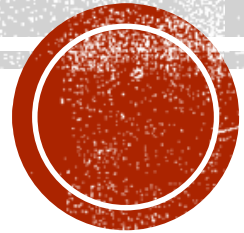
THE CHAIN RULE

Keeper 17

Honors Calculus



THE CHAIN RULE

Used to take the derivative of a composition

$f(x) = (\quad)^2$

$g(x) = x+3$

$(x+3)^2$

$f(x)$ = outside function

$g(x)$ = inside function

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

deriv. of out · deriv. of in

FIND THE DERIVATIVE

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

$f(x)$ outside $= (\quad)^5$

$g(x)$ inside $= 2x^3 + 4$

deriv. out · deriv. in

$y' = 5(2x^3+4)^4 \cdot 6x^2$

$y' = 30x^2(2x^3+4)^4$

FIND THE DERIVATIVE

2. $f(x) = (x^2 + 5x + 3)^4$

out: $(\ )^4$ or x^4

in: x^2+5x+3

$$f'(x) = 4(x^2+5x+3)^3(2x+5)$$

$$f'(x) = (8x+20)(x^2+5x+3)^3$$

FIND THE DERIVATIVE

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

out: $4(\ )^{1/3}$

in: x^2+3x

$f(x) = 4(x^2+3x)^{1/3}$

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

$f'(x) = \frac{4(2x+3)}{3(x^2+3x)^{2/3}}$

$f'(x) = \frac{8x+12}{3\sqrt[3]{(x^2+3x)^2}}$

FIND THE DERIVATIVE

4. $y = \sqrt[2]{(5x+2)^3}$

out: $(\quad)^{3/2}$

in: $5x+2$

$y = (5x+2)^{3/2}$

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

$y' = \frac{15}{2}\sqrt{5x+2}$ or $\frac{15}{2}(5x+2)^{1/2}$

$y' = \frac{15\sqrt{5x+2}}{2}$

FIND THE DERIVATIVE

5. $y = (\sqrt{x} - 1)^2$

out: $(\ )^2$

in: $\sqrt{x} - 1 = x^{1/2} - 1$

$y' = 2(\sqrt{x} - 1)'\left(\frac{1}{2}x^{-1/2}\right)$

$y' = \frac{2}{1}\left(\frac{\sqrt{x} - 1}{1}\right)\left(\frac{1}{2\sqrt{x}}\right)$

$y' = \frac{\sqrt{x} - 1}{\sqrt{x}}$

$y' = \frac{\sqrt{x}}{\sqrt{x}} - \frac{1}{\sqrt{x}}$

$y' = 1 - \frac{1}{\sqrt{x}}$

FIND THE DERIVATIVE

6. $f(x) = \dfrac{1}{\sqrt{2x^3 - 7x^2}}$

$f(x) = (2x^3-7x^2)^{-1/2}$

out: $\frac{1}{\sqrt{\ }}$ or $\frac{1}{(\ )^{1/2}}$ or $(\ )^{-1/2}$

in: $2x^3-7x^2$

$f'(x) = -\frac{1}{2}(2x^3-7x^2)^{-3/2}(6x^2-14x)$

$\frac{-\frac{1}{2}(6x^2-14x)}{(2x^3-7x^2)^{3/2}}$

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

$f'(x) = \frac{-3x^2+7x}{\sqrt{(2x^3-7x^2)^3}}$