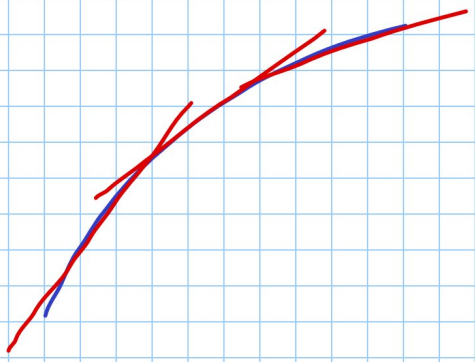
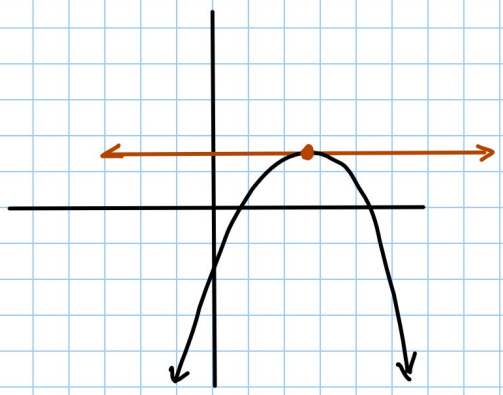
# Section 2.4 The Derivative Function



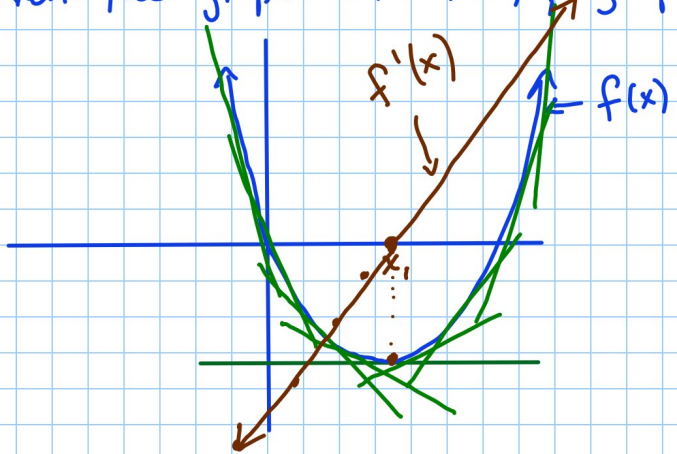
If $f(x)$ is increasing on an interval, then $f'(x) > 0$ on that interval

If $f(x)$ is decreasing on an interval, then $f'(x) < 0$ on that interval.

If $f(x)$ has a horizontal tangent at a point then $f'(x) = 0$ at that point.

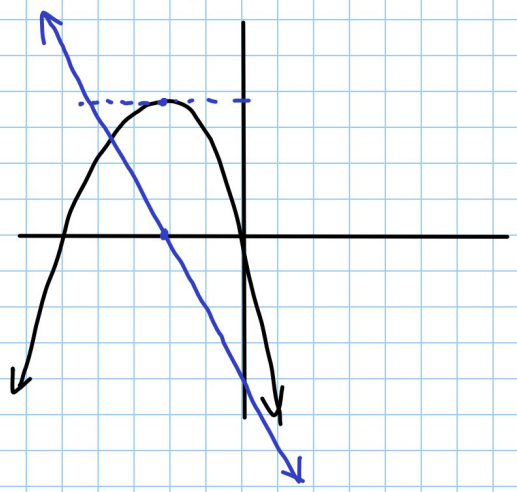


ex: Given the graph of $f(x)$, graph $f'(x)$.




$f'(x_1) = 0$

Try this. Graph $f'(x)$ for given $f(x)$:



ex: Given $f(x) = 7x^2 + 10x$, find $f'(x)$.

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$f'(x) = \lim_{h \to 0} \frac{\left[7(x+h)^2 + 10(x+h)\right] - \left[7x^2 + 10x\right]}{h}$$

$$f'(x) = \lim_{h \to 0} \frac{7(x^2 + 2xh + h^2) + 10x + 10h - 7x^2 - 10x}{h}$$

$$f'(x) = \lim_{h \to 0} \frac{\cancel{7x^2} + 14xh + 7h^2 + \cancel{10x} + 10h - \cancel{7x^2} - \cancel{10x}}{h}$$

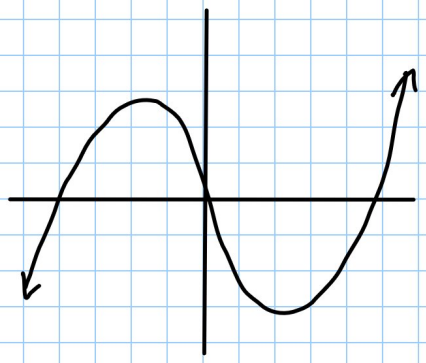
$$f'(x) = \lim_{h \to 0} \frac{\cancel{h}(14x + 7h + 10)}{\cancel{h}}$$

$$f'(x) = 14x + 7 \cdot 0 + 10$$

$$f'(x) = 14x + 10$$

## Assignment

1) Graph $f'(x)$ for $f(x)$



2) Calculate $f'(x)$ using

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

for each of the following:

A) $f(x) = 3\sqrt{x}$

B) $f(x) = 4x^2 - 7x$

C) $f(x) = \frac{5}{x}$