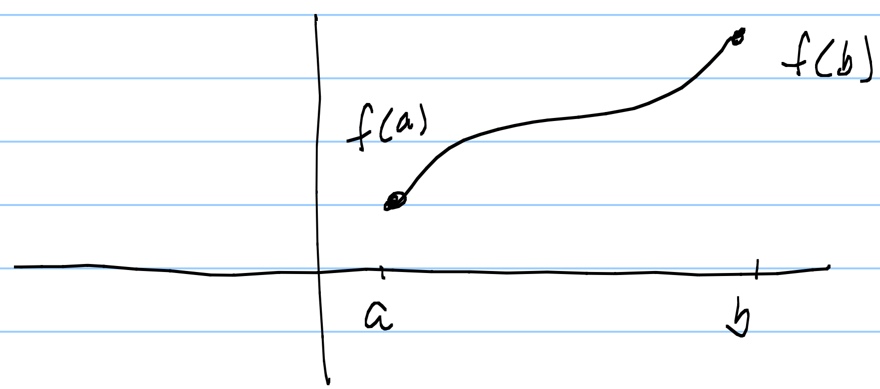
Note Title 3/13/2018

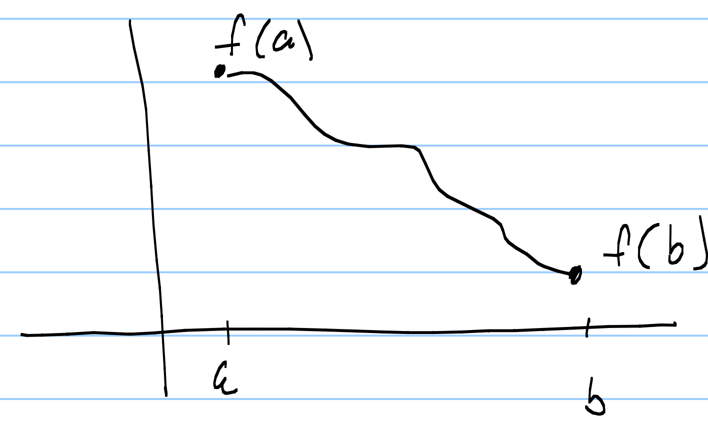
# CHAPTER 3 – GRAPHING.

- USING 1ST DERIVATIVES TO FIND MAX/MIN VALUES AND GRAPH SKETCHING.

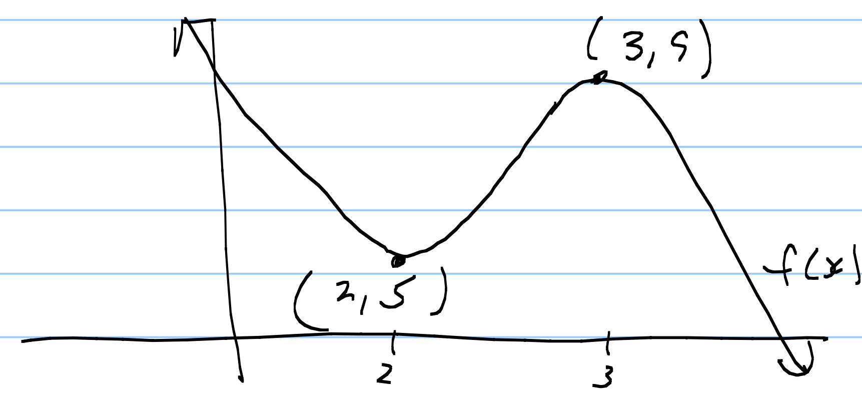
- A FUNCTION IS INCREASING ON AN INTERVAL IF, AND ONLY IF, FOR EVERY $a$ AND $b$ IN THE INTERVAL WHERE $a < b$ THEN $f(a) < f(b)$



