

Closing Tues: 4.4-5 (graphing)
 Closing Thurs: 4.7 (applied max)
 Final: Sat, Dec. 9, 1:30-4:20pm, Kane 130
 Assigned seats, for your seat go to:
catalyst.uw.edu/gradebook/aloveles/102715

Homework Problem 5 Note:

$y = \sqrt{|x|} + \frac{x}{10}$ is two function

- a) If $x \geq 0$, then $y = \sqrt{x} + \frac{x}{10}$
- b) If $x < 0$, then $y = \sqrt{-x} + \frac{x}{10}$

4.5 Curve Sketching

1. Domain?
2. Asymptotes?
 Vertical (limit - both sides)?
 Horizontal (limit $x \rightarrow \pm\infty$)?
3. 1st deriv. info?
4. 2nd deriv. info?
5. Plot points

Example: Sketch the graph of

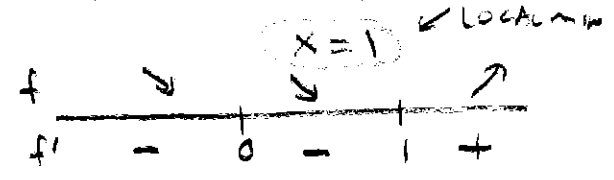
$$f(x) = \frac{e^x}{x}$$

1 $x \neq 0$

2 VERTICAL: $\lim_{x \rightarrow 0^-} \frac{e^x}{x} = -\infty$
 $\lim_{x \rightarrow 0^+} \frac{e^x}{x} = +\infty$

HORIZONTAL: $\lim_{x \rightarrow \infty} \frac{e^x}{x} = \infty$ $\lim_{x \rightarrow -\infty} \frac{e^x}{x} = 0$

3 $f'(x) = \frac{x e^x - e^x}{x^2} = \frac{e^x(x-1)}{x^2} = 0$



4 $f''(x) = \frac{x^2(e^x(x-1) + e^x) - 2xe^x(x-1)}{x^4}$

$= \frac{xe^x(x(x-1+1) - 2(x-1))}{x^4}$

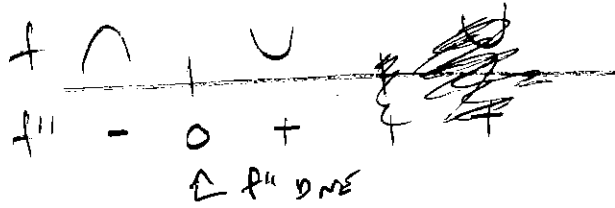
$= \frac{xe^x(x^2 - 2x + 2)}{x^3} = 0$
 $x = \frac{2 \pm \sqrt{4 - 4(1)}}{2(1)}$

~~Handwritten scribbles and a circled '0'.~~
 NEGATIVE NO SOLN

$$f''(x) \stackrel{?}{=} 0$$

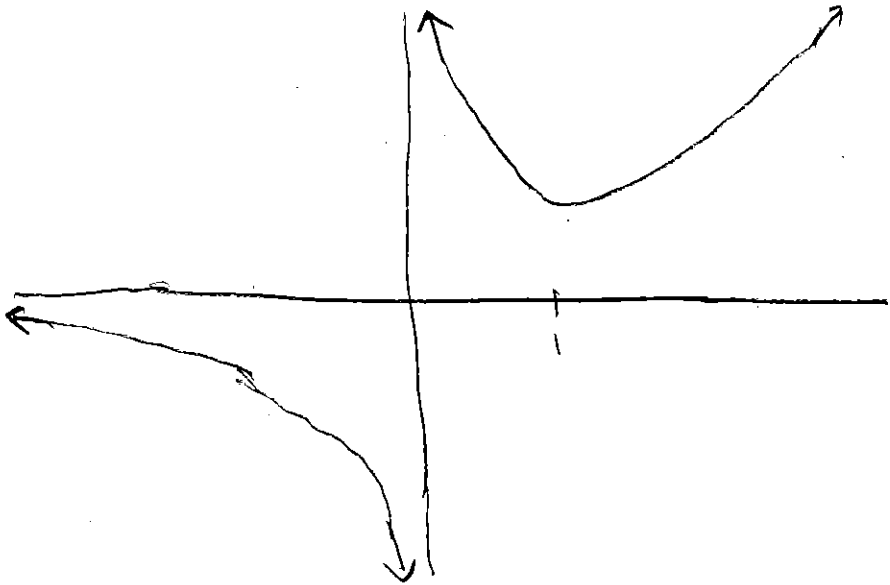
~~EXCEPT~~

~~NOT AN~~
IN ELECTRON P.S.

