Intervals of Increase and Decrease

Let f be a function that is continuous on a closed interval $[a,b]$ and differentiable on the open interval (a,b).

(a) If $f'(x) > 0$ for every value of x in (a,b), then f is **increasing** on $[a,b]$.

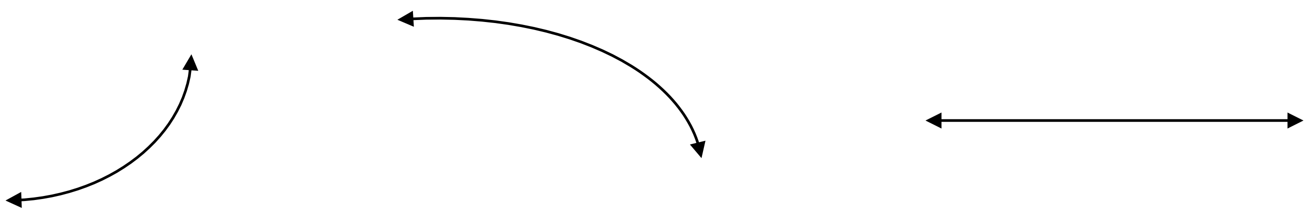
f is increasing on any interval where its graph has tangent lines with positive slope.

(b) If $f'(x) < 0$ for every value of x in (a,b), then f is **decreasing** on $[a,b]$.

f is decreasing on any interval where its graph has tangent lines with negative slope.

(c) If $f'(x) = 0$ for every value of x in (a,b), then f is **constant** on $[a,b]$.

f is constant on any interval where its graph has tangent lines with zero slope.



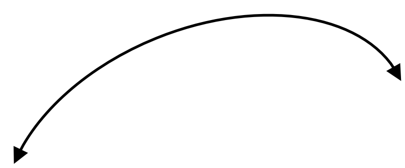
Concavity

Concave up

- "holds water"
- The curve lies above its tangent lines.
- If you travel left to right along the curve its tangent lines rotate counterclockwise so that their slopes increase.
- f is concave up on the interval if f' is increasing on the interval.
- If $f'' > 0$ on an open interval (a,b), then f is **concave up** on (a,b).

Concave down

- "spills water"
- The curve lies below its tangent lines.
- If you travel left to right along the curve its tangent lines rotate clockwise so that their slopes decrease.
- f is concave down on the interval if f' is decreasing on the interval.
- If $f'' < 0$ on an open interval (a,b), then f is **concave down** on (a,b).



Inflection Points

- Points where graphs change from concave up to concave down or vice versa are called **inflection points**.

  If f is continuous on an open interval containing x_0, and if f changes the direction of its concavity at x_0, then the point $(x_0, f(x_0))$ on the graph of f is called an **inflection point** of f, and we say that f has an inflection point at x_0.