Instructions:

- This exam contains 13 pages. When we begin, check you have *one* of each page.
- You will have 75 minutes to complete the exam.
- Please **show all work**, and then **write your answer on the line provided.**
  In order to receive full credit, solutions must be complete, logical and understandable.
- Turn smart phones, cell phones, and other electronic devices off now!

Academic Honesty:

By writing my name below, I agree that all the work which appears on this exam is entirely my own.

I will not look at other peoples' work, and I will not communicate with anyone else during the exam.

I will not use any calculators, notes, etc.

I understand that violating the above carries *serious consequences*, both moral and academic.

Printed Name: Key Signature: _____

Section: _____

Page:	2	3	4	5	6	7	8	9	10	11	12	13	Total
Points:	10	10	10	10	10	8	10	6	6	10	4	6	100
Score:													

1. [5 points] True or false (1 point each – no work required):

   (a) $(1+\sqrt{x})^2 = 1+x$

   (a) False

   (b) $(1+x)^2 = 1+x^2$

   (b) False

   (c) $(1+x)^2 = 1+2x+x^2$

   (c) True

   (d) $\sqrt{1+x} = 1+\sqrt{x}$

   (d) False

   (e) $\dfrac{x-2}{x+3} = \dfrac{x}{x+3} - \dfrac{2}{x+3}$

   (e) True

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

   (f) False

2. [5 points] Solve the following *equation* for x:

$$|3x+1| = 2$$

$\Leftrightarrow$

$3x+1 = 2$ or $3x+1 = -2$

$3x = 1$ $\qquad$ $3x = -3$

$x = \frac{1}{3}$ or $x = -1$

2. $x = \frac{1}{3}$ or -1

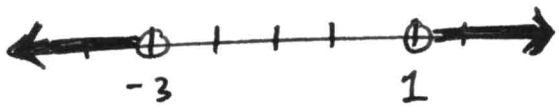
3. [10 points] Find the set of x where the following *inequality* is true:

$$x^2 + 2x - 3 > 0$$

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

equality holds when

$x = 1$ or $x = -3$



false when = holds

⇒ use open dots

Checking intervals

$x = -4 \Rightarrow (-4-3)(-4+3) = (-7)(-1)$ ✓

$x = -1 \Rightarrow (-1-1)(-1+3) = (-2)(2)$ ✗

$x = 2 \Rightarrow (2-1)(2+3) = (1)(5)$ ✓

3. $(-\infty, -3) \cup (1, \infty)$

4. [10 points] Find the set of x such that the *inequality* is true:

$$\frac{x+3}{2x-4} \geq 0$$

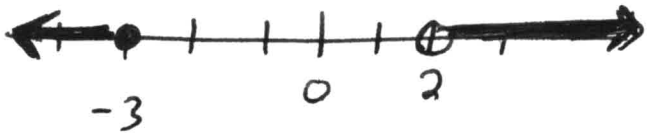
equality holds

when $\frac{x+3}{2x-4} = 0$

when $x+3 = 0$

when $x = -3$

(true when = holds
⇒ use solid dot)



undefined when

$2x-4 = 0$

when $2x = 4$

when $x = 2$

(Plot with open dot)

check intervals:

$x = -4 \Rightarrow \frac{(-4)+3}{2(-4)-4} = \frac{-1}{-12}$ ✓

$x = 0 \Rightarrow \frac{0+3}{2\cdot 0-4} = \frac{3}{-4}$ X

$x = 3 \Rightarrow \frac{3+3}{2\cdot 3-4} = \frac{6}{2}$ ✓

4. $(-\infty, -3] \cup (2, \infty)$

5. [10 points] Find the set of x where the following *inequality* is true:

$$|3x + 1| \leq 2$$

equality holds when

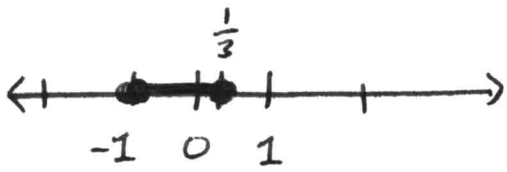
$|3x+1| = 2$

$\Leftrightarrow$

$3x+1 = 2$ or $3x+1 = -2$

$3x = 1$ | $3x = -3$

$x = \frac{1}{3}$ or $x = -1$



true when = holds
⇒ use dot

check intervals:

