

FINDING RELATIVE EXTREMA (local)

First Derivative Test

$$f(x) = 2x^3 - 3x^2 - 4$$

$$f'(x) = 6x^2 - 6x = 0$$

$$\Rightarrow 6x(x-1) = 0$$

$$x=0 \quad x=1$$



Rel max @ (0, -4)
Rel min @ (1, -5)

$$\begin{array}{r} 0 \overline{) -4} \\ \underline{1 -5} \end{array}$$



- 1) Find critical pts.
- 2) Test pts. around crit pts.
- 3) Do the Mountain Test
- 4) State coordinates.



2ND DERIVATIVE TEST

$$f(x) = x^3 + 3x^2 + 16$$

$$f'(x) = 3x^2 + 6x = 0$$

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

$$x = 0, -2$$

$$f''(x) = 6x + 6$$

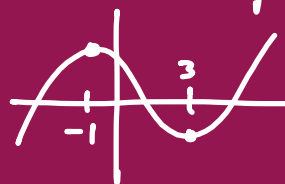
$$f''(0) = 0 + 6 = 6 \quad + \cup$$

$$f''(-2) = -12 + 6 = -6 \quad - \cap$$

Rel min @ (0, 16)

Rel max @ (-2, 20)

1) Find critical points



2) Test crit pts in f'' for concave up/down

$$\begin{array}{r} 0 \overline{)16} \\ -2 \overline{)20} \end{array}$$

3) Write solution as word.

$$f''(\#) = 0 \quad \text{inconclusive}$$

go back & use 1st Deriv Test

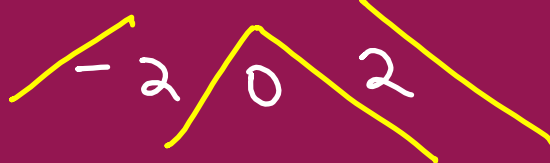
$$f(x) = \sqrt[3]{4-x^2} = (4-x^2)^{1/3}$$

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

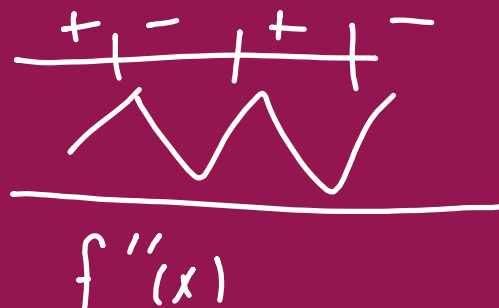
$$0 = \frac{-2x}{3\sqrt[3]{(4-x^2)^2}}$$

$$\begin{array}{l} -2x=0 \quad 4-x^2=0 \\ x=0 \quad 4=x^2 \end{array}$$

$$\begin{array}{c} \begin{array}{c} + \quad + \quad + \quad + \\ + \quad + \quad + \quad + \end{array} \\ \begin{array}{c} -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \end{array} \end{array}$$



Rel max $(0, \sqrt[3]{4})$



$$f(x) = 2x^2 \ln x - 11x^2$$

$\nearrow (0, \infty)$
 $\searrow (0, \infty)$

$$f(x) = x^4 + x^3$$

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

$$x^2(4x + 3)$$

$$x = 0, -3/4$$

$$f''(x) = 12x^2 + 6x$$

$$f''(0) = 12(0)^2 + 6(0) = 0$$

$$\begin{array}{ccccccc} + & - & + & + & + & + & \\ - & + & + & + & & & \\ \hline & - & 3/4 & 0 & & & \\ - & 1 & - & 1/2 & 1 & & \end{array}$$

$$\sqrt{-3/4} \quad \cup$$

$$+ \cup$$

$$- \cap$$