

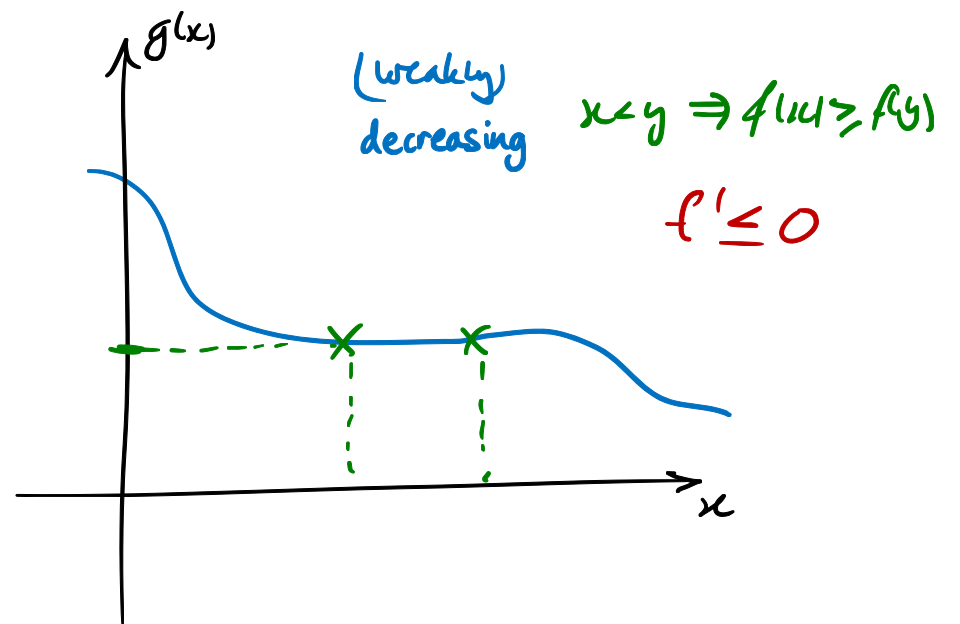
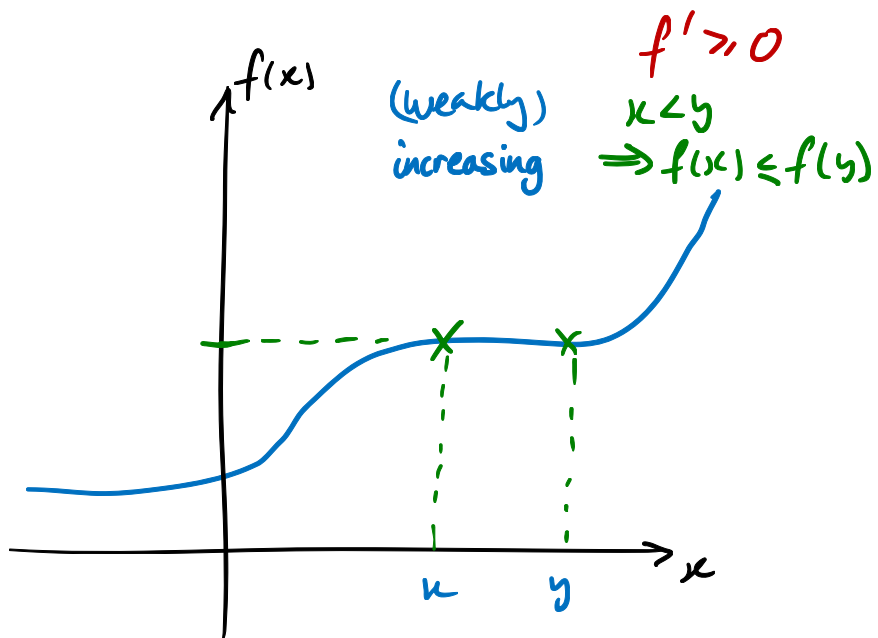
