1. The equation of the line through the point (1, 1) with y-intercept 2 is

(A) \( y = -x + 2 \)  (B) \( y = x - 2 \)  (C) \( y = 3x - 2 \)
(D) \( y = -3x + 2 \)  (E) None of the above

2. A taxi driver buys a new car for $50,000. The car will have a scrap value of $10,000 after 8 years. Using the straight-line depreciation method, find the value of the car after 4 years.

(A) $10,000 (B) $13,000 (C) $15,000 (D) $25,000 (E) $30,000

3. In a study of the relationship between the year and the number of cyclists killed in an accident, scientists applied a regression analysis, but could not find any significant linear relation between the two factors. Which of the following is most likely the value of the correlation coefficient?

(A) 0.05 (B) 0.93 (C) −0.91 (D) −1 (E) 1.25

4. What is the domain of the function \( f(x) = \frac{1}{\sqrt{1-x^2}} \)?

(A) \((-1, 0]\)  (B) \((0, 1)\)  (C) \((-1, 1)\)
(D) \([-1, 1]\)  (E) None of the above

5. The vertex of the parabola \( f(x) = -x^2 + bx + c \) is \((4, 17)\). What is the value of \( c \)?

(A) 17  (B) 6  (C) 1
(D) 5  (E) −4
6. Which of the following functions has a graph that is symmetric about the origin? (In other words: which one is an odd function?)

(A) \( y = x^2 \)  
(B) \( y = 3x^2 + 7x \)  
(C) \( y = 2x^3 + 4x^5 \)  
(D) \( y = 2x^3 + 1 \)  
(E) None of the above

7. A circle has radius 3, and its center is at the point \((3, -2)\). What is the equation of the circle?

(A) \((x - 3)^2 + (y + 2)^2 = 9\)  
(B) \((x + 3)^2 + (y - 2)^2 = 3\)  
(C) \((x - 9)^2 + (y - 2)^2 = 9\)  
(D) \((x + 3)^2 + (y + 2)^2 = 3\)  
(E) \((x - 3)^2 + (y - 2)^2 = 3\)

8. The demand function for a product is given by \( p + 2x = 100 \), and the supply function is given by \( p - 3x = 60 \). Find the market equilibrium price.

(A) $68  
(B) $84  
(C) $76  
(D) $80  
(E) $78

9. Find the tangent line to the curve \( y = x^{\frac{1}{3}} \) at the point where \( x = 27 \).

(A) \( y = \frac{1}{9}(x - 27) + 3 \)  
(B) \( y = \frac{1}{27}(x - 27) + 3 \)  
(C) \( y = \frac{1}{3}(x - 27) + 9 \)  
(D) \( y = \frac{1}{27}(x - 9) + 9 \)  
(E) \( y = \frac{1}{27}(x - 9) + 3 \)

10. Consider the function \( f(x) = x^6 + x^{-6} \). Calculate \( f'(1) \).

(A) 0  
(B) 1  
(C) 2  
(D) 6  
(E) 12
11. Given the following function,

\[ f(x) = \begin{cases} 
  x + 1, & x < 1 \\
  3 - x, & x \geq 1 
\end{cases} \]

which of the following statements is true?

(A) \( \lim_{x \to 1^+} f(x) = 3 \)  
(B) \( \lim_{x \to 1^-} f(x) = 1 \)  
(C) \( f(x) \) is continuous at \( x = 1 \)  
(D) \( \lim_{x \to 1^-} f(x) \) does not exist  
(E) \( f(x) \) is undefined at \( x = 1 \)

12. Evaluate \( \lim_{x \to +\infty} \frac{5x^3 - 7}{2x^3 - 18} \).

(A) 0  
(B) \( +\infty \)  
(C) 3  
(D) \( \frac{7}{18} \)  
(E) \( \frac{5}{2} \)

13. Find the vertical asymptote(s) of \( y = \frac{2x^2 + 2x}{x^2 - x} \).

(A) \( x = 2 \) only  
(B) \( x = 1 \) only  
(C) \( x = 0 \) and \( x = 1 \)  
(D) \( x = 0 \) only  
(E) \( x = 0 \) and \( x = 2 \)

14. Given the equation \( x^2 + y^2 = 9 \), calculate \( \frac{dy}{dx} \) with implicit differentiation.

(A) 0  
(B) \( 2x/y \)  
(C) \( x/y \)  
(D) \( -x/y \)  
(E) \( -x/2y \)

15. If \( f(x) = \sqrt[3]{2x^4 + 3x} \), find \( f'(x) \).

(A) \( \frac{1}{3}(8x^3 + 3)^{-2/3} \)  
(B) \( \frac{1}{3}(8x^3 + 3) \)  
(C) \( (8x^3 + 3)(2x^4 + 3x)^{2/3} \)  
(D) \( \frac{1}{3}(8x^3 + 3)(2x^4 + 3x)^{-2/3} \)  
(E) \( \frac{1}{3}(2x^4 + 3x)(8x^3 + 3)^{-2/3} \)
16. For which \( x \)-values does the graph of \( y = x^4 - 4x^3 \) have a horizontal tangent line?

