

Chapter 2 Derivatives And Their Uses
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1. Complete the table and use it to predict the limit, if it exists.

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

$$\lim_{x \rightarrow -0.5} f(x) = ?$$

$x$	$f(x)$
-0.51	
-0.501	
-0.5001	
↓	↓
-0.5	?
↑	↑
-0.4999	
-0.499	
-0.49	

- A) -160.0  
 B) 80.0  
 C) -80.0  
 D) -0.5  
 E) does not exist

Ans: C

2. Use properties of limits and algebraic methods to find the limit, if it exists.

$$\lim_{x \rightarrow 3} (8x^3 - 13x^2 + 3x + 13)$$

- A) -121  
 B) 121  
 C) 141  
 D) -141  
 E) does not exist

Ans: B

3. Find  $\lim_{x \rightarrow 5} \frac{x^2 - x}{2x - 5}$  without using a graphing calculator or making tables.

- A) 2  
 B) -5  
 C) 0  
 D) 4  
 E)  $\infty$

Ans: D

4. Use properties of limits and algebraic methods to find the limit, if it exists.

$$\lim_{x \rightarrow 1/4} \frac{-7 - 8x}{144x^2 + 5}$$

- A)  $\frac{9}{14}$   
 B)  $\frac{1}{14}$   
 C)  $-\frac{1}{14}$   
 D)  $-\frac{9}{14}$   
 E) does not exist

Ans: D

5. Use properties of limits and algebraic methods to find the limit, if it exists.

$$\lim_{x \rightarrow -5} \frac{x^2 + 9x + 14}{x^2 + 2x}$$

- A)  $\frac{2}{5}$   
 B)  $-\frac{2}{5}$   
 C)  $-\frac{5}{2}$   
 D)  $\frac{5}{2}$   
 E) does not exist

Ans: B

6. Use properties of limits and algebraic methods to find the limit, if it exists.

$$\lim_{x \rightarrow 13} \frac{x^2 - 4x - 32}{x^2 - 9x + 8}$$

- A)  $-\frac{17}{12}$   
 B)  $\frac{17}{12}$   
 C)  $\frac{12}{17}$   
 D)  $-\frac{12}{17}$   
 E) does not exist

Ans: B

7. Use properties of limits and algebraic methods to find the limit, if it exists.

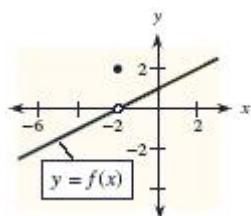
$$\lim_{h \rightarrow 0} \frac{9(x+h)^2 - 9x^2}{h}$$

- A) 0  
 B)  $2x$   
 C)  $9x$   
 D)  $18x$   
 E) does not exist

Ans: D

8. A graph of  $y = f(x)$  is shown and a  $c$ -value is given. For this problem, use the graph to find  $\lim_{x \rightarrow c} f(x)$ .

$$c = -2$$



- A) 0  
 B) 2  
 C) -6  
 D) -4  
 E) does not exist

Ans: A

9. Use properties of limits and algebraic methods to find the limit, if it exists.

$$\lim_{x \rightarrow 3} f(x), \text{ where } f(x) = \begin{cases} 16 - 7x & \text{for } x < 3 \\ x^2 - 5x & \text{for } x \geq 3 \end{cases}$$

- A) 5  
 B) 6  
 C) -6  
 D) -5  
 E) does not exist

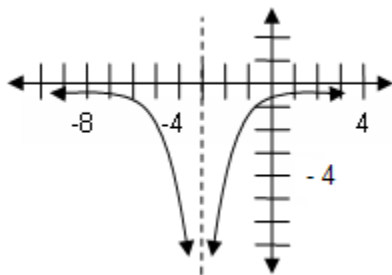
Ans: E

10. Find  $\lim_{x \rightarrow -6^+} f(x)$  for  $f(x) = \frac{|x+6|}{x+6}$ .

- A) 6  
 B) -1  
 C) 0  
 D) 1  
 E) -6

Ans: D

11. Find  $\lim_{x \rightarrow -3^+} f(x)$  for the graph of  $f(x)$  given below.



- A)  $-\infty$   
 B) 0  
 C) -3  
 D) inf  
 E) 3  
 Ans: A

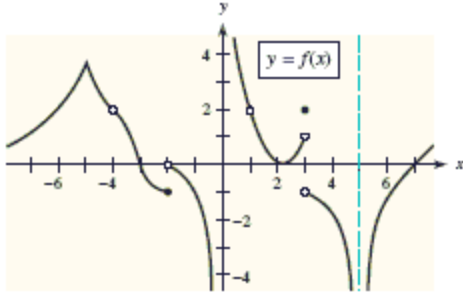
12. Find  $\lim_{x \rightarrow -1^-} \frac{1}{x+1}$ .

