

Name: Key

Section: _____

You have 12 minutes to complete the quiz. Please **show all work**, and then **write your answer on the line provided**.

1. (2 points). Suppose $200 = 100e^{4k}$. Solve for k .

$$2 = \frac{200}{100} = e^{4k}$$

$$\ln(2) = \ln(e^{4k}) = 4k$$

$$k = \frac{\ln(2)}{4}$$

Answer: $\frac{\ln(2)}{4}$

2. Let $f(x) = x^3 - 3x + 2$

(a) (2 points). Find the critical points of f .

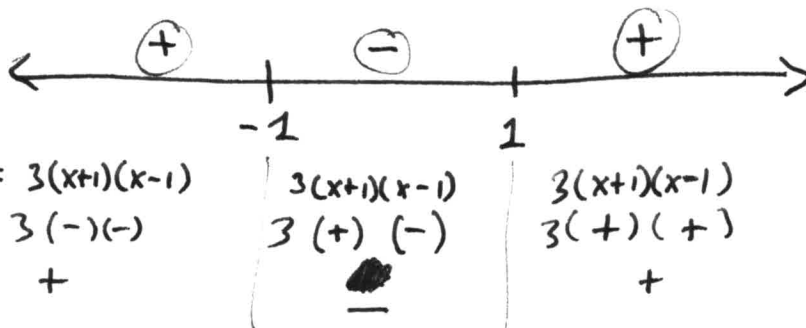
$$f'(x) = 3x^2 - 3 = 3(x^2 - 1) = 3(x+1)(x-1)$$

$$f'(x) = 0 \iff x = 1 \text{ or } -1$$

$f'(x)$ always defined

Answer: $x = -1$ or 1

(b) (2 points). Which points of f are local minima and maxima?



Answer: local max at -1

local min at 1



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3. Let $f(x) = 3\ln(x) + \frac{1}{x}$

(a) (2 points). Find the linear approximation to $f(x)$ at $a = 1$.

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

$$f(a) = f(1) = 3 \cdot \ln(1) + \frac{1}{1} = 3 \cdot 0 + 1 = 1$$

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

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

$$L(x) = 2(x-1) + 1 = 2x - 1$$

Answer: _____

(b) (2 points). Approximate $f(1.1)$.

$$\begin{aligned} f(1.1) &\approx L(1.1) = 2(1.1-1) + 1 \\ &= 2(.1) + 1 \\ &= 1.2 \end{aligned}$$

Answer: 1.2