NAME JULY 10, 2018

Instructions: *Include all relevant work to get full credit. Write your solutions using proper notations. Encircle your final answers.*

Quiz #13

1. Find c that satisfies the conclusion of the Mean Value Theorem for $f(x) = x^3 - 3x + 2$ on $[-2, 2]$. [3]

$$\Rightarrow f'(x) = 3x^2 - 3 \quad = \frac{f(b) - f(a)}{b - a} = \frac{f(2) - f(-2)}{2 - (-2)}$$

$$= \frac{4 - 0}{4} = 1$$

$$\Rightarrow f'(c) = 3c^2 - 3 = 1$$

$$\Rightarrow c^2 = \frac{4}{3} \quad \Rightarrow c = \pm\sqrt{\frac{4}{3}}.$$

2. Consider the function $f(x) = x^4 - 4x^3$. Construct the first derivative chart that shows the critical values and where $f'(x)$ is positive and negative. Also, include in this chart where the $f(x)$ is increasing and decreasing. Then specify if there is any local maximum and/or local minimum points. [4]

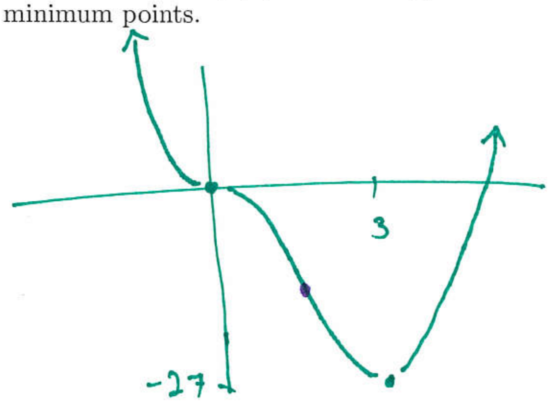
$$f'(x) = 4x^3 - 12x^2 = 0$$

$$\Rightarrow 4x^2(x-3) = 0$$

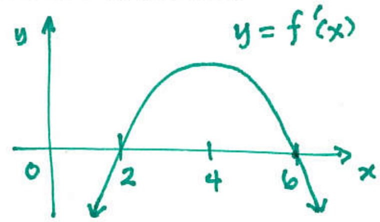
$$x = 0 \mid x = 3$$

$4x^2$	+	0	+		+
$(x-3)$	−		−	0	+
$f'(x)$	−	0	−	3	+
$f(x)$	dec ↘		dec ↘		inc ↗

local min



3. Use the graph of the derivative (shown below) to answer the following questions:



a. What are the critical values? [1]

$x = 2, 6$

b. For what values of x is $f(x)$ decreasing? Give your answer in interval notation. [1]

$= (-\infty, 2) \cup (6, \infty)$

c. At what value of x does $f(x)$ have a local maximum? [1]

$x = 6$

Bonus: State the **Mean Value Theorem**. [1]

If $f(x)$ is cont. on $[a,b]$ and differentiable on (a,b), then $\exists\, c$ in (a,b) s.t. $f'(c) = \frac{f(b)-f(a)}{b-a}$.