(A) \( x = 4 \) only  \( \)  (B) \( x = 0 \) only  \( \)  (C) \( x = 0 \) and \( x = 3 \)
(D) \( x = 0 \) and \( x = 4 \)  \( \)  (E) \( x = 2 \) and \( x = 4 \)

17. If \( f(x) = \frac{4x^2}{x^2 + 1} \), find \( f'(x) \).

(A) \( \frac{8x}{(x^2 + 1)^2} \)  \( \)  (B) \( \frac{-8x}{(x^2 + 1)^2} \)  \( \)  (C) \( \frac{4x + 2}{(x^2 + 1)^2} \)  \( \)  (D) \( \frac{-4x - 2}{(x^2 + 1)^2} \)  \( \)  (E) \( \frac{-8x + 4}{(x^2 + 1)^2} \)

18. Air is being pumped into a spherical balloon at a rate of 5 cubic feet per minute. Find the rate of change of the radius when the radius is 3 feet.

(\text{The volume of a sphere is given as } V = \frac{4}{3} \pi r^3.)

(A) \( \frac{20}{3\pi} \) ft./min.  \( \)  (B) \( \frac{16}{3\pi} \) ft./min.  \( \)  (C) \( \frac{9}{16\pi} \) ft./min.  \( \)  (D) \( \frac{5}{4\pi} \) ft./min.  \( \)  (E) \( \frac{5}{36\pi} \) ft./min.

19. Given the following matrix equation:

\[ -2X + \begin{pmatrix} 1 & 7 \\ 6 & 5 \end{pmatrix} = \begin{pmatrix} 3 & 9 \\ 12 & 7 \end{pmatrix}, \]

find the matrix \( X \).

(A) \( X = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix} \)  \( \)  (B) \( X = \begin{pmatrix} 1 & 0 \\ 3 & 1 \end{pmatrix} \)  \( \)  (C) \( X = \begin{pmatrix} -1 & -1 \\ -3 & -1 \end{pmatrix} \)
(D) \( X = \begin{pmatrix} -1 & 0 \\ -3 & 1 \end{pmatrix} \)  \( \)  (E) \( X = \begin{pmatrix} 1 & 1 \\ 0 & -3 \end{pmatrix} \)

20. Compute the matrix product:

\( \begin{pmatrix} 2 & 0 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} 1 & -2 & 1 \\ 0 & 1 & 3 \end{pmatrix} \)

(A) \( \begin{pmatrix} 2 & -3 \\ 4 & -5 \end{pmatrix} \)  \( \)  (B) \( \begin{pmatrix} 2 & -5 & -6 \\ 4 & -2 & -3 \end{pmatrix} \)  \( \)  (C) \( \begin{pmatrix} 2 & -4 & 2 \\ 3 & -5 & 6 \end{pmatrix} \)
(D) \( \begin{pmatrix} 2 & -6 \\ 5 & -3 \end{pmatrix} \)  \( \)  (E) The two matrices cannot be multiplied.
21. If \( A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \), find \( A^{-1} \).

(A) \( \begin{pmatrix} 4 & -2 \\ -3 & 1 \end{pmatrix} \)  
(B) \( \begin{pmatrix} -1 & 3 \\ 2 & -4 \end{pmatrix} \)  
(C) \( \begin{pmatrix} -2 & 1 \\ 3/2 & -1/2 \end{pmatrix} \)  
(D) \( \begin{pmatrix} 1/2 & -3/2 \\ -1 & 2 \end{pmatrix} \)  
(E) \( \begin{pmatrix} -3/2 & 1/2 \\ -2 & 1 \end{pmatrix} \)

22. The augmented matrix below represents a system of equations in the variables \((x, y, z)\). What is the solution of the system?

\[
\begin{pmatrix} 1 & 0 & 3 & 1 \\ 0 & 1 & -1 & 5 \\ 0 & 0 & 0 & 0 \end{pmatrix}
\]

(A) \((1, 5, k)\) for any real number \(k\)
(B) \((1 - 3k, 5 + k, k)\) for any real number \(k\)
(C) \((3 + k, -1 - 5k, k)\) for any real number \(k\)
(D) \((3 - k, -1 + 5k, k)\) for any real number \(k\)
(E) Inconsistent system, no solution

23. If \( f(x) = 2x^2 + 3x \), simplify the difference quotient \( \frac{f(x+h) - f(x)}{h} \) (for \( h \neq 0 \)).

(A) \(4x + h + 3\)  
(B) \(4x + 3\)  
(C) \(1\)  
(D) \(4x + 2h + 3\)  
(E) \(4h + 3\)

24. Part of the graph of a function \( f(x) \) is shown below:

For which values of \( x \) between 0 and 5 is \( f(x) \) not differentiable?

