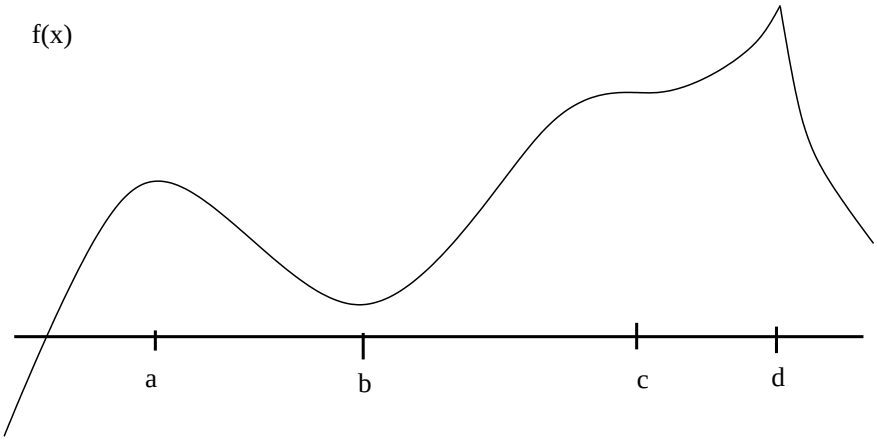
Section 5.1: First Derivatives and Graphs

Definition: A function is said to be **increasing** on an interval if the y-values get larger as the x-values increase. A function is said to be **decreasing** on an interval if the y-values get smaller as the x-values increase.



Definition: $x = a$ is called a **critical value** of $f(x)$ provided that

1)

2)

The critical values can be divided into three categories: **local (relative) minimum**, **local (relative) maximum**, or **neither**. The local minimums and local maximums are sometimes grouped together and call **local extrema**.

Example: Find the intervals where the function is increasing and where it is decreasing. Also classify all critical values.

A) $y = x^3 + 2x^2 - 9x + 8$

B) $y = 3x^5 - 20x^3 + 20$

C) $y = \dfrac{x^2 + 1}{x}$

D) $y = e^{x^2 - 4x}$

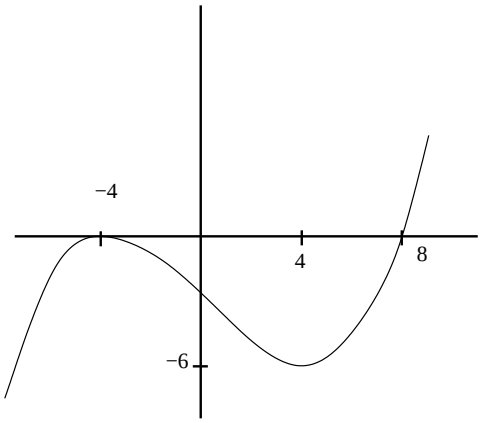
E) $y' = (x-4)^3(x+5)^2$, Note: domain of y is all real numbers.

F) $y = x\ln(x) + 1$

G) $y = \dfrac{x}{(x-3)^2}$ also $y' = \dfrac{-x-3}{(x-3)^3}$

H) $y = (x^2 - 4x)^{2/3}$

Example: Here is the graph of $f'(x)$.



Where is $f(x)$ increasing?

Where is $f(x)$ decreasing?