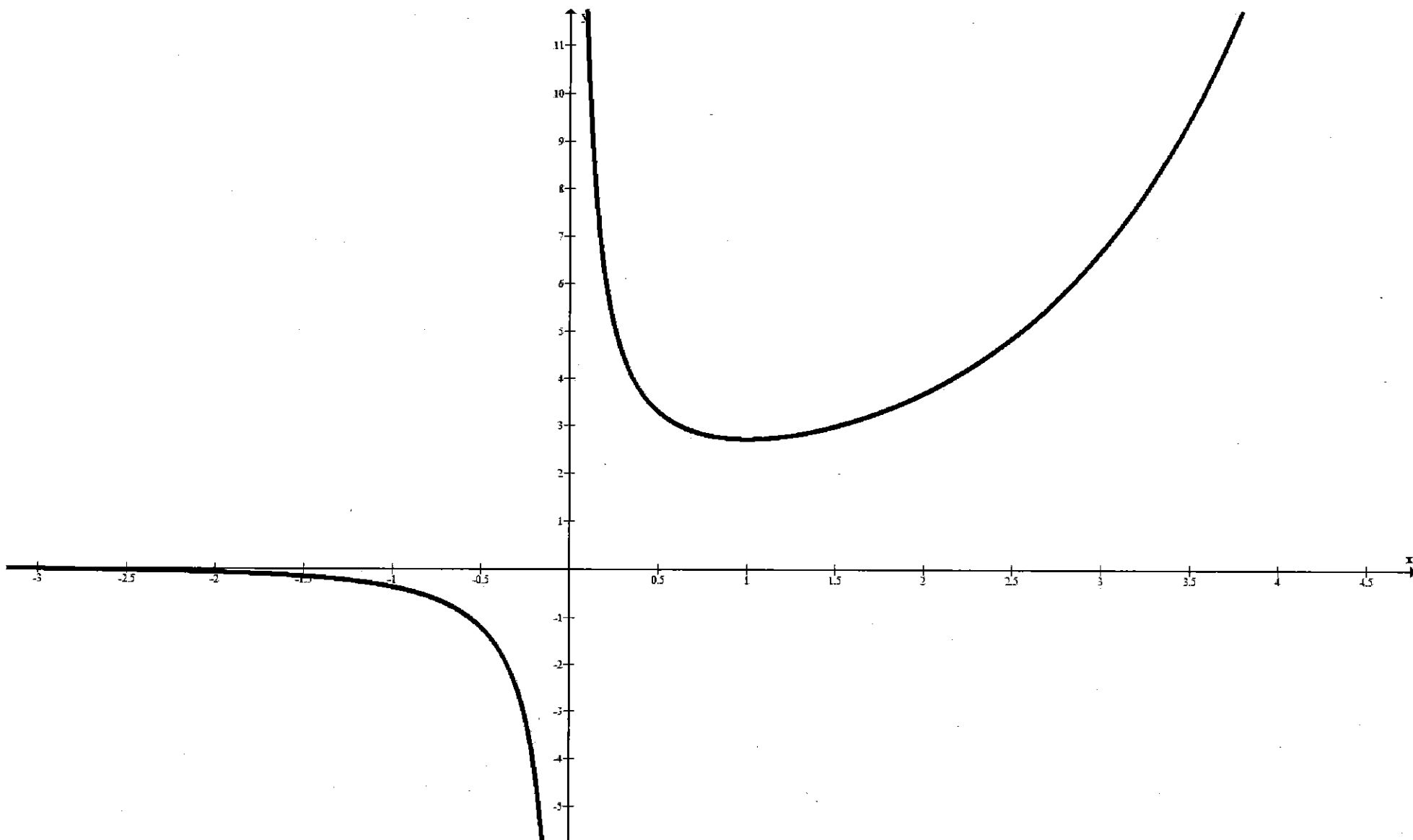


$$\boxed{5} \quad f(1) = \frac{e^1}{1} = e$$

ANY OTHER EASY PTS TO PLOT? NO



$$f(x) = \frac{e^x}{x}$$



Example: Sketch the graph of

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

1 $x \neq 0$

2 $\lim_{x \rightarrow 0^-} \frac{x^2 - 3x + 2}{x} = -\infty$

$\lim_{x \rightarrow 0^+} \frac{x^2 - 3x + 2}{x} = +\infty$

$\lim_{x \rightarrow \infty} \frac{x^2 - 3x + 2}{x} = \lim_{x \rightarrow \infty} (x - 3) = \infty$

