Indicate the answer choice that best completes the statement or answers the question.

1. Find the values of $x$ that satisfy the inequality.

$$\frac{x - 20}{x - 4} \leq 5$$

a. $(-\infty, 0) \cup [4, \infty)$

b. $(0,4)$

c. $(-\infty,0] \cup (4, \infty)$

d. $(4, \infty)$

e. $(\infty,0)$

2. Find the values of $x$ that satisfy the inequality.

$$\frac{x + 7}{x - 4} \geq 0$$

a. $(-\infty, -7)$

b. $(-\infty, -7] \cup [4, \infty)$

c. $(-\infty, -7] \cup (4, \infty)$

d. $(4, \infty)$

e. $(-7,4)$

3. Find the values of $x$ that satisfy the inequality.

$$(x + 3)(x - 3) \leq 0$$

a. $(-\infty, -3) \cup [3, \infty)$

b. $[-3,3]$  

c. $(-\infty,3)$

d. $(-\infty,-3)$

e. $[3, \infty)$
4. Find an equation of the line that passes through the point (9, -4) and has the indicated slope \( m = 2 \).
   
   a. \( y = 2x - 20 \)
   b. \( y = 2x - 18 \)
   c. \( y = 2x - 23 \)
   d. \( y = 2x - 25 \)
   e. \( y = 2x - 22 \)

5. Find the domain of the function.

   \[ f(x) = x^2 - x - 15 \]
   
   a. \([-15, 15]\)
   b. \((-15, 15)\)
   c. \((-\infty, 15) \cup (15, \infty)\)
   d. \((-\infty, \infty)\)
   e. \((-\infty, -15) \cup (-15, 15) \cup (15, \infty)\)

6. Find the domain of the function.

   \[ f(x) = \frac{x}{x^2 - 36} \]
   
   a. \((-\infty, -6) \cup (-6, 6) \cup (6, \infty)\)
   b. \((-6, 6)\)
   c. \((-\infty, \infty)\)
   d. \((-\infty, -6) \cup (6, \infty)\)
   e. \([-6, 6]\)

7. Find the domain of the function.

   \[ f(x) = \sqrt{x^2 + 17} \]
   
   a. \((-\infty, 17]\)
   b. \((-\infty, \infty)\)
   c. \((-17, 17]\)
   d. \([-17, \infty)\)
   e. \([-17, 17]\)
8. Find and simplify \( \frac{f(x+h)-f(x)}{h} \) for the function.

\( f(x) = x^2 - 5 \)

a. \( 2h - a \)
b. \( 2h + a \)
c. \( 2a - h \)
d. \( -2a + h \)
e. \( 2a + h \)

9. Find and simplify \( \frac{f(x+h)-f(x)}{h} \) for the function.

\( f(x) = \frac{1}{x} \)

a. \( \frac{a}{(a+h)} \)
b. \( -\frac{1}{a(a+h)} \)
c. \( \frac{1}{(a+h)} \)
d. \( \frac{1}{a(a-h)} \)
e. \( \frac{1}{a(a+h)} \)

10. Determine whether the given function is a polynomial function or rational function. State the degree, if it is a polynomial function.

\( f(x) = 2x^6 - 8x^2 + 5 \)

a. The given function is a polynomial function with degree 12
b. The given function is a polynomial function with degree 2
c. The given function is a polynomial function with degree 6
d. The given function is a rational function with degree 6
e. The given function is a rational function
11. Determine whether the given function is a polynomial function or rational function. State the degree, if it is a polynomial function.

\[ f(t) = 4t^4 + 5\sqrt{t} \]

a. The given function is neither a rational function nor a polynomial function.
b. The given function is a polynomial function with degree \( \frac{5}{2} \).
c. The given function is a rational function.
d. The given function is a polynomial function with degree 1.
e. The given function is a polynomial function with degree 2.

