

SHOW ALL YOUR WORK! GOOD LUCK!

NAME: \_\_\_\_\_

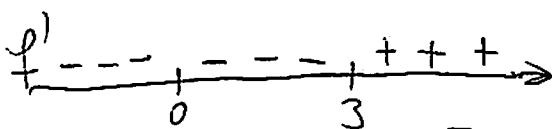
1. (5pts.) On what intervals is the function  $f(x) = x^4 - 4x^3$  both decreasing and concave up?

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

$$f'(x) = 0 \Rightarrow 4x^3 - 12x^2 = 0$$

$$4x^2(x-3) = 0$$

$$x = 0 \text{ or } x = 3$$



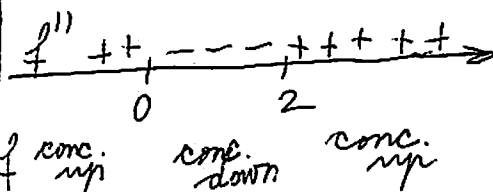
decreasing on  $(-\infty, 3)$   
 increasing on  $(3, \infty)$

$$f''(x) = 12x^2 - 24x$$

$$f''(x) = 0 \Rightarrow 12x^2 - 24x = 0$$

$$12x(x-2) = 0$$

$$x = 0 \text{ or } x = 2$$



So, the function is both decreasing and concave up on the intervals  $(-\infty, 0)$  and  $(2, 3)$

2. (5pts.) Find the equation of the line tangent to the function  $f(x) = \frac{1}{x^2}$  at point (1,1).

equation:  $y - 1 = m(x - 1)$

$$m = f'(1)$$

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

$$f'(1) = -\frac{2}{1^3} = -2$$

So, the equation of the tangent line is:

$$y - 1 = -2(x - 1)$$

or  $y = -2x + 3$