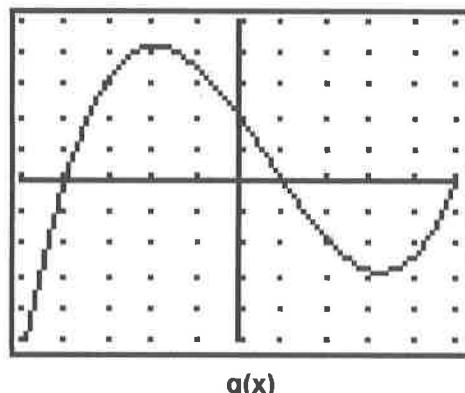
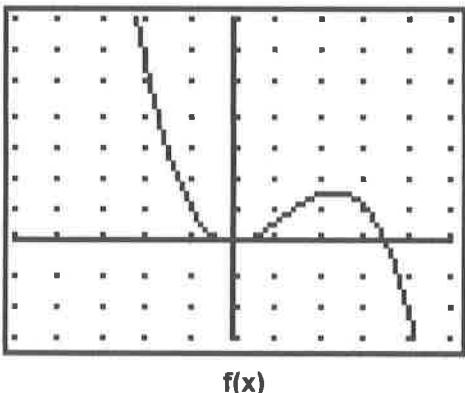


HW

Name Key

Date _____ Pd _____

The Chain Rule--Using the Rule of ThreeLet f and g be the functions defined below

$$\text{Let } h(x) = f(g(x)), w(x) = g(f(x)), k(x) = f(x^4).$$

1. Evaluate $h(-2)$, $h(1)$, and $h(2)$.
2. Is $h'(-1)$ positive, negative, or equal to zero? Justify your answer

$$h'(-1) = \frac{f'(g(-1)) \cdot g'(-1)}{f'(g(-1)) \cdot g'(-1)} \Rightarrow (-\#)(-\#) = \boxed{\text{positive}}$$

$$h'(x) = f'(g(x)) \cdot g'(x)$$
3. Determine the sign $h'(-2)$, $h'(1)$, and $h'(2)$.

$$h'(-2) = 0$$

$$h'(1) = \frac{f'(g(1)) \cdot g'(1)}{f'(0) \cdot g'(1)} \quad h'(2) = \frac{f'(g(2)) \cdot g'(2)}{f'(-2) \cdot g'(2)}$$

$$0 \cdot (-) \rightarrow \quad (-\#) \cdot (-\#) = \boxed{\text{positive}}$$
4. Determine the sign of $w'(2)$

$$w'(x) = g'(f(x)) \cdot f'(x)$$

$$w'(2) = g'(f(2)) \cdot f'(2) \rightarrow \boxed{\text{positive}}$$

$$g'(1.5) f'(2) \quad (-)(+)$$

$$\text{the sign of } w'(2) \text{ is zero}$$
5. Determine the sign of $w'(-1)$.

$$w'(-1) = g'(f(-1)) \cdot f'(-1) \rightarrow g'(0.5) \cdot f'(-1) \rightarrow w'(-1) \text{ is negative}$$

$$(-)(+)$$
6. Determine if $k(x)$ is decreasing or increasing on the interval containing $x = -1$. Justify your answer.

