	Determine the local extrema of the function 33) $f(x)= x^4 - 4x^{3/2}$ 36) $f(x)= x^{-2} - 4x^{-1}$ $x > 0$

	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

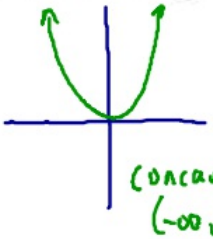
Concavity and Inflection Points

* concave up $f'' > 0$
concave down $f'' < 0$

Determine the intervals of concavity and the inflection points

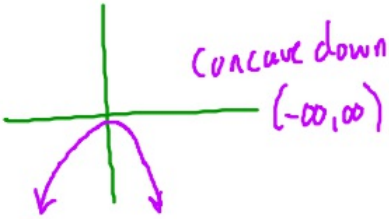
A) $y = x^2$

$y = x^2$



$y = x^2$
$y' = 2x$
$y'' = 2 > 0$

B) $y = -x^2$



$y = -x^2$
$y' = -2x$
$y'' = -2 < 0$

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

PIPS: $-\sqrt{3}$, 0, $\sqrt{3}$

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

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

$f''(x) = 60x - 20x^3$

Possible Inflection Points (P.I.P.S)

$0 = 60x - 20x^3$

$0 = 20x(3 - x^2)$

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

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

$\pm\sqrt{3} = x$

$x = -\sqrt{3}, 0, \sqrt{3}$ are all inflection pts. b/c f'' changes sign b/c $f''(-\sqrt{3}) = f''(0) = f''(\sqrt{3}) = 0$

$(-\infty, -\sqrt{3})$ $f''(-2) = -120 + 160 > 0$
$f(x)$ concave up

$(-\sqrt{3}, 0)$ $f''(-1) = -60 + 20 < 0$
$f(x)$ concave down

$(0, \sqrt{3})$ $f''(1) = 60 - 20 > 0$
$f(x)$ concave up

$(\sqrt{3}, \infty)$ $f''(2) = 120 - 160 < 0$
$f(x)$ concave down

P.I.P.S

$f'' = 0$

f'' undefined

$(0,9)$ $f''(1) = -4 < 0$

$f(x)$ concave down

$(9,\infty)$ $f''(16) = \frac{1}{2} > 0$

$f(x)$ concave up

Determine the intervals of concavity and the inflection points

9) $f(x) = x(x - 8\sqrt{x}) \quad x \geq 0$

$f(x) = x^1(x^1 - 8x^{1/2}) = x^2 - 8x^{3/2}$

$f'(x) = 2x - 12x^{1/2}$

$f''(x) = 2 - 6x^{-1/2}$

$0 = 2 - \frac{6}{\sqrt{x}}$

$(\sqrt{x})\frac{6}{\sqrt{x}} = 2(\sqrt{x})$

$6 = 2\sqrt{x}$

$3 = \sqrt{x}$

$9 = x$ P.I.P.S.

f'' und

$x = 0$

$x = 9$ Pt of Inflection b/c f'' changes sign and $f''(9) = 0$

Determine the intervals of concavity and the inflection points

6) $f(x) = 5x^2 + x^4$