

Differentiability ... Practice Set 2

Differentiate these. The given answers are not simplified.

1. $f(x) = 4x^5 - 5x^4$

2. $f(x) = e^x \sin x$

3. $f(x) = (x^4 + 3x)^{-1}$

4. $f(x) = 3x^2(x^3 + 1)^7$

5. $f(x) = \cos^4 x - 2x^2$

6. $f(x) = \frac{x}{1 + x^2}$

7. $f(x) = \frac{x^2 - 1}{x}$

8. $f(x) = (3x^2)(x^{\frac{1}{2}})$

9. $f(x) = \ln(xe^{7x})$

10. $f(x) = \frac{2x^4 + 3x^2 - 1}{x^2}$

11. $f(x) = (x^3)\sqrt[5]{2 - x}$

12. $f(x) = 2x - \frac{4}{\sqrt{x}}$

Differentiability ... Practice Set 2

Answers

1. $f'(x) = 20x^4 - 20x^3$

3. $f'(x) = -1(x^4 + 3x)^{-2}(4x^3 + 3)$

5. $f'(x) = 4(\cos x)^3(-\sin x) - 4x$

7. $f'(x) = 1 + x^{-2}$ (*Simplify f first.*)

9. $f'(x) = \frac{1}{x} + 7$ (*Simplify f first.*)

11. $f'(x) = x^3 \cdot \frac{1}{5}(2-x)^{-\frac{4}{5}}(-1) + (2-x)^{\frac{1}{5}}(3x^2)$

2. $f'(x) = e^x \cos x + (\sin x)e^x$

4. $f'(x) = 3x^2 \cdot 7(x^3 + 1)^6(3x^2) + (x^3 + 1)^7 \cdot 6x$

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

8. $f'(x) = 3 \cdot \frac{5}{2} x^{\frac{3}{2}}$ (*Simplify f first.*)

10. $f'(x) = 4x + 0 + 2x^{-3}$ (*Simplify f first.*)

12. $f'(x) = 2 + 2x^{-\frac{3}{2}}$

Differentiability ... Practice Set 2

Differentiate these. The given answers are not simplified.

$$13. f(x) = \frac{4(3x-1)^2}{x^2+7^x}$$

$$14. f(x) = \sqrt{x^2+8}$$

$$15. f(x) = \frac{x}{\sqrt{1-(\ln x)^2}}$$

$$16. f(x) = \frac{6}{(3x^2-\pi)^4}$$

$$17. f(x) = \frac{(3x^2-\pi x)^4}{6}$$

$$18. f(x) = \frac{x}{(x^2+\sqrt{3x})^5}$$

$$19. f(x) = (xe^x)^\pi$$

$$20. f(x) = [\arctan(2x)]^{10}$$

$$21. f(x) = (e^{2x}+e)^{\frac{1}{2}}$$

$$22. f(x) = (x^6+1)^5(4x+7)^3$$

$$23. f(x) = (7x+\sqrt{x^2+3})^6$$

$$24. f(x) = \frac{\frac{1}{x} + \frac{1}{x^2}}{x-1}$$

Differentiability ... Practice Set 2

Answers

$$\begin{aligned} 13. f'(x) &= \frac{(x^2 + 7^x)[4 \cdot 2(3x - 1)(3)] - 4(3x - 1)^2(2x + 7^x \ln 7)}{(x^2 + 7^x)^2} & 14. f'(x) &= \frac{1}{2}(x^2 + 8)^{-\frac{1}{2}}(2x) \\ 15. f'(x) &= \frac{(1 - (\ln x)^2)^{\frac{1}{2}}(1) - x \cdot \frac{1}{2}(1 - (\ln x)^2)^{-\frac{1}{2}}(-2(\ln x) \cdot \frac{1}{x})}{1 - (\ln x)^2} & 16. f'(x) &= -24(3x^2 - \pi)^{-5}(6x) \\ 17. f'(x) &= \frac{1}{6}[4(3x^2 - \pi x)^3(6x - \pi)] & 18. f'(x) &= \frac{(x^2 + \sqrt{3x})^5(1) - x[5(x^2 + \sqrt{3x})^4(2x + \frac{1}{2}(3x)^{-\frac{1}{2}} \cdot 3)]}{(x^2 + \sqrt{3x})^{10}} \\ 19. f'(x) &= \pi(xe^x)^{(\pi-1)}[xe^x + e^x] & 20. f'(x) &= 10[\arctan(2x)]^9 \cdot \frac{1}{1 + (2x)^2} \cdot 2 \\ 21. f'(x) &= \frac{1}{2}(e^{2x} + e)^{-\frac{1}{2}}(e^{2x} \cdot 2 + 0) & 22. f'(x) &= (x^6 + 1)^5[3(4x + 7)^2(4)] + (4x + 7)^3[5(x^6 + 1)^4(6x^5)] \\ 23. f'(x) &= 6(7x + \sqrt{x^2 + 3})^5(7 + \frac{1}{2}(x^2 + 3)^{-\frac{1}{2}} \cdot 2x) & 24. f'(x) &= \frac{(x - 1)(-x^{-2} - 2x^{-3}) - (x^{-1} + x^{-2})(1)}{(x - 1)^2} \end{aligned}$$

