

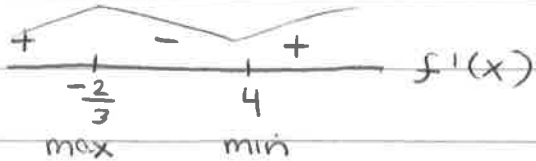
Extrema Quiz Review

1. $f(x) = x^3 - 5x^2 - 8x + 4$

$$f'(x) = 3x^2 - 10x - 8$$

$$0 = (3x+2)(x-4)$$

$$\text{CN: } x = -\frac{2}{3} \quad x = 4$$

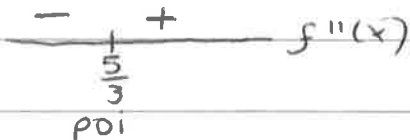


$$f''(x) = 6x - 10$$

$$0 = 6x - 10$$

$$10 = 6x$$

$$\text{CN: } x = \frac{5}{3}$$



a) $(-\infty, -\frac{2}{3}) \cup (4, \infty)$

b) $(-\frac{2}{3}, 4)$

c) $(\frac{5}{3}, \infty)$

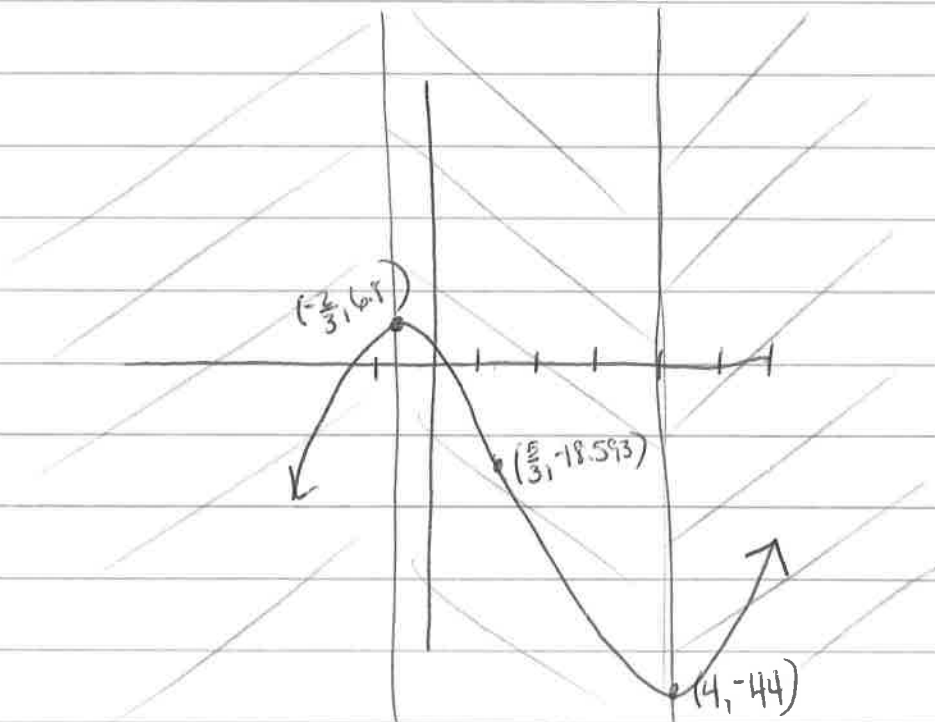
d) $(-\infty, \frac{5}{3})$

e) $(-\frac{2}{3}, 6.815)$

f) $(4, -44)$

g) $(\frac{5}{3}, -18.593)$

h) see graph



$$2. f(x) = 12x^{1/3} - x$$

$$f'(x) = 4x^{-2/3} - 1$$

$$0 = \frac{4}{x^{2/3}} - 1$$

$$1 = \frac{4}{x^{2/3}}$$

$$(x^{2/3})^{3/2} = (4)^{3/2}$$

$$CN: x = \pm 8 \text{ \& } x = 0$$

$$\begin{array}{c} + \quad + \quad + \quad + \\ | \quad | \quad | \quad | \\ -8 \quad 0 \quad 8 \end{array} f'(x)$$