12. Economists define the disposable annual income for an individual by the equation \( D = (1 - r)T \), where \( T \) is the individual's total income and \( r \) is the net rate at which he or she is taxed. What is the disposable income for an individual whose income is $40,000 and whose net tax rate is 35%?

a. $14,000
b. $26,000
c. $66,000
d. $40,000
e. $92,000

13. The revenue (in dollars) realized by Apollo from the sale of its inkjet printers is given by

\[ R(x) = -0.4x^2 + 300x \]

where \( x \) denotes the number of units manufactured each month. What is Apollo's revenue when 500 units are produced?

a. $50,000
b. $49,500
c. $50,500
d. $500
e. $51,000
14. Experiments conducted by A. J. Clark suggest that the response \( R(x) \) of a frog's heart muscle to the injection of \( x \) units of acetylcholine (as a percent of the maximum possible effect of the drug) may be approximated by the rational function

\[
R(x) = \frac{200x}{b+x} \quad (x \geq 0)
\]

where \( b \) is a positive constant that depends on the particular frog. If a concentration of 20 units of acetylcholine produces a response of 40\% for a certain frog, find the "response function" for this frog.

a. \( R(x) = \frac{200x}{80+x} \)

b. \( R(x) = \frac{200x}{90-x} \)

c. \( R(x) = \frac{200x}{80-x} \)

d. \( R(x) = \frac{200x}{90+x} \)

e. \( R(x) = \frac{200x}{70+x} \)

15. Solve the equation for \( x \).

\[
2^{2x} - 12 \cdot 2^x + 32 = 0
\]

a. \( x = 2 \)

b. \( x = 2 \) or \( x = 3 \)

c. \( x = 4 \) or \( x = 8 \)

d. \( x = 8 \)

16. Solve the equation for \( x \).

\[
2^x - x^2 = \frac{1}{4^5}
\]

a. \( x = 0 \) or \( x = 6 \)

b. \( x = 0 \)

c. \( x = 0 \) or \( x = 3 \)

d. \( x = 3 \)

e. \( x = 6 \)
17. Write the expression as the logarithm of a single quantity.

\[
\frac{1}{2}\ln x + 2\ln y - 4\ln z
\]

a. \(\ln \sqrt[4]{x^2} \div z^4\)

b. \(\ln \sqrt{x^2} \div z^4\)

c. \(\ln \sqrt{x^2} \div z^3\)

d. \(\ln \sqrt[4]{x^2} \div z^3\)

e. \(\ln \sqrt{x^2} \div z^4\)

18. Use the laws of logarithms to simplify the expression.

\[\ln(x + 9)(x + 6)\]

a. \(-\ln x + \ln(x + 9) + \ln(x + 6)\)

b. \(\ln x + \ln(x + 9) + \ln(x + 6)\)

c. \(\ln9x + \ln(x + 9) - \ln(x + 6)\)

d. \(6\ln x - \ln(x + 9) + \ln(x + 6)\)

19. Use the laws of logarithms to simplify the expression.

\[\frac{x^3}{\sqrt{x(3 + x)^2}}\]

a. \(\frac{3}{2}\ln x - 2\ln(3 + x)\)

b. \(\frac{5}{2}\ln x - 3\ln(3 + x)\)

c. \(\frac{5}{2}\ln x - 2\ln(3 + x)\)

d. \(\frac{5}{2}\ln x + 2\ln(3 + x)\)

e. \(\frac{3}{2}\ln x - 3\ln(3 + x)\)
20. Use logarithms to solve the equation for $t$.

\[ e^{at} = b \]

a. \[ t = \frac{\ln b}{a} \]

b. \[ t = \frac{\ln b}{\ln a} \]

c. \[ t = \frac{e\ln a}{\ln b} \]

d. \[ t = \ln b - \ln a \]

e. \[ t = \ln b - e \ln a \]

21. Use logarithms to solve the equation for $t$. Round your answer to four decimal places.

\[ \frac{50}{2 + 4e^{0.4t}} = 20 \]

a. \[ t = -4.7828 \]

b. \[ t = -5.3132 \]

c. \[ t = -5.1986 \]

d. \[ t = 5.3262 \]

22. Use logarithms to solve the equation for $t$.

\[ A = Be^{-\frac{t}{2}} \]

a. \[ t = 2\ln\left(\frac{A}{B}\right) \]

b. \[ t = -2\ln\left(\frac{A}{B}\right) \]

c. \[ t = -\ln\left(\frac{A}{2B}\right) \]

d. \[ t = -2\ln\left(\frac{B}{A}\right) \]
23. Use logarithms to solve the equation for $t$. Round your answer to four decimal places.