- A) 1  
 B) 0  
 C)  $-\infty$   
 D) -1  
 E)  $\infty$   
 Ans: C

13. Find  $\lim_{x \rightarrow 6^+} \frac{-1}{(x-6)^2}$ .

- A) 6  
 B)  $\infty$   
 C) 0  
 D) -6  
 E)  $-\infty$   
 Ans: E

14. For the given  $x$ -value, use the figure to determine whether the function is continuous or discontinuous at that  $x$ -value.



$$x = 5$$

- A) discontinuous  
B) continuous

Ans: A

15. Determine whether the function is continuous or discontinuous at the given  $x$ -value.

$$f(x) = \begin{cases} x^2 + 5 & \text{if } x \leq -4 \\ 9x^2 - 123 & \text{if } x > -4 \end{cases} \quad x = -4$$

- A) discontinuous  
B) continuous

Ans: B

16. Determine whether the given function is continuous. If it is not, identify where it is discontinuous.

$$y = 3x^2 - 4x + 7$$

- A) discontinuous at  $x = 5$   
B) discontinuous at  $x = 0$   
C) discontinuous at  $x = -5$   
D) discontinuous at  $x = 10$   
E) continuous everywhere

Ans: E

17. Determine whether the function is continuous or discontinuous at the given  $x$ -value.

$$y = \frac{x^2 - 5}{x + 4}, \quad x = -7$$

- A) continuous  
B) discontinuous

Ans: A

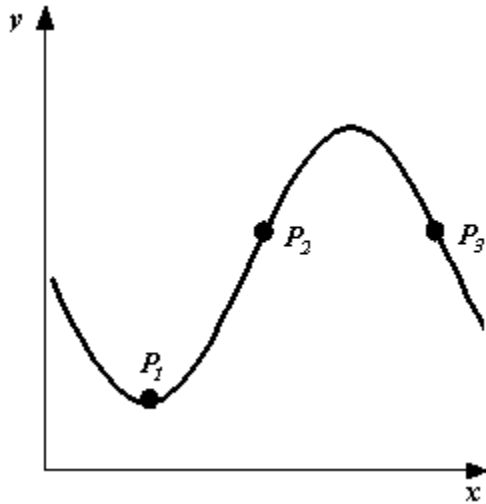
18. Determine whether the given function is continuous. If it is not, identify where it is discontinuous. You can verify your conclusions by graphing the function with a graphing utility, if one is available.

$$y = \frac{8x^2 + 3x + 7}{x + 1/2}$$

- A) discontinuous at  $x = 1/2$
- B) discontinuous at  $x = -1$
- C) discontinuous at  $x = 1$
- D) discontinuous at  $x = -1/2$
- E) continuous everywhere

Ans: D

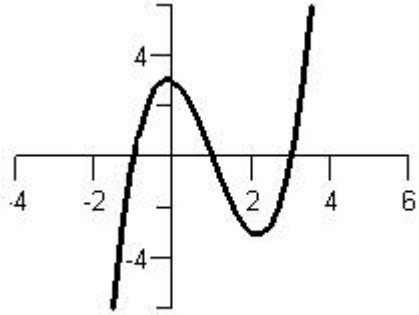
19. By imagining tangent lines at points  $P_1$ ,  $P_2$ , and  $P_3$ , state whether the slopes are positive, zero, or negative at these points.



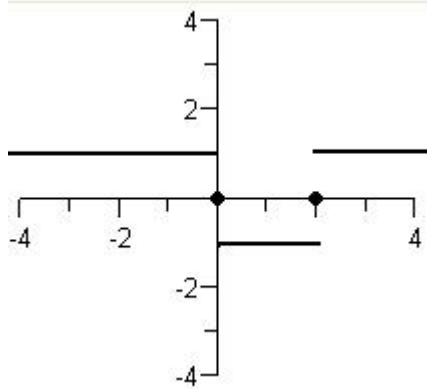
- A) At  $P_1$ : positive slope  
 At  $P_2$ : negative slope  
 At  $P_3$ : positive slope
- B) At  $P_1$ : zero slope  
 At  $P_2$ : negative slope  
 At  $P_3$ : positive slope
- C) At  $P_1$ : zero slope  
 At  $P_2$ : positive slope  
 At  $P_3$ : negative slope
- D) At  $P_1$ : positive slope  
 At  $P_2$ : positive slope  
 At  $P_3$ : positive slope
- E) At  $P_1$ : positive slope  
 At  $P_2$ : negative slope  
 At  $P_3$ : negative slope

Ans: C

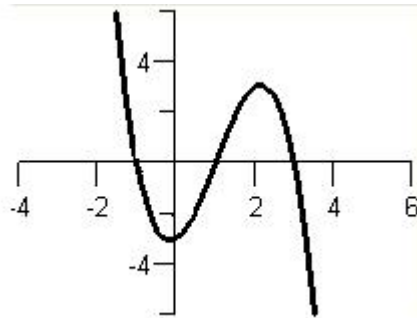
20. Which graph represents  $f'(x)$  if the graph of  $f(x)$  is displayed below?



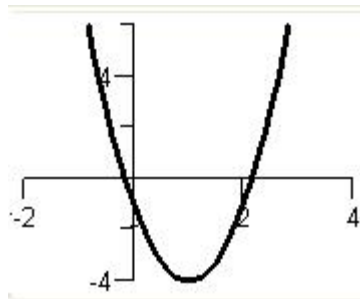
A)



B)

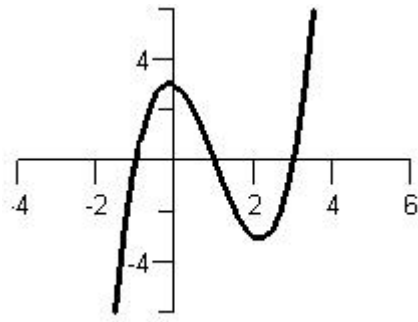


C)

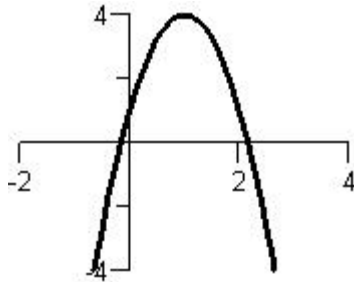


D)





E)



