

Name Answer Key

Date _____

Calc I H - 2.4 day 4 - Chain Rule Practice

Period _____

Find the derivative of each given function using any of the rules we have learned so far.

1) $f(x) = \sqrt{x^2 + 5x + 6} = (x^2 + 5x + 6)^{1/2}$ Chain Rule

$$f'(x) = \frac{1}{2} (x^2 + 5x + 6)^{-1/2} \cdot (2x + 5) \quad \text{Simplify}$$

$$f'(x) = \frac{1}{2} \cdot \frac{1}{(x^2 + 5x + 6)^{1/2}} \cdot \frac{2x + 5}{1} \quad \text{multiply}$$

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

2) $h(x) = 3 \sin(5x^2 - 1)$ Chain Rule

$$h'(x) = 3 \cos(5x^2 - 1) (10x) \quad \text{Simplify}$$

$$h'(x) = 30x \cos(5x^2 - 1)$$

3) $g(x) = \sec^4(x^3 - x) = (\sec(x^3 - x))^4$ Chain Rule x3

$$g'(x) = 4 (\sec(x^3 - x))^3 \cdot \sec(x^3 - x) \tan(x^3 - x) \cdot (3x^2 - 1) \quad \text{Simplify}$$

$$g'(x) = 4 (3x^2 - 1) \underbrace{\sec^3(x^3 - x) \sec(x^3 - x) \tan(x^3 - x)} \quad \text{multiply}$$

$$g'(x) = 4 (3x^2 - 1) \sec^4(x^3 - x) \tan(x^3 - x)$$

4) $p(x) = \cot(3x^2 + 5)^5$ Chain Rule x3

$$p'(x) = -\cot(3x^2 + 5)^5 \csc(3x^2 + 5)^5 \cdot 5(3x^2 + 5)^4 \cdot 6x \quad \text{Simplify}$$

$$p'(x) = -30x (3x^2 + 5)^4 \cot(3x^2 + 5)^5 \csc(3x^2 + 5)^5$$

5) $y = 6x^3(3x^2-2)^7$ Product & Chain Rule

$$y' = 18x^2(3x^2-2)^7 + 7(3x^2-2)^6(6x)(6x^3) \quad \text{Simplify}$$

$$y' = 18x^2(3x^2-2)^7 + 252x^4(3x^2-2)^6 \quad \text{factor GCF } 18x^2(3x^2-2)^6$$

$$y' = 18x^2(3x^2-2)^6(3x^2-2 + 14x^2) \quad \text{Combine like terms}$$

$$y' = 18x^2(3x^2-2)^6(17x^2-2)$$

6) $f(a) = \left(\frac{4a^3-7}{5a+2}\right)^5$ Chain & Quotient Rules

$$f'(a) = 5 \left(\frac{4a^3-7}{5a+2}\right)^4 \cdot \left(\frac{12a^2(5a+2) - 5(4a^3-7)}{(5a+2)^2}\right) \quad \text{Distribute}$$

$$f'(a) = \frac{5}{1} \cdot \frac{(4a^3-7)^4}{(5a+2)^4} \cdot \frac{(60a^3+24a^2-20a^3+35)}{(5a+2)^2} \quad \text{Combine like terms}$$

$$f'(a) = \frac{5}{1} \cdot \frac{(4a^3-7)^4}{(5a+2)^4} \cdot \frac{40a^3+24a^2+35}{(5a+2)^2} \quad \text{multiply}$$

$$f'(a) = \frac{5(4a^3-7)^4(40a^3+24a^2+35)}{(5a+2)^6}$$

Challenge:

7) $f(x) = (\cos(x)-4x+5)^3$ Chain Rule

$$f'(x) = 3(\cos x - 4x + 5)^2(-\sin x - 4) \quad \text{factor negative}$$

$$f'(x) = -3(\cos x - 4x + 5)^2(\sin x + 4)$$

8) $g(x) = \sqrt{\tan(2x^3+1)} = (\tan(2x^3+1))^{1/2}$

$$g'(x) = \frac{1}{2}(\tan(2x^3+1))^{-1/2} \cdot \sec^2(2x^3+1) \cdot 6x$$

$$g'(x) = \frac{3x \sec^2(2x^3+1)}{\sqrt{\tan(2x^3+1)}}$$