$\lim_{x \rightarrow -\infty} \frac{x^2 - 3x + 2}{x} = \lim_{x \rightarrow -\infty} (x - 3) = -\infty$

5 Plot Points

$f(\sqrt{2}) = \sqrt{2} - 3 + \frac{2}{\sqrt{2}} \approx -0.17157$

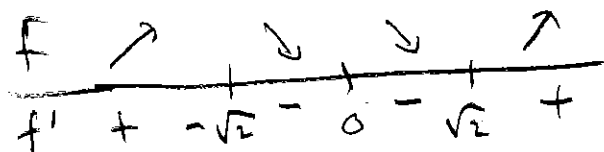
$f(-\sqrt{2}) = -\sqrt{2} - 3 - \frac{2}{\sqrt{2}} = -5.82843$

Other pts?

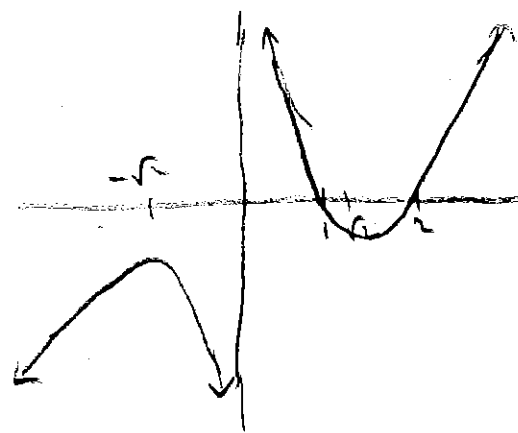
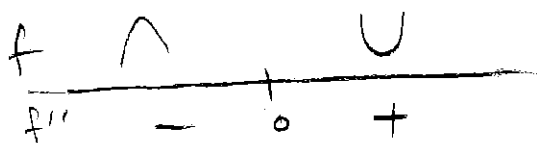
$x^2 - 3x + 2 = (x-3)(x-1) = 0$
 $x=3, x=2$ x-intercepts