Ans: C

21. For the given function, find the average rate of change over the specified interval.

$$f(x) = 5 - 5x - 4x^2 \text{ over } (-2, 4)$$

- A) 0  
 B) -19  
 C) 19  
 D) 13  
 E) -13

Ans: E

22. Find the average rate of change of  $f(x) = 8x + 7$  between  $x = 3$  and  $x = 8$ .

- A) 8  
 B) 7  
 C) 3  
 D) 11  
 E) 5

Ans: A

23. Find the instantaneous rate of change of the function  $f(x) = 6x^2 + 5x$  at  $x = 2$ .

- A) 30  
 B) 26  
 C) 41  
 D) 42  
 E) 29

Ans: E

24. For the function in this problem, find the instantaneous rate of change of the function at the given value.

$$f(x) = 9x^2 - 5x + 5; x = 4$$

- A) 0
- B) 41
- C) 31
- D) 67
- E) 77

Ans: D

25. For the function in this problem, find the slope of the tangent line at the given value.

$$f(x) = 5x^2 - 9x + 9; x = 1$$

- A) 1
- B) 14
- C) -4
- D) 0
- E) 19

Ans: A

26. Find the slope of the tangent at  $x = -1$ .

$$f(x) = 6x^2 + 2x$$

- A) -14
- B) -4
- C) -10
- D) 4
- E) 0

Ans: C

27. For the function in this problem, find the derivative, by using the definition.

$$f(x) = 5x^2 - 3x + 9$$

- A)  $5x^2 - 3x + 9$
- B)  $5x^2 - 3x$
- C)  $10x$
- D)  $5x - 3$
- E)  $10x - 3$

Ans: E

28. Find the slope of the tangent to the graph of  $f(x)$  at any point.

$$f(x) = 9x^2 + 6x$$

- A)  $18x + 6$
- B)  $18x - 6$
- C)  $9x + 6$
- D)  $9x^2 + 6x$
- E)  $3x$

Ans: A

29. Find  $f'(x)$  of  $f(x) = -7x + 8$  by using the definition of the derivative.

- A)  $f'(x) = 8$
- B)  $f'(x) = -7$
- C)  $f'(x) = 7x$
- D)  $f'(x) = 7$
- E)  $f'(x) = -7x$

Ans: B

30. Write the equation of the line tangent to the graph of  $f(x)$  at  $x = -1$ .

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

- A)  $y = -2x - 2$
- B)  $y = -2x + 2$
- C)  $y = -2x$
- D)  $y = -2x - 5$
- E)  $y = -2x + 5$

Ans: D

31. The population of a town is  $f(x) = 3x^2 - 15x + 200$  people after  $x$  weeks (for  $0 \leq x \leq 20$ ). Find  $f'(x)$  to find the instantaneous rate of change of the population after 8 weeks.

- A) 48
- B) 64
- C) 33
- D) 31
- E) 49

Ans: C

32. An automobile dealership finds that the number of cars that it sells on day  $x$  of an advertising campaign is  $S(x) = -x^2 + 18x$  (for  $0 \leq x \leq 7$ ). Find  $S'(x)$  to find the instantaneous rate of change on day  $x = 2$ .

- A) 14
- B) 18
- C) 16
- D) 22
- E) 21

Ans: A

33. Differentiate the given function.

$$y = \frac{9x^6}{6}$$

- A)  $6x^5$
- B)  $9x^6$
- C)  $9x^7$
- D)  $54x^5$
- E)  $9x^5$

Ans: E

34. Find the derivative of  $g(w) = 20\sqrt[4]{w}$ .

- A)  $g'(w) = \frac{5}{\sqrt[4]{w^3}}$
- B)  $g'(w) = \frac{20}{\sqrt[4]{w^3}}$
- C)  $g'(w) = \frac{4}{\sqrt[4]{w^3}}$
- D)  $g'(w) = 5\sqrt[4]{w^3}$
- E)  $g'(w) = 20\sqrt[4]{w^3}$

Ans: A

35. Find the derivative of the function.

$$y = 5x^{-1} - 9x^{-2} + 13$$

- A)  $-5x^{-2} - 18x^{-3}$
- B)  $-5x^{-2} + 18x^{-3}$
- C)  $-5 - 18x^{-1}$
- D)  $-5x^{-2} - 9x^{-3}$
- E)  $-5x^{-1} + 9x^{-2}$

Ans: B

36. For the function given, find  $f'(x)$ .

$$f(x) = x^4 - 13x - 8$$

- A)  $x^3 - 13$
- B)  $4x^3 - 8$
- C)  $4x^3 - 13$
- D)  $4x^4 - 13x$
- E)  $x^4 - 13x - 8$

Ans: C

37. Find the derivative of the function.

$$f(x) = 9x^{-8/3} - 9x^{-10/3}$$

- A)  $-24x^{-11/3} - 30x^{-13/3}$   
 B)  $-24x^{-5/3} + 30x^{-7/3}$   
 C)  $-24x^{-11/3} + 30x^{-13/3}$   
 D)  $-24x^{-5/3} - 30x^{-7/3}$   
 E)  $-72x^{-11/3} - 90x^{-13/3}$

Ans: C

38. Find the derivative of  $f(x) = \frac{8}{\sqrt[4]{x}}$ .

- A)  $f'(x) = -\frac{2}{\sqrt[4]{x^3}}$   
 B)  $f'(x) = -\frac{2}{\sqrt[4]{x^5}}$   
 C)  $f'(x) = \frac{4}{\sqrt[4]{x^3}}$   
 D)  $f'(x) = -\frac{4}{\sqrt[4]{x^5}}$   
 E)  $f'(x) = \frac{2}{\sqrt[4]{x^5}}$

