Name:

Montgomery College
Rockville Campus
Department of Mathematics
MATH 181 Calculus I
Derivative and Shapes of Curves

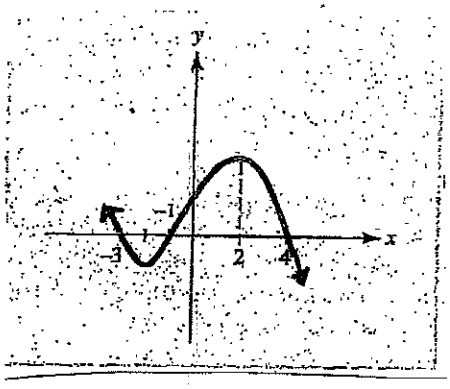
Derivative and Shapes of Curves Rules
Intervals of Increase and Decrease

Fill in the blanks.

* If $f'(x) > 0$(above x-axis) on an open interval then $f(x)$ is _____ on that open interval.

* If $f'(x) < 0$(below x-axis) on an open interval then $f(x)$ is _____ on that open interval.

1. The graph of the **derivative** of f(x) is given below. Specify the interval(s) on which $f(x)$ is increasing or decreasing.



Critical Numbers

* If c is in the domain of $f(x)$, c is a critical number if $f'(c) =$_____ OR if $f'(c)$ _____.

2. Based on the graph given in question 1. Identify the critical numbers of $f(x)$.

First Derivative Test

* The first derivative test is used to determine if a critical number c is a local maximum, local minimum or neither.

Let c be a critical number of $f(x)$ and $f(c)$ is defined.

* If $f(x)$ is decreasing to the left of c and increasing to to the right of c then at $x = c$ is a _____. In coordinate form, it is _____.

* If $f(x)$ is increasing to the left of c and decreasing to to the right of c then at $x = c$ is a _____. In coordinate form, it is _____.

3. Use First Derivative Test to classify each critical number found in question 2.

True/False

Determine if each statement is true or false. If the statement is false, explain why?

4. If f has a local maximum or local minimum at c and $f'(c)$ exists, then $f'(c) = 0$.

5. If $f'(c)$ exists and $f'(c) = 0$ then at $x = c$ is a local maximum or local minimum.

Concavity

* If $f''(x) > 0$ on an open interval then $f(x)$ is _____ on that open interval. If $f''(x) > 0$ on an open interval then $f'(x)$ is _____ on that open interval.

* If $f''(x) < 0$ on an open an interval then $f(x)$ is _____ on that open interval. If $f''(x) < 0$ for all x an open interval then $f'(x)$ is _____ on that open interval.

Inflection Points

* An inflection point is the point where $f(x)$ changes concavity.

6. Determine where the given function is concave up or concave down. Find the point(s) of inflection.

$$f(x) = x^4 - 4x^3 + 10x - 9$$

Application

7. A drug is injected into the blood stream of a patient through the right arm. The drug concentration in the bloodstream of the *left* arm t hours after the injection is approximately

$$C(t) = \frac{0.28t}{t^2+4} \quad 0 < t < 24$$

(a.) Find the critical numbers of $C(t)$.
(b.) When is the drug concentration increasing or decreasing?
(c.) When is the highest concentration of the drug in the bloodstream of the left arm?
(d.) When is the rate of change of the concentration increasing or decreasing?
(e.) When is the rate of change maximized or minimized?