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? X = each side length of the square 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. $\lim_{x \to 1} \frac{x^2 + 4x - 5}{x^2 - 1} =$
   A. -3 *B.* 0 *C.* 3 *D.* 5 *E.* Limit does not exist.

10. $\lim_{x\to\infty} \dfrac{x^3 - x^2}{2x^2 - 3x + 1} =$

A. -1 *B.* 0 *C.* $\frac{1}{2}$ *D.* 1 *E.* Limit goes toward ∞.

11. $\lim_{h\to 0} \dfrac{(x+h)^2 - 3(x+h) - (x^2 - 3x)}{h} =$

A. $-4x+3$ *B.* 3 *C.* $-4x$ *D.* $2x-3$ *E.* -3

12. Find y' if $y = 9x^2 + \dfrac{1}{4x^3} - \sqrt{x} + 1.$

A. $18x - \dfrac{3}{4x^4} + \dfrac{1}{2x^{3/2}}$ *B.* $18x - \dfrac{12}{x^4} - \dfrac{1}{2x^{1/2}}$ *C.* $18x - \dfrac{3}{4x^4} - \dfrac{1}{2x^{1/2}}$

D. $18x - \dfrac{12}{x^4} + \dfrac{1}{2x^{3/2}}$ *E.* $18x - \dfrac{3}{4x^2} - \dfrac{1}{2x^{1/2}}$

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 $\dfrac{x^2+1}{x+5}$ is:

A. $\dfrac{x^2 + 10x - 1}{(x+5)^2}$ *B.* $2x$ *C.* $\dfrac{2x^2 + 10x}{(x^2+1)^2}$ *D.* $\dfrac{3x^2 + 10x + 1}{(x+5)^2}$ *E.* $\dfrac{-x^2 - 10x + 1}{(x+5)^2}$

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 $f(x) = x - \dfrac{1}{x}$ 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 11^{th} 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 $f(t) = 2t^2 \ (0 \le t \le 30)$. 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 $C(t) = \dfrac{t}{5t^2 + 125}$, 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 $f'(x) = x^2 - \dfrac{8}{x}$. 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 $f(x) = \dfrac{x - x^2}{3x^2 - x - 4}$.

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 $y = \ln(1 - x^2)$ with domain $D = (-1,1)$, then $y' =$
A. $\dfrac{1}{1-x^2}$ *B.* $\dfrac{2x}{\sqrt{1-x^2}}$ *C.* $\dfrac{-2x}{1-x^2}$ *D.* $\dfrac{1}{2(1-x^2)}$ *E.* $\dfrac{2x}{1-x^2}$

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 $\dfrac{dy}{dx}$ 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 $y = \ln\sqrt{1-x^2}$ with domain $D = (-1,1)$, then $y' =$

A. $\dfrac{1}{\sqrt{1-x^2}}$ *B.* $\dfrac{-2x}{\sqrt{1-x^2}}$ *C.* $\dfrac{-x}{1-x^2}$ *D.* $\dfrac{1}{2(1-x^2)}$ *E.* $\dfrac{1}{2\sqrt{1-x^2}}$

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

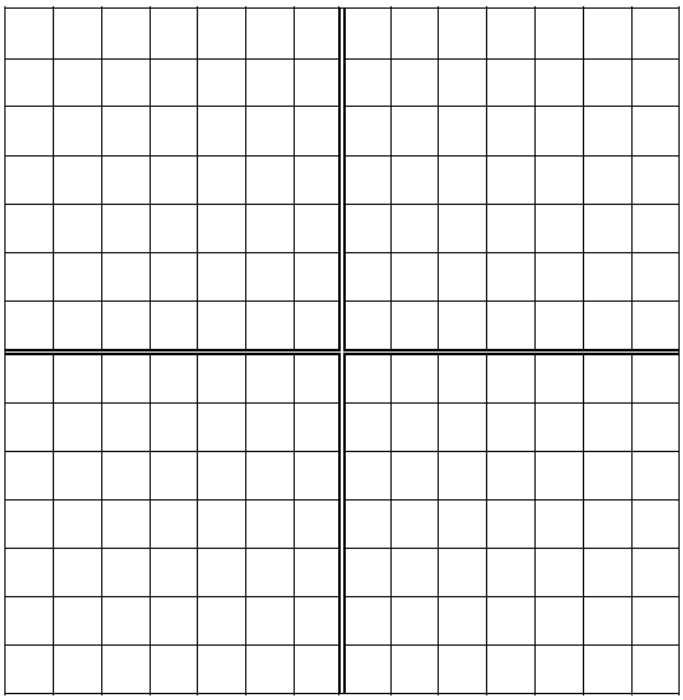
35. Simplify completely: $\dfrac{1-\frac{a}{b}}{\frac{a^2}{b^2}-1}$

A. $\dfrac{ab-b^2}{a^2-b^2}$ *B.* $\dfrac{b}{a+b}$ *C.* $\dfrac{b}{a}$ *D.* $\dfrac{-b}{a+b}$ *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.* $3loz - \log x - 2\log y$

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?

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 inters 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.

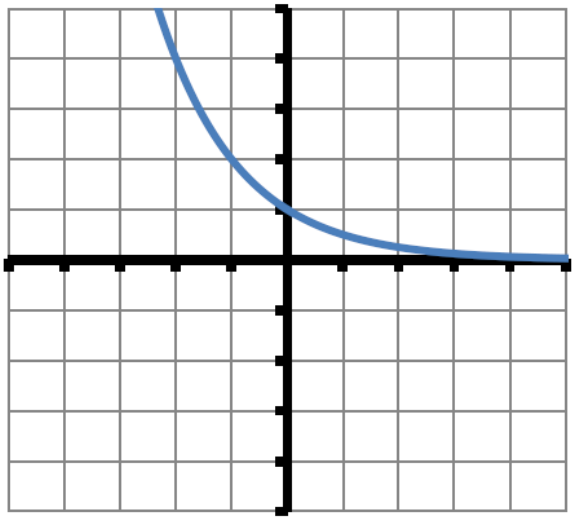
45. The value of a rare book is increasing linearly. It was worth \$54 in 1981 and \$62 in 1983. Which of the following linear equations represent the value v of the book t years after 1980?

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: $\dfrac{4}{2p-3} + \dfrac{10}{4p^2-9} = \dfrac{1}{2p+3}$

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:

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;