Ans: B

39. Find the derivative of the function.

$$y = 7x^4 - 2x^2 + 6x - 7$$

- A)  $28x^4 - 4x^2 + 6x - 7$   
 B)  $28x^3 - 4x + 6$   
 C)  $7x^3 - 2x + 6$   
 D)  $28x^3 - 4x$   
 E)  $7x^4 - 2x^2 + 6x - 7$

Ans: B

40. Find the derivative of the function.

$$h(x) = 11x^{21} + 19x^{11} - 7x^8 + 14x - 6$$

- A)  $220x^{20} + 190x^{10} - 49x^7 + 14$   
 B)  $231x^{21} + 209x^{11} - 56x^8 + 14x$   
 C)  $11x^{20} + 19x^{10} - 7x^7 + 14$   
 D)  $231x^{20} + 209x^{10} - 56x^7 + 14$   
 E)  $220x^{21} + 190x^{11} - 49x^8 + 14x$

Ans: D

41. Find the derivative of  $h(x) = 3\sqrt[3]{x^2} - \frac{6}{\sqrt[3]{x}}$ .

A)  $h'(x) = \frac{1}{\sqrt[3]{x}} - \frac{1}{\sqrt[3]{x^4}}$

B)  $h'(x) = \frac{2}{\sqrt[2]{x}} + \frac{2}{\sqrt[2]{x^3}}$

C)  $h'(x) = \frac{2}{\sqrt[3]{x}} + \frac{2}{\sqrt[3]{x^4}}$

D)  $h'(x) = \frac{1}{\sqrt[2]{x}} - \frac{1}{\sqrt[2]{x^3}}$

E)  $h'(x) = \frac{2}{\sqrt[2]{x}} - \frac{2}{\sqrt[2]{x^3}}$

Ans: C

42. At the indicated point, find the instantaneous rate of change of the function.

$$R(x) = 17x + 2x^2, \quad x = 3$$

A) 29

B) 52

C) 19

D) 21

E) 23

Ans: A

43. If  $f(x) = 60\sqrt[4]{x^3} - \frac{972}{\sqrt[4]{x}}$ , find  $f'(81)$ .

A)  $f'(81) = 14$

B)  $f'(81) = 15$

C)  $f'(81) = 21$

D)  $f'(81) = 16$

E)  $f'(81) = 26$

Ans: D

44. Find the derivative at the given  $x$ -value with the appropriate rule.

$$y = 8 - 24\sqrt{x} \quad \text{at } x = 9$$

A) -8

B) -64

C) 8

D) -4

E) 0

Ans: D

45. If  $f(x) = x^5$ , find  $\left. \frac{df}{dx} \right|_{x=-2}$ .

A)  $\left. \frac{df}{dx} \right|_{x=-2} = -32$

B)  $\left. \frac{df}{dx} \right|_{x=-2} = -192$

C)  $\left. \frac{df}{dx} \right|_{x=-2} = 320$

D)  $\left. \frac{df}{dx} \right|_{x=-2} = -128$

E)  $\left. \frac{df}{dx} \right|_{x=-2} = 80$

Ans: E

46. If  $f(x) = \frac{250}{\sqrt{x}} + 30\sqrt{x}$ , find  $\left. \frac{df}{dx} \right|_{x=25}$ .

A)  $\left. \frac{df}{dx} \right|_{x=25} = 2$

B)  $\left. \frac{df}{dx} \right|_{x=25} = -2$

C)  $\left. \frac{df}{dx} \right|_{x=25} = 10$

D)  $\left. \frac{df}{dx} \right|_{x=25} = -10$

E)  $\left. \frac{df}{dx} \right|_{x=25} = 4$

Ans: A

47. Suppose the Marginal Cost Businesses can buy multiple licenses for *PowerZip* data compression software at a total cost of approximately  $C(x) = 24x^{2/3}$  dollars for  $x$  licenses. Find the derivative of this cost function at  $x = 64$ .

A)  $C'(64) = 8$

B)  $C'(64) = 4$

C)  $C'(64) = 2$

D)  $C'(64) = 12$

E)  $C'(64) = 6$

Ans: B

48. Suppose the number of people newly infected on day  $t$  of a flu epidemic is  $f(t) = 13t^2 - t^3$  (for  $0 \leq t \leq 13$ ). Find the instantaneous rate of change of this number on day 10.