(A) \(x = 1\) only  
(B) \(x = 4\) only  
(C) \(x = 1\) and \(x = 4\)  
(D) \(x = 2\) and \(x = 4\)  
(E) \(x = 1, x = 2\) and \(x = 4\)

25. The cost, in dollars, of producing \( x \) radios is given by \( C(x) = x^3 + 20x + 1200 \). Find the marginal cost when \( x = 10 \).

(A) 3120  
(B) 140  
(C) 320  
(D) 20  
(E) 0
26. The monthly cost of driving a car depends on the number of miles driven. Jack found that in one month, it cost him $236 to drive 200 miles; and in another month, it cost him $445 to drive 400 miles. Determine the cost if he drives 327 miles in a month, assuming that a linear relationship gives a suitable model.

26. (A) $368.72 (B) $343.74 (C) $334.32 (D) $123.71 (E) $489.15

27. A manufacturer has fixed costs of $43, a cost per item for production of $7, and expects to sell 29 items. At what price will the manufacturer break even?

27. (A) $8.12 (B) $8.48 (C) $3.38 (D) $5.23 (E) $12.38

28. At what \( x \) value is the slope of the graph of \( f(x) = 3x^4 + x^2 \) equal to \(-1.7\)? Round your answer to three decimal places.

28. (A) \( x = -0.216 \) (B) \( x = -0.416 \) (C) \( x = 0.483 \) (D) \( x = -0.454 \) (E) No solution.

29. Find the linear regression equation for the following data set:

<table>
<thead>
<tr>
<th>( x )</th>
<th>-7</th>
<th>-5</th>
<th>-1</th>
<th>2</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>11</td>
<td>8</td>
<td>6</td>
<td>2</td>
<td>-4</td>
</tr>
</tbody>
</table>

29. (A) \( y = -1.1845x + 3.5565 \) (B) \( y = 3.0235x + 3.5332 \) (C) \( y = -5.2013x + 3.3589 \) (D) \( y = -1.0909x + 3.5091 \) (E) \( y = -1.5483x + 3.1254 \)

30. A food market sells tomatoes at a price of $1.32 per pound. The cost is given by the equation \( C(x) = 0.11x^2 + 0.31x - 1.65 \), where \( x \) is the number of pounds sold. Compute the maximum possible profit from selling tomatoes.

30. (A) $3.97 (B) $4.34 (C) $5.12 (D) $6.44 (E) $12.45
31. The position $s(t)$ of a particle at time $t$ is given by the equation $s(t) = 2t^4 - t^2 - t + 1$, for $t > 0$. At what time(s) does its velocity become zero?

(A) 0.54  (B) 0.54 and 0.63  (C) 1.17 and 0.54 and 0.63  
(D) 1.17 and 0.54  (E) 0.66

32. Find a matrix $X$ such that the equation $AX = B$ holds, where

$A = \begin{pmatrix} 4 & 5 \\ 2 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 6 \\ 1 & 8 \end{pmatrix}$.

(A) $\begin{pmatrix} 3/5 & -11/10 \\ 2/5 & -37/10 \end{pmatrix}$  (B) $\begin{pmatrix} 7/2 & 2 \\ 2/5 & -1 \end{pmatrix}$  (C) $\begin{pmatrix} 6/5 & -9/10 \\ 8/5 & -27/10 \end{pmatrix}$

(D) $\begin{pmatrix} 1/2 & 4 \\ 1/5 & -2 \end{pmatrix}$  (E) $\begin{pmatrix} 17 & 64 \\ 6 & 12 \end{pmatrix}$

33. Find $\lim_{h \to 0} \frac{(0.7 + h)^9 - 0.7^9}{h}$.

(A) -0.6869  (B) 0.1425  (C) 0.5188

(D) 0.9453  (E) 0.7364

34. Find the average rate of change of the function $f(x) = 3x^4 - 5x^2$ over the interval $[1.1, 2.4]$. Round your answer to two decimal places.

(A) 63.20  (B) 72.39  (C) 105.32

(D) 136.92  (E) 55.69

35. Find the solution to the linear system:

$$\begin{cases} 5x + 5y - 7z = 3 \\ 2y - 5z = 1 \\ 4x + 3z = 3 \end{cases}$$

(A) $x = \frac{15}{7}, y = -\frac{29}{7}, z = -\frac{13}{7}$

(B) $x = \frac{2}{7}, y = -\frac{15}{7}, z = \frac{22}{7}$

(C) $x = -\frac{8}{7}, y = -\frac{10}{7}, z = \frac{16}{7}$

(D) No solution

(E) Infinitely many solutions
1. A  
2. E  
3. A  
4. C  
5. C  
6. C  
7. A  
8. B  
9. B  
10. A  
11. C  
12. B  
13. B  
14. D  
15. D  
16. C  
17. A  
18. E  
19. C  
20. C  
21. C  
22. B  
23. D  
24. C  
25. C  
26. A  
27. B  
28. B  
29. D  
30. A  
31. E  
32. D  
33. C  
34. E  
35. A