- A FUNCTION IS DECREASING $a < b$ THEN $f(a) > f(b)$




– FIND WHERE $f(x)$ IS INCREASING, DECREASING OR NEITHER



SOLN

- INCREASING BETWEEN $(2, 3)$
- DECREASING BETWEEN $(-\infty, 2)$ AND $(3, \infty)$
- NEITHER AT $x = 2$ AND $x = 3$

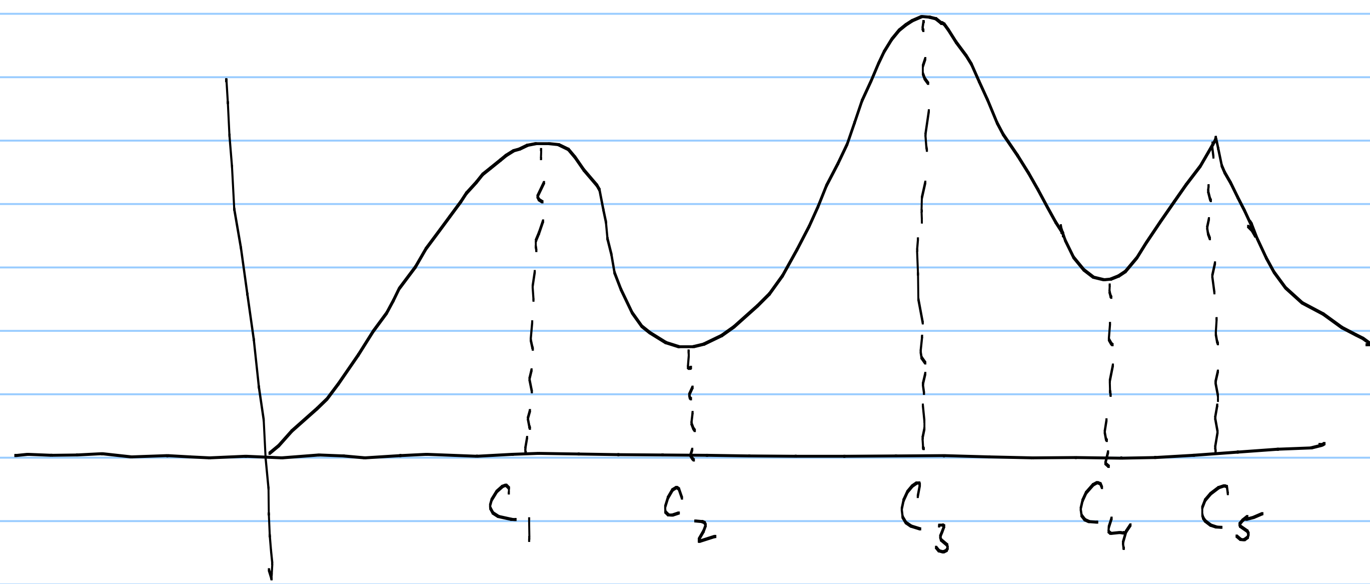
THESE ARE CALLED CRITICAL POINTS

THEOREM

IF $f'(x) > 0$, $\underbrace{\forall x \in I}_{\text{FOR EVERY } x \text{ IN THE INTERVAL}}$, THEN $f$ IS INCREASING IN $I$ (IE. SLOPE IS POSITIVE)

IF $f'(x) < 0$, $\forall x \in I$, THE $f$ IS DECREASING IN $I$ AND THE SLOPE IS NEGATIVE

IF $f'(x) = 0$ OR $f'(x) = \pm\infty$ THEN $f$ IS A CRITICAL POINT OR $f'(x)$ DNE.



RELATIVE MAX = CRITICAL POINTS ARE HIGHER THAN
ANY SURROUNDING POINTS

ABSOLUTE MAX = HIGHEST POINT

RELATIVE MIN = CRITICAL POINTS ARE LOWER THAN
ANY SURROUNDING POINTS

ABSOLUTE MIN = LOWEST POINT.

