Differentiation Rules ... Set 1

Differentiate these for fun, or practice, whichever you need. 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. $f(x) = \dfrac{x}{1 + x^2}$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Differentiation Rules ... Set 1

<p style="text-align:center; color:red;">Answers</p>

<p style="text-align:center;">Absolutely not simplified ... you should simplify more.</p>

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

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

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

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

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

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

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

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

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

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

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

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

13. $f'(x) = \dfrac{(x^2 + 7^x)\left[4 \cdot 2(3x - 1)(3)\right] - 4(3x - 1)^2(2x + 7^x \ln 7)}{(x^2 + 7^x)^2}$

14. $f'(x) = \dfrac{1}{2}(x^2 + 8)^{\frac{-1}{2}}(2x)$

15. $f'(x) = \dfrac{\left(1 - (\ln x)^2\right)^{\frac{1}{2}}(1) - x \cdot \frac{1}{2}\left(1 - (\ln x)^2\right)^{\frac{-1}{2}}\left(-2(\ln x) \cdot \frac{1}{x}\right)}{1 - (\ln x)^2}$

16. $f'(x) = -24(3x^2 - \pi)^{-5}(6x)$

17. $f'(x) = \dfrac{1}{6}\left[4(3x^2 - \pi x)^3(6x - \pi)\right]$

18. $f'(x) = \dfrac{(x^2 + \sqrt{3x})^5(1) - x\left[5(x^2 + \sqrt{3x})^4\left(2x + \frac{1}{2}(3x)^{\frac{-1}{2}} \cdot 3\right)\right]}{(x^2 + \sqrt{3x})^{10}}$

19. $f'(x) = \pi(xe^x)^{(\pi - 1)}\left[xe^x + e^x\right]$

20. $f'(x) = 10\left[\arctan(2x)\right]^9 \cdot \dfrac{1}{1 + (2x)^2} \cdot 2$

21. $f'(x) = \dfrac{1}{2}(e^{2x} + e)^{\frac{-1}{2}}(e^{2x} \cdot 2 + 0)$

22. $f'(x) = (x^6 + 1)^5\left[3(4x + 7)^2(4)\right] + (4x + 7)^3\left[5(x^6 + 1)^4(6x^5)\right]$

23. $f'(x) = 6(7x + \sqrt{x^2 + 3})^5\left(7 + \dfrac{1}{2}(x^2 + 3)^{\frac{-1}{2}} \cdot 2x\right)$

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

Differentiation Rules … Set 1

Differentiate these for fun, or practice, whichever you need. The given answers are not simplified.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Differentiation Rules … Set 1

Answers

Absolutely not simplified … you should simplify more.

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

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

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

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

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

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

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

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

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

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

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

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

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

Differentiation Rules … Set 1

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

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

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

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

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

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

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

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

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

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

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

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

Differentiation Rules ... Set 1

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

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

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

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

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

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

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

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

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

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

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