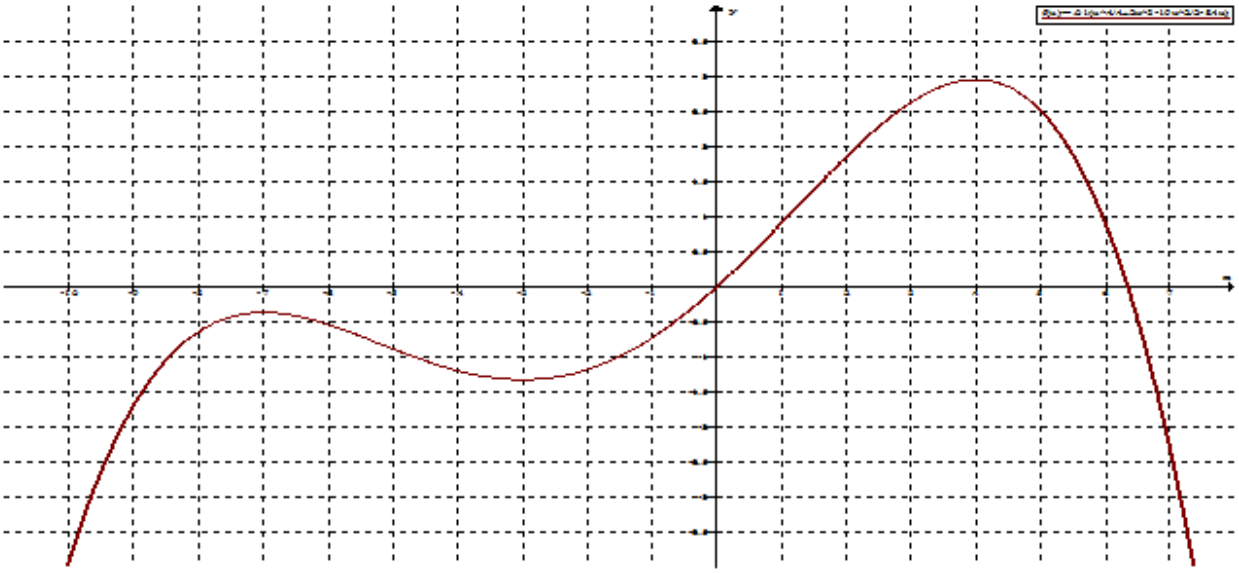
3.1 Increasing and Decreasing Functions

Goal: To define and identify increasing/decreasing functions and critical points, perform a first derivative test, and to use the first derivative/properties to sketch a function.



- A function is **INCREASING** on an interval if _____.

  The slope of the tangent will be _____.

- A function is **DECREASING** on an interval if_____.

  The slope of the tangent will be _____.

- A function is at a **CRITICAL POINT** if _____.

  The slope of the tangent is _____.

  This can occur at a _____ , _____ , _____ , or _____.

Example 1: Determine values of *x* for which the derivative of $f(x) = \frac{1}{4}x^4 - 2x^3$ equals zero.

To find the ***intervals of increase or decrease*** for the function, use the **FIRST DERIVATIVE TEST.**

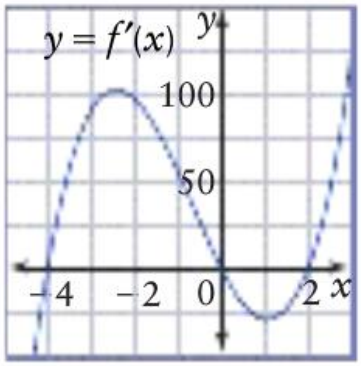
The ***intervals*** are separated by the ***critical points*** (where $f'(x) = 0$ or $f'(x) = DNE$).

