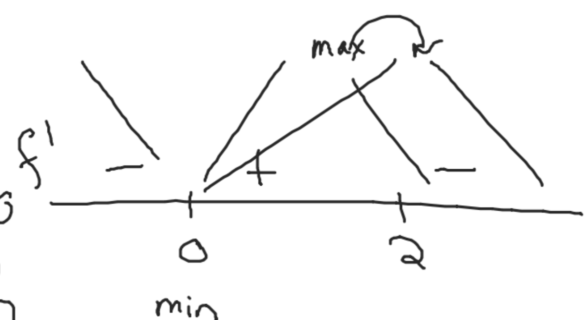
7R #6 Find the relative extrema $\quad f'(x)=0$

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

$$f'(x) = x^2(e^{-x})(-1) + e^{-x}(2x)$$

$$= -x^2e^{-x} + 2xe^{-x}$$

$$0 = xe^{-x}(-x+2)$$



$xe^{-x}=0$ and $-x+2=0$

$-x=-2$

$\boxed{x=0}$ $\quad e^{-x}=0$ $\quad \boxed{x=2}$

$(0,0)$ $\quad \frac{1}{e^x}=0$

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

$$=\frac{4}{e^2}$$

$(2, e^2)$

75 #6

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

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

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

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

$$= \frac{-8x^2}{(x^2+1)^3} + \frac{2}{(x^2+1)^2} \cdot \frac{(x^2+1)}{(x^2+1)}$$

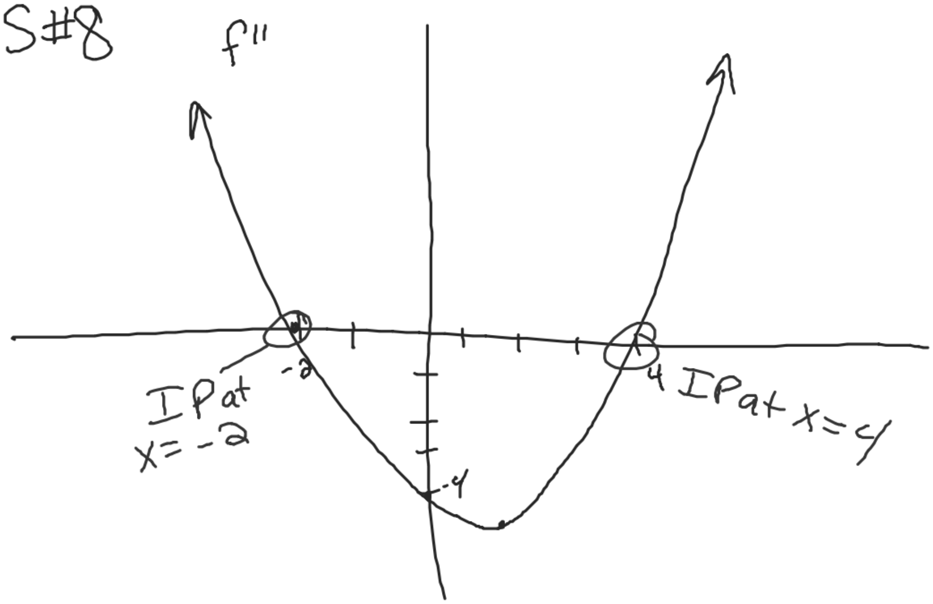
$$\frac{3x^2 - 2(x^2+1)}{(x^2+1)^3} = \frac{6x^2+2}{(x^2+1)^3}$$

$$\frac{6x^2+2}{\cancel{(x^2+1)^3}} = 0 \qquad 6x^2+2=0$$

$$6x^2 = -2$$

$$x^2 = -\frac{2}{6} = -\frac{1}{3}$$

7S#8



$f''(x) > 0$, f is concave up

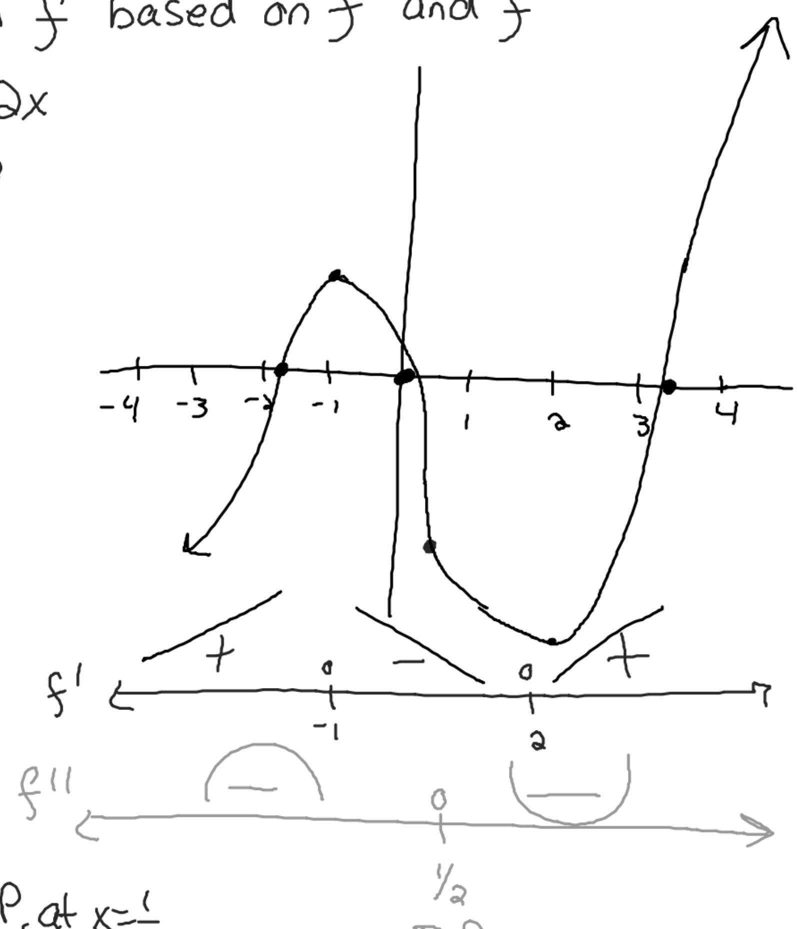
$(-\infty, -2)$ and $(4, \infty)$

$f''(x) < 0$, f is $\frown$

$(-2, 4)$

More practice with graphs:
need to sketch f based on f' and f''

a) $f(x) = 2x^3 - 3x^2 - 12x$
$f'(x) = 6x^2 - 6x - 12$
$f''(x) = 12x - 6$



$(0,0), (-1.8,0), (3.31,0)$

$f(x)$ x-int: ($y=0$) $0 = 2x^3 - 3x^2 - 12x$
$0 = \cancel{x}(2x^2 - 3x - 12)$

y-int: ($x=0$) $(0,0)$

$f'(x)$ inc: $(-\infty,-1)$ and $(2,\infty)$
dec: $(-1,2)$
max: $f(-1) =$ $(-1,7)$
min: $f(2) =$ $(2,-20)$

$f''(x)$ inflection pts
CUP $(1/2,\infty)$
CD $(-\infty,1/2)$

I.P. at $x = \frac{1}{2}$
$(1/2, -13/2)$