Differentiability ... Practice Set 2

Differentiate these. The given answers are not simplified.

$$25. f(x) = \sqrt[3]{x^2} - \frac{1}{\sqrt{x^3}}$$

$$26. f(x) = \sqrt{\frac{2x+5}{7x-9}}$$

$$27. f(x) = \frac{\sin x}{\cos x}$$

$$28. f(x) = e^x(x^2 + 3)(x^3 + 4)$$

$$29. f(x) = \frac{5x^2 - 7x}{x^2 + 2}$$

$$30. f(x) = [\ln(5x^2 + 9)]^3$$

$$31. f(x) = \ln(5x^2 + 9)^3$$

$$32. f(x) = \cot(6x)$$

$$33. f(x) = \sec^2 x \cdot \tan x$$

$$34. f(x) = \arcsin(2^x)$$

$$35. f(x) = \tan(\cos x)$$

$$36. f(x) = [(x^2 - 1)^5 - x]^3$$

Differentiability ... Practice Set 2

Answers

$$25. f'(x) = \frac{2}{3}x^{-\frac{4}{3}} + \frac{3}{2}x^{-\frac{5}{2}}$$

$$26. f'(x) = \frac{1}{2} \left(\frac{2x+5}{7x-9} \right)^{-\frac{1}{2}} \left[\frac{(7x-9)(2) - (2x+5)(7)}{(7x-9)^2} \right]$$

$$27. f'(x) = \sec^2 x$$

$$28. f'(x) = [e^x(x^2+3)](3x^2) + (x^3+4)[e^x(2x) + (x^2+3)e^x]$$

$$29. f'(x) = \frac{(x^2+2)(10x-7) - (5x^2-7x)(2x)}{(x^2+2)^2}$$

$$30. f'(x) = 3[\ln(5x^2+9)]^2 \cdot \frac{1}{5x^2+9}(10x+0)$$

$$31. f'(x) = \frac{1}{(5x^2+9)^3} \cdot [3(5x^2+9)^2(10x+0)]$$

$$32. f'(x) = -\csc^2(6x) \cdot 6$$

$$33. f'(x) = \sec^2 x(\sec^2 x) + \tan x[2 \cdot \sec x(\sec x \tan x)]$$

$$34. f'(x) = \frac{1}{\sqrt{1-(2^x)^2}} \cdot 2^x \ln 2$$

$$35. f'(x) = (\sec^2(\cos x))(-\sin x)$$

$$36. f'(x) = 3[(x^2-1)^5 - x]^2 (5(x^2-1)^4 \cdot 2x - 1)$$

Differentiability ... Practice Set 2

Differentiate these. The given answers are not simplified.

37. $f(x) = \sec x \cdot \sin(3x)$

38. $f(x) = \frac{(x-1)^3}{x(x+3)^4}$

39. $f(x) = \log_5(3x^2 + 4x)$

In problems 40 – 42, find $\frac{dy}{dx}$. Assume y is a differentiable function of x .

40. $3y = xe^{5y}$

41. $xy + y^2 + x^3 = 7$

42. $\frac{\sin y}{y^2 + 1} = 3x$

If f and g are differentiable functions such that $f(2) = 3$, $f'(2) = -1$, $f'(3) = 7$, $g(2) = -5$ and $g'(2) = 2$, find the numbers indicated in problems 43 – 48.

