Today's Plan:

Learning Target (standard): I will use the 1st derivative test to describe the characteristics of a function.

Students will: Complete practice problems over previous concepts at the boards, put up homework problems on the board and make necessary corrections to their own work, take notes over new material and complete practice problems over new concepts.

Teacher will: Provide practice problems over previous concepts, check homework problems for accuracy and provide students feedback, describe and provide examples of new concepts and assign students assessment problems over new concepts.

Assessment: Board work, homework check and homework assignment

Differentiation: Students will work at the board, go over and correct homework at their seats, actively engage in lecture over new concepts, practice new concepts with the aid of other students and the teacher and complete homework assignment.

Find all numbers *c* satisfying the MVT.

$f(x) = x^3 - x^2 - x + 1; [-1, 2]$ continuous $[-1,2]$ ✓

$f'(x) = 3x^2 - 2x - 1$ differentiable $(-1,2)$ ✓

$f(2) - f(-1) = (2+1)(3c^2 - 2c - 1)$

$3 - 0 = 3(3c^2 - 2c - 1)$

$3 = 3(3c^2 - 2c - 1)$

$1 = 3c^2 - 2c - 1$

$0 = 3c^2 - 2c - 2$

$c = \dfrac{2 \pm \sqrt{4 - 4(3)(-2)}}{2(3)}$

$= \dfrac{2 \pm \sqrt{4 + 24}}{6}$

$= \dfrac{2 \pm \sqrt{28}}{6} = \dfrac{2 \pm 2\sqrt{7}}{6}$

$c = \dfrac{1+\sqrt{7}}{3}, \dfrac{1-\sqrt{7}}{3}$

Find the equation of the normal line to the curve through the given point.

$f(x) = 6 - x - x^2$ $(-1, 6)$

$@ x = -1$

$f(-1) = 6 + 1 - (-1)^2$

$= 6 + 1 - 1$

$f(-1) = 6$

$f'(x) = -1 - 2x$

$f'(-1) = -1 - 2(-1)$

$f'(-1) = -1 + 2$

$f'(-1) = 1$

$m_{normal}(-1, 6) = -1$

$m_{tan}(-1, 6) = 1$

$y = mx + b$

$6 = (-1)(-1) + b$

$6 = 1 + b$

$b = 5$

$y = -x + 5$

$\boxed{x + y = 5}$

Find the equation of the tangent line to the curve through the given point.

$f(x) = \dfrac{10x}{x^2 + 1}$

$(2, 4)$

$f'(x) = \dfrac{10(x^2+1) - 2x(10x)}{(x^2+1)^2}$

$= \dfrac{10x^2 + 10 - 20x^2}{(x^2+1)^2}$

$f'(x) = \dfrac{-10x^2 + 10}{(x^2+1)^2}$

$m_{tan}(2, 4) = f'(2)$

$f'(2) = \dfrac{-10(2)^2 + 10}{(2^2+1)^2}$

$= \dfrac{-40 + 10}{25}$

$f'(2) = \dfrac{-30}{25}$

$m_{tan}(2, 4) = -\dfrac{6}{5}$

$y = mx + b$

$4 = -\dfrac{6}{5}(2) + b$

$4 = -\dfrac{12}{5} + b$

$\dfrac{32}{5} = b$

$5\left(y = -\dfrac{6}{5}x + \dfrac{32}{5}\right)$

$5y = -6x + 32$

$\boxed{6x + 5y = 32}$

Find the derivative.

$$y=(2x-3)^{-4}(x+5)^{3}$$

$$y' = -4(2x-3)^{-5}(2)(x+5)^{3} + 3(x+5)^{2}(2x-3)^{-4}$$
$$= -8(2x-3)^{-5}(x+5)^{3} + 3(x+5)^{2}(2x-3)^{-4}$$
$$= (2x-3)^{-5}(x+5)^{2}\left[-8(x+5)+3(2x-3)\right]$$
$$= (2x-3)^{-5}(x+5)^{2}(-8x-40+6x-9)$$
$$y' = (2x-3)^{-5}(x+5)^{2}(-2x-49)$$

Critical #s: $f'(x)=0$ or $f'(x)=\text{und}$

$2x-3=0$, $2x=3$, $x=\frac{3}{2}$

$x+5=0$, $x=-5$

$-2x-49=0$, $-2x=49$, $x=-\frac{49}{2}$

Critical #s:

$x=\frac{3}{2}, -5, -\frac{49}{2}$

Find the derivative.

