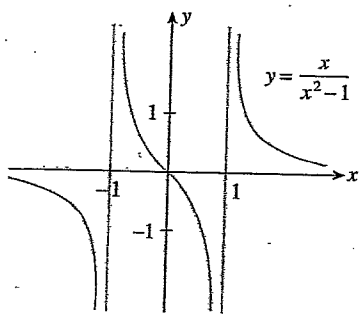
Math 111 Sec 4 Instructor: P. Konichek

Quiz 6 (4.3 Curve Sketching & 4.4 Absolute Extrema) Name Key

For problems 1-4 find the horizontal and vertical asymptotes of the graph of the function.

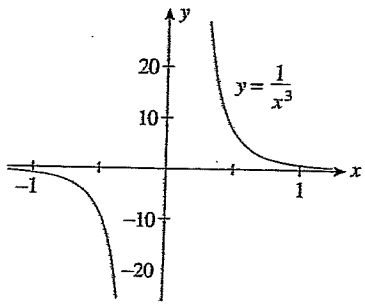
1.



Horizontal asymptote(s) $y = 0$

Vertical asymptote(s) $x = 1$; $x = -1$

2.



Horizontal asymptote(s) $y = 0$

Vertical asymptote(s) $x = 0$

For problems 3 & 4 Find the horizontal and vertical asymptotes of the graph of the function. (You need NOT sketch the graph.)

3. $f(x) = (x-2)/(x+2)$

$$\lim_{x\to\infty} \frac{(x-2)}{(x+2)} = \lim_{x\to 0} \frac{\frac{x}{x} - \frac{2}{x}}{\frac{x}{x} + \frac{2}{x}} = \lim_{x\to 0} \frac{1}{1}$$

Horizontal asymptote(s) $y = 1$

Vertical asymptote(s) $x = -2$

Numbers 4-8 all deal with sketching the graph of

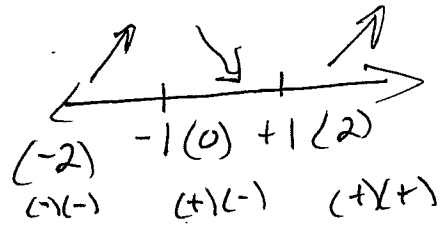
$f(x) = x^3 - 3x + 1$ where you'll ultimately sketch the graph

4. Determine the intervals where f is increasing and where f is decreasing

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

$3(x^2 - 1)$

$3(x+1)(x-1)$



f is increasing in the interval(s) $(-\infty, -1) \cup (+1, \infty)$

f is decreasing in the interval(s) $(-1, +1)$

5. Find the relative extrema of $f(x) = x^3 - 3x + 1$

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

$3(x+1)(x-1) = 0$

$x = -1$

$x = 1$

$f(-1) = -1 + 3 + 1$

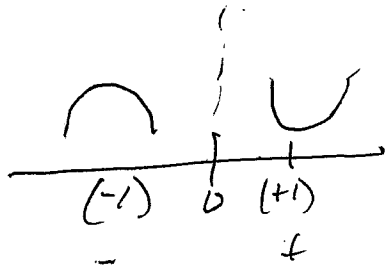
$f(-1) = 3$

$f(1) = 1 - 3 + 1$

$f(1) = -1$

The relative extrema are points $(-1, 3); (1, -1)$

6. Determine the concavity of the graph of $f(x) = x^3 - 3x + 1$



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

$f''(x) = 6x$

$6x = 0$

$x = 0$

Concave upward on the interval (0 , ∞)

Concave downward on the interval ($-\infty$, 0)

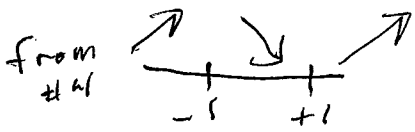
7. Find the inflection point of $f(x) = x^3 - 3x + 1$

from #6 $x = 0$

$f(0) = 0 - 0 + 1$

$f(0) = 1$

Inflection point (0 , 1)



