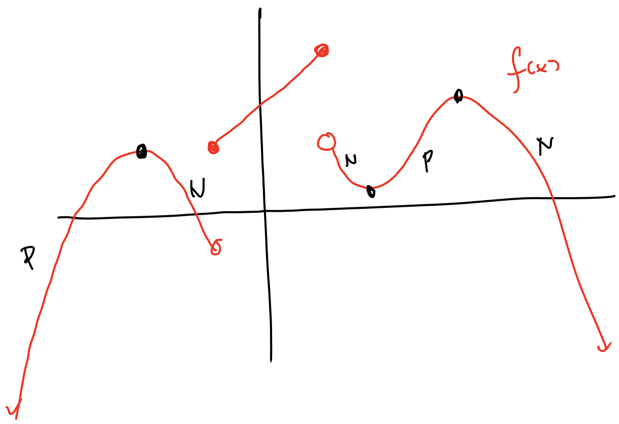
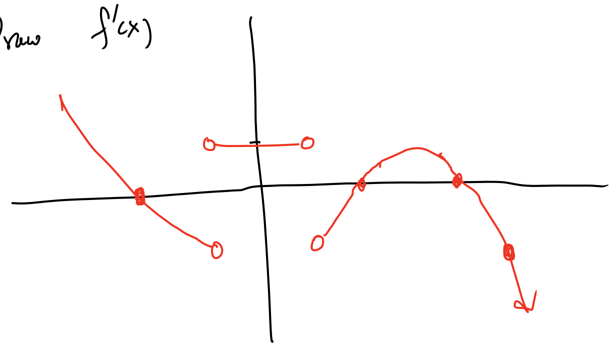


Draw $f'(x)$



It costs 10¢ per minute if you watch 30 mins or less,

8¢ per minute if you watch more than 30.

Write a formula for $f(x) =$ cost of x minutes. in cents

$$f(x) = \begin{cases} 10x & \text{if } x \leq 30 \\ 8x & \text{if } x > 30 \end{cases}$$

First 30 mins cost 10¢,
each additional minute costs 8¢.

$$f(x) = \begin{cases} 10x & \text{if } x \le 30 \\ \underbrace{300}_{\text{cost of first 30 mins}} + \underbrace{8(x-30)}_{\text{cost of additional mins.}} & \text{if } x > 30 \end{cases}$$

Is it continuous?

plug 30 into each piece.

$10x \to 10 \cdot 30 = 300$ ← same!

$300+8(x-30) \to 300+8(30-30) = 300$

so it is continuous at $x=30$

3.2 #20

$$f(x) = \begin{cases} x-1 & \text{if } x<1 \\ 0 & \text{if } 1 \le x \le 4 \\ x-2 & \text{if } x>4 \end{cases}$$

$\lim_{x \to 1^-} f(x) = 1-1 = 0$

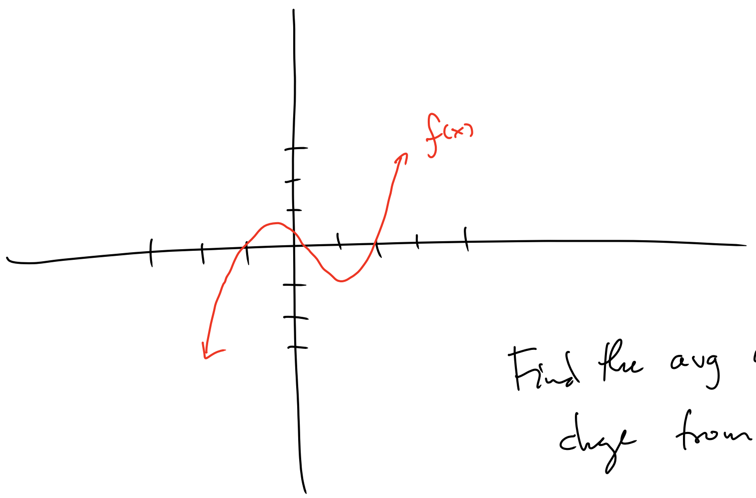
$\lim_{x \to 1^+} f(x) = 0$

is cont. at $x=1$

$\lim_{x \to 4^-} f(x) = 0$

$\lim_{x \to 4^+} f(x) = 4-2 = 2$

f is discontinuous at $x = 4$.



Find the avg rate of change from $x = -1$ to $x = 1$.

$$\frac{f(b) - f(a)}{b - a} = \frac{f(1) - f(-1)}{1 - -1}$$

$$= \frac{-1 - 0}{2} = -1/2$$

x	$f(x)$
-2	3
-1	2
0	7
1	8
2	5

find avg rate of change from $x = -2$ to 1

$$\frac{f(1) - f(-2)}{1 - -2} = \frac{8 - 3}{1 - -2} = \frac{5}{3}$$

Find inst. rate of change of

$f(x) = 7x - x^2$ at $a = 1$.

$$f'(1) = \lim_{h\to 0} \frac{f(1+h)-f(1)}{h} = \lim_{h\to 0} \frac{7(1+h)-(1+h)^2-(7\cdot 1-1^2)}{h}$$

$$= \lim_{h\to 0} \frac{7+7h-(1+2h+h^2)-6}{h}$$

$$= \lim_{h\to 0} \frac{\cancel{7}+7h-\cancel{1}-2h-h^2-\cancel{6}}{h}$$

$$= \lim_{h\to 0} \frac{7h-2h-h^2}{h} = \lim_{h\to 0} \frac{5h-h^2}{h}$$

$$= \lim_{h\to 0} \frac{\cancel{h}(5-h)}{\cancel{h}} = \lim_{h\to 0} 5-h = 5$$

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

Find $f'(x)$. $\qquad 8x-2$

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

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

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

$$= \lim_{h\to 0} \frac{\cancel{4x^2}+8xh+4h^2-\cancel{2x}-2h-\cancel{4x^2}+\cancel{2x}}{h}$$

$$= \lim_{h\to 0} \frac{8xh+4h^2-2h}{h} = \lim_{h\to 0} \frac{\cancel{h}(8x+4h-2)}{\cancel{h}}$$

$= 8x + 4 \cdot 0 - 2$

$= 8x - 2 = 2(4x - 1)$