A)  $f'(10) = 300$

B)  $f'(10) = -27$

C)  $f'(10) = -40$

D)  $f'(10) = 230$

E)  $f'(10) = 60$

Ans: C

49. Find the derivative of  $f(x) = 6\sqrt[3]{x}(8x+1)$  by using the Product Rule. Simplify your answer.

A)  $f'(x) = \frac{1}{\sqrt[3]{x^2}} + 32\sqrt[3]{x}$

B)  $f'(x) = \frac{6}{\sqrt[3]{x^2}} + 32\sqrt[3]{x}$

C)  $f'(x) = \frac{6}{\sqrt[3]{x^2}} + 64\sqrt[3]{x}$

D)  $f'(x) = \frac{2}{\sqrt[3]{x^2}} + 64\sqrt[3]{x}$

E)  $f'(x) = \frac{2}{\sqrt[3]{x^2}} + 32\sqrt[3]{x}$

Ans: D

50. Find  $\frac{ds}{dt}$  if  $s = (t^6 + 8)(t^3 - 8)$ .

A)  $6t^8 - 6t^5 + 24t^2$

B)  $9t^8 + 48t^5 + 3t^2$

C)  $6t^8 + 48t^5 + 24t^2$

D)  $9t^8 - 6t^5 + 3t^2$

E)  $9t^8 - 48t^5 + 24t^2$

Ans: E



51. Find the derivative, but do not simplify your answer.

$$y = (7x^7 - 3x^3 - 9x)(3x^5 - 8x^8 + 9x^9 - 6)$$

- A)  $(7x^7 - 3x^3 - 9x)(15x^4 - 64x^7 + 81x^8) + (49x^6 - 9x^2 - 9)(3x^5 - 8x^8 + 9x^9 - 6)$   
 B)  $(15x^4 - 64x^7 + 81x^8) + (49x^6 - 9x^2 - 9)$   
 C)  $(49x^6 - 9x^2 - 9)(15x^4 - 64x^7 + 81x^8)$   
 D)  $(49x^6 - 9x^2 - 9)(3x^5 - 8x^8 + 9x^9 - 6) - (7x^7 - 3x^3 - 9x)(15x^4 - 64x^7 + 81x^8)$   
 E)  $(7x^7 - 3x^3 - 9x)(15x^4 - 64x^7 + 81x^8) - (49x^6 - 9x^2 - 9)(3x^5 - 8x^8 + 9x^9 - 6)$

Ans: A

52. Find the derivative of  $f(z) = (z^{28} + z^{14} + 1)(z^{15} - z)$  by using the Product Rule.

Simplify your answer.

- A)  $f'(z) = 43z^{42} - z$   
 B)  $f'(z) = 42z^{43} + 29z^{30} - z^2$   
 C)  $f'(z) = 42z^{43} - z^2$   
 D)  $f'(z) = 43z^{42} + 30z^{29} - 1$   
 E)  $f'(z) = 43z^{42} - 1$

Ans: E

53. Find the derivative of  $\frac{1}{x^6}$ .

- A)  $\frac{1}{6x^5}$   
 B)  $\frac{-6}{x^7}$   
 C)  $\frac{-1}{6x}$   
 D)  $\frac{-6}{x^5}$   
 E)  $\frac{1}{6x^7}$

Ans: B

54. Find the indicated derivative and simplify.

$$C'(x) \text{ for } C(x) = \frac{7x^3}{2x^4 + 7}$$

A)  $-\frac{14x^2(2x^4 + 21)}{(2x^4 + 7)^2}$

B)  $\frac{x^2(2x^4 - 21)}{(2x^4 + 7)^2}$

C)  $-\frac{x^2(2x^4 + 21)}{(2x^4 + 7)^2}$

D)  $-\frac{7x^2(2x^4 - 21)}{(2x^4 + 7)^2}$

E)  $\frac{7x^2(2x^4 + 21)}{(2x^4 + 7)^2}$

Ans: D

55. Find the derivative of  $f(x) = \frac{x+5}{4x^2+5}$  by using Quotient Rule. Simplify your answer.

A)  $f'(x) = \frac{12x^2 + 40x + 5}{(4x^2 + 5)^3}$

B)  $f'(x) = -\frac{4x^2 + 40x - 5}{(4x^2 + 5)^3}$

C)  $f'(x) = \frac{4x^2 + 40x - 5}{(4x^2 + 5)^2}$

D)  $f'(x) = -\frac{4x^2 + 40x - 5}{(4x^2 + 5)^2}$

E)  $f'(x) = -\frac{12x^2 + 40x + 5}{(4x^2 + 5)^2}$

Ans: D

56. Find the indicated derivative and simplify.

$$\frac{dy}{dx} \text{ for } y = \frac{1-6x^2}{x^4-4x^2+2}$$

A) 
$$\frac{2x(3x^4+x^2-4)}{(x^4-4x^2+2)^2}$$

B) 
$$\frac{2x(3x^3-x-4)}{(x^4-4x^2+2)^2}$$

C) 
$$\frac{4x(3x^4-x^2-4)}{(x^4-4x^2+2)^2}$$

D) 
$$\frac{4x(3x^3+x-4)}{(x^4-4x^2+2)^2}$$

E) 
$$\frac{4x(3x^4+x^2-4)}{(x^4-4x^2+2)^2}$$

Ans: C

57. Find the derivative of  $f(x) = (x^6 + 3) \frac{x^2 + 2}{x + 2}$ .

A) 
$$f'(x) = 6x^5 \frac{x^2 + 2}{x + 2} + (x^6 + 3) \frac{3x^2 + 4x + 2}{(x + 2)^2}$$

B) 
$$f'(x) = 7x^6 \frac{x^2 + 2}{x + 2} + (x^6 + 3)$$

C) 
$$f'(x) = 6x^5 \frac{x^2 + 2}{x + 2} + (x^6 + 3) \frac{x^2 + 4x - 2}{(x + 2)^2}$$

D) 
$$f'(x) = 6x^5 \frac{x^2 + 2}{x + 2} + (x^6 + 3)$$

E) 
$$f'(x) = 7x^6 \frac{x^2 + 2}{x + 2} + (x^6 + 3) \frac{x^2 + 4x - 2}{(x + 2)^2}$$

Ans: C

58. Find the indicated derivative and simplify.

$$f'(x) \text{ for } f(x) = \frac{(x+4)(x-7)}{x^2+6}$$

A)  $\frac{11x^2 - 62x - 18}{(x^2 + 6)^2}$

B)  $\frac{3x^2 - 34x - 18}{(x^2 + 6)^2}$

C)  $\frac{3x^2 + 68x - 18}{(x^2 + 6)^2}$

D)  $\frac{11x^2 - 34x - 18}{(x^2 + 6)^2}$

E)  $\frac{11x^2 - 68x - 18}{(x^2 + 6)^2}$

Ans: C

59. Find the derivative of  $\frac{\sqrt{x+1}}{\sqrt{x-1}}$ .

A) 1

B)  $\frac{1}{4x}$

C)  $\frac{-1}{(x-1)\sqrt{x^2-1}}$

D)  $-x$

E)  $\frac{-1}{\sqrt{x}(\sqrt{x}-1)^2}$

Ans: E

60. If the cost  $C$  (in dollars) of removing  $p$  percent of the particulate pollution from the exhaust gases at an industrial site is given by

$$C(p) = \frac{2000p}{130 - p},$$

find the rate of change of  $C$  with respect to  $p$ .

