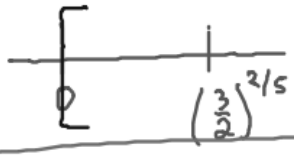
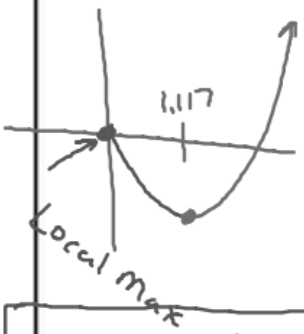
Determine the local extrema of the function

33) $f(x) = x^4 - 4x^{3/2}$

$\boxed{f(x) = x^4 - 4x^{3/2}}$ $\boxed{x \geq 0}$





$\boxed{f'(x) = 4x^3 - 6x^{1/2}}$

$0 = 4x^3 - 6x^{1/2}$

$0 = 2x^{1/2}(2x^{5/2} - 3)$

$0 = 2\sqrt{x}$ $\quad 0 = 2x^{5/2} - 3 \rightarrow \left(x^{5/2}\right)^{2/5} = \left(\frac{3}{2}\right)^{2/5}$

$0 = x$ $\quad$ critical pts $\quad x = 1.176$

$f'(-1) =$ No Real Solution

$f'(1) = -2 < 0$ $\quad f(x)$ dec $\left(0, \left(\frac{3}{2}\right)^{2/5}\right)$

$f(4) = 256 - 12 > 0$ $\quad f(x)$ Inc $\left(\left(\frac{3}{2}\right)^{2/5}, \infty\right)$

$\boxed{x = 0 \text{ Local Max b/c } f(x) \text{ dec } \left(0, \left(\frac{3}{2}\right)^{2/5}\right)}$

$x = \left(\frac{3}{2}\right)^{2/5}$ is a local min because f' changes from neg to pos

36) $f(x) = x^{-2} - 4x^{-1}$ $\quad x > 0$

	Determine the relative extrema of the function 37) $f(x)=\frac{1}{x^2+1}$ 32) $f(x)=x^5+x^3+x$

What you'll Learn About
How to find intervals of concavity
How to find local extrema using the second derivative

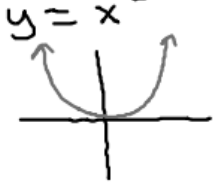
Concavity and Inflection Points

change concavity

Determine the intervals of concavity and the inflection points

A) $y = x^2$

$y = x^2$



concave up $(-\infty, \infty)$

$y = x^2$

$y' = 2x$ → $y'' = 2 > 0$

B) $y = -x^2$

concave down $(-\infty, \infty)$

$y = -x^2$

$y' = -2x$ → $y'' = -2 < 0$

5) $f(x) = 10x^3 - x^5$

$f(x) = 10x^3 - x^5$

$f'(x) = 30x^2 - 5x^4$

$\boxed{f''(x) = 60x - 20x^3}$

Possible Inflection Points

$f''(x) = 0$

$f''(x)$ UND

$0 = 60x - 20x^3$

$\boxed{0 = 20x(3 - x^2)}$

P.I.P.S

$20x = 0$ $\quad 3 - x^2 = 0$

$x = 0$ $\quad x = \pm\sqrt{3}$

$f''(-2) = -120 + 160 > 0$

$f(x)$ concave up $(-\infty, -\sqrt{3})$

$f''(-1) = -40 < 0$

$f(x)$ concave down $(-\sqrt{3}, 0)$

$f''(1) = 40 > 0$

$f(x)$ concave up $(0, \sqrt{3})$

$f(2) = -40 < 0$

$f(x)$ concave down $(\sqrt{3}, \infty)$

$x = 0, \pm\sqrt{3}$ are Inflection points b/c the sign of f'' changes