

## 1 5.1: Graphical Interpretation of $f$ , $f'$ , and $f''$

**Graphical Interpretations of  $f'$ :**

If  $f'(x) > 0$  for all  $x \in (a, b)$  then  $f$  is

If  $f'(x) < 0$  for all  $x \in (a, b)$  then  $f$  is

**Example:** Draw a function  $f$  from  $(1,0)$  to  $(4,5)$  with  $f' > 0$ :

**Definitions:**

a differentiable function  $f$  is **concave up** on an interval  $(a, b)$  if and only if

a differentiable function  $f$  is **concave down** on an interval  $(a, b)$  if and only if

**Therefore...**

If  $f''(x) > 0$  for all  $x \in (a, b)$ , then

If  $f''(x) < 0$  for all  $x \in (a, b)$ , then

**Examples:**

Maplet: "Properties of the Graph of a Function/First Derivative/Second Derivative" found at <http://calclab.math.tamu.edu/maple/maplets/> (Good source of On Your Own problems)

Sketch the graph of a continuous function which satisfies the following:

- $f'(x) < 0$  for  $x \in (-1, 1)$
- $f'(x) > 0$  for  $x \in (-\infty, -1) \cup (1, \infty)$
- $f(-1) = 4, f(1) = 0$
- $f''(x) < 0$  for all  $x \neq 1$