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

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

$$\boxed{\begin{aligned} y &= \sin f(x) \\ y' &= f'(x)\cos f(x) \end{aligned}}$$

$$y=\tan(\sec x)$$

$$\boxed{\begin{aligned} y &= \tan f(x) \\ y' &= f'(x)\sec^{2} f(x) \end{aligned}}$$

$$y' = \tan x \sec x \sec^{2}(\sec x)$$

Find the derivative.

$$y = x^{2x+1}$$

$$\ln y = \ln x^{2x+1}$$

$$\ln y = (2x+1)\ln x$$

$$\frac{1}{y}y' = 2\ln x + (2x+1)\frac{1}{x}$$

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

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

$$y' = y\left[\frac{2x\ln x + 2x + 1}{x}\right]$$

$$y' = x^{2x+1}\left[\frac{2x\ln x + 2x + 1}{x}\right] \qquad \frac{x^{2x+1}}{x^1} = x^{2x+1-1}$$

$$y' = x^{2x}(2x\ln x + 2x + 1)$$

Find the derivative.

$$f(x) = \log_4\left(x^2 - 3x - 4\right)$$

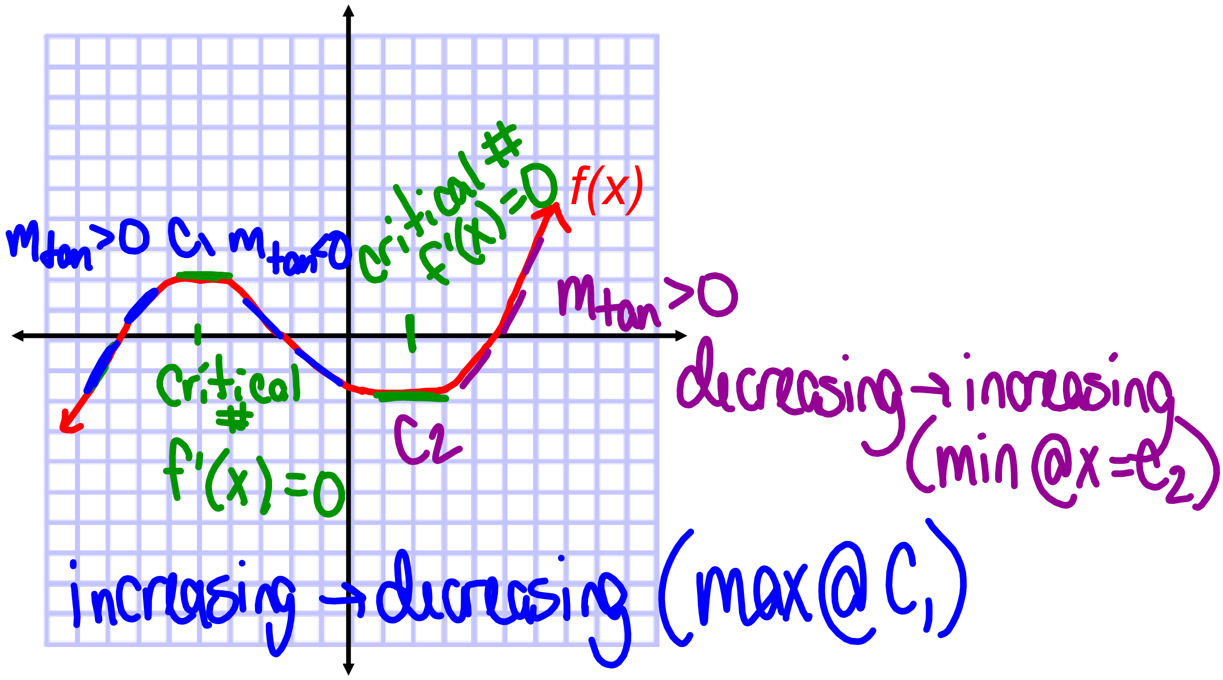
$$\boxed{\begin{array}{l} y = \log_a f(x) \\ y' = \dfrac{f'(x)}{f(x)\cdot \ln a} \end{array}}$$

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

$$f'(x) = \frac{2x-3}{(x-4)(x+1)\ln 4}$$

The 1st Derivative Test:

- a method used to describe the behavior of the function based on properties of the derivative
- when the derivative is zero or is undefined, the function has a critical number
- when the derivative is positive, the function is increasing
- when the derivative is negative, the function is decreasing
- when the derivative goes from positive to negative, the function has a maximum
- when the derivative goes from negative to positive, the function has a minimum

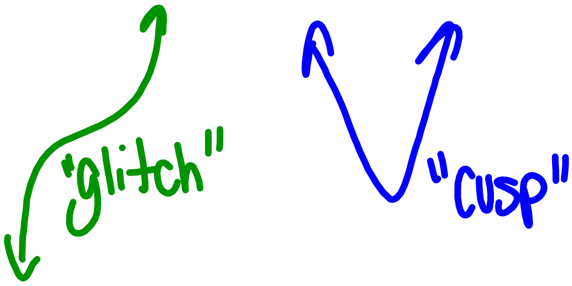


The 1st Derivative Test:

- when the derivative has no sign change, the function will have a glitch

- when the derivative is undefined and the function is not, the function will have a cusp

- when the derivative is undefined and the function is as well, the function will have a vertical asymptote



Assignment:

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* Find the critical numbers *