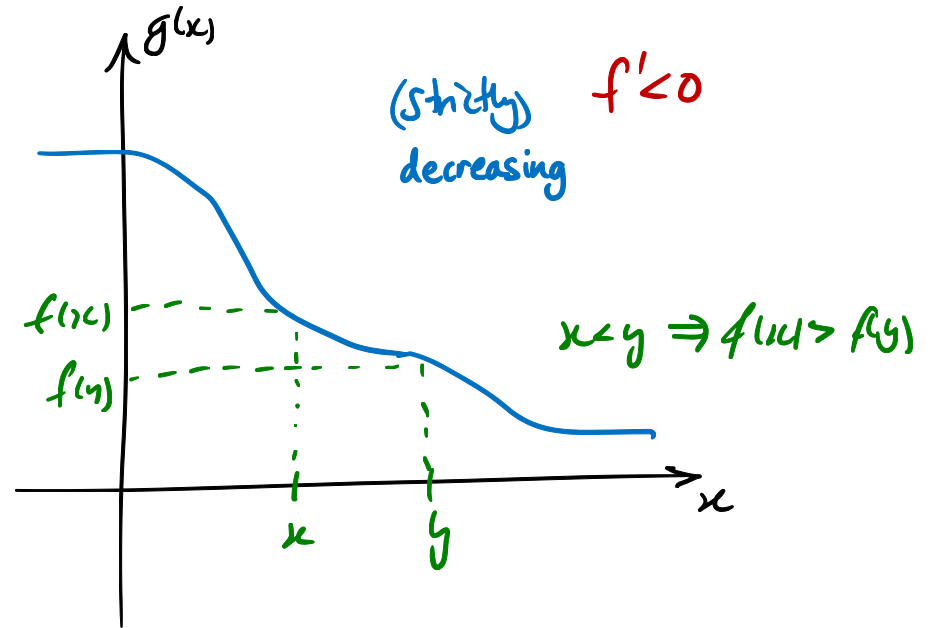
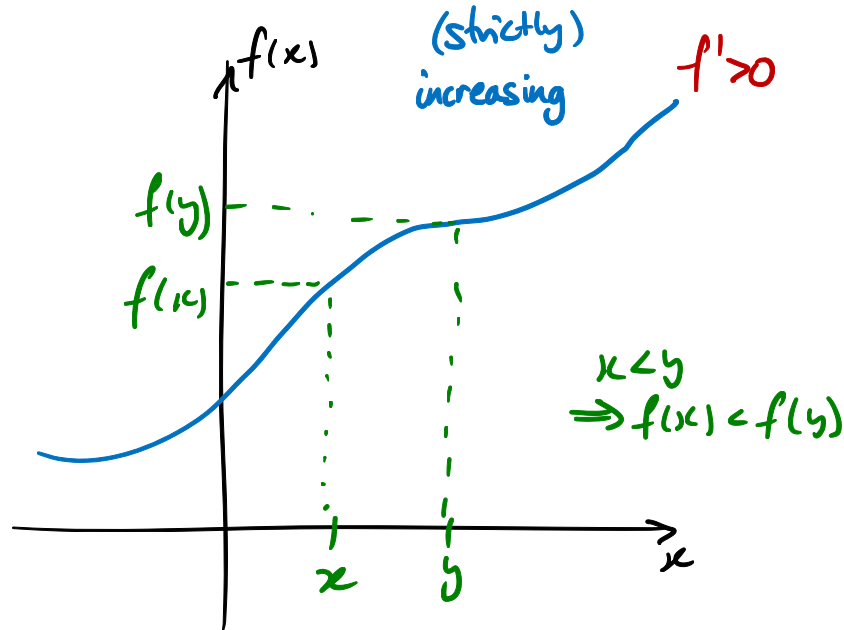
Monotonicity & derivatives

