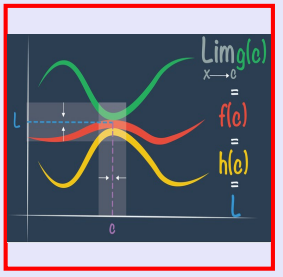
# Calculus I

# Lecture 39




Feb 19-8:47 AM

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

Domain $(-\infty, 1) \cup (1, \infty)$ VA $x = 1$

Y-Int $(0,0)$ , X-Int $(0,0)$ twice (even)

Long Division

$$x-1 \overline{)\, x^2 + 0x + 0} \quad x+1$$
$$-(x^2 - x)$$
$$x + 0$$
$$-(x - 1)$$
$$1$$

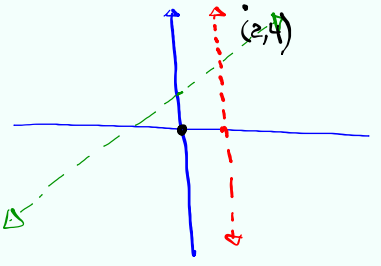
$f(x) = x + 1 + \frac{1}{x-1}$

$y = x+1$ is slant Asymptote

$f'(x) = 1 - \frac{1}{(x-1)^2}$

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

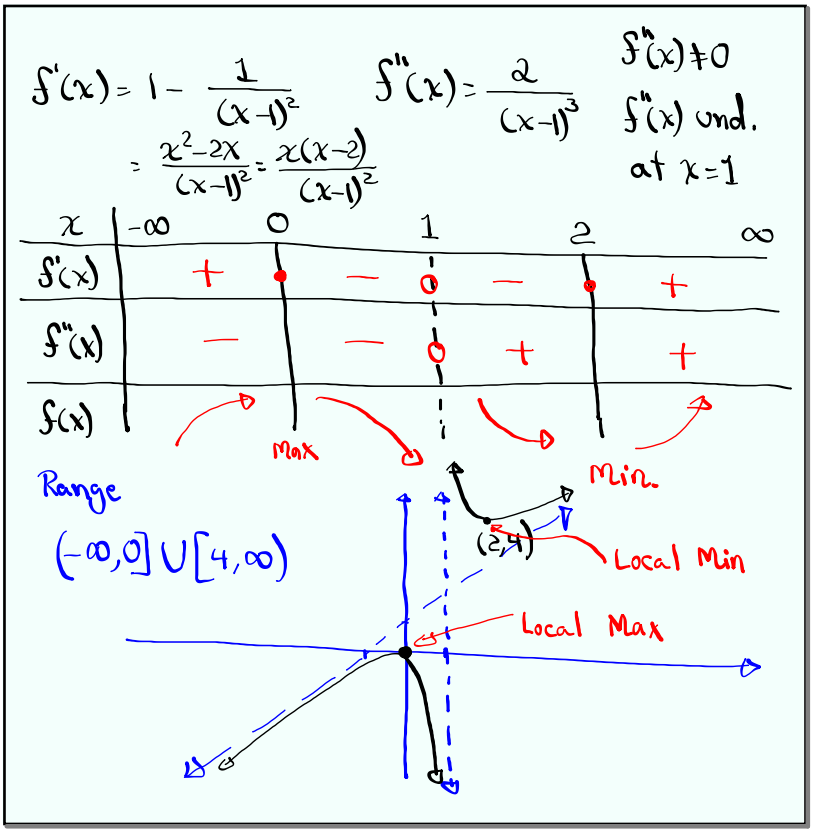
$= \frac{x^2 - 2x}{(x-1)^2}$



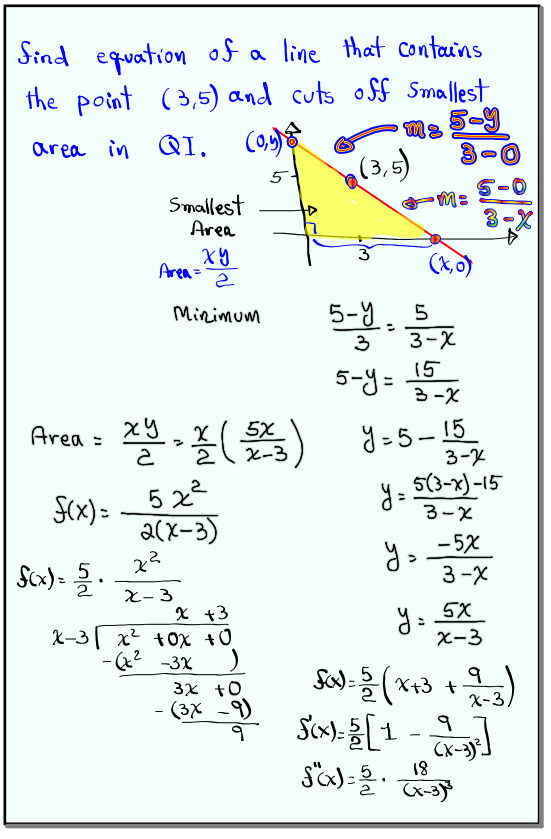

$f'(x) = 0$ $\quad x^2 - 2x = 0$ $\quad x = 0, 2$ $\quad (0,0), (2,4)$

$f'(x)$ undefined $\quad (x-1)^2 = 0$ $\quad x = 1$

Nov 6-7:46 AM




Nov 7-7:30 AM




Nov 6-7:52 AM

$f'(x) = \frac{5}{2}\left[1 - \frac{9}{(x-3)^2}\right]$

$f''(x) = \frac{5}{2} \cdot \frac{18}{(x-3)^3}$

$f''(x) = \frac{45}{(x-3)^3}$

$f'(x) = \frac{5}{2} \cdot \frac{(x-3)^2 - 9}{(x-3)^2}$

$f'(x) = \frac{5}{2} \cdot \frac{x^2 - 6x}{(x-3)^2}$

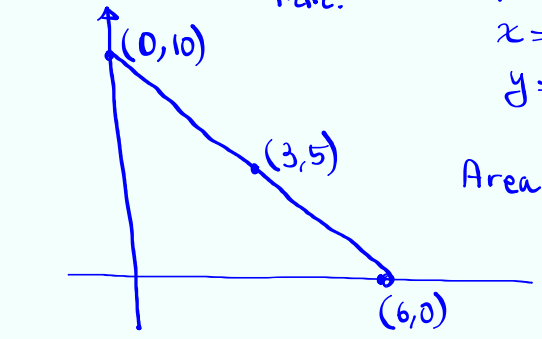
$f'(x) = \frac{5}{2} \cdot \frac{x(x-6)}{(x-3)^2}$

C.P. $f'(x) = 0$ or und.

$x = 0, 6, 3$

$f''(0) < 0$ Max

$f''(6) > 0$ Min.




Smallest Area

$x = 6$

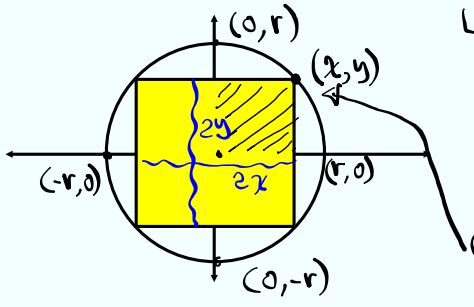
$y = \frac{5x}{x-3} = \frac{5(6)}{6-3} = \frac{30}{3} = 10$

$\text{Area} = \frac{xy}{2} = \frac{6 \cdot 10}{2}$

$= 30$ units$^2$

Nov 7-7:44 AM

Find the **largest area** of a rectangle inscribed in a circle of radius r.




$L = 2x$, $W = 2y$

$A = 4xy$

$A(x,y) = 4xy$

Circle $x^2 + y^2 = r^2$