II FIND CP'S AND SKETCH

$$f(x) = \frac{1}{3}x^3 + \frac{1}{2}x^2 - 6x$$

SOLN

x - INTERCEPTS

$$\frac{1}{3}x^3 + \frac{1}{2}x^2 - 6x = 0$$

$$x\left(\frac{1}{3}x^2 + \frac{1}{2}x - 6\right) = 0$$

$x = 0$ $\quad x = 3.5$ $\quad x = -5$

y - INTERCEPT

$$\frac{1}{3}(0)^3 + \frac{1}{2}(0)^2 - 6(0) = y$$

$$0 = y$$

CP'S $\Rightarrow f'(x) = x^2 + x - 6$

$$x^2 + x - 6 = 0$$

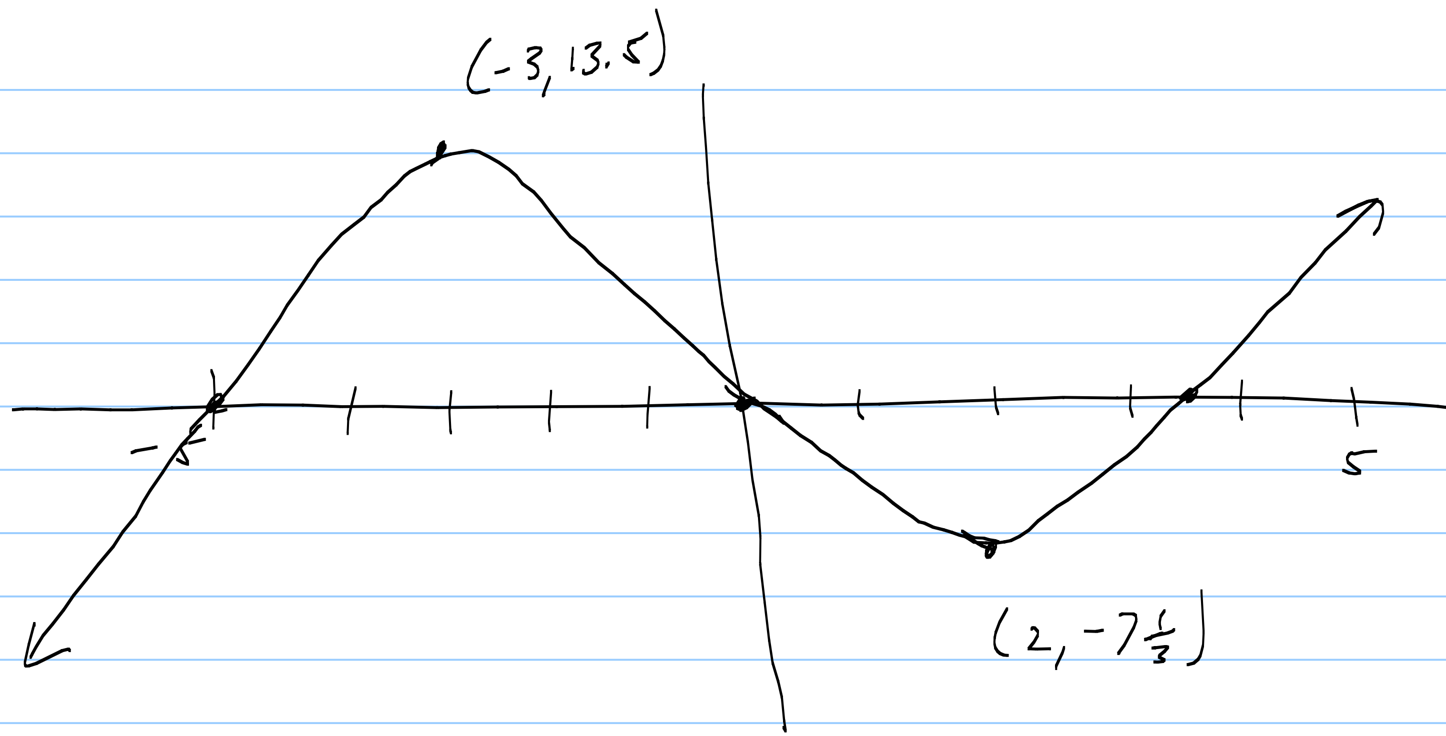
$(x+3)(x-2)=0$

$x=-3 \quad x=2$

SUB INTO ORIGINAL FUNCTION $y = 13.5$, $y = -7\frac{1}{3}$

$(-3, 13.5) \quad (2, -7\frac{1}{3})$

| | $-\infty \to -3$ | $-3$ | $-3 \to 2$ | $2$ | $2 \to \infty$ |
|---|---|---|---|---|---|
| $f'(x)$ | $+ \ (>0)$ | 0 | $- \ (<0)$ | 0 | $+$ |
| $f(x)$ | INCREASING | 0 | DECREASING | 0 | INCREASING |

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# 1, 12, 19, 27, 31, 33, 34