On which regions is $g(x) = 2x^2 - 8x + 15$ increasing or decreasing?

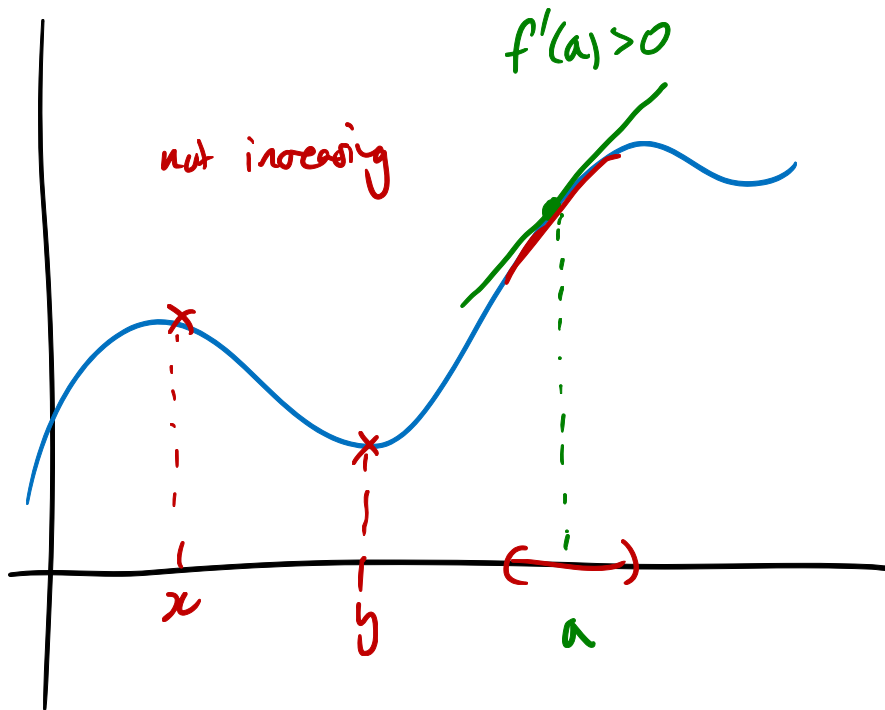
On which regions is $f(t) = 2t^3 - 3t^2 + 7$ increasing or decreasing?

On which regions is $\varphi(a) = a^3$ increasing or decreasing?

