

20 Wednesday, October 18.

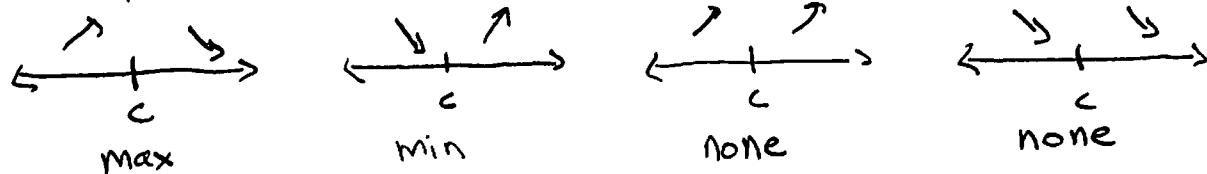
Review.

- Given the graph of $f(x)$, $f(x) > 0$ ($f(x) < 0$) when it is above (below) the x -axis.
- Inc/Dec:
 - Definition: $f(x)$ is increasing (decreasing) if its graph is trending upwards (downwards) when reading it left to right.
 - FDT: $f(x)$ is increasing (decreasing) over (a,b) when $f'(x) > 0$ ($f'(x) < 0$).

- Extrema:

- Definition: $f(c)$ is a relative max (min) if there is an open interval containing c such that $f(c)$ is the greatest (least).

- FDT: if $x=c$ is a critical number of f ($f'(c)=0$ or DNE), then



- SDT: if $f'(c)=0$, then $f(c)$ is a max (min) if $f''(c) < 0$ ($f''(c) > 0$).

- Concavity.

- Definition: f is concave up (down) over (a,b) when f' is increasing (decreasing) on (a,b) .

- Given a graph of f , it is concave up (down) when it is curving upward (downward).



- SDT: $f(x)$ is concave up (down) over (a,b) when $f''(x) > 0$ ($f''(x) < 0$) over (a,b) .

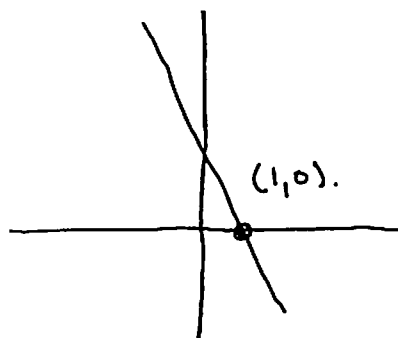
- Inflection Points.

when $f(x)$ changes concavity and f is continuous.

Ex:

Find inc/dec, extrema, concavity, and inflection points of f .

(1) Graph of $f(x)$.



I: none

D: $(-\infty, \infty)$

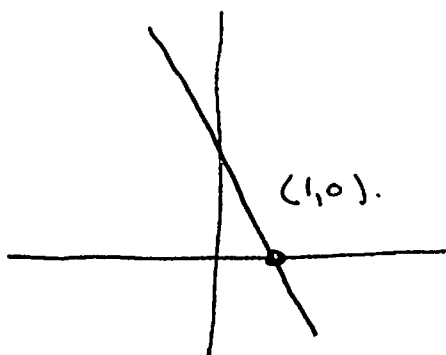
Extrema:
none

CU: none

CD: none.

IP:
none

(2) Graph of $f'(x)$.



I: $(-\infty, 1)$.

D: $(1, \infty)$.

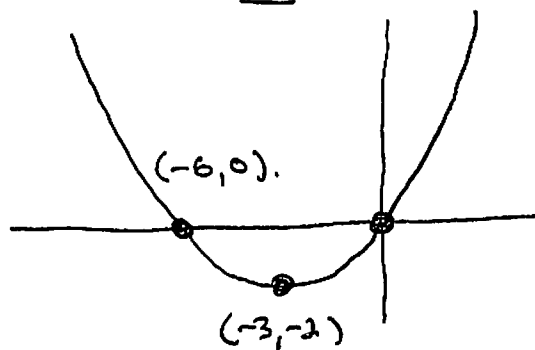
Critical numbers:
 $x = 1$ max.

CU: none

CD: $(-\infty, \infty)$.

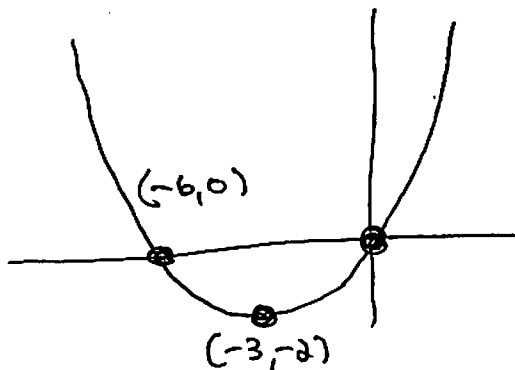
IP:
none

(3) Graph of $f(x)$.



