Math 1300
Fall 2025
Quiz 9

Name: Champ

1. (2 points) Where does the absolute maximum of the function

$$g(x) = \ln(x^2 + 1)$$

occur on the interval $[-1, 2]$?

(a) $x = -1$
(b) $x = 0$
(c) $x = 1$
(d) $x = 2$
(e) Does not exist

$g'(x) = \frac{2x}{x^2+1} \Rightarrow$ Critical #: $x=0$

Compare value with endpoints to find largest:

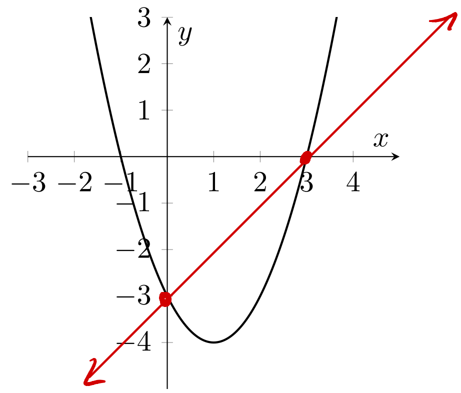
$g(-1) = \ln(2)$, $g(0) = 0$, $g(2) = \ln(5)$

2. (2 points) Suppose f is a function which is continuous and differentiable on the interval $[-2, 2]$. Which of the following conditions would guarantee that $f'(c) = 0$ for some c between -2 and 2?

(a) f is a parabola.
(b) f has a change in concavity.
(c) $f(-2) = f(2)$.
(d) f has no horizontal tangent lines.
(e) f is decreasing.

Rolle's Thm

3. (2 points) The following is a graph of $f(x) = x^2 - 2x - 3$.



On the interval $[0, 3]$, for which value of x does the conclusion of the Mean Value Theorem hold?

(a) 0
(b) 1/2
(c) 1
(d) 3/2
(e) 2

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

Need $2x - 2 = \frac{f(3) - f(0)}{3} = \frac{0 - (-3)}{3} = 1$

$x = \frac{3}{2}$

4. (4 points) Let $f(x) = \sqrt{4-x}$.

(a) Use the linearization of $f(x)$ at $a = 0$ to estimate $\sqrt{3.95}$.

$L(x) = f'(0)(x-0) + f(0)$

$f'(x) = \frac{1}{2}(4-x)^{-1/2} \cdot (-1)$

$= \frac{-1}{2\sqrt{4-x}}$

$= -\frac{1}{4}$

- $f(0) = 2$
- $f'(0) = -1/4$

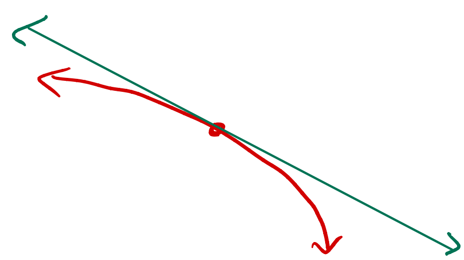
$L(x) = -\frac{1}{4}x + 2$

$\sqrt{3.95} = f(0.05) \approx L(0.05) = -\frac{1}{4} \cdot \frac{1}{20} + 2 = 2 - \frac{1}{80}$

(b) Is your estimate from part (a) an overestimate or an underestimate? Justify your answer.

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

$f''(0) = -\frac{1}{4}(4)^{-3/2} < 0$



$f'(x)$ is concave down at $x=0$ and so the tangent line lies above the curve. Hence the estimate will be an overestimate