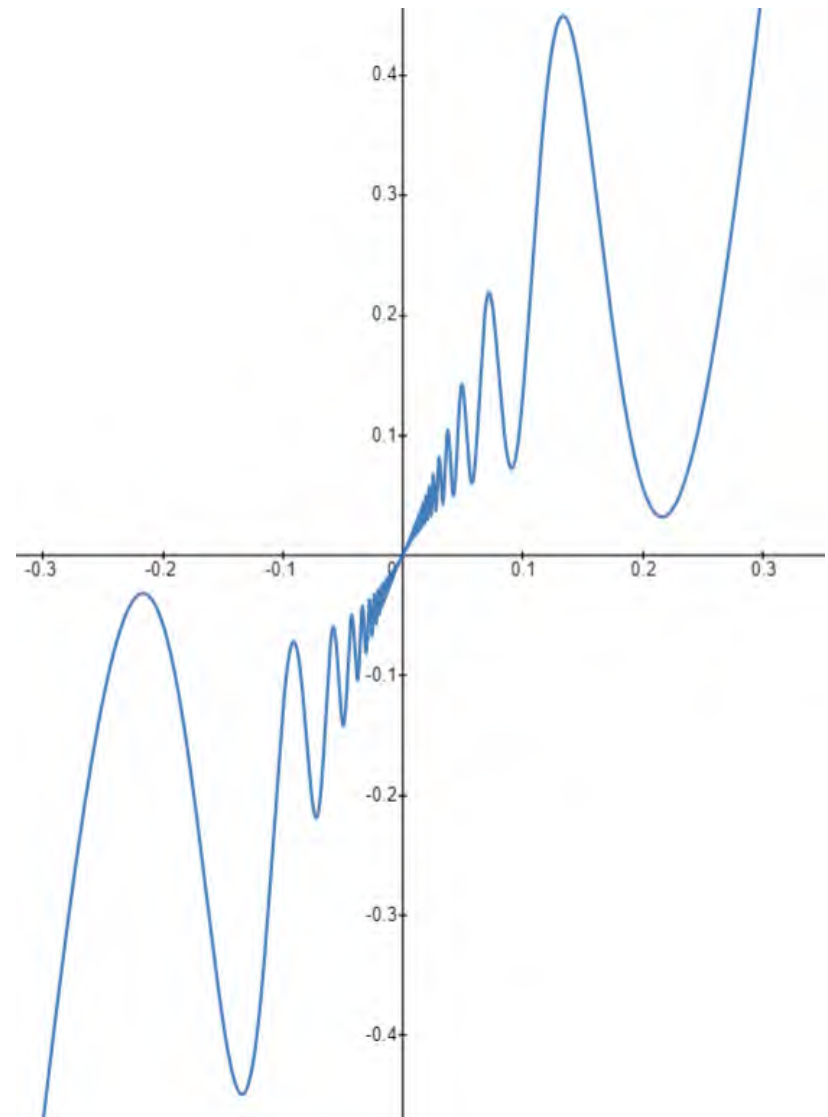
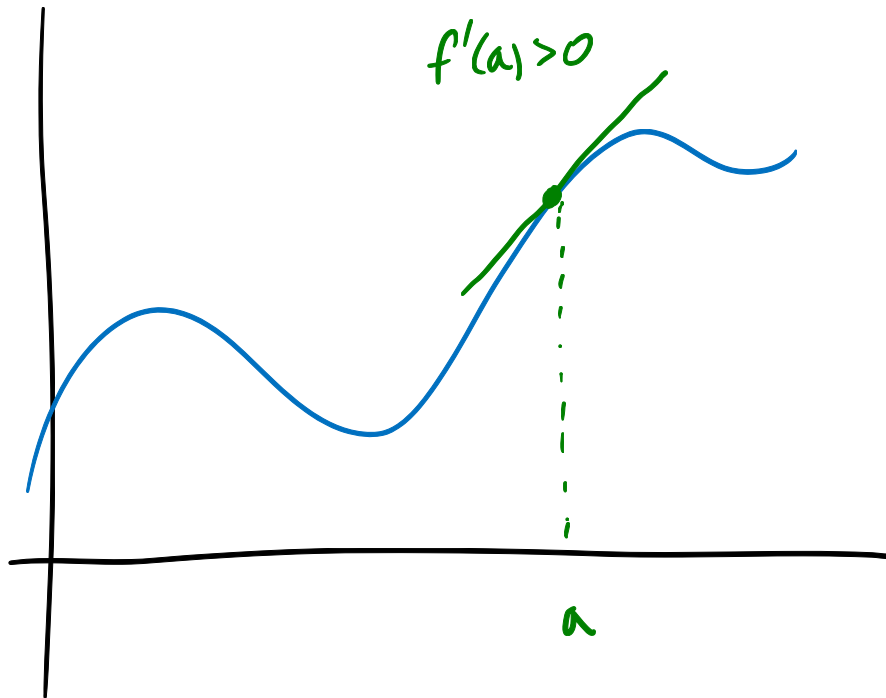
Monotonicity & derivatives