$$f''(x) = -\frac{8}{3}x^{-5/3}$$

$$0 = -\frac{8}{3x^{5/3}}$$

$$0 = -8$$

$$CN: x = 0$$

$$\begin{array}{c} + \quad - \\ | \quad | \\ 0 \\ \text{poi} \end{array} f''(x)$$

$$a) (-\infty, -8) \cup (-8, 0) \cup (0, 8) \cup (8, \infty)$$

$$b) \text{ none}$$

$$c) (-\infty, 0)$$

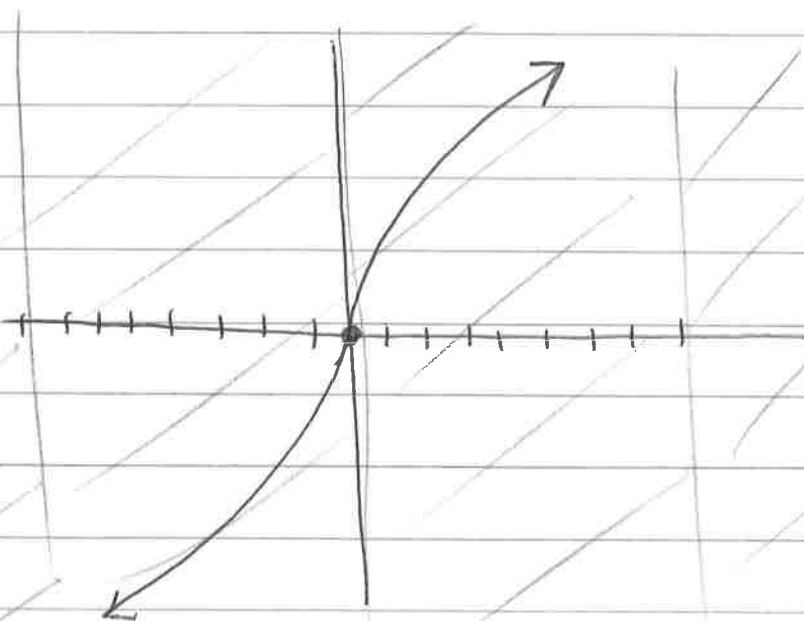
$$d) (0, \infty)$$

$$e) \text{ none}$$

$$f) \text{ none}$$

$$g) (0, 0)$$

$$h) \text{ see graph}$$



3. $f(x) = \frac{x+2}{x-9} \quad x \neq 9$ HA: $y=1$

$$f'(x) = \frac{(1)(x-9) + (x+2)(-1)}{(x-9)^2}$$

$$0 = \frac{-11}{(x-9)^2}$$

$$0 = -11$$

$$\text{CN: } x=9$$



a) increasing: none

b) decreasing: $(-\infty, 9) \cup (9, \infty)$
 $(-\infty, \infty)$ b/c $f'(x) < 0$

