Graph $f(x) = (x-2)(x+3)$
$= x^2 + x - 6$

Plot <u>only</u> important points!!!

☆ 1) critical points!!!
(since they could be relative extrema)

2) intercepts (maybe)
$(0, \_)$
$(\ , \underline{0})$

3) See section 3.2
3.3

$f(x) = x^2 + x - 6$

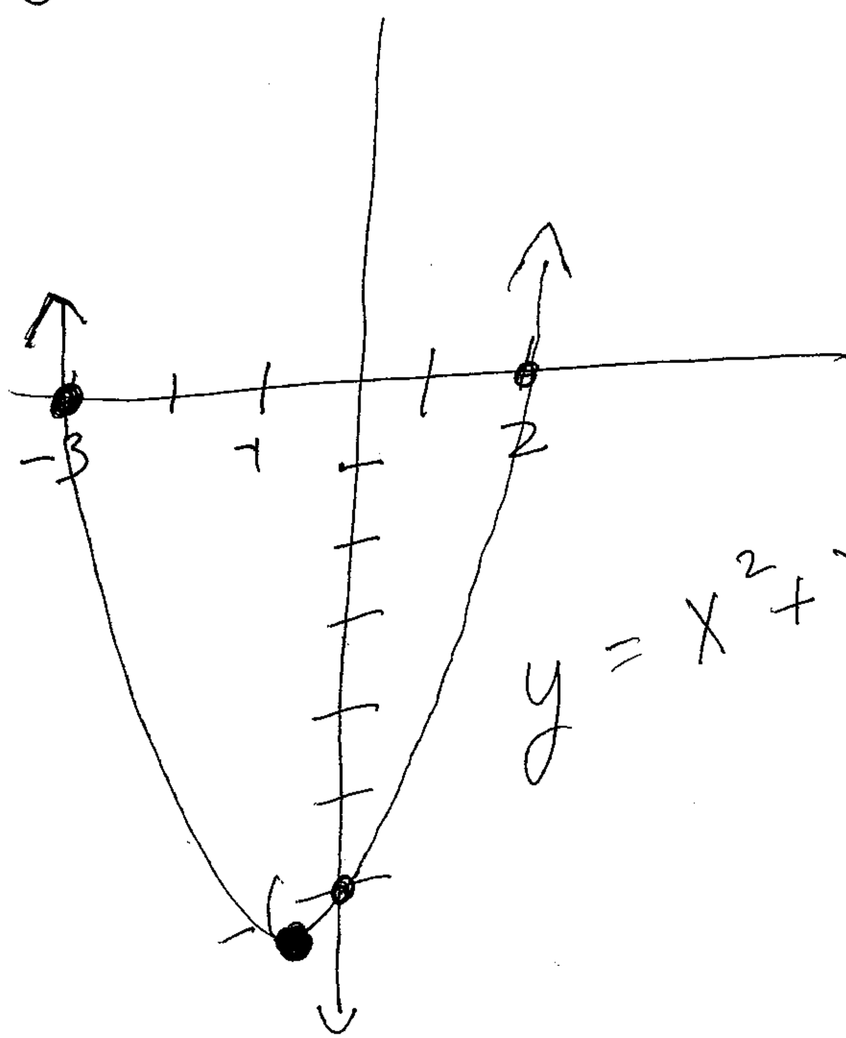
$f'(x) = 2x + 1 = 0, \text{ DNE}$

$\Rightarrow 2x = -1 \text{ or } x = -\frac{1}{2}$

