

The Second Derivative

The derivative of the derivative is called the **second derivative**.

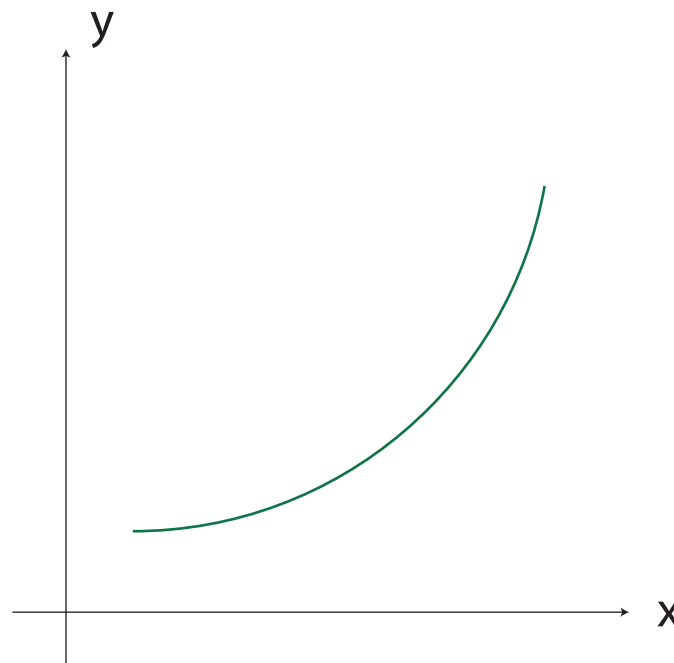
the second derivative of $f = f''(x) = \frac{d^2 f}{dx^2}$

The Second Derivative

f'' provides information about f' and f :

When f'' is positive, f' is increasing, i.e., the rate at which f is changing is increasing.

When f'' is positive, the slopes of the tangents to the graph of f are increasing and the graph of f is concave up.

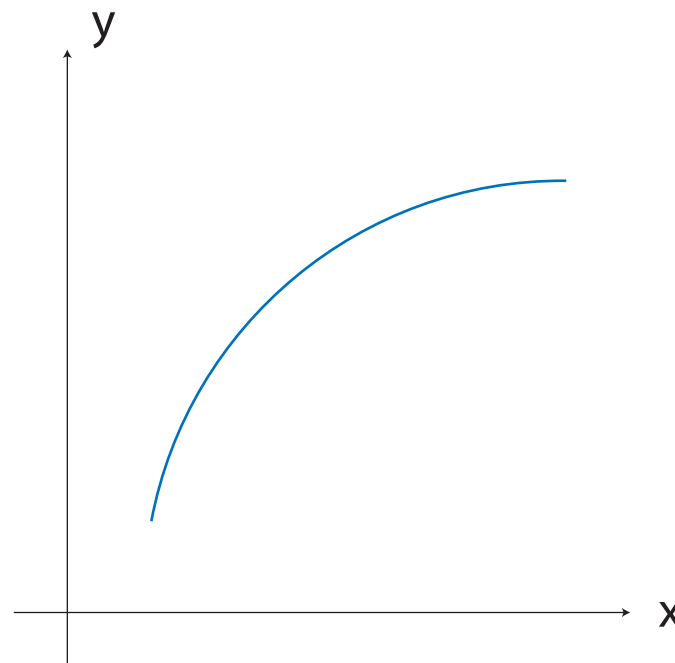


The Second Derivative

f'' provides information about f' and f :

When f'' is negative, f' is decreasing, i.e., the rate at which f is changing is decreasing.

When f'' is negative, the slopes of the tangents to the graph of f are decreasing and the graph of f is concave down.



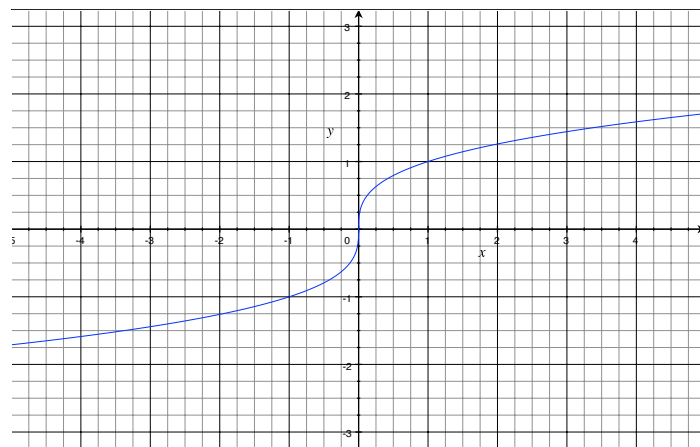
The Second Derivative

When the graph of f changes concavity at a point in the domain of f , this point is called an **inflection point**.

Note:

At an inflection point,
 $f''=0$ or f'' D.N.E.

Example: $f(x) = x^{1/3}$



The Second Derivative

Example:

Find the first and second derivatives of

$$f(x) = e^{-x^2}$$

and use them to sketch a graph.