$$2e^{-0.2t} - 11 = 7$$

a. −10.9861  

b. −12.1861  

c. −9.7861  

d. −10.386  

e. −11.5861

24. Find the effective rate corresponding to the given nominal rate. Round your answers to two decimal places.

15% / year compounded semiannually

$$\hat{r}_{\text{eff}} = \boxed{\_\_\_\%}$$

8% / year compounded quarterly

$$\hat{r}_{\text{eff}} = \boxed{\_\_\_\%}$$

a. 8.24%, 8.30%  

b. 8.30%, 8.33%  

c. 15.56%, 8.24%  

d. 8.24%, 8.33%

25. Find the effective rate corresponding to the given nominal rate. Round your answers to three decimal places.

3% / year compounded monthly

$$\hat{r}_{\text{eff}} = \boxed{\_\_\_\%}$$

3% / year compounded daily

$$\hat{r}_{\text{eff}} = \boxed{\_\_\_\%}$$

a. 3.045%, 3.034%  

b. 3.034%, 3.000%  

c. 3.045%, 3.000%  

d. 3.042%, 3.045%
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26. Use the graph of the given function $f$ to determine $\lim_{x \to a} f(x)$ at the indicated value of $a$, if it exists.

![Graph of function f(x)]

a. $\lim_{x \to -3} f(x) = 2$

b. $\lim_{x \to -3} f(x) = 5$

c. $\lim_{x \to -3} f(x) = -3$

d. The limit does not exist

27. Find the indicated limit, if it exists.

$$\lim_{x \to \infty} \frac{4x^4 - 3x^2 + 1}{2x^4 + x^3 + x^2 + x + 1}$$

a. $\infty$

b. $-\frac{3}{2}$

c. $-\infty$

d. 2

e. The limit does not exist.

28. Find the indicated limit, if it exists.

$$\lim_{x \to 5} \frac{7x + 6}{x - 5}$$

a. 7

b. -5

c. $\frac{-6}{5}$

d. 6

e. The limit does not exist.
29. Find the indicated limit.

\[ \lim_{x \to 4} \sqrt{7x^4 + x^2} \]

a. -4  
b. \( \sqrt{113} \)  
c. \(-4\sqrt{113}\)  
d. \(4\sqrt{113}\)  
e. \(-\sqrt{113}\)

30. Sketch the graph of the function \( f \) and evaluate \( \lim_{x \to a} f(x) \), if it exists, for the given value of \( a \).

\[ f(x) = \begin{cases} 
|x - 1| & \text{if } x \neq 1 \\
0 & \text{if } x = 1 \quad (a = 1) 
\end{cases} \]

a. \( \lim_{x \to 1} f(x) = 1 \)  
b. \( \lim_{x \to 1} f(x) = 0 \)  
c.  
d. 
31. Find the limit, if it exists.

\[ \lim_{x \to 1} f(x) = -1 \]
\[ \lim_{x \to 1} f(x) = 0 \]

\[ \lim_{s \to 0} (5s^2 - 9)(5s + 3) \]

a. - 23
b. - 25
c. - 27
d. - 21
e. The limit does not exist

32. Determine all values of x at which the function is discontinuous.

\[ f(x) = \frac{7}{x^2 - 25} \]

a. 4
b. -3
c. -5 and 5
d. -7 and 7
33. Determine all values of \( x \) at which the function is discontinuous.

\[
\frac{x^2 - 2x}{x^2 - 6x + 8}
\]

a. 4
b. 4 and 2
c. –4 and –2
d. 2

34. Find the slope of the tangent line to the graph of each function at the given point and determine an equation of the tangent line.

\( f(x) = 3x^2 \) at \((2, 12)\)

a. 16; \( y = 16x + 16 \)
b. 3; \( y = 3x - 12 \)
c. 4; \( y = 4x + 16 \)
d. 12; \( y = 12x - 12 \)

35. Find the slope of the tangent line to the graph of each function at the given point and determine an equation of the tangent line.

