

Math 1121

Homework # 8

2.9 # 33, 3.1 # 50

3.1 # 55, 3.2 # 29

2.9 # 33 Estimate $\sqrt[3]{1001}$ use $f(x) = x^{1/3}$, $a = 1000$

$$f'(x) = \frac{1}{3}x^{-2/3} = \frac{1}{3} \cdot \frac{1}{(\sqrt[3]{x})^2}$$

$$f'(a) = \frac{1}{3} \cdot \frac{1}{(\sqrt[3]{1000})^2} = \frac{1}{3} \cdot \frac{1}{10^2} = \frac{1}{300}$$

$$L(x) = f(a) + f'(a)(x-a)$$
$$= \sqrt[3]{1000} + \frac{1}{300}(x-1000)$$

$$\approx 10 + \frac{1}{300}(x-1000)$$

S. $\sqrt[3]{1001} \approx L(1001)$

$$= 10 + \frac{1}{300}(1001 - 1000)$$

$$= 10 + \frac{1}{300} = 10.003333$$

3.1 #50 $f(x) = 5 + 54x - 2x^3$ on $[0, 4]$

$$f'(x) = 54 - 6x^2$$

$$f' = 0: 6x^2 = 54$$

$$x^2 = 9$$

$$x = \pm 3$$

outside the interval

plug in $x = 0, 4, \cancel{-3}, 3$

$$f(0) = 5 \leftarrow \text{min}$$

$$f(4) = 5 + 54 \cdot 4 - 2 \cdot 4^3 = 93$$

$$f(3) = 5 + 54 \cdot 3 - 2 \cdot 3^3 = 113 \leftarrow \text{max}$$

$f(0) = 5$ is the abs min

$f(3) = 113$ is the abs max

#55 $x + \frac{1}{x}$ on $[0.2, 4]$

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

$$f' = 0: 1 - \frac{1}{x^2} = 0$$

$$1 = \frac{1}{x^2}$$

$$x^2 = 1$$

$$x = 1$$

$$x = -1 \leftarrow \text{(outside interval)}$$

$$f' \text{ DNE: } x = 0 \leftarrow \text{(outside interval)}$$

plug:

$$f(0.2) = 0.2 + \frac{1}{0.2} = 5.2$$

$$f(1) = 1 + \frac{1}{1} = 2$$

$$f(4) = 4 + \frac{1}{4} = 4.25$$

$f(1) = 2$ is the min,

$f(0.2) = 5.2$ is the max.

#29 $f(1) = 10$ and $f'(x) \geq 2$ for $1 \leq x \leq 4$.

$$\text{so } f'(c) = \frac{f(4) - f(1)}{4 - 1}$$

$$f'(c) = \frac{f(4) - 10}{3}$$

$$\text{so } 2 \leq \frac{f(4) - 10}{3}$$

$$6 \leq f(4) - 10$$

$$\text{so } \underline{f(4) \geq 16}$$