$y^2 = r^2 - x^2$

$y = \sqrt{r^2 - x^2}$

Area $\rightarrow f(x) = 4x \cdot \sqrt{r^2 - x^2}$

$f'(x)$, C.P.

$f''(x)$, $f''(\text{C.P.})$

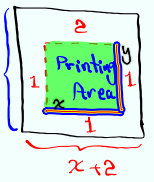
$f''(\text{C.P.}) > 0$ Min

$f''(\text{C.P.}) < 0$ Max

Nov 7-7:50 AM

A poster in rectangular shape has an area of $180\ in^2$ with 1-inch margins at bottom and sides but 2-inch margin at the top.

what dimensions will give us the largest Printing Area?




$xy$ Printing Area Maximize

$\text{Area}_{\text{Poster}} = (x+2)(y+3) = 180$

$xy + 3x + 2y + 6 = 180$

we need to maximize $xy$

$xy + 2y = 180 - 6 - 3x$

$xy$

$y(x+2) = 174 - 3x$

$f(x) = x\left(\frac{174-3x}{x+2}\right)$

$y = \frac{174-3x}{x+2}$

$f'(x)$ , C.P. $\quad f''(x)$ , $f''$(C.P.)

$f''(CP) > 0$ Min

$f''(CP) < 0$ Max

Nov 7-7:58 AM

$f''(x) = \overbrace{12x}^{6\cdot 2x} - \overbrace{12x^2}^{4\cdot 3x^2} - 2$

$f(0) = 4$ ✓

$f(1) = 6$

Find $f(x)$.

$f'(x) = \underbrace{6x^2}_{2\cdot 3x^2} - 4x^3 - 2x + C$

$f(x) = 2x^3 - x^4 - x^2 + Cx + D$

$f(0) = 2(0)^3 - 0^4 - 0^2 + C(0) + D = 4$

$D = 4$

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

$f(1) = 2 - 1 - 1 + C + 4 = 6$

$C = 2$

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

Nov 7-8:08 AM

Class QZ 14

$f(x) = x^3 - 6x^2 - 15x + 4$

Find the x-value of all Critical Points and possible inflection Points.

$f'(x) = 3x^2 - 12x - 15$

$f'(x) = 0$

$3x^2 - 12x - 15 = 0$

$x^2 - 4x - 5 = 0$

$(x-5)(x+1) = 0$

$x - 5 = 0$ $\quad$ $x + 1 = 0$

$\boxed{x = 5}$ $\quad$ $\boxed{x = -1}$

$f''(x) = 6x - 12$

$f''(x) = 0$

$6x - 12 = 0$

$\boxed{x = 2}$

Nov 7-8:17 AM