Practice Differentiation Problems (solutions at end)

1. $f(x) = 3x^{\frac{5}{3}}; f'(x) =$

2. $f(x) = (2x + 3)(3x^3 - 2x^2 + x - 6); f'(x) =$

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

4. $f(x) = sin^2(x); f'(x) =$

5. $f(x) = 2e^{-2x}; f'(x) =$

6. $f(x) = ln(x + 1); f'(x) =$

7. $f(x) = sin\, 2\, x - cos\, 2\, x; f'(x) =$

8. $f(x) = tan\, 2\, x - cot\, 2\, x; f'(x) =$

9. $f(x) = sec\, 2\, x - csc\, 2\, x; f'(x) =$

10. $f(x) = \frac{x + sin\, x}{cos\, x - x}; f'(x) =$

11. $f(x) = sin^2(x^2 - x); f'(x) =$

12. $f(x) = xe^{-x^2}; f'(x) =$

13. $f(x) = x^{\frac{1}{2}} \tan x\, ; f'(x) =$

14. $f(x) = x\, ln(x^2 + 1); f'(x) =$

15. $f(x) = \frac{sin\, 2x - cos\, 2x}{x}; f'(x) =$

16. $f(x) = ln\left(\frac{x + sin\, x}{cos\, x - x}\right); f'(x) =$

17. $f(x) = x\, csc\, x\, ; f'(x) =$

18. $f(x) = x\sqrt{x^2 - 2x}; f'(x) =$

Practice Differentiation Problems - Solutions

1. $f(x) = 3x^{\frac{5}{3}}$; $f'(x) = \frac{5}{3} \cdot \left(3x^{\frac{5}{3}-1}\right) = 5x^{\frac{2}{3}}$ (power rule)

2. $f(x) = (2x+3)(3x^3 - 2x^2 + x - 6); f'(x) = 2(3x^3 - 2x^2 + x - 6) + (2x+3)(9x^2 - 4x + 1)$
(product rule and power rule)

3. $f(x) = \frac{3x+1}{5x-2}; f'(x) = \frac{3(5x-2)-5(3x+1)}{(5x-2)^2}$ (quotient rule and power rule)

4. $f(x) = sin^2(x); f'(x) = 2\sin(x) \cdot \cos(x)$ (chain rule, power rule, and sine rule)

5. $f(x) = 2e^{-2x}; f'(x) = -2(2e^{-2x})$ (chain rule and exponential rules)

6. $f(x) = ln(x+1); f'(x) = \frac{1}{x+1}$ (logarithm rule)

7. $f(x) = sin\, 2\, x - cos\, 2\, x; f'(x) = 2cos2x - 2(-sin2x)$
(chain rule and sine/cosine rules)

8. $f(x) = tan\, 2\, x - cot\, 2\, x; f'(x) = 2sec^2 2x - 2(-csc^2 2x)$
(chain rule and tangent/secant rules)

9. $f(x) = sec\, 2\, x - csc\, 2\, x; f'(x) = 2sec2xtan2x - 2(-csc2xcot2x)$
(chain rule and cotangent/cosecant rules)

10. $f(x) = \frac{x+sin\, x}{cos\, x - x}; f'(x) = \frac{(1+cosx)(cosx-x)-(x+xsinx)(-sinx-1)}{(cosx-x)^2}$
(quotient rule and sine/cosine rules)

11. $f(x) = sin^2(x^2 - x); f'(x) = 2\sin(x^2 - x) \cdot \cos(x^2 - x) \cdot (2x - 1)$
(chain rule, power rule, and sine rules)

12. $f(x) = xe^{-x^2}; f'(x) = 1 \cdot e^{-x^2} + -2x(xe^{-x^2})$ (product, chain, power, and exponential rules)

13. $f(x) = x^{\frac{1}{2}} \tan x\,; f'(x) = \frac{1}{2}x^{\frac{1}{2}-1}tanx + x^{\frac{1}{2}}sec^2x$

(product, power, and tangent rules)

14. $f(x) = x\, ln(\,x^2 + 1); f'(x) = 1 \cdot ln(\,x^2 + 1) + x \cdot 2x \cdot \frac{1}{x^2+1}$

(product, chain, logarithm, and power rules)

15. $f(x) = \frac{\sin 2x - \cos 2x}{x}; f'(x) = \frac{[2cos2x - 2(-sin2x)] \cdot x - 1 \cdot (\sin 2x - \cos 2x)}{x^2}$

(quotient, chain, sine/cosine rules)

16. $f(x) = ln\left(\frac{x + \sin x}{\cos x - x}\right); f'(x) = \frac{(1+cosx)\cdot(cosx - x) - (-sinx - 1)\cdot(x + sinx)}{(cosx - x)^2} \cdot \frac{1}{\frac{x + \sin x}{\cos x - x}}$

(chain, quotient, sine/cosine, logarithm rules)

17. $f(x) = x\, csc\, x\,; f'(x) = 1 \cdot cscx + x \cdot (-cscxcotx)$

(product rule, cosecant rule)

18. $f(x) = x\sqrt{x^2 - 2x} = x(x^2 - 2x)^{\frac{1}{2}}; f'(x) = 1 \cdot (x^2 - 2x)^{\frac{1}{2}} + x \cdot \frac{1}{2}(2x - 2) \cdot (x^2 - 2x)^{\frac{1}{2}-1}$

(product, chain, power rules)