3 $f'(x) = 1 - 2x^{-2} = 1 - \frac{2}{x^2} \stackrel{?}{=} 0$

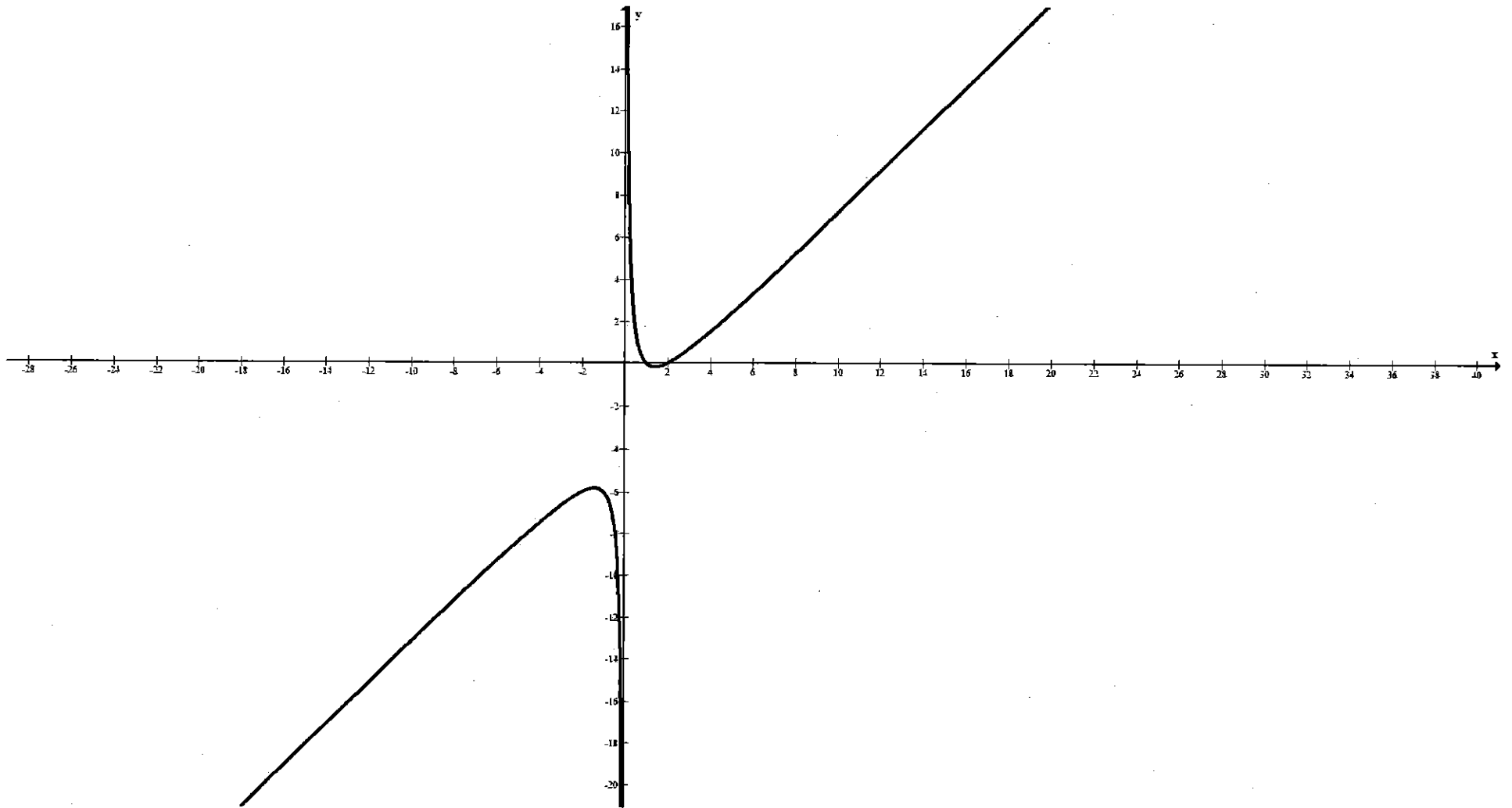
$\Rightarrow x^2 = 2 \Rightarrow x = \pm\sqrt{2}$



4 $f''(x) = 4x^{-3} = \frac{4}{x^3} \stackrel{?}{=} 0$ ← NEVER



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



Example: Sketch the graph of

$$f(x) = x^{\frac{1}{3}}(x^2 - 7) = x^{\frac{7}{3}} - 7x^{\frac{1}{3}}$$

1] NO DOMAIN RESTRICTIONS

2] $\lim_{x \rightarrow \infty} f(x) = \infty$, $\lim_{x \rightarrow -\infty} f(x) = -\infty$

3] $f'(x) = \frac{7}{3}x^{\frac{4}{3}} - \frac{7}{3}x^{-\frac{2}{3}} = \left(\frac{7}{3}x^{\frac{4}{3}} - \frac{7}{3} \frac{1}{x^{\frac{2}{3}}}\right) \stackrel{?}{=} 0 \cdot x^{\frac{4}{3}}$

$$\Rightarrow \frac{7}{3}x^2 - \frac{7}{3} = 0 \Rightarrow \frac{7}{3}(x^2 - 1) = 0$$

$$x = 1 \text{ or } x = -1$$

ALSO f' DNE AT $x = 0$

f	\nearrow		\searrow		\searrow		\nearrow
f'	+	-	-	0	-	-	+

4] $f''(x) = \frac{28}{9}x^{\frac{1}{3}} + \frac{14}{9}x^{-\frac{5}{3}} = \left(\frac{28}{9}x^{\frac{1}{3}} + \frac{14}{9} \frac{1}{x^{\frac{5}{3}}}\right) \stackrel{?}{=} 0 \cdot x^{\frac{1}{3}}$