e) rel max: none

f) rel min: none

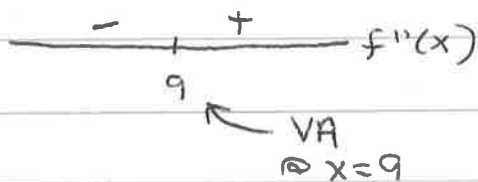
$$f'(x) = -11(x-9)^{-2}$$

$$f''(x) = 22(x-9)^{-3}$$

$$0 = \frac{22}{(x-9)^3}$$

$$0 = 22$$

$$\text{CN: } x=9$$

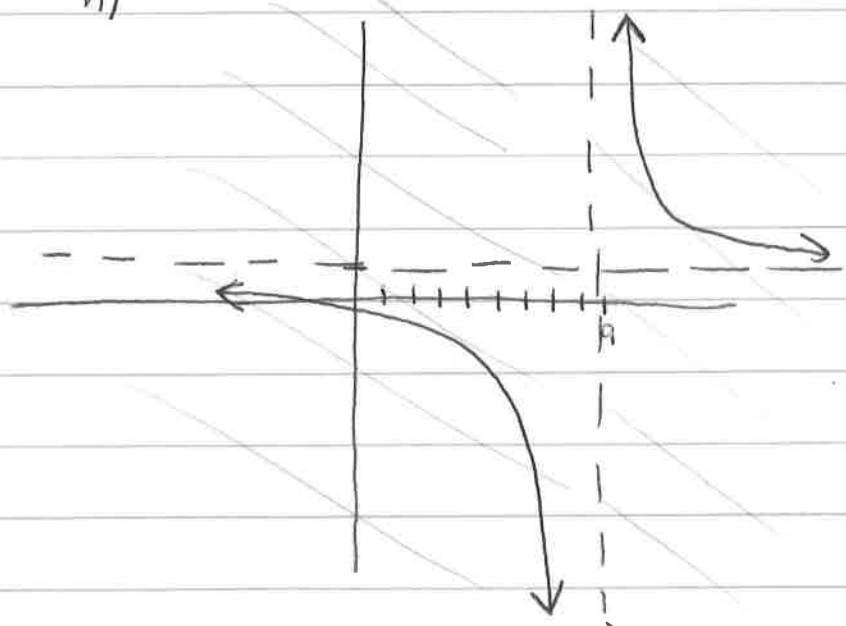


c) concave up: $(9, \infty)$ b/c $f''(x) > 0$

d) concave down: $(-\infty, 9)$ b/c $f''(x) < 0$

g) poi: none

h)



$$4. f(x) = x^2 - 12x + 4 \quad [-3, 5]$$

$$f'(x) = 2x - 12$$

$$0 = 2(x - 6)$$

$$\text{CN. } x = 6$$

$$f(-3) = 49 \rightarrow \text{abs. max}$$

$$f(5) = -31 \rightarrow \text{abs. min}$$

$$f(6) = \text{not on interval}$$

$$5. f(x) = x^2 - 3x + 2 \quad [0, 5]$$

$$f'(x) = 2x - 3$$

$$2 = 2x - 3$$

$$5 = 2x$$

$$x = \frac{5}{2}$$

$$f(0) = 2$$

$$f(5) = 12$$

$$m = \frac{12 - 2}{5 - 0} = 2$$

$$6. f(x) = x^{2/3} - 4 \quad [-1, 8]$$

$$f'(x) = \frac{2}{3}x^{-1/3}$$

$$\frac{1}{3} = \frac{2}{3x^{1/3}}$$

$$3x^{1/3} = 6$$

$$(x^{1/3})^3 = (2)^3$$

$$x = 8$$

$$f(-1) = -3$$

$$f(8) = 0$$

$$m = \frac{0 + 3}{8 + 1} = \frac{1}{3}$$

$$7. a) \text{ increasing: } (-1, 3)$$

$$\text{decreasing: } (-\infty, -1) \cup (3, \infty)$$

$$b) \text{ concave up: } (-\infty, 1)$$

$$\text{concave down: } (1, \infty)$$

$$c) \text{ max}(s): x = 3$$

$$\text{min}(s): x = -1$$

$$d) \text{ poi: } x = 1$$

8. a) increasing: $(-\infty, -3)$

~~decreasing~~ decreasing: $(-3, 3) \cup (3, \infty)$

b) concave up: $(0, 3)$

concave down: $(-\infty, 0) \cup (3, \infty)$

c) max(s): $x = -3$

min(s): none

d) poi: $x = 0$ & $x = 3$

9. see graph

9)

