

2.2

Increasing & Decreasing  
Incr Decr

function Incr & Decr over x interval

Ex  $f(x) = x^3 - 12x - 5$  Incr? decr?

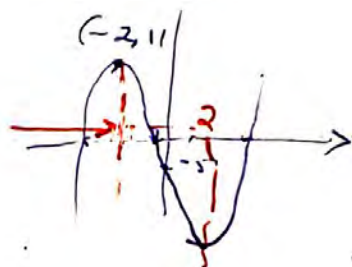
$$f'(x) = 3x^2 - 12 = 0$$

$$\nearrow x^2 = 4 \rightarrow \underline{CN: x = \pm 2}$$

$$\begin{array}{c} -2 \quad 0 \quad 2 \\ + \quad | \quad - \quad | \quad + \end{array}$$

Incr:  $(-\infty, -2) \quad (2, \infty)$

Decr:  $(-2, 2)$



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

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

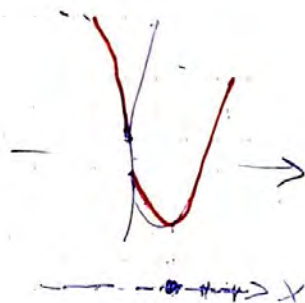
$$= \frac{4}{3} \left( \frac{x - 1}{x^{2/3}} \right) = 0$$

$$\underline{CN: x = 1, 0} \nearrow$$

$$\begin{array}{c} 1 \quad 2 \dots \\ - \quad | \quad + \end{array}$$

Incr:  $(1, \infty)$

Decr:  $(-\infty, 1)$



extreme points (LMAX, LMIN) Critical points

$$x = 1 \text{ or } f(1) = 1(1-4) = -3$$

Min point  $(1, -3)$

$$y.6. \quad f(x) = x \sqrt{x+1}$$

$$f'(x) = \frac{1}{2\sqrt{x+1}} (x+1 + \frac{1}{2}x)$$

$$= \frac{1}{2\sqrt{x+1}} (\frac{3}{2}x + 1) = 0$$

$$N: x = -\frac{2}{3}, -1$$

$$\frac{-2/3}{-1}$$

$$\text{near } (-\frac{2}{3}, \infty)$$

$$\text{Dec: } (-\infty, -\frac{2}{3})$$

$$\text{Min point: } (-\frac{2}{3}, -\frac{2}{3\sqrt{3}})$$

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

$$= -\frac{2\sqrt{3}}{9}$$

Concavities

second derivative  $f''(x) = 0$

Point of inflection: pt infl  $x = ?$

$$f(x) = x^4 - 8x^3 + 18x^2$$

$$f'(x) = 4x^3 - 24x^2 + 36x$$

$$f''(x) = 12x^2 - 48x + 36 = 0$$

$$\text{pt. of inf: } x = 1, 3$$

$$\begin{array}{c|c|c|c} 0 & 1 & 3 & \\ \hline + & - & + & \end{array}$$

Concave up:  $(-\infty, 1) \quad (3, \infty)$

" down:  $(1, 3)$

$x = 2$  is  
a

Concave up (upward)  
" down (downward)