\( f(x) = \frac{1}{x} \) at \((-3, -\frac{1}{3})\)

a. \(-\frac{1}{3}; y = -\frac{1}{3}x - \frac{1}{3}\)
b. \(\frac{1}{9}; y = \frac{1}{9}x + \frac{2}{3}\)
c. \(-\frac{1}{9}; y = -\frac{1}{9}x - \frac{2}{3}\)
d. \(\frac{1}{3}; y = \frac{1}{3}x + \frac{1}{3}\)

36. Let \( f(x) = 5x^2 + 3 \)

Find the equation of the tangent line to the curve at the point \((1, 8)\).

a. \( y = 10x + 7 \)
b. \( y = 10x - 2 \)
c. \( y = 18x + 7 \)
d. \( y = 18x - 2 \)
37. Under a set of controlled laboratory conditions, the size of the population of a certain bacteria culture at time \( t \) (in minutes) is described by the function

\[ P = f(t) = 4t^2 + 3t + 1 \]

Find the rate of population growth at \( t = 20 \) min.

a. 144 bacteria per minute  
b. 151 bacteria per minute  
c. 163 bacteria per minute  
d. 165 bacteria per minute

38. In the following figure, \( f(t) \) gives the population \( P_1 \) of a certain bacteria culture at time \( t \) after a portion of bactericide A was introduced into the population at \( t = 0 \). The graph of \( g \) gives the population \( P_2 \) of a similar bacteria culture at time \( t \) after a portion of bactericide B was introduced into the population at \( t = 0 \).

Which population is decreasing faster at \( t_1 \) and at \( t_2 \)?

a. The populations are decreasing at the same rate at \( t_1 \), \( P_1 \) is decreasing faster at \( t_2 \)  
b. \( P_2 \) is decreasing faster at \( t_1 \), \( P_1 \) is decreasing faster at \( t_2 \)  
c. \( P_2 \) is decreasing faster at \( t_1 \), the populations are decreasing at the same rate at \( t_2 \)  
d. \( P_1 \) is decreasing faster at \( t_1 \), \( P_2 \) is decreasing faster at \( t_2 \)
39. Find the derivative of the function $f$ by using the rules of differentiation.

$$f(t) = \frac{5}{t^5} - \frac{4}{t^4} + \frac{1}{t}$$

a. $f'(t) = -\frac{5}{t^6} + \frac{4}{t^5} - \frac{1}{t^2}$
b. $f'(t) = \frac{25}{t^6} + \frac{16}{t^5} - \frac{1}{t^2}$
c. $f'(t) = \frac{25}{t^6} - \frac{16}{t^5} + \frac{1}{t}$
d. $f'(t) = \frac{25}{t^6} - \frac{16}{t^5} + \frac{1}{t}$
e. $f'(t) = -\frac{25}{t^5} + \frac{16}{t^4} - \frac{1}{t}$

40. Find the derivative of the function by using the rules of differentiation.

$$f(x) = x^5$$

a. $f''(x) = 4x^3$
b. $f''(x) = 5x^4$
c. $f''(x) = 9x^5$
d. $f''(x) = x^4$

41. Find the derivative of the function by using the rules of differentiation.

$$f(x) = \frac{8}{7}x^7 - \frac{6}{7}x^6 + x^2 - 5x + 1$$

a. $f'(x) = x^6 - \frac{1}{7}x^5 - 5$
b. $f'(x) = \frac{16}{7}x^6 + 2x + 1$
c. $f'(x) = \frac{16}{7}x^5 - \frac{1}{7}x^2 + 2x - 2$
d. $f'(x) = \frac{16}{7}x^5 - \frac{1}{7}x^2 + 2x - 5$
42. Find the derivative of the function by using the rules of differentiation.

\[ f(x) = \frac{x^3 - 6x^2 + 4}{x} \]

a. \( f'(x) = 2x + 6x - \frac{4}{x} \)
b. \( f'(x) = 2x + 6x + \frac{4}{x^2} \)
c. \( f'(x) = 2x + 6 + \frac{4}{x^2} \)
d. \( f'(x) = 2x - 6x - \frac{4}{x^2} \)
e. \( f'(x) = 2x - 6 - \frac{4}{x^2} \)