- A)  $\frac{4000000}{(130 - p)^2}$   
 B)  $\frac{260000}{(130 - p)^2}$   
 C)  $\frac{16900}{(130 - p)^2}$   
 D)  $\frac{2000}{(130 - p)}$   
 E)  $\frac{130}{(130 - p)}$

Ans: B

61. The number of bottles of whiskey that a store will sell in a month at a price of  $p$  dollars per bottle is  $N(p) = \frac{2250}{p + 2}$ . Find the rate of change of this quantity when the price is

\$9.

- A) -18.60  
 B) 204.55  
 C) -18.75  
 D) 18.50  
 E) -9.30

Ans: A

62. After  $x$  months, monthly sales of a compact disc are predicted to be  $S(x) = x^2(125 - x^3)$  thousand. Find the rate of change of the sales after 2 months in thousands per month.

- A) -48  
 B) 452  
 C) 420  
 D) 476  
 E) 468

Ans: C

63. Find  $f'(x)$  and  $f''(x)$ .

$$f(x) = 6 + 5x - 5x^3$$

A)  $f'(x) = 5 - 15x^2, f''(x) = -30x$

B)  $f'(x) = 30x, f''(x) = 30$

C)  $f'(x) = 15x^2, f''(x) = 30x$

D)  $f'(x) = 5 - 15x^2, f''(x) = 30$

E)  $f'(x) = -10, f''(x) = 0$

Ans: A

64. Find the third derivative.

$$y = 7x^3 - 5x^2 + 7x$$

A) 42

B)  $42x$

C) 21

D)  $21x$

E) 0

Ans: A

65. Find the indicated derivative.

Find  $y^{(4)}$  if  $y = x^8 - 8x^3$ .

A)  $336x^5$

B)  $336x^4$

C)  $336x^4 - 48x$

D)  $1680x^5 - 48x$

E)  $1680x^4$

Ans: E

66. Find  $f''(x)$  for the function  $\sqrt{x^{11}}$ .

A)  $\frac{99}{4}x^{\frac{7}{2}}$

B)  $\frac{99}{8}x^{\frac{7}{2}}$

C)  $\frac{11}{2}x^{\frac{9}{2}}$

D)  $\frac{99}{16}x^{\frac{7}{2}}$

E)  $\frac{11}{4}x^{\frac{9}{2}}$

Ans: A

67. Find  $f'''(x)$  for the function  $\sqrt{x^{21}}$ .

A)  $\frac{399}{4}x^{\frac{15}{2}}$

B)  $\frac{6783}{8}x^{\frac{15}{2}}$

C)  $\frac{399}{4}x^{\frac{17}{2}}$

D)  $\frac{6783}{16}x^{\frac{15}{2}}$

E)  $\frac{399}{8}x^{\frac{17}{2}}$

Ans: B

68. Find  $f^{(4)}(x)$  for the function  $\sqrt{x^{13}}$ .

A)  $\frac{9009}{4}x^{\frac{9}{2}}$

B)  $\frac{9009}{8}x^{\frac{5}{2}}$

C)  $\frac{143}{8}x^{\frac{7}{2}}$

D)  $\frac{9009}{16}x^{\frac{5}{2}}$

E)  $\frac{143}{16}x^{\frac{7}{2}}$

Ans: D

69. Find the second derivative.

$$h(x) = x^6 - \frac{1}{x^6}$$

A)  $42x^4 - \frac{30}{x^8}$

B)  $42x^4 + \frac{42}{x^8}$

C)  $30x^4 - \frac{42}{x^8}$

D)  $42x^4 - \frac{30}{x^4}$

E)  $30x^4 + \frac{42}{x^4}$

Ans: C

70. Find  $f''(5)$  for the function  $\frac{1}{4x^3}$ .

- A)  $\frac{1}{625}$
- B)  $\frac{1}{500}$
- C)  $\frac{3}{3125}$
- D)  $\frac{9}{500}$
- E)  $\frac{1}{4}$

Ans: C

71. Find the third derivative.

$$y = \frac{2}{x^3}$$

- A)  $\frac{-120}{x^5}$
- B)  $\frac{120}{x^6}$
- C) 0
- D)  $\frac{40}{x^5}$
- E)  $\frac{-120}{x^6}$

Ans: E

72. Find the second derivative of the function  $(x^2 - 3)(x^2 + 7)$ .

- A)  $4x^3 + 8x - 21$
- B)  $4x^3 - 8x$
- C)  $12x^2 + 20$
- D)  $12x^2 + 8$
- E)  $4x^3 + 20x + 21$

Ans: D

73. Evaluate the expression  $\left. \frac{d^3}{dx^3} x^7 \right|_{x=-1}$ .

- A) 7
- B) 42
- C) -42
- D) -210
- E) 210

Ans: E



74. Find the second derivative of the function  $\frac{2x-7}{2x+7}$ .

A)  $-\frac{56}{(2x+7)^3}$

B)  $\frac{112}{(2x+7)^3}$

C)  $-\frac{112}{(2x+7)^3}$

D)  $-\frac{28}{(2x+7)^2}$

E)  $\frac{28}{(2x+7)^2}$

Ans: C

75. If the formula describing the distance  $s$  (in feet) an object travels as a function of time  $t$  (in seconds) is  $s = 60 + 90t - 17t^2$ . What is the acceleration of the object when  $t = 5$ ?