$$k(x) = f(x^4)$$

$$k'(x) = f'(x^4) \cdot 4x^3$$

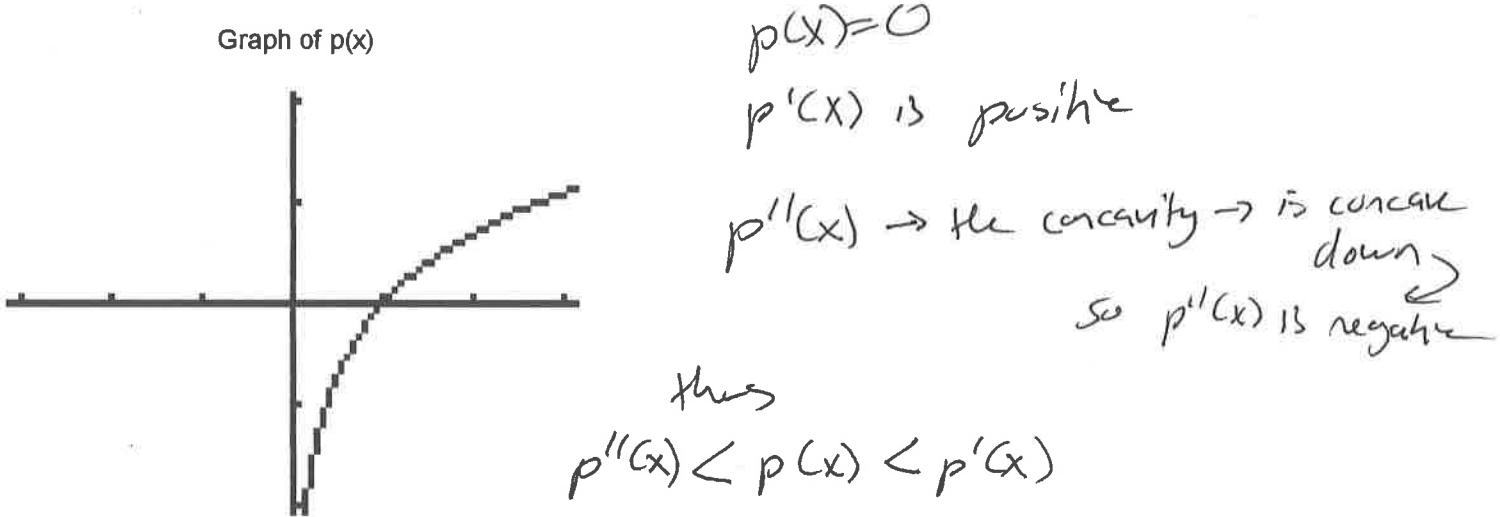
$$k'(-1) = f'((-1)^4) \cdot 4(-1)^3$$

$$f'(1) \cdot 4(-1)$$

negative value

decreasing

7. The graph of a function $p(x)$ is shown in the figure below. Find the relationship in the values of $p(x)$, $p'(x)$, and $p''(x)$ at $x = 1$.



x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	6	4	2	5
2	9	2	3	1
3	10	-4	4	2
4	-1	3	6	7

The functions f and g are differentiable for all real numbers and g is strictly increasing. The table above gives the values of the functions and their first derivatives for selected values of x . The function h is given by $h(x) = f(g(x))$. $h'(x) = f'(g(x)) \cdot g'(x)$

8. Using the table of values above, determine $h'(2)$.

$$\boxed{f(4)}$$

$$f'(g(2)) \cdot g'(2)$$

$$f'(g(3)) \cdot (1)$$

9. Write the equation of the line tangent to $h(x)$ at $x=3$.

$$h(3) = f(g(3)) \rightarrow f(4) \rightarrow -1 \quad h'(3) = f'(g(3)) \cdot g'(3) \quad \text{pt: } 3, -1 \quad m = 6$$

$$10. \text{ Write the line } \underline{\text{normal}} \text{ to the graph of } h(x) \text{ at } x=3 \rightarrow f'(g(3)) \cdot g'(3) \rightarrow y = -1 + 6(x-3)$$

11. The function w is defined as $w(x) = [h(x)]^2$, is $w(x)$ increasing or decreasing when $x=2$. Justify

$$w(x) = [h(x)]^2$$

$$w'(x) = 2[h(x)] \cdot h'(x)$$

$$w'(x) = 2[f(g(x))] \cdot f'(g(x)) \cdot g'(x)$$

$$2[f(g(2))] \cdot f'(g(2)) \cdot g'(2)$$

$$2[f(g(3))] \cdot f'(g(3)) \cdot g'(3)$$

$$2 \cdot 10 \cdot -4 \cdot 1 = -80$$

decreasing since
slope is
negative
(-80
specifically)