from #5

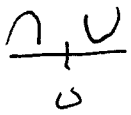
relative extrema

$(-1, 3)$

$(1, -1)$

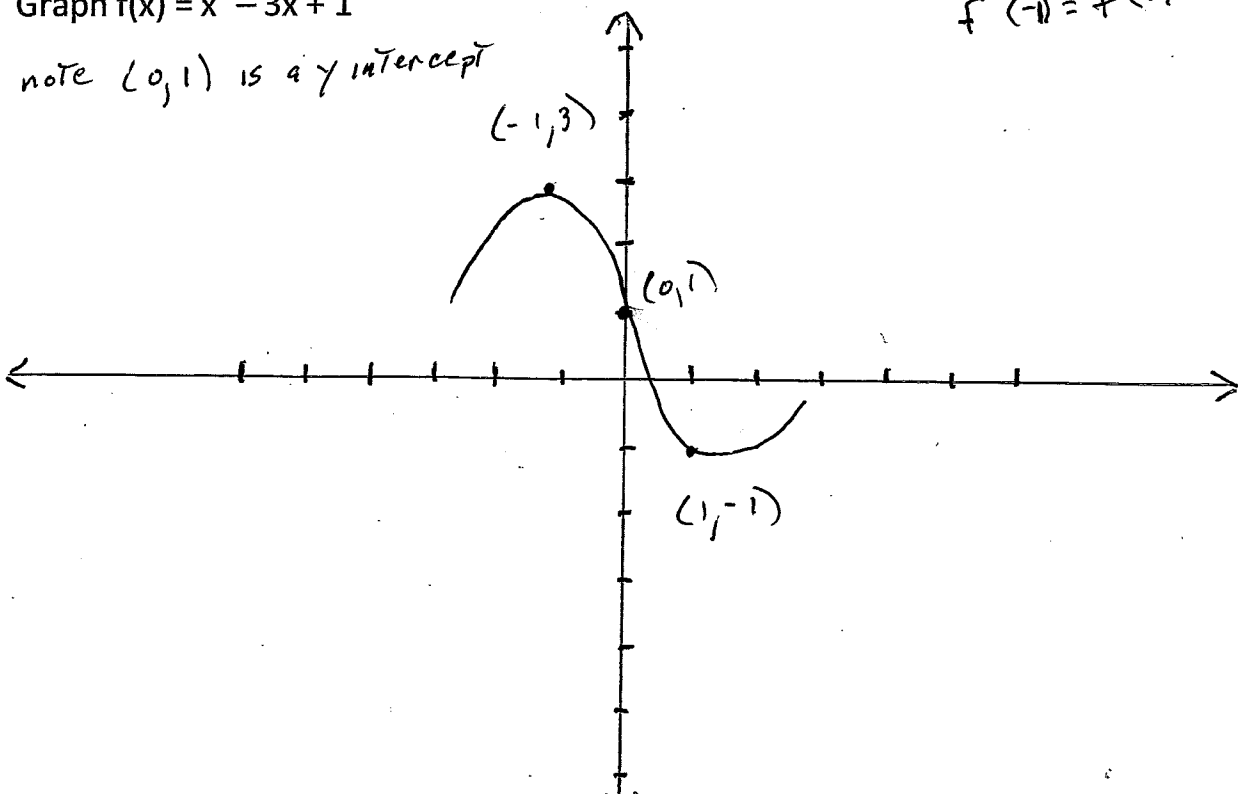
$f'(-1) = f'(1) = 0$

from #6

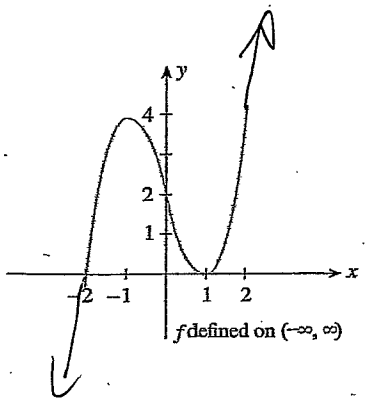


8. Graph $f(x) = x^3 - 3x + 1$

also note $(0,1)$ is a y intercept



9. Find the absolute minimum and the absolute maximum of the graph of a function f defined on the indicated interval.



absolute maximum value none

however relative extrema exists.

absolute minimum value none

Find the absolute maximum value and the absolute minimum value of the function.

10. $f(x) = x^3 + 3x^2 - 1$ on [-3,2]

$f'(x) = 3x^2 + 6x$

$3x(x+2) = 0$

$x = 0$ & $x = -2$

$f(-3) = -27 + 27 - 1 = -1$

$f(-2) = -8 + 12 - 1 = +3$

$f(0) = 0 + 0 - 1 = -1$

smallest

$f(2) = 8 + 12 - 1 = 19$ largest

absolute maximum value 19

absolute minimum value -1