A)  $0 \text{ ft/sec}^2$

B)  $-34 \text{ ft/sec}^2$

C)  $-80 \text{ ft/sec}^2$

D)  $34 \text{ ft/sec}^2$

E)  $80 \text{ ft/sec}^2$

Ans: B

76. After  $t$  hours, a car is a distance  $s(t) = 60t + \frac{300}{t+4}$  miles from its starting point. Find the velocity after 6 hours.

A) 51 miles/hour

B) 66 miles/hour

C) 54 miles/hour

D) 57 miles/hour

E) 63 miles/hour

Ans: D

77. If  $f(g(x)) = \sqrt{x^2 - 3x + 2}$  and  $f(x) = \sqrt{x}$ , find  $g(x)$ .

A)  $x$

B)  $x - 3$

C)  $\sqrt{x^2 - 3x + 2}$

D)  $x^2 - 3x + 2$

E)  $x - \sqrt{3x} + \sqrt{2}$

Ans: D

78. If  $f(g(x)) = \frac{1}{8x^2 + 6x}$  and  $g(x) = 8x^2 + 6x$ , find  $f(x)$ .

- A)  $\frac{1}{x}$   
 B)  $\frac{1}{8x+6}$   
 C)  $\frac{1}{8x^2+6x}$   
 D)  $\frac{1}{8x^2} + \frac{1}{6x}$   
 E)  $8x^2 + 6x$

Ans: A

79. If  $f(g(x)) = \left(\frac{x+4}{x-4}\right)^2$  and  $f(x) = x^2$ , find  $g(x)$ .

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

Ans: E

80. Find  $f'(x)$  for the given function.

$$f(x) = 3 - (x^2 - 1)^2$$

- A)  $-4x(x^2 - 1)$   
 B)  $2x(x^2 - 1)$   
 C)  $-x(x^2 - 1)$   
 D)  $x(x^2 - 1)$   
 E)  $-2x(x^2 - 1)$

Ans: A

81. Differentiate the given function.

$$y = \frac{(5x)^4}{4}$$

- A)  $5(5x)^4$
- B)  $5(4x)^3$
- C)  $5(5x)^3$
- D)  $(5x)^3$
- E)  $(20x)^3$

Ans: C

82. Find the derivative of the given function. Simplify and express the answer using positive exponents only.

$$y = \frac{9}{2}(4x^4 - 5x^2 + 2)^6$$

- A)  $27(4x^4 - 5x^2 + 2)^5(8x^2 - 5)$
- B)  $108x(4x^4 - 5x^2 + 2)^5(16x^2 - 5)$
- C)  $54x(4x^4 - 5x^2 + 2)^5(8x^2 - 5)$
- D)  $27x(4x^4 - 5x^2 + 2)^5(16x^2 - 5)$
- E)  $108x(4x^4 - 5x^2 + 2)^5(8x^2 - 5)$

Ans: C

83. Differentiate the given function.

$$k(x) = \frac{2}{7}(5x^7 - x + 6)^{14}$$

- A)  $28(5x^7 - x + 6)^{13}(35x^6 - x)$
- B)  $4(5x^7 - x + 6)^{13}(35x^6 - 1)$
- C)  $4(35x^6 - 1)^{13}$
- D)  $4(5x^7 - x - 6)^{15}(7x^6 - 1)$
- E)  $2(5x^7 - x + 12)^{13}(35x^7 - 1)$

Ans: B

84. Differentiate the given function.

$$y = \sqrt{7x^5 + 3x}$$

- A)  $\frac{1}{2}(35x^4 + 3)^{-1/2}$   
 B)  $\frac{1}{2}(7x^5 + 3x)^{-1/2}$   
 C)  $\frac{1}{2}(35x^5 + 3x)^{-1/2}(7x^5 + 3)$   
 D)  $\frac{1}{2}(7x^5 + 3x)^{-1/2}(35x^4 + 3)$   
 E)  $-\frac{1}{2}(7x^5 + 3x)^{-3/2}(35x^4 + 3)$

Ans: D

85. Differentiate the given function.

$$p(q) = (q^3 + 7)^{-4}$$

- A)  $-\frac{12q^2}{(q^3 + 7)^6}$   
 B)  $-\frac{3q^2}{(q^3 + 7)^5}$   
 C)  $-\frac{12q^2}{(q^3 + 7)^5}$   
 D)  $-\frac{3q^2}{(q^3 + 7)^3}$   
 E)  $-\frac{4q^3}{(q^3 + 7)^5}$

Ans: C

86. Differentiate the given function.

$$y = \frac{(7x+1)^6 - 7x}{17}$$

- A)  $\frac{7}{17} [6(7x+1)^5 - 1]$   
 B)  $\frac{1}{17} [6(7x+1)^5 - 7]$   
 C)  $\frac{7}{17} [(7x+1)^6 - 7]$   
 D)  $\frac{7}{17} [6(x+1)^5 - 7]$   
 E)  $\frac{1}{17} [42(7x+1)^5 - 1]$