$$\frac{28}{9}x^2 + \frac{14}{9} = 0$$

$$\frac{14}{9}(2x^2 + 1) = 0$$

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

↓
NO SOLUTION

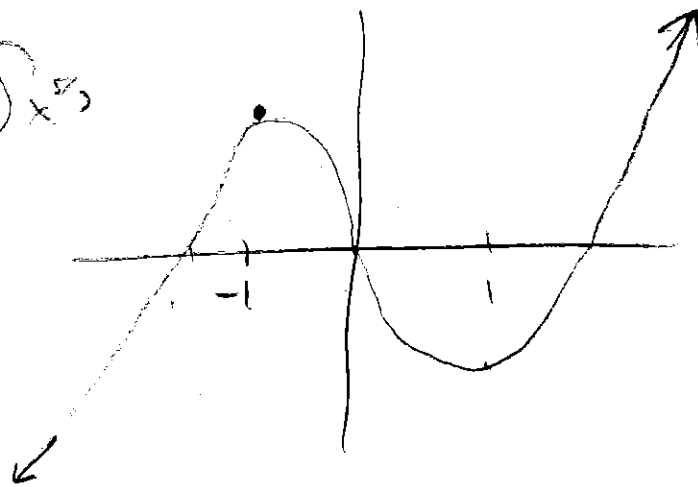
f	\wedge		\cup
f''	-	0	+

5] $f(0) = 0$

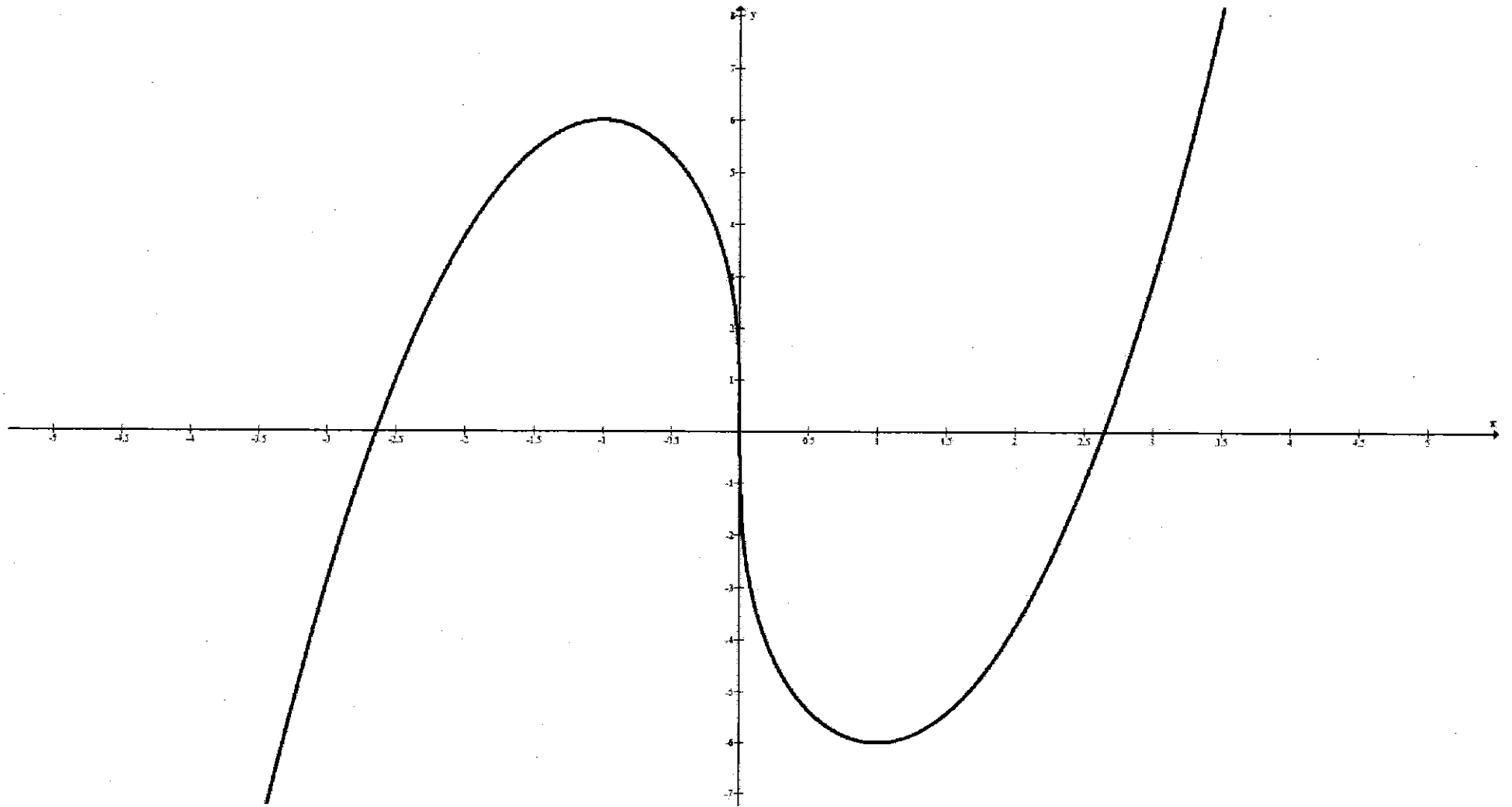
$$f(-1) = (-1)(-6) = 6$$

$$f(1) = 1(-6) = -6$$

$$f(x) = 0 \text{ WHEN } x = \pm\sqrt{7} \text{ OR } x = 0$$



$$f(x) = x^{\frac{1}{3}}(x^2 - 7)$$



Example: Sketch the graph of

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

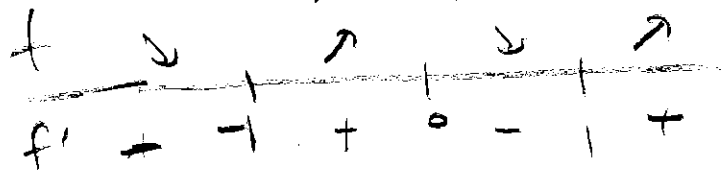
1] NO DOMAIN RESTRICTION