x	y
$-1/2$	$-6\frac{1}{4}$
0	-6
2	0
-3	0

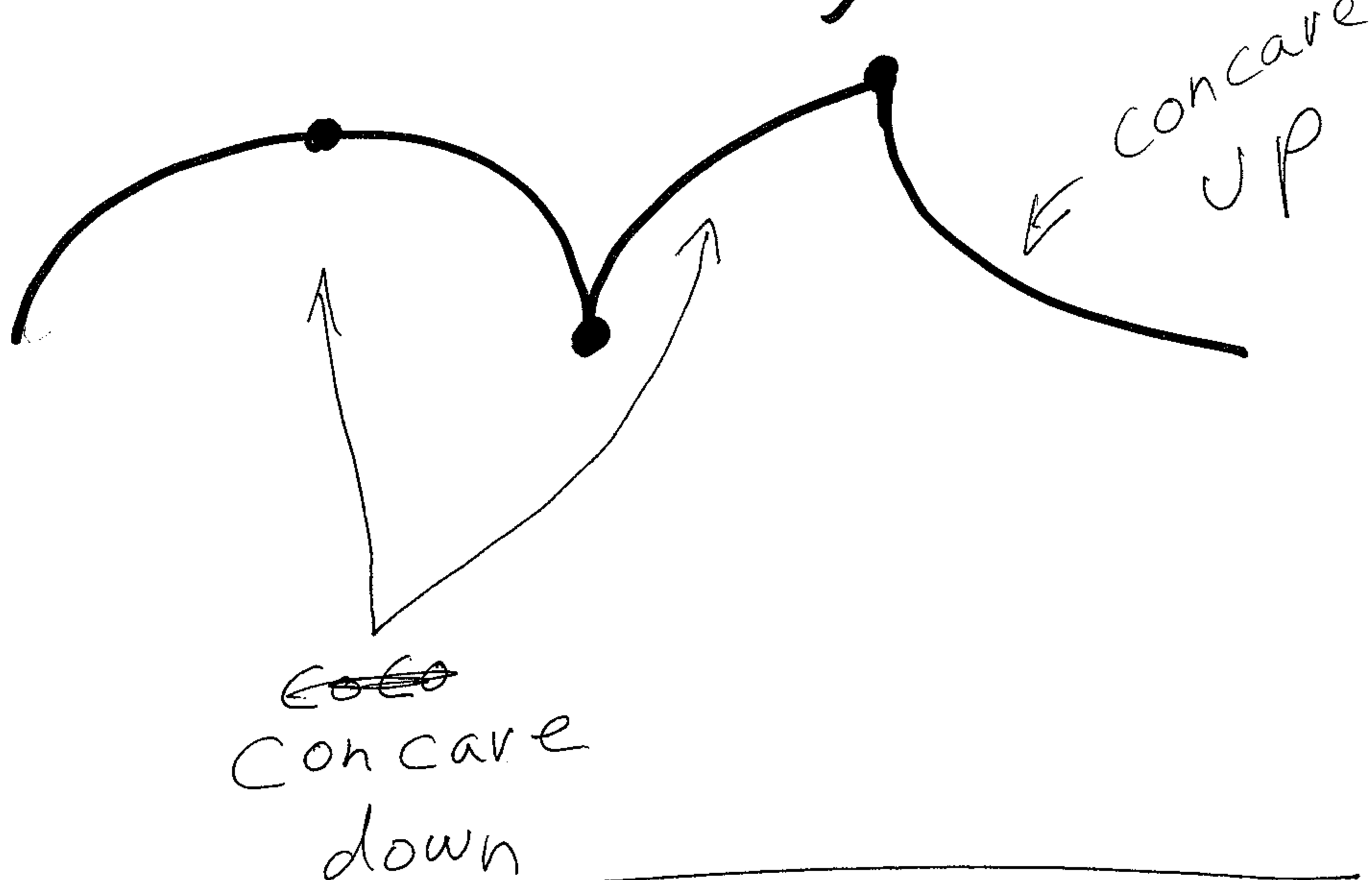
$f(-\frac{1}{2}) = \frac{1}{4} - \frac{1}{2} - 6$

$= -6\frac{1}{4}$

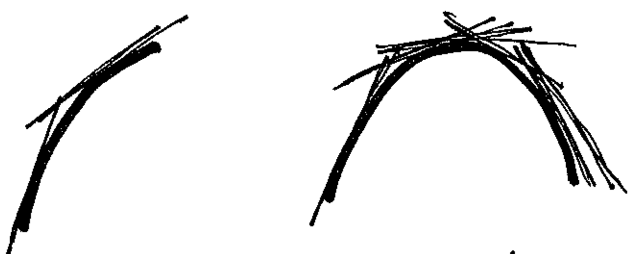


$y = x^2 + x - 6$

3.2 Concavity



Concave down



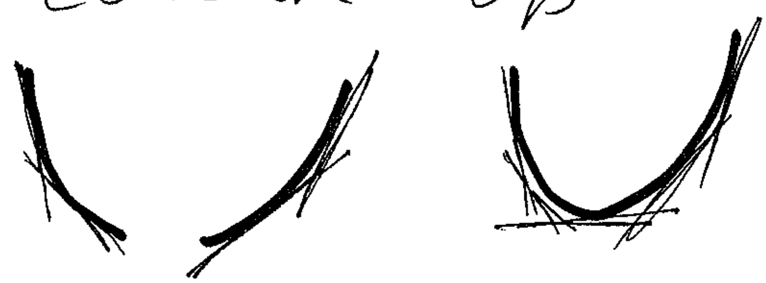
on on interval tangent lines lie above graph

