Kuta Software - Infinite Calculus

Name W/ Soln

Differentiation - Chain Rule

Date _____ Period ____

Differentiate each function with respect to x.

1) $y = (x^3 + 3)^5$

$y' = 5(x^3+3)^4 \cdot (3x^2)$

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

$y' = 3(-3x^5+1)^2 \cdot (-15x^4)$

3) $y = (-5x^3 - 3)^3$

$y' = 3(-5x^3-3) \cdot (-15x^2)$

4) $y = (5x^2 + 3)^4$

$y' = 4(5x^2+3)^3 \cdot (10x)$

5) $f(x) = \sqrt[4]{-3x^4 - 2}$

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

$f'(x) = \frac{1}{4}(-3x^4-2)^{-\frac{3}{4}} \cdot (-12x^3)$

6) $f(x) = \sqrt{-2x^2 + 1}$

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

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

7) $f(x) = \sqrt[3]{-2x^4 + 5}$

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

$f'(x) = \frac{1}{3}(-2x^4+5)^{-\frac{2}{3}} \cdot (-8x)$

8) $y = (-x^4 - 3)^{-2}$

$y' = -2(-x^4-3)^{-3} \cdot (-4x^3)$

9) $y = (3x^3 + 1)(-4x^2 - 3)^4$

$y' = (3x^3+1)'(-4x^2-3)^4 + (3x^3+1)[(-4x^2-3)^4]'$

$= 9x^2(-4x^2-3)^4 + (3x^3+1)\cdot 4(-4x^2-3)^3 \cdot (-8x)$

10) $y = \dfrac{(x^3+4)^5}{3x^4-2}$

$y' = \dfrac{5(x^3+4)(3x^2)(3x^4-2) - (x^3+4)^5(12x^3)}{(3x^4-2)^2}$

11) $y = ((x+5)^5 - 1)^4$ ← 2 chain Rules

$y' = 4((x+5)^5-1)^3 \cdot 5(x+5)^4 \cdot 1$

12) $y = (5x^3 - 3)^5 \sqrt[4]{-4x^5 - 3}$

$y = (5x^3-3)^5(-4x^5-3)^{\frac{1}{4}}$

$y' = 5(5x^3-3)\cdot(15x^2)(-4x^5-3)^{\frac{1}{4}} + (5x^3-3)^5 \cdot \frac{1}{4}(-4x^5-3)^{-\frac{3}{4}} \cdot (-20x^4)$

Critical thinking question:

13) Give a function that requires three applications of the chain rule to differentiate. Then differentiate the function.

Similar to 11) above. 11) requires 2 chain rules

consider $y = (((x+5)^5-1)^4-1)^2$.

then $y' = 2[((x+5)^5-1)^4-1]\cdot 4((x+5)^5-1)^3 \cdot 5(x+5)^4 \cdot 1$.