Sec 2.3 The Quotient Rule

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

low d hi - hi d low
low squared

ex. $f(x)=\dfrac{x+1}{x-1}$

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

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

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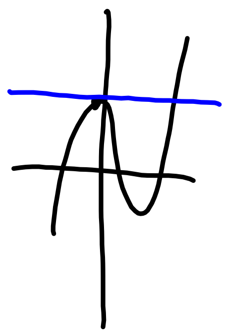
Simplify before differentiating:

Find an equation of the tangent line to the graph of $f(x)=\dfrac{3-\frac{1}{x}}{x+5}$ at the point (-1, 1)

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

$$f'(-1)=\frac{\overset{4}{(-1+5)}\left(\overset{1}{\frac{1}{(-1)^2}}\right)-\left(\overset{4}{3-\frac{1}{-1}}\right)}{\underset{16}{\underset{4}{(-1+5)^2}}}=\frac{0}{16}=0$$



$y-y_1=m(x-x_1)$

$y-1=0(x--1) \Rightarrow \boxed{y=1}$

Sep 24-11:57 AM

Sometimes it looks like a quotient, but...

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

$y' = \frac{1}{3}x + \frac{1}{2}$

$\frac{1}{6}[2x + 3] = \frac{1}{3}x + \frac{1}{2}$

ex. $y = \dfrac{5x^4}{8} = \frac{\overset{1}{\cancel{4}}}{1}\frac{5}{\underset{2}{\cancel{8}}}x^4 \Rightarrow y' = \frac{5}{2}x^3$

ex. $y = \dfrac{-3(3x - 2x^2)}{7x} = \dfrac{-9\cancel{x} + 6x^{\cancel{2}}}{7\cancel{x}} = -\frac{9}{7} + \frac{6}{7}x$

$y' = \frac{6}{7}$

ex. $y = \dfrac{9}{5x^2} = \frac{9}{5}x^{-2}$

$y' = -2\left(\frac{9}{5}\right)x^{-3} = \dfrac{-18}{5x^3}$

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Derivatives of Trig Functions

must memorize!

THEOREM 2.9 DERIVATIVES OF TRIGONOMETRIC FUNCTIONS

$\dfrac{d}{dx}[\tan x] = \sec^2 x$ $\dfrac{d}{dx}[\cot x] = -\csc^2 x$

$\dfrac{d}{dx}[\sec x] = \sec x \tan x$ $\dfrac{d}{dx}[\csc x] = -\csc x \cot x$

ex. y = x - tanx

$\boxed{y' = 1 - \sec^2 x}$

$y' = -1(\sec^2 x - 1)$

$\boxed{y' = -\tan^2 x}$

$\sec^2 x = \tan^2 x + 1$

$\sec^2 x - 1 = \tan^2 x$

ex. y = x secx

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Remember that Trig functions can be changed with identities...

We know that $\sin^2 x = 1 - \cos^2 x$ so it would stand to reason that the derivative of both would be the same answer?

$y = \sin^2 x = (\sin x)^2$

$y' = 2(\sin x)\cos x$

$y' = 2\sin x\cos x$

$y' = \sin 2x$

$y = 1 - \cos^2 x = 1 - (\cos x)^2$

$y' = -2(\cos x)(-\sin x)$

$y' = 2\cos x\sin x$

$y' = \sin 2x$

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Higher Order Derivatives

s(t) = position function

v(t) = s'(t) = velocity 1st derivative

a(t) = v'(t) = s''(t) = acceleration 2nd derivative

We can take the derivative of derivatives over and over again. They are used for many applications... most common used is the 1st and 2nd derivative.

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