	Determine the local extrema using the second derivative test A) $y = x^2$ B) $y = -x^2$
2nd derivative test for local extrema	Determine the local extrema using the second derivative test 25) $f(x) = x^3 - 12x^2 + 45x$ $\boxed{f'(x) = 3x^2 - 24x + 45}$ $\frac{0 = 3x^2 - 24x + 45}{3}$ $0 = x^2 - 8x + 15$ $0 = (x-5)(x-3)$ C.P. $x = 5, x = 3$ $f''(x) = 6x - 24$ $f''(3) = -6 < 0$ At $x=3$ $f(x)$ is concave down so $x=3$ Local max $f''(5) = 6 > 0$ At $x=5$ $f(x)$ is concave up so $x=5$ is local min 27) $f(x) = 3x^4 - 8x^3 + 6x^2$

$f'(x)$ und C.P $x=0$	Determine the local extrema using the second derivative test 31) $f(x)=6x^{3/2}-4x^{1/2}$ → $x \geq 0$ $f(x)=6x^{3/2}-4x^{1/2}$ $f'(x)=9x^{1/2}-2x^{-1/2}$ → $f''(x)=\frac{9}{2}x^{-1/2}+x^{-3/2}$ $(\sqrt{x})\ 0 = (\sqrt{x})\,9\sqrt{x}-\frac{2}{\sqrt{x}}(\sqrt{x})$ $\quad f''(x)=\frac{9}{2\sqrt{x}}+\frac{1}{\sqrt{x^3}}$ $0=9x-2$ $\quad f''(0)=$ UND 2nd derivative test for local extrema fails $x=\frac{2}{9}$ C.P. $f''\left(\frac{2}{9}\right)>0$ $f(x)$ concave up $\boxed{x=\frac{2}{9} \text{ local min b/c } f'\left(\frac{2}{9}\right)=0 \text{ and } f''\left(\frac{2}{9}\right)>0}$ 5) $f(x)=10x^3-x^5$

What you'll Learn About
How to describe the key features of a graph using the 1st and 2nd derivative

2) $f(x) = -2x^3 + 6x^2 - 3$ $[-1, 3]$

$\boxed{f'(x) = -6x^2 + 12x}$

$0 = -6x^2 + 12x$

$0 = -6x(x-2)$

C.P. $x = 0$ $x = 2$

$(-1, 0)$ $f'(-1) = -18 < 0$ $f(x)$ dec

$(0, 2)$ $f'(1) = 6 > 0$ $f(x)$ inc

$(2, 3)$ $f'(3) = -18 < 0$ $f(x)$ dec

$f''(x) = -12x + 12$

$0 = -12x + 12$

$x = 1$

$f''(0) = 12 > 0$

$x = 0$ local min b/c $f'(0) = 0$

$f(x)$ = concave up $(-1, 1)$

$f''(2) = -12 < 0$

$x = 2$ local max b/c $f'(2) = 0$

$f(x)$ concave down $(1, 3)$

Extreme Values: $f(x) = -2x^3 + 6x^2 - 3$

$f(-1) = 2 + 6 - 3 = 5$

$f(0) = -3$

$f(2) = -16 + 24 - 3 = 5$

$f(3) = -54 + 54 - 3 = -3$

Abs max $(-1, 5)$ and $(2, 5)$

Abs min $(0, -3)$ and $(3, -3)$