Ans: A

87. Differentiate the given function.

$$y = \frac{1}{(6x^8 + 3x + 1)^{7/2}}$$

- A)  $-\frac{7}{2} (6x^8 + 3x + 1)^{-\frac{9}{2}}$   
 B)  $-\frac{7}{2} (48x^7 + 3)^{-\frac{5}{2}} (6x^8 + 3x + 1)$   
 C)  $-\frac{7}{2} (6x^8 + 3x + 1)^{-\frac{5}{2}} (48x^7 + 3)$   
 D)  $-\frac{9}{2} (6x^8 + 3x + 1)^{-\frac{5}{2}} (6x^8 + 3x + 1)$   
 E)  $-\frac{7}{2} (6x^8 + 3x + 1)^{-\frac{9}{2}} (48x^7 + 3)$

Ans: E

88. Find the derivative of the given function. Simplify and express the answer using positive exponents only.

$$y = (4 - x^2)(8x^2 + 7x)^4$$

- A)  $-x^3 (8x + 7)^3 (40x^3 - 21x^2 + 128x - 56)$   
 B)  $-x^3 (8x + 7)^3 (40x^3 + 21x^2 - 128x + 56)$   
 C)  $-x^3 (8x + 7)^3 (40x^3 - 21x^2 - 128x - 56)$   
 D)  $-2x^3 (8x + 7)^3 (40x^3 - 21x^2 - 128x + 56)$   
 E)  $-2x^3 (8x + 7)^3 (40x^3 + 21x^2 - 128x - 56)$

Ans: E

89. Use the Generalized Power Rule to find the derivative of the function  $x^4\sqrt{x^4-1}$ .

A)  $\frac{2x^3(3x^4-1)}{\sqrt{x^4-1}}$

B)  $\frac{2x^4(-3x^4+2)}{\sqrt{x^4-1}}$

C)  $\frac{2x^4(3x^4-2)}{\sqrt{x^4-1}}$

D)  $\frac{2x^3(-3x^4+2)}{\sqrt{x^4-1}}$

E)  $\frac{2x^3(3x^4-2)}{\sqrt{x^4-1}}$

Ans: E

90. Differentiate the given function.

$$y = \frac{7}{(6x)^6}$$

A)  $\frac{252}{(6x)^7}$

B)  $-\frac{42}{(6x)^7}$

C)  $-\frac{252}{(6x)^7}$

D)  $\frac{42}{(6x)^7}$

E)  $-\frac{42}{(6x)^5}$

Ans: C

91. Differentiate the given function.

$$y = \frac{3}{4x^4}$$

A)  $-\frac{12}{x^5}$

B)  $-\frac{3}{x^4}$

C)  $-\frac{12}{x^4}$

D)  $-\frac{3}{x^5}$

E)  $-\frac{4}{x^5}$

Ans: D

92. A company's cost function is  $C(x) = \sqrt{2x^2 + 800}$  dollars, where  $x$  is the number of units. Find the marginal cost function and evaluate it for  $x = 30$ . Round your answer to two decimal places.

A) 1.18 dollars

B) 2.35 dollars

C) 50.99 dollars

D) 17.65 dollars

E) 66.33 dollars

Ans: A

93. If \$1800 is deposited in a bank paying  $r\%$  interest compounded annually, 5 years later its value will be  $V(r) = 1800(1 + 0.01r)^5$  dollars. Find  $V'(8)$ . Round your answer to nearest cent.

A) 122.44 dollars

B) 132.24 dollars

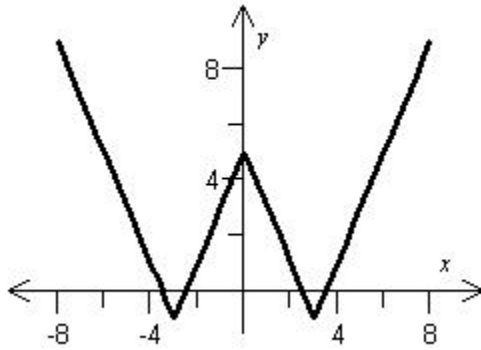
C) 24.49 dollars

D) 26.45 dollars

E) 142.82 dollars

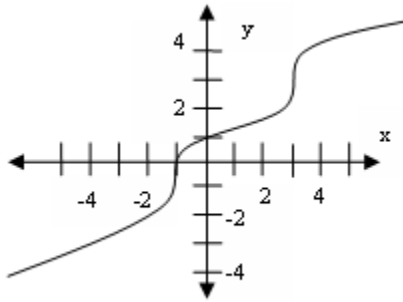
Ans: A

94. For the function displayed in the graph below, find all x-values at which the derivative does not exist.



- A) 3  
 B)  $-3, 0, 3$   
 C) 4  
 D)  $-1, 5$   
 E) none  
 Ans: B

95. For the function displayed in the graph below, find all x-values at which the derivative does not exist.



- A) 2  
 B)  $0, 3$   
 C) none  
 D)  $-1$   
 E)  $-1, 3$   
 Ans: E

96. For the function  $f(x) = (x+2)^{2/9}$ , find the x-value at which the derivative does not exist.

- A)  $-2$   
 B)  $2$   
 C)  $0$   
 D)  $-\frac{7}{9}$   
 E) none  
 Ans: A



97. Use the numerical derivative function on a graphing calculator to calculate the derivative of the function  $f(x) = \frac{1}{x^2}$  at  $x = 0$ . Is the calculator correct?

- A)  $-2$ ; No, the calculator is not correct.
- B)  $0$ ; Yes, the calculator is correct.
- C)  $\frac{1}{2}$ ; No, the calculator is not correct.
- D)  $0$ ; No, the calculator is not correct.
- E)  $-2$ ; Yes, the calculator is correct.

Ans: D

98. If a function is continuous at a point, then it is also not defined at that same point?

- A) True
- B) False

Ans: B