3.3

3.3 Rules for Differentiation

Objectives:

-I can use the rules of differentiation to find the derivative of a function

- I can find the second derivative of a function

Rule Sheet

$50. \dfrac{d}{dx}(c) = 0$

$51b. \dfrac{d}{dx}(c \cdot u) = c \cdot u'$

$51. \dfrac{d}{dx}(cx) = c$

$52. \text{ The power rule}: \dfrac{d}{dx}(x^n) = nx^{n-1}$

Find each derivative:

1. $y = 2x + 4$

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

Rule Sheet $53. \dfrac{d}{dx}(u \pm v) = u' \pm v'$

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

9. $y = \dfrac{3}{x^2} + \dfrac{4}{x^3} - \dfrac{8}{x^4}$

3. $y = 2x^3$

4. $y = 2\pi^5$

5. $g(x) = \dfrac{x^2}{3}$

6. $f(x) = \dfrac{1}{x^5}$

7. $y = \dfrac{4}{x}$

$$55. \text{ The Quotient Rule}: \frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v \cdot u' - u \cdot v'}{v^2}$$

11. $y = \dfrac{4x-2}{x+1}$ 12. $g(x) = \dfrac{2x}{x^2+1}$

Rule Sheet

$$54. \text{ The Pr}oduct\ Rule: \frac{d}{dx}(u \cdot v) = u \cdot v' + v \cdot u'$$

10. $y = (x^2 + 3)(x-2)$

13. $h(x) = \dfrac{6x^2 - 7x}{x}$ 14. $y = \dfrac{e^2}{x^3}$

15. $f(x) = \dfrac{8}{4+x^2}$

The Second Derivative

Tips for finding derivatives

Notation: $f''(x)$ or $\dfrac{d^2 y}{dx^2}$

- Know the rules and stick to them

- Don't jump right in the rule. It might be easier to simplify first

16. Find the second derivative of $y = x^4 - 7x^3 + 5x^2 - 4x + 10$

- Practice, practice, practice! You will want to be able to find derivates quickly and accurately

17. Find the equation of the tangent line to $f(x)=x^2-4x+1$ at x=3

18. In the formula $V = \dfrac{4r+s^2}{t}+16rst^2$ r and s are constants. Find $\dfrac{dV}{dt}$

24. Suppose u and v are functions of x that are differentiable at x=2 and that u(2)=3, u'(2)= -4, v(2)=1, and v'(2)=2. Find the values of the following derivatives at x=2

a. $\dfrac{d}{dx}(uv)$

b. $\dfrac{d}{dx}\left(\dfrac{u}{v}\right)$

c. $\dfrac{d}{dx}\left(\dfrac{v}{u}\right)$

d. $\dfrac{d}{dx}(3u-2v+2uv)$