43. Find the derivative of the function.

\[ f(t) = (3+\sqrt{t})(4t^2-7) \]

a. \( f'(t) = \frac{(20t^3 + 24\sqrt{t} - 7)}{2\sqrt{t}} \)
b. \( f'(t) = \frac{(10t^2 - 24\sqrt{t} - 7)}{\sqrt{t}} \)
c. \( f'(t) = \frac{(20t^2 + 48\sqrt{t} - 7)}{2\sqrt{t}} \)
d. \( f'(t) = \frac{(10t^2 + 24\sqrt{t} - 7)}{\sqrt{t}} \)
e. \( f'(t) = \frac{(20t^2 - 48\sqrt{t} - 7)}{2\sqrt{t}} \)
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44. Find the derivative of the function.

\[ f(x) = \frac{x^3 - 4}{x^2 + 5} \]

a. \( f'(x) = \frac{x^4 - x^2 + 8x}{(x^2 + 5)^2} \)

b. \( f'(x) = \frac{x^4 - x^2 + 4x}{(x^2 + 5)^2} \)

c. \( f'(x) = \frac{x^4 + 15x^2 + 4x}{(x^2 + 5)^2} \)

d. \( f'(x) = \frac{x^4 + 15x^2 + 8x}{(x^2 + 5)^2} \)

e. \( f'(x) = \frac{x^4 + 15x^2 + 8x}{x^2 + 5} \)

45. Find the derivative of the function.

\[ f(x) = (5x^2 - 7) \left( x^2 - \frac{1}{x} \right) \]

a. \( f'(x) = 14x - \frac{7}{x^2} \)

b. \( f'(x) = - \frac{10x^2 - 14x - 5}{x^2 - \frac{1}{x}} \)

c. \( f'(x) = - \frac{(5x^2 - 7)^2}{x^2} \)

d. \( f'(x) = 20x^3 - 14x - 5 - \frac{7}{x^2} \)
46. Find the derivative of the function.

\[ f(x) = \frac{(x + 4)(x^2 + 4)}{x - 5} \]

a. \[ f'(x) = \frac{-11x^2 - 40x - 36}{x - 5} \]

b. \[ f'(x) = \frac{2x^3 - 11x^2 - 40x - 36}{(x - 5)^2} \]

c. \[ f'(x) = x - 5 \]

d. \[ f'(x) = -\frac{(x - 5)^2}{36} \]

47. Find the derivative of the function.

\[ f(x) = \frac{1}{6}x^6 + (x^2 + 7)(x^2 - x - 7) + 30 \]

a. \[ f'(x) = 3x^3 - 7x - 8 \]

b. \[ f'(x) = x^3 + 9x^2 + 9 \]

c. \[ f'(x) = x^5 + 4x^3 - 3x^2 - 7 \]

d. \[ f'(x) = 9x^5 + 3 \]

48. Find the derivative of the function.

\[ f(x) = \sqrt{6x^2 - 8x + 5} \]

a. \[ \frac{6x - 4}{\sqrt{6x^2 - 8x + 5}} \]

b. \[ \frac{1}{\sqrt{6x^2 - 8x + 5}} \]

c. \[ \frac{1}{2\sqrt{12x - 8}} \]

d. \[ \frac{12x - 8}{\sqrt{6x^2 - 8x + 5}} \]
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49. Find the derivative of the function.

\[ f(x) = 4x^2(9 - 5x)^4 \]

a. \((-8x)(9 - 5x)^3(3x - 9)\)
b. \((-12x^2)(9 - 5x)^2(5x - 9)\)
c. \((-24x)(9 - 5x)^3(5x - 3)\)
d. \(8x(9 - 5x)^3\)

50. Find the derivative of the function.

\[ f(x) = \left(\frac{x - 2}{x + 2}\right)^3 \]

a. \(\frac{3(x + 2)^2}{(x - 2)^4}\)
b. \(3\left(\frac{x - 2}{x + 2}\right)^2\)
c. \(-\frac{12(x - 2)^4}{(x + 2)^2}\)
d. \(\frac{12(x - 2)^2}{(x + 2)^4}\)
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51. Find the derivative of the function.

\[ g(t) = \frac{(4t - 3)^2}{(5t + 1)^4} \]

a. \[ \frac{8(4t - 3)}{(5t + 1)^8} \]

b. \[ \frac{38(4t - 3)}{(5t + 1)^5} \]

c. \[ -\frac{2(4t - 3)(3t - 7)}{(5t + 1)^5} \]

d. \[ -\frac{4(4t - 3)(10t - 17)}{(5t + 1)^5} \]

