 125}$, then the concentration is a maximum when $t =$?
- A. 25 min. B. 15 min. C. 5 min. D. 10 min. E. There is no maximum.
22. If $f(x) = 2x^4 - 6x^2$ then which one of the following is true?
- A. f has a relative maximum at $x = \pm\sqrt{\frac{3}{2}}$ and a relative minimum at $x = 0$.
- B. f has a relative maximum at $x = 0$ and a relative minimum at $x = \pm\sqrt{\frac{3}{2}}$.
- C. f has a relative maximum at $x = -\sqrt{\frac{3}{2}}$ and a relative minimum at $x = \sqrt{\frac{3}{2}}$.
- D. f has a relative maximum at $x = \sqrt{\frac{3}{2}}$ and a relative minimum at $x = -\sqrt{\frac{3}{2}}$.
- E. f has no relative maximum points, but has a relative minimum at $x = \pm\sqrt{\frac{3}{2}}$.
23. The derivative of a function f is $f'(x) = x^2 - \frac{8}{x}$. Then at $x = 2$, f has:
- A. an inflection point B. a relative maximum
C. a vertical tangent D. a vertical asymptote
E. a relative minimum
24. If $f(x) = \frac{1}{3}x^3 - 9x + 2$, then on the interval $[0, 4]$,
- A. f has an absolute maximum at $x = 3$ and an absolute minimum at $x = 0$.
B. f has an absolute maximum at $x = 4$ and an absolute minimum at $x = 3$.
C. f has an absolute maximum at $x = 0$ and an absolute minimum at $x = 4$.
D. f has an absolute maximum at $x = 0$ and an absolute minimum at $x = 3$.
E. f has an absolute maximum at $x = 4$ and an absolute minimum at $x = 0$.

25. A cost function is given by $C(x) = 1000\sqrt{x^3 + 1}$. Find the marginal cost when $x = 2$.
 A. \$166.67 B. \$333.33 C. \$4000 D. \$2000 E. \$1000
26. A display case is in the shape of a rectangular box with a square base and open top. Suppose the volume is 21 cubic feet. If x is the length of one side of the base, what value should x have to minimize the surface area? Round your answer to two decimal places.
 A. 2.78 ft. B. 3.48 ft. C. 4.58 ft. D. 48 ft. E. 9.17 ft.
27. A manufacturer determines that in order to sell x units of a product, the price per unit must be $p = 1000 - x$. The manufacturer also determines that the total cost of producing x units is $C(x) = 3000 + 20x$. Calculate the maximum profit.
 A. \$490 B. \$121,500 C. \$237,100 D. \$23,000 E. There is no maximum.
28. Find all asymptotes of the function $f(x) = \frac{x - x^2}{3x^2 - x - 4}$.
 A. vertical: $x = -1, x = \frac{4}{3}$, horizontal: $y = -\frac{1}{3}$
 B. vertical: $x = 0, x = 1$, horizontal: $y = -1, y = \frac{4}{3}$
 C. vertical: $x = -1, x = \frac{4}{3}$, horizontal: $y = 0$
 D. vertical: $x = 0, x = 1$, horizontal: $y = 0$
 E. vertical: $x = 0, x = 1$ horizontal: $y = -\frac{1}{3}$
29. If $y = e^{x^2}$, then $y' =$
 A. e^{x^2} B. $x^2 e^{x^2-1}$ C. $2xe^{x^2-1}$ D. $2xe^{x^2}$ E. e^{2x}
30. If $y = \ln(1 - x^2)$, then $y' =$
 A. $\frac{1}{1-x^2}$ B. $\frac{2x}{\sqrt{1-x^2}}$ C. $\frac{-2x}{1-x^2}$ D. $\frac{1}{2(1-x^2)}$ E. $\frac{2x}{1-x^2}$
31. A population grows exponentially. In 1960 it was 50,000 and in 1965 it was 100,000. What was the population in 1970?
 A. 200,000 B. 150,000 C. 250,000 D. 300,000 E. 225,000
32. Find $\frac{dy}{dx}$ if $y = x^2 e^{3x}$.
 A. $xe^{3x}(x+2)$ B. $3x^3 e^{3x-1}$ C. $6xe^{3x}$ D. $5x^3 e^{3x}$ E. $xe^{3x}(3x+2)$