Monotonicity & derivatives

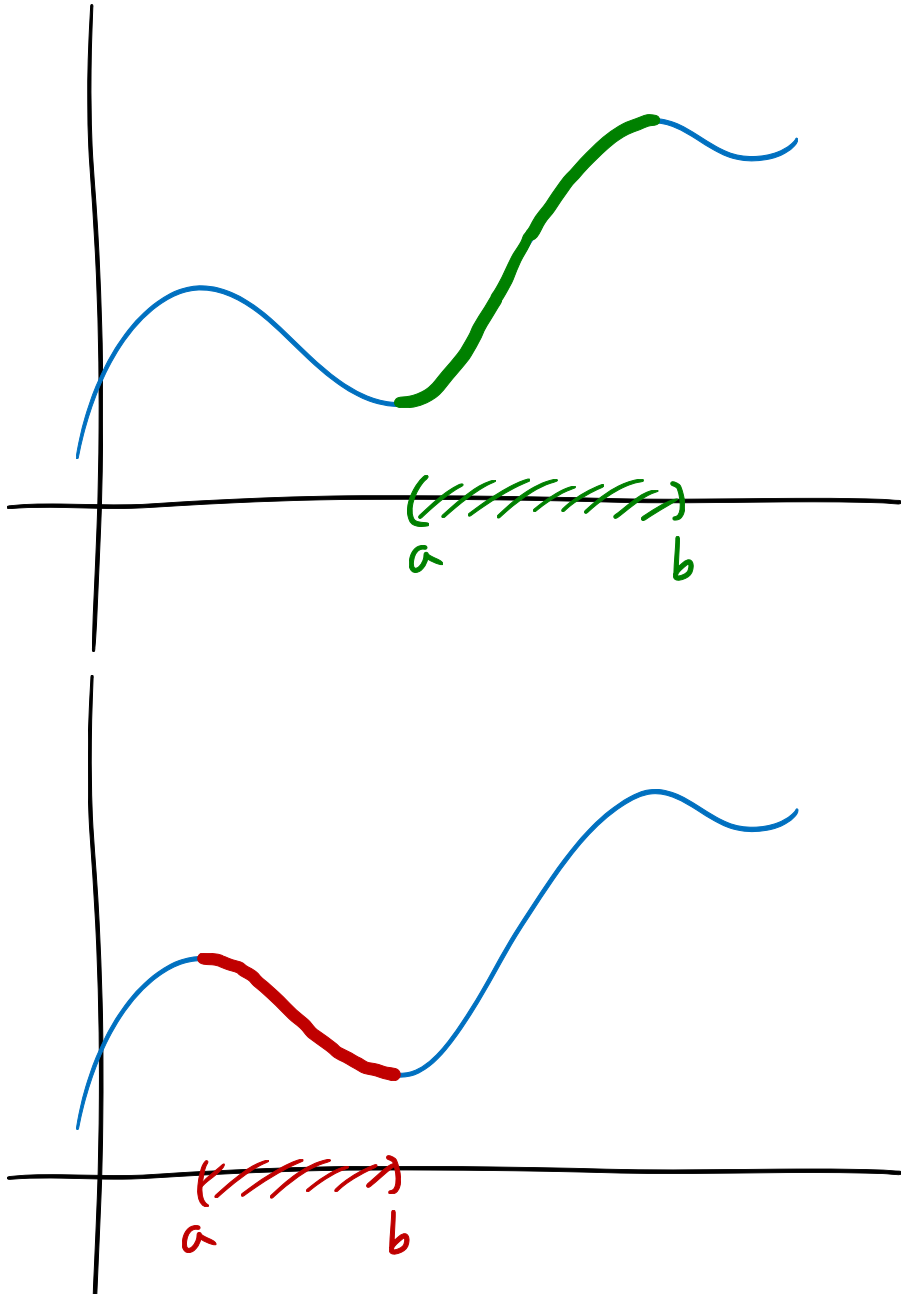


Monotonicity & derivatives



<https://www.desmos.com/calculator/cbnnooyvy>

Monotonicity & derivatives



Monotonicity Theorem

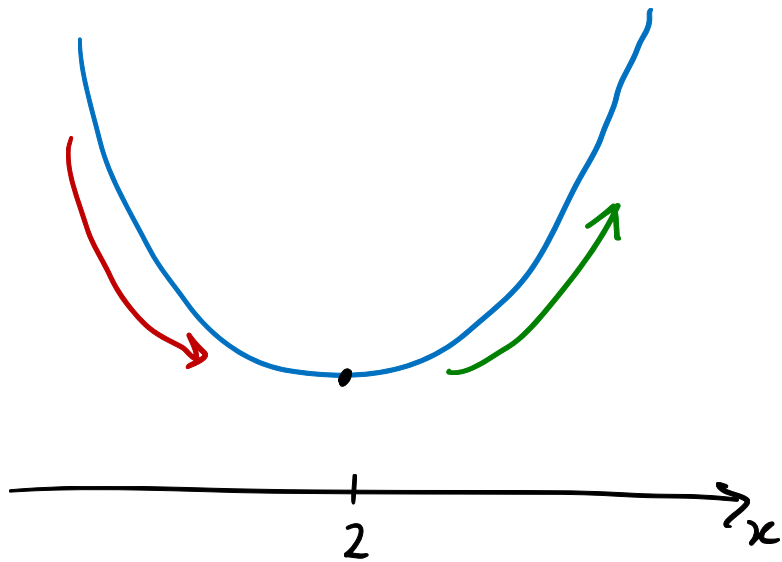
- If $f'(x) > 0$ for all x with $a < x < b$, then f is (strictly) increasing on the region $a < x < b$
- If $f'(x) \geq 0$ for all x with $a < x < b$, then f is (weakly) increasing on the region $a < x < b$
- If $f'(x) < 0$ for all x with $a < x < b$, then f is (strictly) decreasing on the region $a < x < b$
- If $f'(x) \leq 0$ for all x with $a < x < b$, then f is (weakly) decreasing on the region $a < x < b$