$\boxed{\text{on an interval } I \quad f'(x) \text{ is decreasing}}$

ie f' is decreasing on I

$$\boxed{f'' < 0}$$

concave up



on an interval tangent lines lie below graph

$\boxed{\text{on an interval } I \quad f'(x) \text{ is increasing}}$

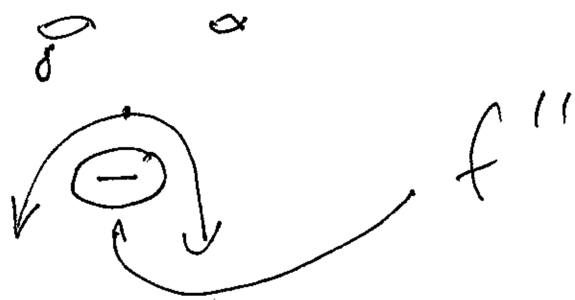
ie f' is increasing on I

$$\boxed{f'' > 0}$$

Thm 4: Concavity test

1) $f'' > 0$ on an interval I
$\Rightarrow f$ is concave up

2) $f'' < 0$ on an interal I
$\Rightarrow f$ is concave down



Thm 5: 2nd derivative test for rel max / mins

If f' exists on (a, b), $f'(c) = 0$ for $c \in (a, b)$ $[a < c < b]$

Then

1) $f''(c) > 0 \Rightarrow f$ has rel min at $x = c$ 

2) $f''(c) < 0 \Rightarrow f$ has rel max at c 

3) $f''(c) = 0$, DNE $\Rightarrow$ no info

$$f(x) = 5x^{\frac{2}{3}} - x^{5/3}$$

$$f'(x) = \frac{10}{3}x^{-1/3} - \frac{5}{3}x^{2/3} = 0, DNE$$

$$f''(x) = \frac{-10}{9}x^{-4/3} - \frac{10}{9}x^{-1/3} = 0, DNE$$

$$f': \frac{10}{3}x^{-1/3} - \frac{5}{3}x^{\frac{2}{3}} = 0, DNE$$

To find critical points

$$\frac{5}{3}x^{-1/3}(2 - x) = 0, DNE$$

$$\boxed{x = 0, 2} \leftarrow \text{critical points}$$

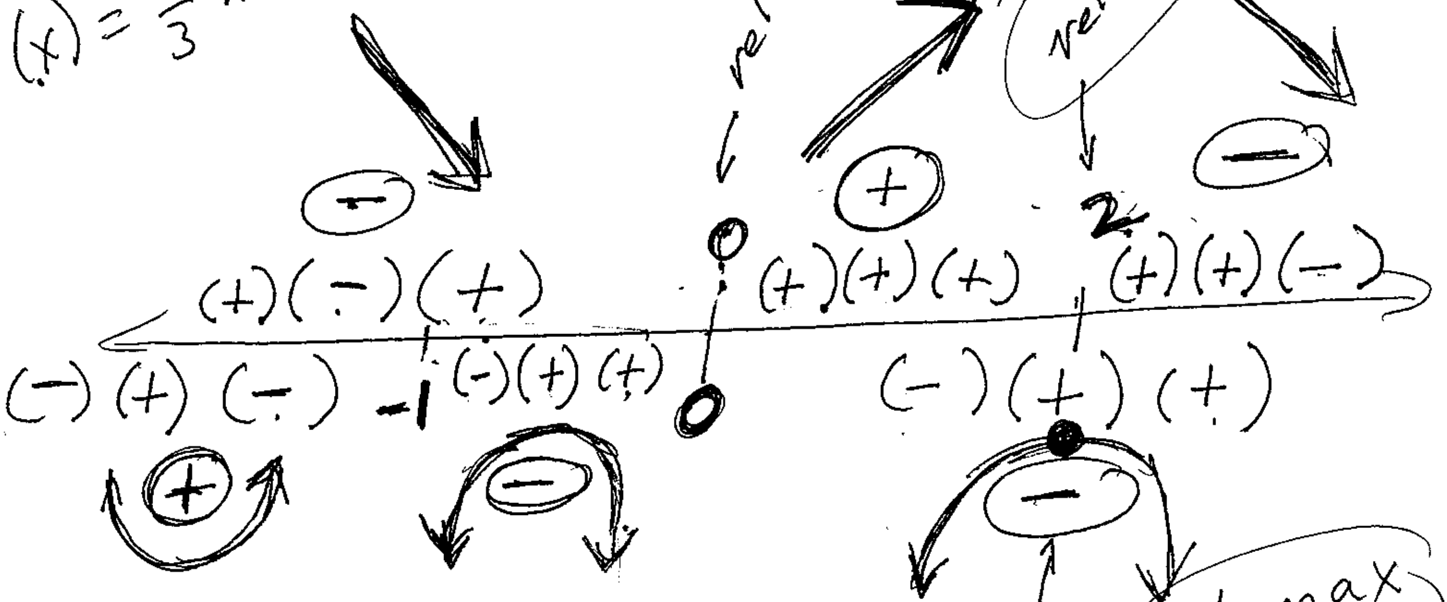
$$f'': -\frac{10}{9}x^{-\frac{4}{3}} - \frac{10}{9}x^{-1/3} = 0, DNE$$

$$-\frac{10}{9}x^{-\frac{4}{3}}(1 + x) = 0, DNE$$

$$\boxed{x = 0, -1} \leftarrow \text{from } f''$$

5

$f'(x) = \frac{5}{3}x^{-1/3}(2-x)$



$f''(x) = -\frac{10}{9}x^{-4/3}(1+x)$

rel max at $x=2$

critical $\{0, 2$

x	$y = 5x^{\frac{2}{3}} - x^{5/3}$
critical 2	$5\sqrt[3]{4} - 2\sqrt[3]{4} = 3\sqrt[3]{4}$
critical 0	0
f'' −1	$5-(-1) = 6$
0	5
1	$5-1=4$

$f(x) = 5x^{\frac{2}{3}} - x^{5/3}$

$= x^{2/3}(5-x) = 0$