I: $(-3, \infty)$ Extrema: $CU: (-\infty, \infty)$ IP: none.
D: $(-\infty, -3)$ $x = -3$ min. $CD: \text{none}$

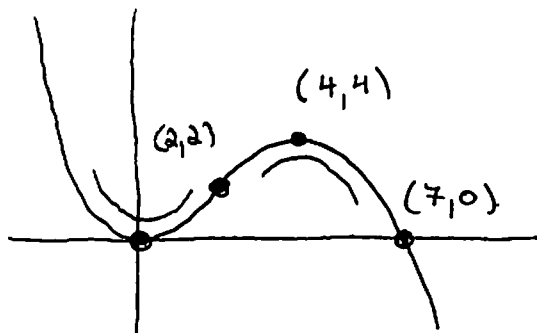
(4) Graph of $f'(x)$.



I: $(-\infty, -6) \cup (0, \infty)$ Critical #'s:
D: $(-6, 0)$ $x = 0$ min
 $x = -6$ max.

$CU: (-3, \infty)$ IP:
 $CD: (-\infty, -3)$ $x = -3$.

(5) Graph of $f(x)$



$$I: (0, 4)$$

$$D: (-\infty, 0) \cup (4, \infty)$$

Extrema:

$$\begin{array}{ll} x=0 & \text{min} \\ x=4 & \text{max} \end{array}$$

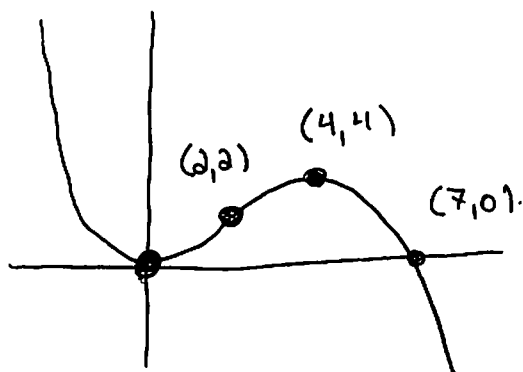
$$CU: (-\infty, 2)$$

$$CD: (2, \infty)$$

IP:

$$x=2$$

(6) Graph of $f'(x)$



$$I: (-\infty, 7)$$

$$D: (7, \infty)$$

Critical #'s:

$$\begin{array}{ll} x=0 & \text{none} \\ x=7 & \text{max} \end{array}$$

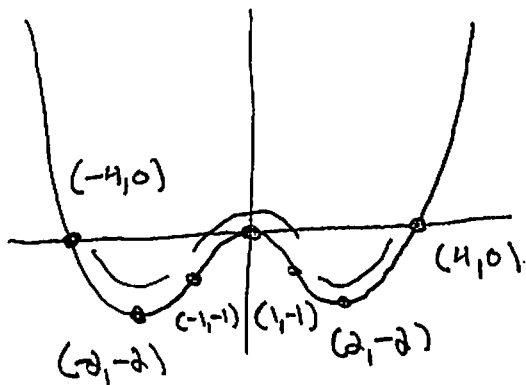
$$CU: (0, 4)$$

$$CD: (-\infty, 0) \cup (4, \infty)$$

IP:

$$x=0, 4$$

(7) Graph of $f(x)$



$$I: (-\infty, -2) \cup (2, \infty)$$

$$D: (-\infty, -2) \cup (0, 2)$$

Extrema:

$$x = -2 \quad \text{min}$$

$$x = 0 \quad \text{max}$$

$$x = 2 \quad \text{min}$$

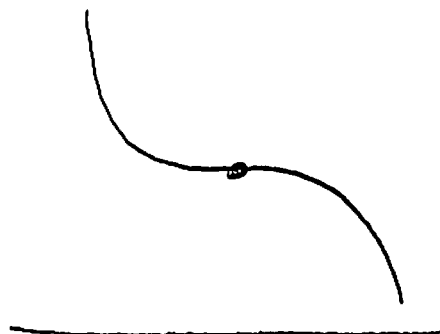
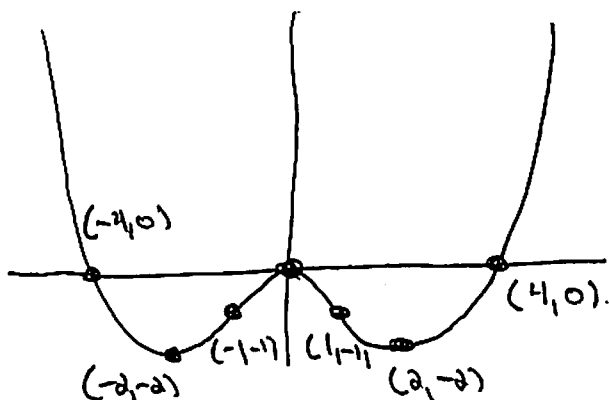
$$CU: (-\infty, -1) \cup (1, \infty)$$

$$CD: (-1, 1)$$

IP:

$$x = \pm 1$$

(8) Graph of $f'(x)$



$$I: (-\infty, -4) \cup (4, \infty)$$

$$D: (-4, 4)$$

Critical #'s:

$$x = -4 \quad \text{max}$$

$$x = 0 \quad \text{none}$$

$$x = 4 \quad \text{min.}$$

$$CU: (-2, 0) \cup (2, \infty)$$

$$CD: (-\infty, -2) \cup (0, 2)$$

IP:

$$x = \pm 2, 0$$