52. Find the derivative of the function.

\[ f(x) = x^4e^x \]

a. \[ f'(x) = x^3e^x(x + 4) \]

b. \[ f'(x) = 4x^3e^x \]

c. \[ f'(x) = x^3e^x(x + 4) \]

d. \[ f'(x) = x^3e^x(x + 1) \]

53. Find the derivative of the function.

\[ f(x) = (x - 1)e^{5x+3} \]

a. \[ f'(x) = e^{5x+3}(5x - 4) \]

b. \[ f'(x) = e^{5x+3}(5x + 4) \]

c. \[ f'(x) = 5e^{5x+3}(x - 1) \]

d. \[ f'(x) = e^{5x+3}(5x - 4)(5x + 3) \]
54. Find the derivative of the function.

\[ f(x) = e^{\sqrt{x}} \]

a. \[ f'(x) = \frac{e^{\sqrt{x}}}{4\sqrt{x}} \]

b. \[ f'(x) = \frac{e^{\sqrt{x}}}{2\sqrt{x}} \]

c. \[ f'(x) = \frac{e^{\sqrt{x}}}{\sqrt{x}} \]

d. \[ f'(x) = \frac{e^{\sqrt{x}}}{2\sqrt{x}} \]

e. \[ f'(x) = \frac{e^{\sqrt{x}}}{\sqrt{x}} \]

55. A women's clothing chain store, found that \( t \) days after the end of a sales promotion the volume of sales was given by \( S(t) = 15,000(1 + e^{-0.3t}) \), \( 0 \leq t \leq 5 \) dollars. Find to the nearest integer the rate of change of sales volume when \( t = 2 \).

a. The rate of change of sales volume is - $8,232 per day.

b. The rate of change of sales volume is - $2,474 per day.

c. The rate of change of sales volume is - $2,470 per day.

d. The rate of change of sales volume is - $1 per day.

56. The unit selling price \( p \) (in dollars) and the quantity demanded (in pairs) of a certain brand of women's gloves is given by the demand equation \( p = 140e^{-0.0001x} \), \( 0 \leq x \leq 20,000 \).

What is the marginal revenue to the nearest cent per day when \( x = 100 \)?

a. The marginal revenue when \( x = 100 \) is $139.99 per day.

b. The marginal revenue when \( x = 100 \) is $139.47 per day.

c. The marginal revenue when \( x = 100 \) is $0.98 per day.

d. The marginal revenue when \( x = 100 \) is $137.22 per day.
57. The monthly demand for a certain brand of table wine is given by the demand equation
   \[ p = 140 \left( 1 - \frac{4}{4 + e^{-0.0005x}} \right) \]
   where \( p \) denotes the wholesale price per case (in dollars) and \( x \) denotes the number of cases demanded. Find the rate of change of the price to the nearest hundredth of a cent per case when \( x = 1,000 \).

   a. The rate of change of the price is - 0.60 cents per case.
   b. The rate of change of the price is - 0.80 cents per case.
   c. The rate of change of the price is - 1.46 cents per case.
   d. The rate of change of the price is - 0.73 cents per case.

58. Find the derivative of the function.
   \[ f(x) = 1\ln(\sqrt{x} + 4) \]
   a. \( f'(x) = \frac{1}{x + 4\sqrt{x}} \)
   b. \( f'(x) = \frac{1}{2(x + 4\sqrt{x})} \)
   c. \( f'(x) = -\frac{1}{\sqrt{x} + 4} \)
   d. \( f'(x) = -\frac{1}{\sqrt{x} + 4} \)
   e. \( f'(x) = -\frac{1}{2(x + 4\sqrt{x})} \)

