Chain Rule $y = f(g(x))$

$\rightarrow \frac{dy}{dx} = f'(g(x)) \cdot g'(x)$

Section 4.1: Chain Rule Practice

1. Let h(x) = f(g(x)). Use what is given in the table to fill in the rest.

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

x	f(x)	f'(x)	g(x)	g'(x)	h(x)	h'(x)
1	1	2	4	3	3	12
2	2	1	3	4	4	12
3	4	3	1	2	1	4
4	3	4	2	1	2	1

$h'(1) = f'(g(1)) \cdot g'(1) = f'(4) \cdot 3 = 4 \cdot 3 = 12$

$h'(2) = f'(\underbrace{g(2)}) \cdot \underbrace{g'(2)}$

$= \underbrace{f'(3)} \cdot (4)$

$= 3 \cdot 4 = 12$

h

2. Assume g is a function such that g'(x) exists for all x. Find f'(x). Your answers will involve g and g'. n is a constant

a) $f(x) = g(x) \bullet x^n$

$f'(x) = g(x) \cdot n x^{n-1} + g'(x) \cdot x^n$

Prod. Rule

b) $f(x) = (g(x))^n$

$f'(x) = n(g(x))^{n-1} \cdot g'(x)$

Chain Rule

c) $f(x) = g(x^n)$

$f'(x) = g'(x^n) \cdot (n x^{n-1})$

Chain Rule

3. Find $\frac{dy}{dx}$.

a) $y = (x^2 + 3)^{29}$

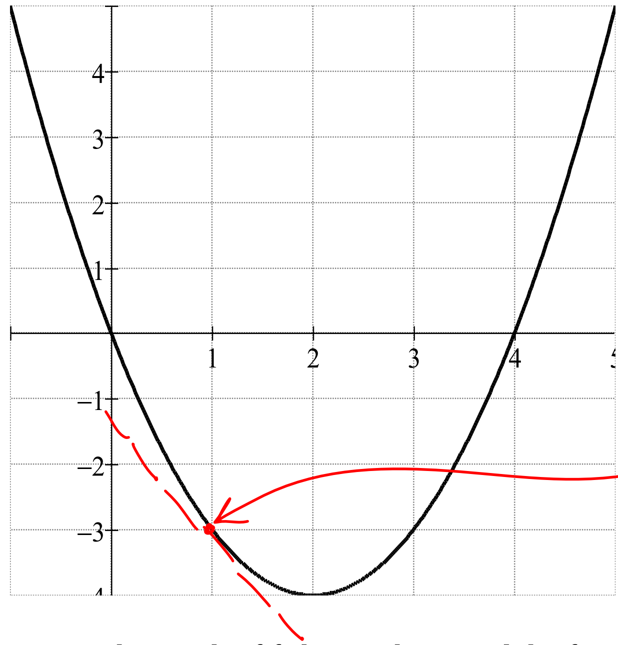
$\frac{dy}{dx} = 29(x^2+3)^{28} \cdot 2x$

$= 58x(x^2+3)^{28}$

b) $y = \sqrt{2 + \sin x}$

$\frac{dy}{dx} = \frac{1}{2}(2+\sin x)^{-1/2} \cdot \cos x$

$= \frac{\cos x}{2\sqrt{2+\sin x}}$



graph of f

$f'(1) = \text{neg } \#$ because f has neg. slope @ $x=1$

4. Use the graph of f shown above and the fact that $g(x) = f(x^2)$.

Is g increasing or decreasing at -1?

g is increasing @ $x=-1$ because $g'(-1)$ is positive.

$g'(x) = f'(x^2) \cdot 2x$

$g'(-1) = f'(1) \cdot -2$

$= (\text{neg.}\#) \cdot -2 = \boxed{\text{pos.}\#}$

5. Suppose that f(1)=2, that f' is the function shown below, and that k(x) = $f(x^3)$. Evaluate $k'(-1)$.

$k'(x) = f'(x^3) \cdot 3x^2$

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

$= 4 \cdot 3$

$= \boxed{12}$