43. $(g - f)'(2)$

44. $(fg)'(2)$

45. $\left(\frac{f}{g}\right)'(2)$

46. $(5f + 3g)'(2)$

47. $(f \circ f)'(2)$

48. $\left(\frac{f}{f+g}\right)'(2)$

Differentiability ... Practice Set 2

Answers

$$37. f'(x) = \sec x (\cos(3x) \cdot 3) + \sin(3x) (\sec x \tan x)$$

$$38. f'(x) = \frac{x(x+3)^4 [3(x-1)^2(1)] - (x-1)^3 [x \cdot 4(x+3)^3(1) + (x+3)^4(1)]}{x^2(x+3)^8}$$

$$39. f'(x) = \frac{1}{(3x^2 + 4x) \cdot \ln 5} \cdot (6x + 4)$$

$$40. \frac{dy}{dx} = \frac{e^{5y}}{3 - 5xe^{5y}}$$

$$41. \frac{dy}{dx} = \frac{-3x^2 - y}{x + 2y}$$

$$42. \frac{dy}{dx} = \frac{3(y^2 + 1)^2}{(y^2 + 1)(\cos y) - 2y \sin y}$$

$$43. 3$$

$$44. 11$$

$$45. \frac{-1}{25}$$

$$46. 1$$

$$47. -7$$

$$48. \frac{-1}{4}$$

Differentiability ... Practice Set 2

Differentiate these. The given answers are not simplified.

- | | | |
|---|---|--|
| 1. $f(x) = 4x^5 - 5x^4$ | 2. $f(x) = e^x \sin x$ | 3. $f(x) = (x^4 + 3x)^{-1}$ |
| 4. $f(x) = 3x^2(x^3 + 1)^7$ | 5. $f(x) = \cos^4 x - 2x^2$ | 6. $f(x) = \frac{x}{1 + x^2}$ |
| 7. $f(x) = \frac{x^2 - 1}{x}$ | 8. $f(x) = (3x^2)(x^{\frac{1}{2}})$ | 9. $f(x) = \ln(xe^{7x})$ |
| 10. $f(x) = \frac{2x^4 + 3x^2 - 1}{x^2}$ | 11. $f(x) = (x^3)\sqrt[5]{2 - x}$ | 12. $f(x) = 2x - \frac{4}{\sqrt{x}}$ |
| 13. $f(x) = \frac{4(3x - 1)^2}{x^2 + 7^x}$ | 14. $f(x) = \sqrt{x^2 + 8}$ | 15. $f(x) = \frac{x}{\sqrt{1 - (\ln x)^2}}$ |
| 16. $f(x) = \frac{6}{(3x^2 - \pi)^4}$ | 17. $f(x) = \frac{(3x^2 - \pi x)^4}{6}$ | 18. $f(x) = \frac{x}{(x^2 + \sqrt{3x})^5}$ |
| 19. $f(x) = (xe^x)^\pi$ | 20. $f(x) = [\arctan(2x)]^{10}$ | 21. $f(x) = (e^{2x} + e)^{\frac{1}{2}}$ |
| 22. $f(x) = (x^6 + 1)^5(4x + 7)^3$ | 23. $f(x) = (7x + \sqrt{x^2 + 3})^6$ | 24. $f(x) = \frac{\frac{1}{x} + \frac{1}{x^2}}{x - 1}$ |
| 25. $f(x) = \sqrt[3]{x^2} - \frac{1}{\sqrt{x^3}}$ | 26. $f(x) = \sqrt{\frac{2x + 5}{7x - 9}}$ | 27. $f(x) = \frac{\sin x}{\cos x}$ |
| 28. $f(x) = e^x(x^2 + 3)(x^3 + 4)$ | 29. $f(x) = \frac{5x^2 - 7x}{x^2 + 2}$ | 30. $f(x) = [\ln(5x^2 + 9)]^3$ |
| 31. $f(x) = \ln(5x^2 + 9)^3$ | 32. $f(x) = \cot(6x)$ | 33. $f(x) = \sec^2 x \cdot \tan x$ |
| 34. $f(x) = \arcsin(2^x)$ | 35. $f(x) = \tan(\cos x)$ | 36. $f(x) = [(x^2 - 1)^5 - x]^3$ |
| 37. $f(x) = \sec x \cdot \sin(3x)$ | 38. $f(x) = \frac{(x - 1)^3}{x(x + 3)^4}$ | 39. $f(x) = \log_5(3x^2 + 4x)$ |

In problems 40 – 42, find $\frac{dy}{dx}$. Assume y is a differentiable function of x .