59. Find the derivative of the function.
   \[ f(x) = \ln(7x^2 - 8x + 2) \]
   a. \( f'(x) = \frac{16x^2 - 8}{7x^2 - 8x + 2} \)
   b. \( f'(x) = -\frac{1}{16x - 8} \)
   c. \( f'(x) = \frac{14x - 8}{7x^2 - 8x + 2} \)
   d. \( f'(x) = -\frac{1}{7x^2 - 8x + 2} \)
60. Find the derivative of the function.
\[ f(x) = \ln(x^5 - 5)^7 \]

a. \[ f'(x) = \frac{1}{(x^5 - 5)^7} \]
b. \[ f'(x) = \frac{35x^4}{x^5 - 5} \]
c. \[ f'(x) = 7(x^5 - 5)^6 \]
d. \[ f'(x) = \frac{5x^4}{x^5 - 5} \]

61. Find the derivative of the function.
\[ f(t) = e^{9t\ln(t + 3)} \]

a. \[ f'(t) = \frac{e^{9t}\left[3(t + 3) + \ln(t + 3)\right]}{t + 3} \]
b. \[ f'(t) = \frac{e^{9t}\left[9\ln(t + 3) + 3\right]}{t + 3} \]
c. \[ f'(t) = \frac{e^{9t}\left[9(t + 3)\ln(t + 3) + 1\right]}{t + 3} \]
d. \[ f'(t) = \frac{e^{9t}}{t + 3} \]
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62. Find the indefinite integral.

\[ \int (7 + x + 6x^6 + e^x) \, dx \]

a. \( 7x + x^2 + \frac{6}{7}x^7 + e^x + C \)
b. \( 7 + \frac{1}{2}x^2 + \frac{6}{7}x^7 + xe^x + C \)
c. \( 7x + \frac{1}{2}x^2 + \frac{7}{6}x^7 + e^x + C \)
d. \( 7x + \frac{1}{2}x^2 + \frac{6}{7}x^7 + e^x + C \)

63. Find the indefinite integral.

\[ \int \frac{x^6 - 2}{x^2} \, dx \]

*Hint*: \( \frac{x^6 - 2}{x^2} = x^4 - 2x^{-2} \)

a. \( \frac{1}{5}x^5 - \frac{2}{x} + C \)
b. \( \frac{1}{6}x^5 - \frac{2}{x} + C \)
c. \( \frac{1}{6}x^6 + \frac{2}{x} + C \)
d. \( \frac{1}{5}x^5 + \frac{2}{x} + C \)
64. You are given the graph of a function \( f \). Determine the intervals where \( f \) is increasing, constant, or decreasing.

![Graph of a function](image)

a. Decreasing on \((0, \infty)\) and increasing on \((-\infty,0)\)

b. Decreasing on \((-\infty, -6) \cup (6, \infty)\) and increasing on \((-6,6)\)

c. Decreasing on \((-\infty, 0)\) and increasing on \((0, \infty)\)

65. Find the interval(s) where the function is increasing and the interval(s) where it is decreasing.

\[ g(x) = x^3 + 9x^2 + 6 \]

a. Increasing on \((-\infty, \infty)\)

b. Increasing on \((-\infty,0)\), decreasing on \((0, \infty)\)

c. Increasing on \((-6,0)\), decreasing on \((-\infty, -6)\) and \((0, \infty)\)

d. Increasing on \((-\infty, -6)\) and \((0, \infty)\), decreasing on \((-6,0)\)
66. You are given the graph of a function $f$. Determine the intervals where $f$ is concave downward.

$$a. \ x \in (-\infty, 3) \cup (7, \infty)$$
$$b. \ x \in (3, 7)$$
$$c. \ x \in (-\infty, 4)$$
$$d. \ x \in (-\infty, 3) \cup (5, 7)$$

67. Determine where the function is concave upward.

$$f(x) = -5x^2 - 8x + 5$$

$$a. \ x \in (-\infty, 0)$$
$$b. \ x \in (-5, 5)$$
$$c. \ x \in \emptyset$$
$$d. \ x \in (-\infty, \infty)$$

68. Determine where the function is concave downward.

$$h(t) = \frac{t^2}{t + 2}$$

$$a. \ t \in (-\infty, -2)$$
$$b. \ t \in (-2, \infty)$$
$$c. \ t \in (-2, 2)$$
$$d. \ t \in (-\infty, -2) \cup (2, \infty)$$
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69. The quantity demanded each month of the Walter Serkin recording of Beethoven's Moonlight Sonata, manufactured by Phonola Record Industries, is related to the price/compact disc.