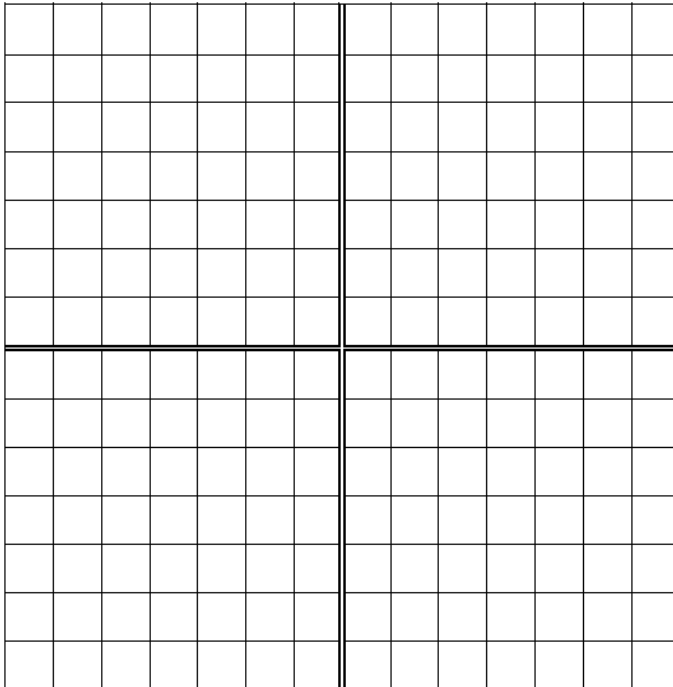
33. If $y = \ln \sqrt{1-x^2}$, then $y' =$
 A. $\frac{1}{\sqrt{1-x^2}}$ B. $\frac{-2x}{\sqrt{1-x^2}}$ C. $\frac{-x}{1-x^2}$ D. $\frac{1}{2(1-x^2)}$ E. $\frac{1}{2\sqrt{1-x^2}}$
34. What lump sum of money should be deposited in a money market certificate paying 8.25% annual interest compounded monthly to amount to \$5000 in 10 years? Round your answer to the nearest dollar.
 A. \$2514 B. \$4669 C. \$2740 D. \$2262 E. \$2197

35. Simplify completely: $\frac{1-\frac{a}{b}}{\frac{a^2}{b^2}-1}$
 A. $\frac{ab-b^2}{a^2-b^2}$ B. $\frac{b}{a+b}$ C. $\frac{b}{a}$ D. $\frac{-b}{a+b}$ E. None of the above.

36. Which of the following statements is(are) true about the function $f(x) = 2^{-x}$? (I have given a coordinate system if you want to graph the function.)

- I. The domain of f is $(-\infty, \infty)$.
 II. The range of f is $(-\infty, \infty)$.
 III. $f(x) \neq 0$

- A. I only
 B. II only
 C. I and III only
 D. II and III only
 E. I, II, and III



37. A job takes 45 minutes for two people working together. If one person works alone he can do the job in 2 hours. How long will it take the other person working alone to complete the job?
- A. $\frac{90}{43}$ hours B. 1 hour 15 minutes C. 43 minutes
 D. 1 hour E. 1 hour 12 minutes
38. Which of the following is equivalent to $\log\left(\frac{z^3}{x\sqrt{y}}\right)$?
- A. $3\log z - \log x - \frac{1}{2}\log y$ B. $\frac{3}{2}\log(z - xy)$ C. $3\log z - \log x - 2\log y$
 D. $\frac{3}{2}\log(z - x + y)$ E. $3\log z - \log x + \frac{1}{2}\log y$
39. How many mL of a 50% acid solution should be added to 40 mL of a 20% acid solution to obtain a solution that is 25% acid?
- A. 10 mL B. 8 mL C. 6 mL D. 4 mL E. None of the above.
40. What is the domain of the function $f(x) = \sqrt{3x-2} + 1$?
- A. $(-\infty, \infty)$ B. $\left[\frac{3}{2}, \infty\right)$ C. $\left[\frac{2}{3}, \infty\right)$ D. $\left(-\infty, \frac{2}{3}\right]$ E. $[0, \infty)$
41. Which of the following statements is (are) true?
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|--|
| I. $\ln 0 = 1$
II. $10^{\log 8} = 8$
III. $\log_4 8 = 2$ |
|--|
- A. I only B. II only C. III only D. I, II, and III E. None are true.
42. Given: $\log_3 m = 8$, $\log_3 n = 10$, and $\log_3 p = 6$, represent $\log_3\left(\frac{\sqrt{mn}}{p^3}\right)$.
- A. -9 B. $\frac{2\sqrt{5}}{27}$ C. 22 D. -56 E. -4
43. Find the equation of a line in slope-intercept form which is parallel to the line $2x - 3y = 7$ and contains the point $(4, -1)$.
- A. $y = \frac{3}{2}x - 7$ B. $y = -\frac{2}{3}x + \frac{5}{2}$ C. $y = \frac{2}{3}x - \frac{11}{3}$ D. $y = \frac{2}{3}x + \frac{14}{3}$
 E. None of the above.

