

Read all directions and answer the questions the best that you can. Reasonable work is expected to be shown for all problems.

Part 1 (3 points each)

Use the graphs of $f(x)$ and $g'(x)$ to answer the following 5 problems.

1.) Find the absolute extremes of $f(x)$ on $[0, 4]$

2.) Where is $f(x)$ concave up?

3.) Where does $f(x)$ have critical numbers?

4.) Where does $g(x)$ have critical numbers?

5.) Where is $g(x)$ decreasing?

Part 2 (4 points each)

Answer the following question. Be sure to support your answer.

Does Rolle's Theorem apply to $f(x)$ on $[-2, 1]$? If yes, find c . (Use $f(x)$ from Part 1)

Part 3 (5 points each)

Find critical numbers for the following functions.

1.) $c(x) = x - 10\sqrt{x} + 2$

2.) $d(x) = 4 \cos x - 2x + 5$ (only on $[0, 2\pi]$)

Part 4 (9 points each)

Answer the following 5 questions.

1.) Where is $e(x) = \frac{x^2 + 5}{x + 2}$ increasing? Decreasing?

2.) Find all critical numbers for $a(x) = (x^2 - 8x + 12)^4$ and classify each as a local max, min or neither.

3.) Find the absolute max and min for $b(x) = x^3 - 3x^2 + 3$ on $[-1, 4]$

4.) Determine where $h(x) = \frac{1}{3}x^6 + \frac{1}{2}x^5 - 5x^4 - 4x + 7$ has points of inflection.

5.) Where is $k(x) = x^3 - 3x^2 + 3$ concave up? Concave down?

Part 5 (8 points)

Sketch the graph of the function $j(x)$ that goes along with the following information.

$j(x)$ has intercepts $(-3, 0)$, $(2, 0)$ and $(0, 2)$

$j(x)$ has asymptotes $x = -2$, $x = 1$ and $y = 1$

$j'(x) < 0$ on $(-\infty, -2) \cup (-2, 0)$

$j'(x) > 0$ on $(0, 1) \cup (1, \infty)$

$j''(x) < 0$ on $(-\infty, -2) \cup (1, \infty)$

$j''(x) > 0$ on $(-2, 1)$

Part 6 (4 points each)

Determine the end behavior for the following functions.

1.) $k(x) = -5x^3 + x^2 + 4$

2.) $m(x) = \frac{8x^2 - 14}{-2x^2 + 2x}$

Part 7 (10 points)

A major factory has costs each month given by the equation $C(x) = x^2 - 4x + 5$ where C is in terms of millions of dollars and x is the number of part time workers they employ in terms of 100. If the factory floor has room for at most 300 part time workers, how many part time workers should they employ if they wish to minimize their monthly costs? Only answers that utilize the tools of calculus will receive full credit.