Sum and Difference Rule

Goal: • Can use sum and difference rule to take the derivative of polynomials • Understands how to derive sum and difference rule
Terminology: • Sum and Difference rule
Reminders • Quiz on Thursday on 2.1-2.3

Review: 1. In order to find the derivative of x^n using the limit definition of the derivative how did we expand $(x+h)^n$?

$(x+h)^n = x^n + nx^{n-1}h + \ldots + h^n$

$-x^n$ $-x^n$

stuff

everything has an h that can cancel

Pascals triangle OR looking for a pattern in $(x+h)^2$, $(x+h)^3$, $(x+h)^4$, ...

2. Given $f(x) = \frac{8}{\sqrt{x^3}}$ determine $f'(x)$ and its domain.

$f(x) = 8x^{-3/2} \Rightarrow f'(x) = \left(\frac{-3}{2}\right)8x^{-3/2-1}$

$= -12x^{-5/2}$

$= \frac{-12}{\sqrt{x^5}}$

$x \geq 0, x \neq 0$

$\Rightarrow \boxed{x > 0}$ → this is where the function is differentiable

3. What does $\frac{dy}{dx}$ measure?

slope of tangent line

it is the Δy over Δx for small Δx

the amount y changes as x changes

We want to be able to take the derivative of an entire polynomial, not just a monomial. On the boards use the definition of the derivative.

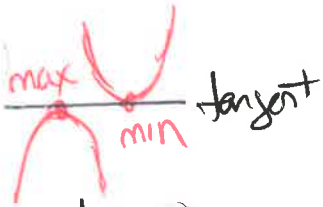
$\frac{d}{dx}\left(f(x)+g(x)\right) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x)$

total change of sum

~~total~~ sum of the change ~~of~~

$(f \pm g)' = f' \pm g'$

Example: Given $y = -\frac{1}{3}x^3 - 3x^2 + 7x + 2$, find point(s) where the slope of the curve is 0.



$\frac{d}{dx}y = \frac{dy}{dx} = \frac{d}{dx}\left(-\frac{1}{3}x^3\right) + \frac{d}{dx}\left(-3x^2\right) + \frac{d}{dx}(7x) + \frac{d}{dx}(2)$

dy by dx

d by dx of y

$= (3)\left(-\frac{1}{3}\right)x^{3-1} + (2)(-3)x^{2-1} + 7 + 0$

$= -x^2 - 6x + 7 = \frac{dy}{dx}$

Set $\frac{dy}{dx} = 0 \Rightarrow 0 = -x^2 - 6x + 7$

$x^2 + 6x - 7 = 0 = (x+7)(x-1)$

$x = 1, -7$

Practice Problems: 2.3: # 1-3 (do what you need), 6-11

12, 13, Problem Plus

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important stuff

$-x^n$ $-x^n$

can divide h

Seeing a pattern in $(x+h)^2$, $(x+h)^3$, $(x+h)^4$, etc

Remember Pascals triangle

2. Given $f(x) = \frac{8}{\sqrt{x^3}}$ determine $f'(x)$ and its domain.

$f(x) = 8x^{-3/2}$

$f'(x) = \left(\frac{3}{2}\right)8x^{-3/2-1} = -12x^{-5/2} = \frac{-12}{\sqrt{x^5}}$

$x \neq 0$ $\{x > 0$ → differentiable

3. What does $\frac{dy}{dx}$ measure?

slope of tangent line

the change in y values as x changes

We want to be able to take the derivative of an entire polynomial, not just a monomial. On the boards use the definition of the derivative.

$$\frac{d}{dx}\big(\, f(x)+g(x) \,\big) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x)$$

$=$

$$= \lim_{h\to 0} \frac{f(x+h)-f(x)}{h} + \lim_{h\to 0} \frac{g(x+h)-g(x)}{h}$$

$$= f'(x) + g'(x)$$

Example: Given $y = -\frac{1}{3}x^3 - 3x^2 + 7x + 2$, find point(s) where the slope of the curve is 0.

$$\frac{dy}{dx} = \frac{d}{dx}\left(-\frac{1}{3}x^3\right) + \frac{d}{dx}\left(-3x^2\right) + \frac{d}{dx}(7x) + \frac{d}{dx}(2)$$

$$= (3)\left(-\frac{1}{3}\right)x^{3-1} + (2)(-3)x^{2-1} + (1)(7)x^{1-1} + 0$$

$$= -x^2 - 6x + 7 = 0$$

$$x^2 + 6x - 7 = 0 = (x-1)(x+7)$$

$$x = 1, -7$$

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