Interval					
Test Value					
Sign of $f'(x)$					
Description of $f(x)$					

The function is increasing over the interval:_____

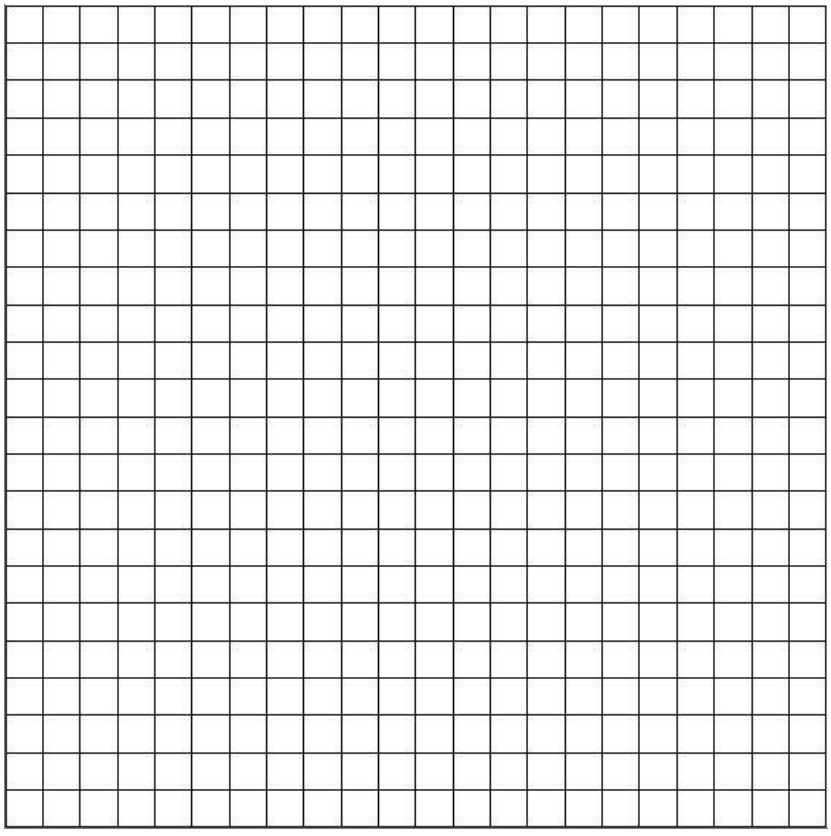
The function is decreasing over the interval:_____

Example 2: Given the graph of $f'(x)$ state the intervals of increase and decrease for the function $f(x)$. Sketch a possible graph of $y = f(x)$.

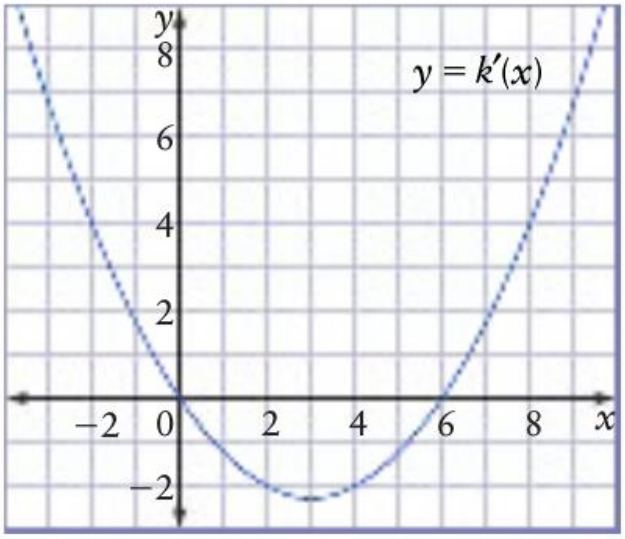


Example 3: Sketch a continuous graph that satisfies the set of conditions:

1. $f'(x) > 0$ when $-1 < x < 3$
2. $f'(x) < 0$ when $x < -1$ and $x > 3$
3. $f(-1) = -\frac{20}{27}$ and $f(3) = 4$



Example 4: Given the graph of $k'(x)$, determine which value of x in each pair gives the greater value of $k(x)$. Explain your reasoning.



a) $k(3)$ or $k(5)$

b) $k(8)$ or $k(12)$

c) $k(9)$ or $k(5)$

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