Monotonicity & derivatives

On which regions is $g(x) = 2x^2 - 8x + 15$ increasing or decreasing?

$$= 2(x-2)^2 + 7$$

$$g'(x) = 4x - 8 = 4(x-2)$$



$$g'(x) > 0 \text{ if } x-2 > 0 \text{ if } x > 2$$

$$g'(x) < 0 \text{ if } x-2 < 0 \text{ if } x < 2$$

$$g'(x) = 0 \text{ at } x = 2$$

So, on region $x > 2$, g is (strictly) increasing
& on region $x < 2$, g is (strictly) decreasing

Monotonicity & derivatives

On which regions is $f(t) = 2t^3 - 3t^2 + 7$ increasing or decreasing?

$$f'(t) = \underline{6t^2} - 6t = \underline{\underline{6t(t-1)}}$$

$$f'(t) > 0 \text{ if } x < 0 \text{ or } x > 1$$

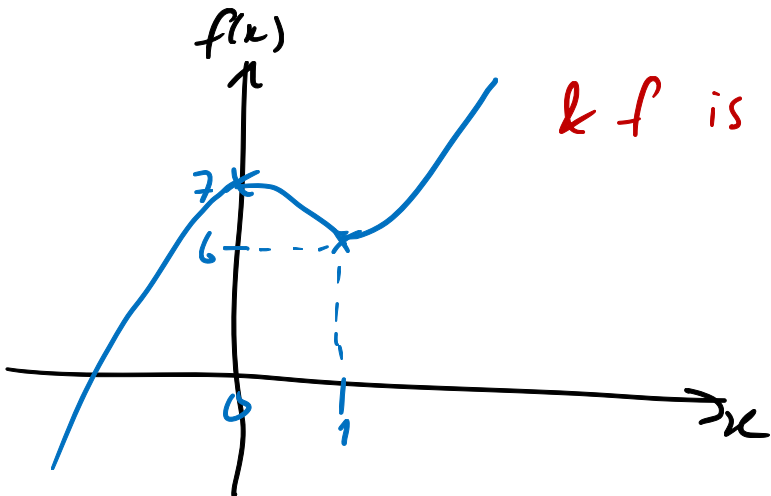
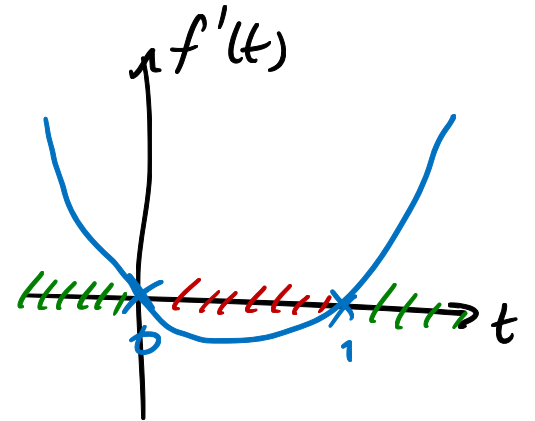
$$f'(t) < 0 \text{ if } 0 < x < 1$$

So f is increasing on regions $x < 0$
& $x > 1$

& f is decreasing on region $0 < x < 1$

$$f(0) = 7$$

$$f(1) = 6$$



Monotonicity & derivatives

On which regions is $\varphi(a) = a^3$ increasing or decreasing?

$$\begin{aligned}\varphi'(a) &= 3a^2 > 0 \text{ if } a \neq 0 \\ &= 0 \text{ if } a = 0\end{aligned}$$

on region $a < 0$, φ is (strictly) increasing
& on $a > 0$, φ is (strictly) increasing

$\varphi'(a) \geq 0$, φ is (weakly) increasing
everywhere