44. A truck enters a freeway traveling 40 miles per hour. One hour later a car enters the same freeway traveling 55 miles per hour. After how many miles will the car overtake the truck?

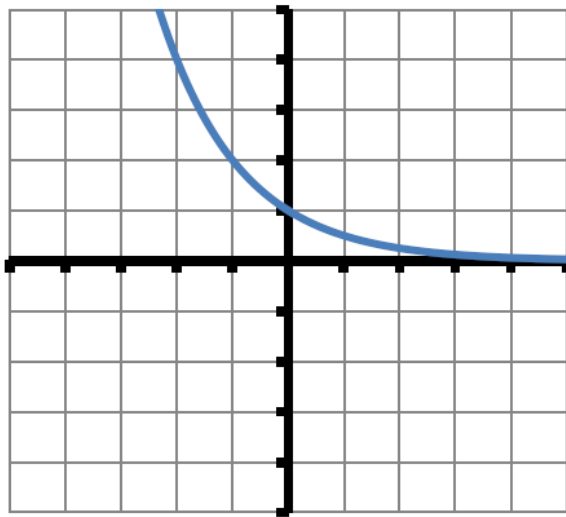
A. $146\frac{2}{3}$ miles B. $201\frac{2}{3}$ miles C. 120 miles D. $106\frac{2}{3}$ miles
E. None of the above.

45. The value of a rare book is increasing linearly. It was worth \$54 in 1981 and \$62 in 1983. Which of the following linear equations represent the value v of the book t years after 1980?

A. $v = 4t + 50$ B. $v = 3t + 48$ C. $v = 3t + 50$ D. $v = 4t + 51$
E. None of the above.

46. The graph below is the graph of which of the following functions?

A. $f(x) = \left(\frac{1}{2}\right)^x$ B. $g(x) = 2^x$ C. $h(x) = -2^x$ D. $j(x) = -\left(\frac{1}{2}\right)^x$ E. $k(x) = 1 - 2^x$



47. If $\log_x 2 = 5$, solve for x . Approximate your answer to four decimal places.

A. 2.2361 B. 1.4142 C. 0.6990 D. 1.1487 E. 0.3010

48. Solve for p : $\frac{4}{2p-3} + \frac{10}{4p^2-9} = \frac{1}{2p+3}$

A. $p = -\frac{3}{2}$ B. $p = \frac{5}{6}$ C. $p = -\frac{25}{6}$ D. There is no solution.
E. None of the above.

49. Parents of a newborn baby are given a gift of \$10,000 and will choose between two options to invest for their child's college fund. Option 1 is to invest the gift in a fund that pays an average annual interest rate of 11% compounded quarterly; option 2 is to invest the gift in a fund that pays an average annual interest rate of 10.75% compounded continuously. Calculate the value of each investment. Assume the investments have terms of 18 years and round your answers to the nearest dollar.
- A. Option 1: \$70,517, Option 2: \$69,240
 - B. Option 1: \$67,494, Option 2: \$72,427
 - C. Option 1: \$72,427, Option 2: \$69,240
 - D. Option 1: \$67,494, Option 2: \$69,240
 - E. Option 1: \$69,240, Option 2: \$70,517

ANSWERS:

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|--------|--------|--------|--------|--------|--------|--------|
| 1. D; | 2. B; | 3. E; | 4. A; | 5. C; | 6. B; | 7. E; |
| 8. A; | 9. C; | 10. E; | 11. D; | 12. C; | 13. B; | 14. A; |
| 15. B; | 16. E; | 17. E; | 18. A; | 19. D; | 20. A; | 21. C; |
| 22. B; | 23. E; | 24. D; | 25. D; | 26. B; | 27. C; | 28. A; |
| 29. D; | 30. C; | 31. A; | 32. E; | 33. C; | 34. E; | 35. D; |
| 36. C; | 37. E; | 38. A; | 39. B; | 40. C; | 41. B; | 42. A; |
| 43. C; | 44. A; | 45. A; | 46. A; | 47. D; | 48. C; | 49. A; |