10-22-19

Aim: The Chain Rule

Do Now

Use the table to write the equation for tangent lines at given values of x.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
-1	-2	4	0	3
2	-5	0	-3	DNE

1) Tangent of $f(x)$ at $x = 2$

$(2, -5)$ $m = -3$

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

2) Tangent of $g(x)$ at $x = -1$

$(-1, 4)$ $m = 3$

$y - 4 = 3(x + 1)$

Nov 4-10:28 AM

The Chain Rule:

If $y = f(u)$ is a differentiable function of u, and $u = g(x)$ is a differentiable function of x, then $y = f(g(x))$ is a differentiable function of x and

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

Or $f'(g(x)) \cdot g'(x)$

This looks more complicated than it really is. Basically, the Chain Rule says to **MULTIPLY THE DERIVATIVE OF THE INSIDE FUNCTION BY THE DERIVATIVE OF THE OUTSIDE FUNCTION.**

Jul 27-12:06 PM

EX #1: Find the derivative of $f(x)=(2x+3)^2$ with and without the chain rule.

A.) without chain rule

$f(x)=(2x+3)^2$

$f(x)=(2x+3)(2x+3)$ (u, v, u1, v1)

$f'(x)=(2x+3)(2)+(2x+3)(2)$

$f'(x)=4x+6+4x+6$

$=8x+12=4(2x+3)$

B.) with chain rule

$f(x)=(2x+3)^2$

$u=2x+3$

u^2

$2u\cdot u'$

$2u(2)$

$2(2x+3)(2)\rightarrow 4(2x+3)$

Jun 30-7:17 PM

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

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

$=20(5x+3)^3$

Oct 22-10:31 AM

The Chain Rule: $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$ or $f'g(x)g'(x)$

(Derivative of the outside function)x(derivative of the inside function)

EX #2: Find $f'(x)$ given $f(x)=\left(4-x^2\right)^3$

The inside function is $4-x^2$

The outside function is u^3

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

$= -6x(4-x^2)^2$

$u = 4-x^2$

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

$= 3(4-x^2)^2(-2x)$

$= -6x(4-x^2)^2$

Sep 22-7:24 PM

For each function below, find the derivative.

EX #3: $f(x)=\sqrt{\left(x^2-1\right)^3}$

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

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

$= 3x\sqrt{x^2-1}$

EX #4: $f(x)=\frac{-7}{(2x-3)^2}$

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

$f'(x) = 14(2x-3)^{-3}(2)$

$= 28(2x-3)^{-3}$

$= \frac{28}{(2x-3)^3}$

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EX #5: $y = \frac{1}{2x-3}$

$y = (2x-3)^{-1}$

$dy/dx = -(2x-3)^{-2}(2)$

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

EX #6: $y = (5-4x^2)^{2/3}$

$dy/dx = \frac{2}{3}(5-4x^2)^{-\frac{1}{3}}(-8x)$

$= \frac{-16x}{3\sqrt[3]{5-4x^2}}$

Sep 22-7:34 PM

EX #7: $y = \frac{-2}{\sqrt[3]{6x+3}}$

$y = -2(6x+3)^{-\frac{1}{3}}$

$y' = \frac{2}{3}(6x+3)^{-4/3}(6)$

$y' = \frac{4}{\sqrt[3]{(6x+3)^4}}$

EX #8: $y = -3\sqrt{x^2-3x-4}$

Sep 22-7:37 PM