2] $\lim_{x \rightarrow \infty} f(x) = \infty, \lim_{x \rightarrow -\infty} f(x) = \infty$

3] $f'(x) = 4x^3 - 4x \stackrel{?}{=} 0$

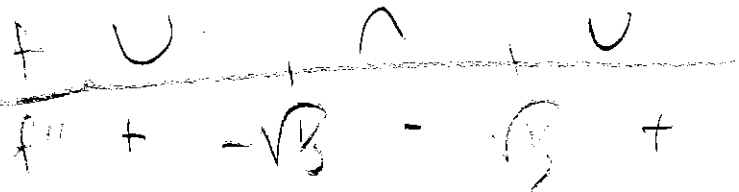
$$4x(x^2 - 1) = 4x(x-1)(x+1) = 0$$

$$x = 1, x = -1, x = 0$$



4] $f''(x) = 12x^2 - 4 \stackrel{?}{=} 0$

$$x^2 = \frac{1}{3} \quad x = \pm \sqrt{\frac{1}{3}}$$

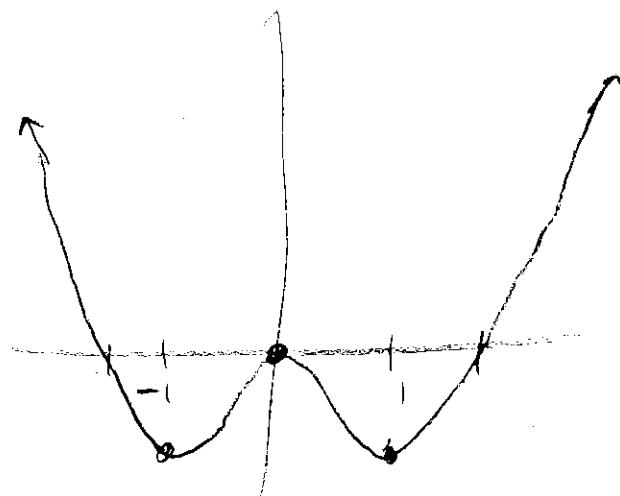


5] $f(0) = 0$

$$f(-1) = -1$$

$$f(1) = -1$$

$$f(x) = 0 \text{ when } x = 0 \text{ or } x = \pm \sqrt{2}$$



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