- | | | |
|--------------------|--------------------------|-----------------------------------|
| 40. $3y = xe^{5y}$ | 41. $xy + y^2 + x^3 = 7$ | 42. $\frac{\sin y}{y^2 + 1} = 3x$ |
|--------------------|--------------------------|-----------------------------------|

If f and g are differentiable functions such that $f(2) = 3$, $f'(2) = -1$, $f'(3) = 7$, $g(2) = -5$ and $g'(2) = 2$, find the numbers indicated in problems 43 – 48.

- | | | |
|---------------------|-----------------------|--|
| 43. $(g - f)'(2)$ | 44. $(fg)'(2)$ | 45. $\left(\frac{f}{g}\right)'(2)$ |
| 46. $(5f + 3g)'(2)$ | 47. $(f \circ f)'(2)$ | 48. $\left(\frac{f}{f + g}\right)'(2)$ |

Differentiability ... Practice Set 2

Power, Product, and Quotient Rules Worksheet

Find the derivative of each function.

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

2. $g(x) = -4x^4 + 5x^3 - 2x + 3$

3. $f(x) = 2\sqrt{x} + 7\sqrt{x^3} - \frac{2}{x^2}$

4. $g(x) = 8\sqrt{x^5} - 7x^4 + \frac{5}{\sqrt{x}}$

5. $f(x) = \frac{x^2 + 7x - 18}{x + 9}$

6. $f(x) = \frac{x^2 - 5x - 24}{x - 8}$

7. $f(x) = \frac{x^{-3} + 7\sqrt{x^3} - 4x^2}{2\sqrt{x}}$

8. $h(x) = \frac{\frac{2}{x^3} + 5x^2 - 8\sqrt{x^7}}{-3\sqrt{x}}$

9. $s(x) = 2x^{-3} \sec(x)$

10. $f(x) = 3x^4 e^x$

11. $f(x) = -7x^3 e^x$

12. $f(x) = 5x^2 \cos(x)$

13. $h(x) = 2e^x \sqrt{x}$

14. $f(x) = 4x^4 - 5x^3 + 2x^2 e^x$

15. $f(x) = \frac{\tan(x)}{2x^2 + 1}$

16. $g(x) = \frac{\sin(x)}{e^x + 5}$

17. $f(x) = \frac{x^2 - 3x + 2}{x + 3}$

18. $f(x) = \frac{2e^x}{x - 2e^x}$

19. $h(x) = \frac{2x^4 \cot(x)}{3x^2}$

20. $f(x) = \frac{\csc(x)}{-4xe^x}$

Differentiability ... Practice Set 2

Chain Rule Worksheet

Find the derivative of each function.

1. $f(x) = (2x^2 - 5x)^3$

2. $f(x) = \sqrt{5x^3 - 2x}$

3. $y = 3 \sin(x - 3)$

4. $y = -2 \cos(x^2 + 2)$

5. $g(x) = \sin^2(3x^2)$

6. $h(x) = \sec^3(x^2 - 5)$

7. $f(x) = 3x^3 e^{2x-5}$

8. $g(x) = -5x^2 e^{x^2+3x}$

9. $y = 3x^2 \sqrt{4x^2 - 5x + 1}$

10. $h(t) = \frac{2}{3} t^3 \sqrt{3t^3 - 5t}$

11. $y = \frac{1}{\sqrt[3]{x^3 - 4x^2 + 1}}$

12. $g(t) = \frac{-3}{\sqrt[4]{2t^3 + 5t - 3}}$

13. $g(m) = \sin(\cos(m))$

14. $f(x) = \cos(\tan x)$

15. $h(x) = \sqrt{x^3 + 2}(x^2 - 1)^4$

16. $h(m) = \sqrt{m^2 + 1}(m^2 + 1)^3$

17. $f(t) = \sqrt[3]{\frac{t^2 + 2}{t^2 - 2}}$

18. $f(t) = \sqrt[4]{\frac{t^3 + 8}{t^3 - 8}}$

19. $h(x) = (2x + 5)^7 (3x^4 - 8)^5$

20. $g(n) = (3n^2 - 2)(4n^3 + 1)$

21. $f(t) = \csc^2(t^3)$

22. $f(t) = \cot^4(2t^2)$

23. $h(x) = e^{\sqrt{2x^3 - x^2}}$

24. $f(x) = e^{\sqrt{4x^2 - 3x}}$

25. $h(x) = \frac{3x}{\sqrt[3]{5 + 2x^2}}$

26. $f(s) = \frac{2s^3}{\sqrt[4]{s^2 - 5s}}$

27. $f(x) = 5^{\sin x^3}$

28. $f(x) = 2^{e^{4x}}$

Differentiability ... Practice Set 2