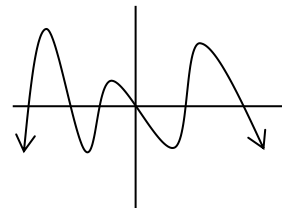


1. What are all values of x for which the function $f(x) = x^3 - 6x^2 + 9x - 1$ is decreasing?

2. Given the function $f(x) = x^4 + 2x^3$, find the relative extrema, and the points of inflection.

3. The figure shows the graph of the derivative of a function f . How many points of inflection does f have in the interval shown?



4. Let f be the function given by $f(x) = x^3 - 3x$. What are all values of c that satisfy the conclusion of the Mean Value Theorem on the closed interval $[-1, 2]$?

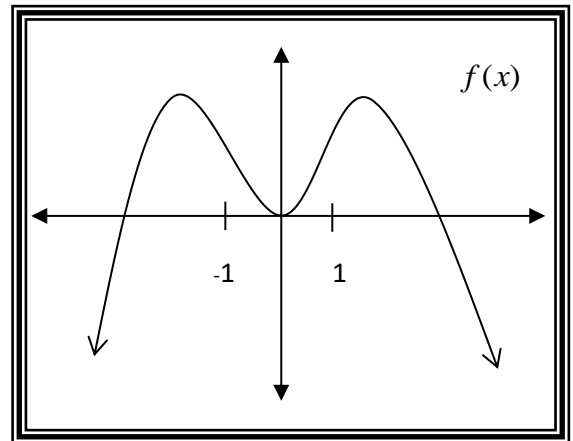
5. What are all values of x for which the graph of $y = \frac{3}{3-x}$ is concave downward?

4. The function f is continuous for $-3 \leq x \leq 3$ and differentiable for $-3 < x < 3$. If $f(-3) = 2$ and $f(3) = -4$, which statement(s) must be true?

- I. There exists c , where $-3 < c < 3$, such that $f'(c) = 0$.
- II. There exists c , where $-3 < c < 3$, such that $f'(c) = -1$.
- III. There exists c , where $-3 \leq c \leq 3$, such that $f(c) \geq f(x)$ for all x on the closed interval $-3 \leq c \leq 3$.

5. Let $f''(x) = 4x^3 - 2x$ and let $f(x)$ have critical numbers $-1, 0,$ and 1 . Use the Second Derivative Test to determine if any of the critical numbers gives a relative minimum.

6. The graph of $f(x)$ is shown in the figure to the right. Where is f' decreasing?



7. Where does the absolute maximum value of the function $f(x) = x^3 - 3x + 1$ occur on the interval $[-3, 2]$?

8. Let f be a function that is continuous on the closed interval $[0,3]$. The function f and its derivatives have the properties indicated in the table below.

x	0	$0 < x < 2$	2	$2 < x < 3$	3	$3 < x < 4$	4
$f(x)$	1	+	0	+	+1	+	-1
$f'(x)$	undefined	-	0	+	undefined	-	undefined
$f''(x)$	undefined	+	0	+	undefined	-	undefined

a) Find the x coordinate for each local extrema (identify whether it is a min or a max). Justify your answer.

b) Find the x - coordinate for any points of inflection. Justify your answer.

c) Where is $f(x)$ concave down? Justify your answer.

d) Sketch the graph of a function with the given characteristics. Justify your answer.



9. For $y' = x^2(x + 3)(x - 2)$, find the x-values of any local max and min (Identify which are maximums and which are minimums).

10. $f(x) = \frac{2}{(x-1)^2}$ Does Rolle's Theorem Apply on the interval $[0,2]$?