WARMUP

Calculate $f'(x)$ for $f(x) = 2x^2$ using

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

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

$(x+h)(x+h)$

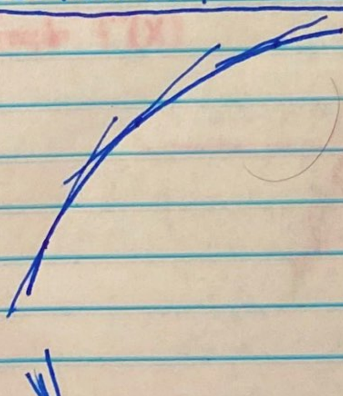
$x^2 + 2xh + h^2$

$$= \lim_{h \to 0} \frac{\cancel{2x^2} + 4xh + 2h^2 - \cancel{2x^2}}{h}$$

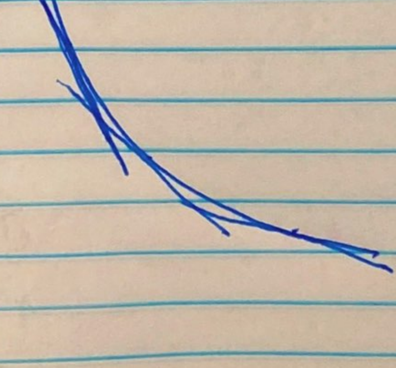
$$= \lim_{h \to 0} \frac{\cancel{h}(4x + 2h)}{\cancel{h}}$$

$$= 4x + 2 \cdot 0 \boxed{= 4x}$$

Section 2.4 The Derivative Function

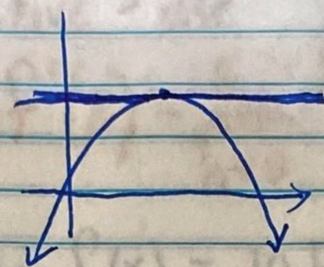


If $f(x)$ is increasing on an interval, then $f'(x) > 0$

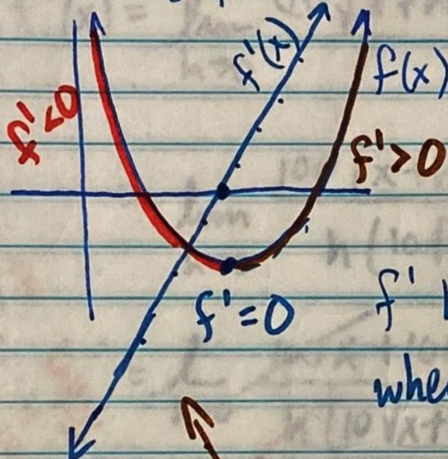


If $f(x)$ is decreasing on an interval, then $f'(x) < 0$

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

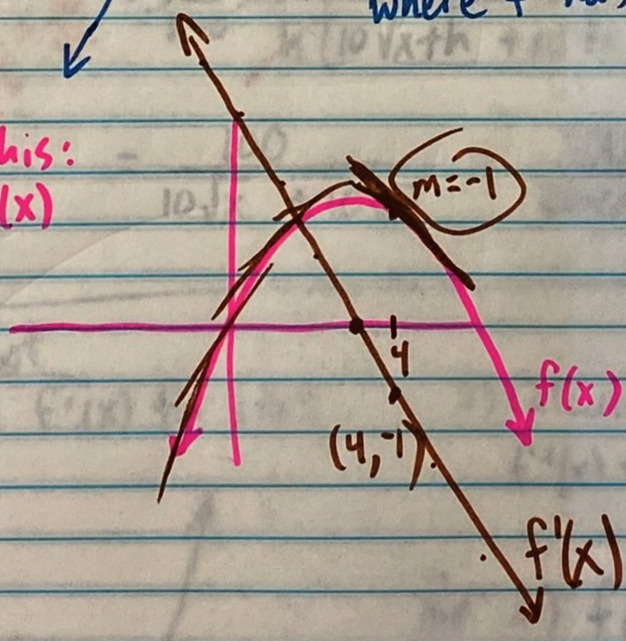


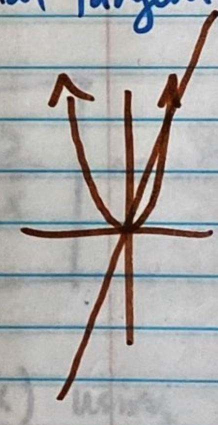
ex: Given the graph of $f(x)$, graph $f'(x)$



f' has an x-int. where f has horizontal tangents

Try this:
Graph $f'(x)$





To algebraically find $f'(x)$ using the definition of derivative use

$$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h} \quad \left.\right\} \text{derivative function}$$

ex: Given $f(x) = 10\sqrt{x}$, find $f'(x)$

$$f'(x) = \lim_{h\to 0} \frac{(10\sqrt{x+h} - 10\sqrt{x})}{h} \cdot \frac{(10\sqrt{x+h} + 10\sqrt{x})}{(10\sqrt{x+h} + 10\sqrt{x})}$$

$$= \lim_{h\to 0} \frac{100(x+h) - 100x}{h(10\sqrt{x+h} + 10\sqrt{x})}$$

$f(x) = 10x^{\frac{1}{2}}$

$f'(x) = 5x^{-\frac{1}{2}}$

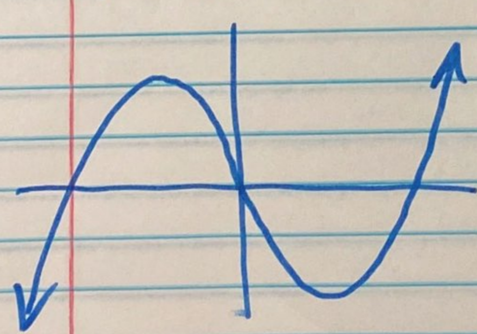
$\frac{5}{x^{\frac{1}{2}}} = \frac{5}{\sqrt{x}}$

$$= \lim_{h\to 0} \frac{\cancel{100x} + 100\cancel{h} - \cancel{100x}}{\cancel{h}(10\sqrt{x+h} + 10\sqrt{x})}$$

$$= \frac{100}{10\sqrt{x} + 10\sqrt{x}} = \frac{100}{20\sqrt{x}} = \boxed{\frac{5}{\sqrt{x}}} \text{ OR } \frac{5\sqrt{x}}{x}$$

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

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

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