

Quiz – Rolles' Theorem, MVT,
First and Second Derivative Test
Calculus AB

Name _____

Date _____ Per _____

10 pts each

1. Use the first derivative test to name the largest open intervals where the function $g(x) = 2x^3 - 3x^2 - 36x - 2$ is decreasing or increasing. Name the x values all relative extrema.
2. Find the largest open intervals where $f(x) = -3x^4 - 8x^3$ function is concave up or concave down. Name any points of inflection.
3. Find all values of c where the Mean Value Theorem applies to the equation $y = x^2 - 6x + 1$ on the interval $[-1, 2]$.
4. Perform the **second** derivative test for $f(x) = 3x^4 - 8x^3$. Box your conclusion.
5. What is a critical point? _____
6. Name the 3 criteria that must exist to apply Rolle's Theorem.
 1. _____
 2. _____
 3. _____

7. Show if Rolles' Theorem applies to $f(x) = (x-2)(x+2)^2$ on the interval $[-2, 2]$. Then if possible, find all value(s) of c where Rolles' Theorem applies.

8. Find the *absolute extrema* $f(x) = 2x - 3x^{\frac{2}{3}}$ on $[-1, 8]$

Find the critical points of each. Box your answers!

9. $f(x) = 3x - 9x^{\frac{2}{3}}$

10. $h(x) = \frac{x^2 + 1}{x^2 - 4}$

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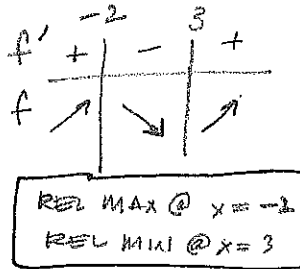
1. Use the first derivative test to name the largest open intervals where the function $g(x) = 2x^3 - 3x^2 - 36x - 2$ is decreasing or increasing. Name the x values all relative extrema.

$$g' = 6x^2 - 6x - 36 = 0$$

$$x^2 - x - 6 = 0$$

$$(x-3)(x+2) = 0$$

3, -2



INC: $(-\infty, -2), (3, \infty)$
DEC: $(-2, 3)$

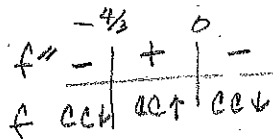
2. Find the largest open intervals where $f(x) = -3x^4 - 8x^3$ function is concave up or concave down. Name any points of inflection.

$$f' = -12x^3 - 24x^2$$

$$f'' = -36x^2 - 48x = 0$$

$$-12x(3x+4)$$

0, -4/3



POI @ $x = -4/3, 0$

ccu: $(-4/3, 0)$
cch: $(-\infty, -4/3), (0, \infty)$

3. Find all values of c where the Mean Value Theorem applies to the equation $y = x^2 - 6x + 1$ on the interval $[-1, 2]$.

$$y = x^2 - 6x + 1$$

$$y' = 2x - 6$$

$$\frac{y(2) - y(-1)}{2 - (-1)} = \frac{-7 - 8}{3} = -5$$

$$2x - 6 = -5$$

$$2x = 1$$

$$x = 1/2$$

$$y(2) = 4 - 12 + 1 = -7$$

$$y(-1) = 1 + 6 + 1 = 8$$

4. Perform the second derivative test for $f(x) = 3x^4 - 8x^3$. Box your conclusion.

$$f' = 12x^3 - 24x^2$$

$$12x^2(x-2)$$

0, 2

$$f''(x) = 36x^2 - 48x$$

$$12x(3x-4)$$

$f''(0) = 0$ TEST FAILS
 $f''(2) = 12$ REL MIN @ $x = 2$

5. What is a critical point? VALUES OF X WHERE f' IS ZERO OR UNDEFINED.

6. Name the 3 criteria that must exist to apply Rolle's Theorem.

- CONTINUOUS
- DIFFERENTIABLE
- SAME Y VALUES
($f(b) = f(a)$)

7. Show if Rolle's Theorem applies to $f(x) = (x-2)(x+2)^2$ on the interval $[-2, 2]$. Then if possible, find all value(s) of c where Rolle's Theorem applies.

$$\boxed{f(2) = 0}$$

$$\boxed{f(-2) = 0}$$

$$f' =$$

$$(1) (x+2)^2 + (x-2)(2)(x+2)'(1)$$

$$(x+2) [x+2 + 2(x-2)]$$

$$\frac{(x+2)[3x-2]}{-2 \quad +2/3}$$

$$\underline{\underline{+2/3}}$$

8. Find the *absolute extrema* $f(x) = 2x - 3x^3$ on $[-1, 8]$

$$f' = 2 - 2x^{-2/3}$$

$$2 - \frac{2}{x^{2/3}}$$

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

$$2x^{2/3} = 2$$

$$x^{2/3} = 1$$

$$x = 1$$

$$f(-1) = -2 - 3(1) = -5 \text{ ABS. MIN!}$$

$$f(0) = 0$$

$$f(1) = -1$$

$$f(8) = 16 - 3(4) = 4 \text{ ABSOLUTE MAX!}$$

Find the critical points of each. Box your answers!

9. $f(x) = 3x - 9x^3$

$$f' = 3 - 6x^{-2/3} = 0$$

$$3 - \frac{6}{x^{2/3}} = 0$$

$$3 = \frac{6}{x^{2/3}}$$

$$x^{2/3} = 2$$

$$x = 8$$

$$\boxed{\text{CP: } 0, 8}$$

10. $h(x) = \frac{x^2+1}{x^2-4}$

$$h'(x) = \frac{(x^2-4)(2x) - (x^2+1)(2x)}{(x^2-4)^2}$$

$$h'(x) = \frac{2x^3 - 8x - 2x^3 - 2x}{(x^2-4)^2}$$

$$h'(x) = \frac{-10x}{(x^2-4)^2}$$

$$\boxed{0, \pm 2}$$