What you'll Learn About
Critical Points/Extreme Values

Find the critical points

- possible max or mins

(1) Set $\frac{dy}{dx} = 0$

(2) Find if $\frac{dy}{dx}$ is undefined

8) $y = \frac{1}{x-1} - \frac{1}{x}$

$y = (x-1)^{-1} - x^{-1}$

$\frac{dy}{dx} = -(x-1)^{-2} + x^{-2}$

$\frac{dy}{dx} = \frac{-1}{(x-1)^2} + \frac{1}{x^2}$

$0 = \frac{-1}{(x-1)^2}\frac{(x^2)}{(x^2)} + \frac{1}{x^2}\frac{(x-1)^2}{(x-1)^2}$

$\frac{dy}{dx}$ und

$x=0 \quad x=1$

not critical points

$\frac{dy}{dx} = 0$

$x = \frac{1}{2}$

critical point

$0 = \frac{-x^2 + (x-1)^2}{x^2(x-1)^2}$

$0 = -x^2 + (x-1)(x-1)$

$0 = -x^2 + x^2 - 2x + 1$

$0 = -2x + 1$

$2x = 1$

$x = \frac{1}{2}$

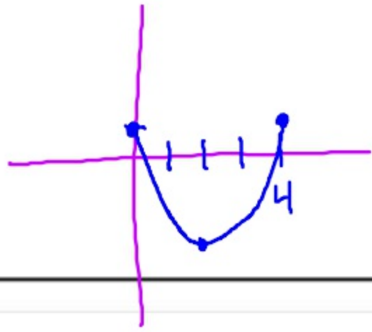
10) $y = \frac{x^2}{x^2 - 4x + 8}$

$y' = \frac{(x^2-4x+8)(2x) - x^2(2x-4)}{(x^2-4x+8)^2}$

$y' = 2x^3 - 8x^2 + 16x - 2x^3 + 4x^2$

$y' = \frac{-4x^2 + 16x}{(x^2-4x+8)^2}$

$\frac{dy}{dx}$ und	$\frac{dy}{dx} = 0$
$(x^2-4x+8)^2 = 0$	$-4x^2 + 16x = 0$
$x^2 - 4x + 8 = 0$	$-4x(x-4) = 0$
$x =$	$x=0 \quad x=4$
	critical points

	12) $f(x) = 4x - \sqrt{x^2+1}$ $f(x) = 4x - (x^2+1)^{1/2}$ $f'(x) = 4 - \frac{1}{2}(x^2+1)^{-1/2} \cdot 2x$ $f'(x) = \frac{4\sqrt{x^2+1}}{1\sqrt{x^2+1}} \quad \frac{x}{\sqrt{x^2+1}}$ No Critical Points $f'(x) = \frac{4\sqrt{x^2+1} - x}{\sqrt{x^2+1}}$ $\frac{dy}{dx}$ und $\sqrt{x^2+1} = 0$ $x^2+1 = 0$ $x^2 \neq -1$ $\frac{dy}{dx} = 0$ $4\sqrt{x^2+1} - x = 0$ $(4\sqrt{x^2+1})^2 = (x)^2$ $16(x^2+1) = x^2$ $16x^2 + 16 = x^2$ $-16x^2 \qquad -16x^2$ $\frac{16}{-15} = \frac{-15x^2}{-15}$ $\frac{-16}{15} \neq x^2$
① Find $\frac{dy}{dx}$ to find C.P. ② Plug the endpts of interval and C.P. back into $f(x)$	Determine the extreme values of each function 21) $f(x) = x^2 - 4x + 1$ on $[0,4]$ $f'(x) = 2x - 4$ $0 = 2x - 4$ $x = 2$ Critical pt. $f(0) = 1$ Abs. max $f(2) = -3$ Absolute min $f(4) = 1$ Abs Max 

Abs Max $(2,10)$ x y Abs Min $(-2,-2)$	Determine the extreme values of each function 34) $f(x) = x^3 + x^2 - x$ on [-2, 2] $f(x) = x^3 + x^2 - x \quad [-2, 2]$ $f'(x) = 3x^2 + 2x - 1$ $0 = 3x^2 + 2x - 1$ $0 = (3x - 1)(x + 1)$ C.P. $x = \frac{1}{3}, -1$ $f(-2) = -8 + 4 + 2 = -2$ $f(-1) = -1 + 1 + 1 = 1$ $f\left(\frac{1}{3}\right) = \frac{1}{27} + \frac{1}{9} - \frac{1}{3} = \frac{-5}{27}$ $f(2) = 8 + 4 - 2 = 10$ 40) $f(x) = \dfrac{1 - x}{x^2 + 3x}$ on [1, 4]

Determine the extreme values of each function

42) $f(x) = 2\left(x^2 + 1\right)^{1/2} - x$ on [0, 2]

56) $f(x) = 3e^x - e^{2x}$ on [-.5,1]

$y = e^x$

$f(x) = 3e^x - e^{2x}$

$f'(x) = 3e^x - 2e^{2x}$

$0 = 3e^x - 2e^{2x}$

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

Critical Pts: $e^x \neq 0$ $\quad 3 - 2e^x = 0$

$\frac{3}{2} = \frac{2e^x}{2}$

$1.5 = e^x$

$\ln(1.5) = x$

Extreme Values

$f(-.5) = 1.451$

$f(\ln(1.5)) = 2.25$

$f(1) = 3e - e^2 = .765$