$$f(-4) = 6, \quad f(5) = 2$$

$$f'(-4) = 0$$

$$f'(x) > 0 \text{ for } (-\infty, -4] \cup (2, \infty)$$

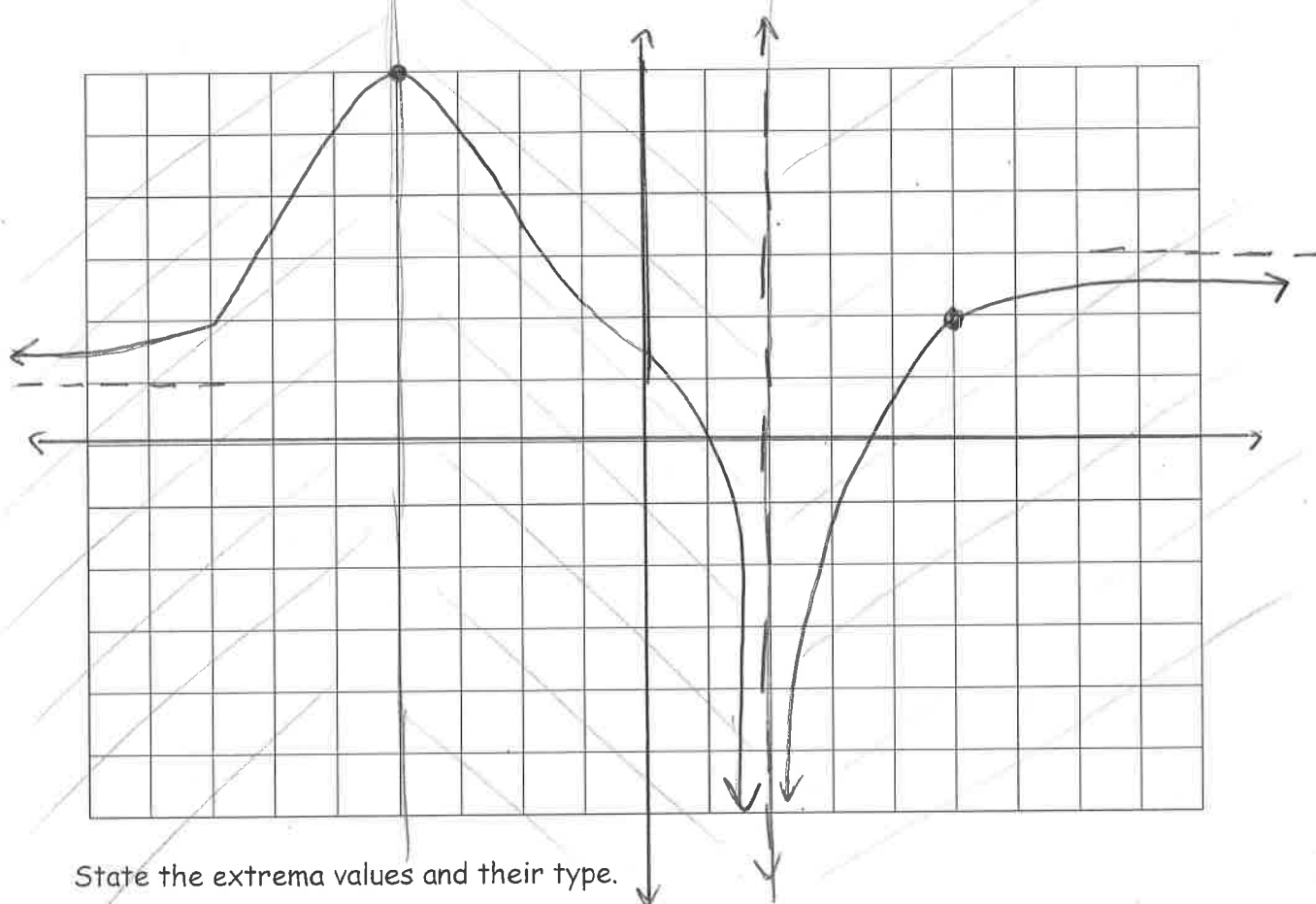
$$f'(x) < 0 \text{ for } [-4, 2)$$

$$f''(-7) = f''(-2) = 0$$

$$f''(x) > 0 \text{ for } (-\infty, -7) \cup (-2, 0)$$

$$f''(x) < 0 \text{ for } (-7, -2) \cup (0, 2) \cup (2, \infty)$$

$$\lim_{x \rightarrow -\infty} f(x) = 1, \quad \lim_{x \rightarrow \infty} f(x) = 3, \quad \lim_{x \rightarrow 2^+} f(x) = -\infty, \quad \lim_{x \rightarrow 2^-} f(x) = -\infty$$



State the extrema values and their type.

relative max: $(-4, 6)$