2) For each function below, find an equation for f'(x) using first principals. Sketch a graph of each function and use it to help check your answers.

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

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

+1

$$= \lim_{h \to 0} \frac{\left[5 - \frac{1}{2}(x+h)\right] - \left[5 - \frac{1}{2}x\right]}{h}$$

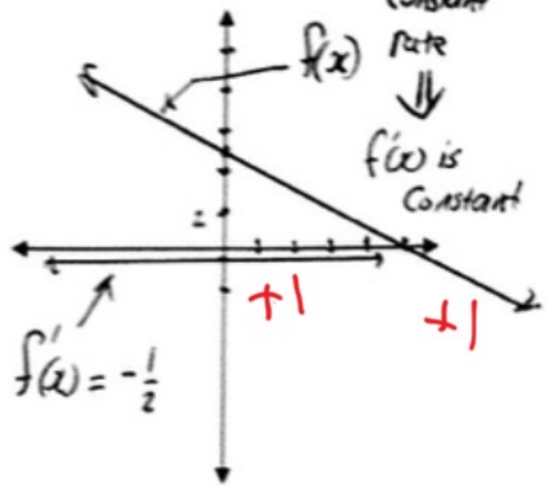
$$= \lim_{h \to 0} \frac{5 - \frac{1}{2}x - \frac{1}{2}h - 5 + \frac{1}{2}x}{h}$$

$$= \lim_{h \to 0} \frac{-\frac{1}{2}h}{h} = \lim_{h \to 0} \left(\frac{1}{2}\right) = \frac{-1}{2}$$

+1

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

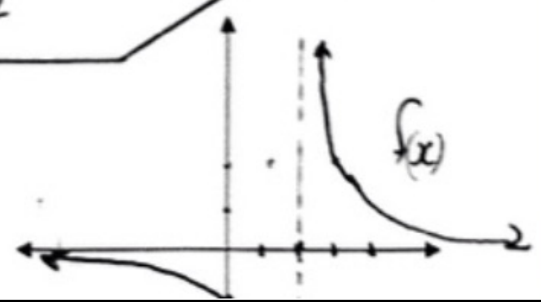
Constant rate of change (see graph)



Constant rate $\Downarrow$ f'(x) is Constant

b) $f(x) = \frac{2}{x-2}$

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



b) $f(x) = \frac{2}{x-2}$

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

$$= \lim_{h \to 0} \left(\frac{2}{(x+h)-2} - \frac{2}{x-2} \right) \frac{1}{h} \quad +1$$

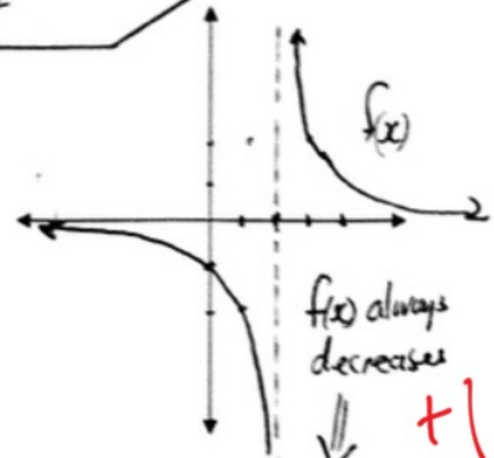
$$= \lim_{h \to 0} \left(\frac{2(x-2)}{(x+h-2)(x-2)} - \frac{2(x+h-2)}{(x+h-2)(x-2)} \right) \frac{1}{h}$$

$$= \lim_{h \to 0} \left(\frac{2x-4-2x-2h+4}{(x+h-2)(x-2)} \right) \frac{1}{h} \quad +1$$

$$= \lim_{h \to 0} \left(\frac{-2h}{(x+h-2)(x-2)} \right) \frac{1}{h} = \lim_{h \to 0} \frac{-2}{(x+h-2)(x-2)}$$