The equation \( p = -0.00032x + 6.2 \) \( (0 \leq x \leq 12,000) \), where \( p \) denotes the unit price in dollars and \( x \) is the number of discs demanded, relates the demand to the price.

The total monthly cost (in dollars) for pressing and packaging \( x \) copies of this classical recording is given by

\[
C(x) = 600 + 2x - 0.00002x^2 \quad (0 \leq x \leq 20,000).
\]

To maximize its profits, how many copies should Phonola produce each month? \textit{Hint}: The revenue is \( R(x) = px \), and the profit is \( P(x) = R(x) - C(x) \).

a. \( x = 7,000 \) copies
b. \( x = 7,300 \) copies
c. \( x = 7,100 \) copies
d. \( x = 6,900 \) copies
e. \( x = 7,200 \) copies

70. A manufacturer of tennis rackets finds that the total cost \( C(x) \) (in dollars) of manufacturing \( x \) rackets/day is given by

\[
C(x) = 400 + 8x + 0.0001x^2
\]

Each racket can be sold at a price of \( p \) dollars, where \( p \) is related to \( x \) by the demand equation \( p = 10 - 0.0004x \).

If all rackets that are manufactured can be sold, find the daily level of production that will yield a maximum profit for the manufacturer.

a. 0 rackets/day
b. –1,000 rackets/day
c. 1,000 rackets/day
d. 2,000 rackets/day
71. A division of Chapman Corporation manufactures a pager. The weekly fixed cost for the division is $20,000, and the variable cost for producing $x$ pagers/week is 

\[ V(x) = 0.000001x^3 - 0.06x^2 + 30x \] 
dollars.

The company realizes a revenue of 

\[ R(x) = -0.07x^2 + 190x \quad (0 \leq x \leq 7500) \] 
dollars from the sale of $x$ pagers/week.

Find the level of production that will yield a maximum profit for the manufacturer. (*Hint*: Use the quadratic formula.)

a. 2,983 pagers/week  
b. 3,333 pagers/week  
c. 3,383 pagers/week  
d. 3,209 pagers/week

72. Find the indefinite integral.

\[ \int 6x^{-6/7} \, dx \]

a. \( \frac{6}{7} \, x^{\frac{6}{7}} + C \) 
b. \( \frac{1}{35} \, x^{\frac{1}{6}} + C \) 
c. \( \frac{1}{35} \, x^{\frac{1}{7}} + C \) 
d. \( \frac{1}{42} \, x^{\frac{1}{7}} + C \)
73. Let the graph below represent $f(x)$. Find the values of $x$ on the graph of $f$ where the tangent line is horizontal.

a. $x = -2, 1, 3$

b. $x = -3.1, 0, 2.2, 3.6$

c. $x = -2$

d. $x = 1, 3$

e. $x = -3.1, 0$

74. The average speed of a vehicle on a stretch of a route between 6 A.M. and 10 A.M. on a typical weekday is approximated by the function

\[ f(t) = 40t - 80\sqrt{t} + 100 \quad (0 \leq t \leq 4), \]

where $f(t)$ is measured in miles per hour and $t$ is measured in hours, with $t = 0$ corresponding to 6 A.M.

At what time of the morning commute is the traffic moving at the slowest rate? What is the average speed of a vehicle at that time?

a. time = 7 A.M. ; average speed = 80 mph

b. time = 7 A.M. ; average speed = 60 mph

c. time = 7 A.M. ; average speed = 65 mph

d. time = 7 A.M. ; average speed = 50 mph
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Answer Key

1. c
2. c
3. b
4. e
5. d
6. a
7. b
8. e
9. b
10. c
11. a
12. b
13. a
14. a
15. b
16. c
17. a
18. b
19. c
20. a
21. c
22. b
23. a
24. c
25. d
26. b
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27. d
28. a
29. d
30. b
31. c
32. c
33. b
34. d
35. c
36. b
37. c
38. d
39. b
40. b
41. d
42. e
43. c
44. d
45. d
46. b
47. c
48. a
49. c
50. d
51. d
52. c
53. a
54. d
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55. c
56. d
57. b
58. b
59. c
60. b
61. c
62. d
63. d
64. c
65. d
66. b
67. c
68. a
69. a
70. d
71. b
72. d
73. a
74. b