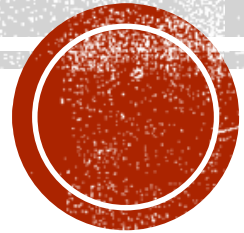
THE PRODUCT AND QUOTIENT RULES

Keeper 23

Honors Calculus



PRODUCT RULE

$$\frac{d}{dx}(f(x)\cdot g(x)) = f(x)\cdot g'(x) + g(x)\cdot f'(x)$$

- $\frac{d}{dx}(1st\cdot 2nd) = 1st\cdot 2nd' + 2nd\cdot 1st'$

FIND THE DERIVATIVE

1. $f(x) = (2x^2 - 1)(x^3 + 3)$

1st 2nd

$f'(x) = 1st \cdot 2nd' + 2nd \cdot 1st'$

$f'(x) = (2x^2 - 1)(3x^2) + (x^3 + 3)4x$

$f'(x) = 6x^4 - 3x^2 + 4x^4 + 12x$

$f'(x) = 10x^4 - 3x^2 + 12x$

FIND THE DERIVATIVE

2. $h(x) = \overset{1st}{x^3}(\overset{2nd}{\sqrt{x}+1})$

$\frac{d}{dx}$ 1st ' $= 3x^2$

2nd ' $= \sqrt{x}+1$

$x^{1/2}+1$

$\frac{1}{2}x^{-1/2}$

$= \frac{1}{2x^{1/2}}$ or $\frac{1}{2\sqrt{x}}$

$h'(x) = x^3\left(\frac{1}{2x^{1/2}}\right) + \left(\sqrt{x}+1\right)(3x^2)$

$h'(x) = \frac{1x^3}{2x^{1/2}} + 3x^{5/2} + 3x^2$

$h'(x) = \frac{1}{2}x^{5/2} + 3x^{5/2} + 3x^2$

$h'(x) = \frac{7}{2}x^{5/2} + 3x^2$

QUOTIENT RULE

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$$

$$\frac{d}{dx}\left[\frac{hi}{lo}\right] = \frac{lodehi - hidelo}{[lo]^2}$$

FIND THE DERIVATIVE

1. $f(x) = \dfrac{x^2 - 3x}{x - 1}$

hi

10

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

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

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

FIND THE DERIVATIVE

2. $f(x) = (1-3x)(x^2+2)^{-1}$

Rewrite $f(x) = \dfrac{1-3x}{x^2+2}$ hi lo

$$f'(x) = \frac{(x^2+2)(-3) + (-2x)(1-3x)}{(x^2+2)^2} \quad \text{or} \quad \frac{-(2x-6x^2)}{(x^2+2)^2}$$

$$f'(x) = \frac{-3x^2-6-2x+6x^2}{(x^2+2)^2}$$

$$f'(x) = \frac{3x^2-2x-6}{(x^2+2)^2}$$