$$= \frac{-2}{(x-2)^2} = f'(x) \longrightarrow * f'(x) < 0 \text{ (see graph)}$$

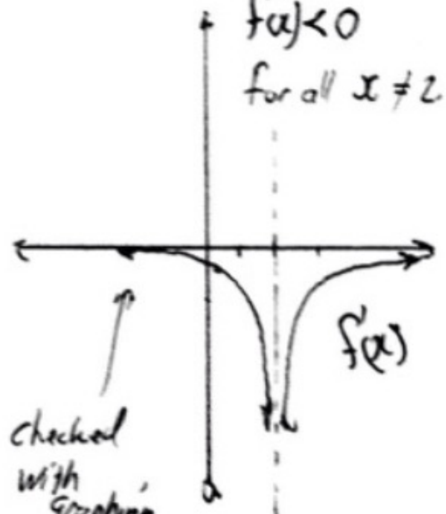
+1



f(x) always decreases +1

$\Downarrow$

$f'(x) < 0$ for all $x \neq 2$



+1

checked with graphing calculator

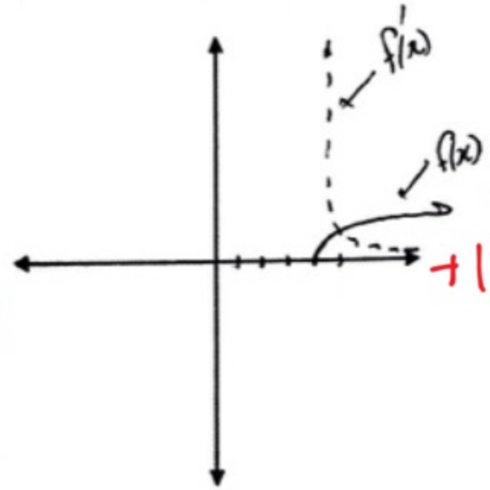
Extend Page

c) $f(x) = \sqrt{x-4}$

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

+0

Run out of time... +0



+1

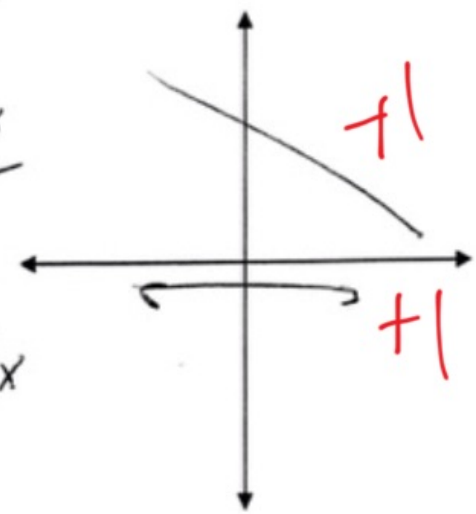
+1

$\frac{11}{14}$ 79% C

2) For each function below, find an equation for f'(x) using first principals. Sketch a graph of each function and use it to help check your answers.

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

$$f'(x) = \lim_{h \to 0} \frac{5 - \frac{1}{2}(x+h) - 5 - \frac{1}{2}x}{h} \quad +1$$

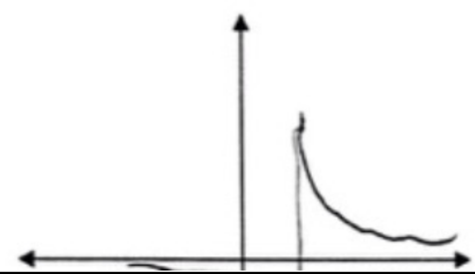


$$5 - \frac{1}{2}x + \frac{1}{2}h - 5 + \frac{1}{2}x$$

$$\frac{\frac{1}{2}h}{h}$$

$$f'(x) = -\frac{1}{2} \quad +0$$

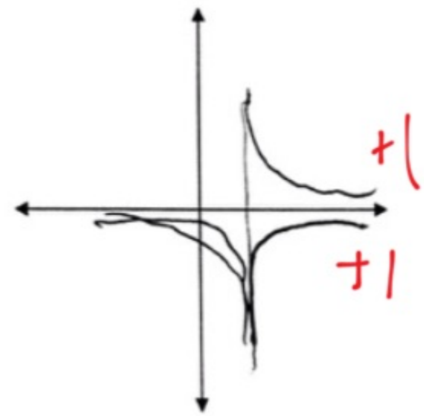
b) $f(x) = \frac{2}{x-2}$



$$f'(x) = \lim \frac{2}{} - \frac{2}{}$$

b) $f(x) = \frac{2}{x-2}$

$$f'(a) = \lim_{h \to 0} \frac{\frac{2}{x+h-2} - \frac{2}{x-2}}{h} \quad +1$$



$$\frac{2x-4 - 2x+2h-4}{(x+h-2)(x-2)} \quad +1$$

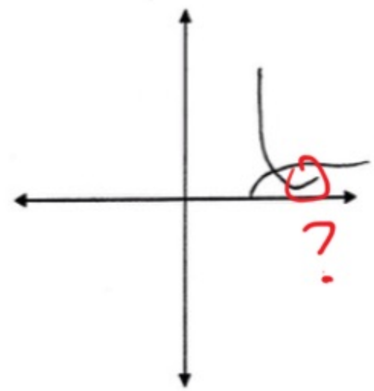
$$\frac{2\cancel{h}}{(x+h-2)(x-2)} \cdot \frac{1}{\cancel{h}}$$

$$= \frac{2}{(x-2)(x-2)} \quad +1$$

Extend Page

c) $f(x)=\sqrt{x-4}$

$$\lim_{h\to 0}\frac{\sqrt{x+h-4}-\sqrt{x-4}}{h} \quad +1$$



+1

+1

$$\frac{\cancel{x}+\cancel{h}-\cancel{4}-\cancel{x}-\cancel{4}}{h\left(\sqrt{x+h-4}+\sqrt{x-4}\right)} \quad +1$$

$$\frac{1}{\sqrt{x+4}+\sqrt{x-4}}$$

$$f'(x)=\frac{1}{2\sqrt{x-4}} \quad +1$$

$\frac{13}{14}$ 93%

A-

or

A...

c) $f(x)=\sqrt{x-4}$

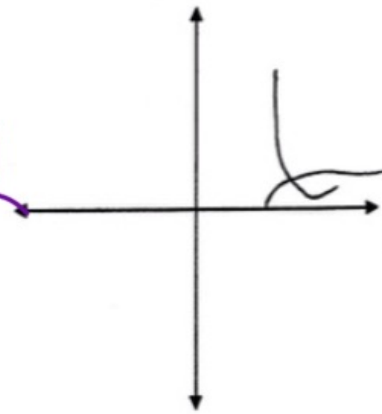
$$\lim_{h\to 0}\frac{\sqrt{x+h-4}-\sqrt{x-4}}{h} \quad +0$$

$$\frac{\cancel{x}+\cancel{h}-\cancel{4}-\cancel{x}-\cancel{4}}{h\left(\sqrt{x+h-4}+\sqrt{x-4}\right)}$$

$$\frac{1}{\sqrt{x-4}+\sqrt{x-4}} \quad +1$$

$$f'(x)=\frac{1}{2\sqrt{x-4}} \quad +1$$

OR



+1

+1

$\frac{12}{14}$

B

?