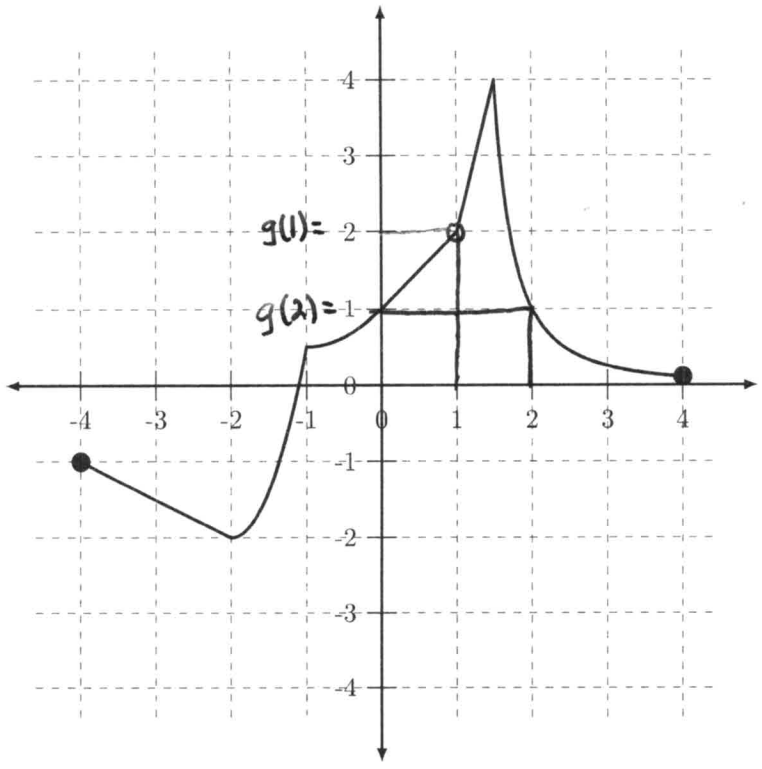
$x = -2 \Rightarrow |3(-2)+1| = |-6+1| = |-5| = 5$ ✗

$x = 0 \Rightarrow |3 \cdot 0 + 1| = |1| = 1$ ✓

$x = 1 \Rightarrow |3 \cdot 1 + 1| = |4| = 4$ ✗

5. $[-1, \frac{1}{3}]$

6. The graph of a function g is given below.



(a) [2 points] Explain why g is a function.

each input has one output

it passes (or) the vertical line test

(b) [2 points] What is $g(1)$?

(b) 2

(c) [2 points] What is $g(2)$?

(c) 1

(d) [2 points] What is the domain of g?

(d) $[-4, 4]$

(e) [2 points] What is the range of g?

(e) $[-2, 4]$

7. [4 points] Find the equation for the line passing through the points $(5, 4)$ and $(7, 2)$. Write your answer in point-slope form and in slope-intercept form.

x_1 y_1 x_2 y_2

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2-4}{7-5} = \frac{-2}{2} = -1$$

$y = m(x - x_1) + y_1$

$y = (-1)(x-5)+4$ or $y = (-1)(x-7)+2$

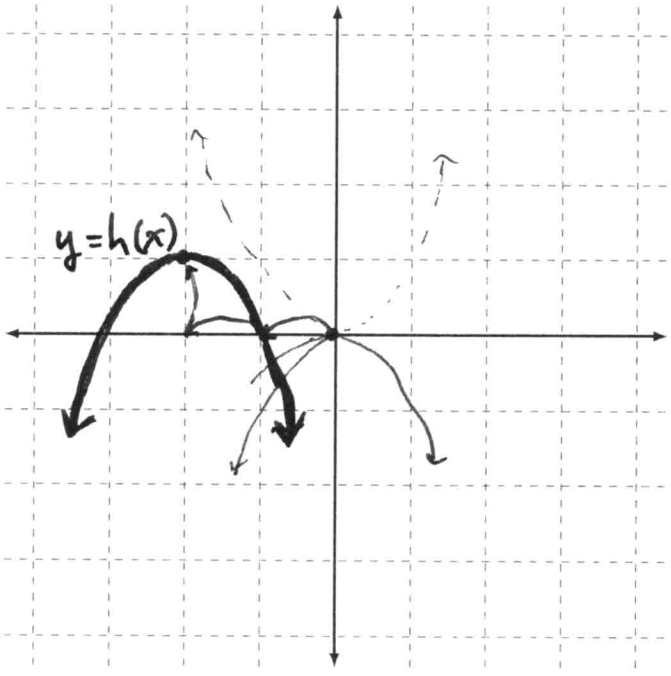
$y = -x + 5 + 4 \Rightarrow \boxed{y = -x+9}$

7. _____

8. [4 points] Sketch the graph of the following parabola. Write its vertex on the line below.

$$h(x) = -(x+2)^2 + 1$$

$y = x^2$, flipped across x, moved left 2, up one



8. vertex = $(-2, 1)$

9. [10 points] Completing the Square to get quadratic in the form $y = a(x-h)^2 + k$, and use this to sketch the graph of the function.

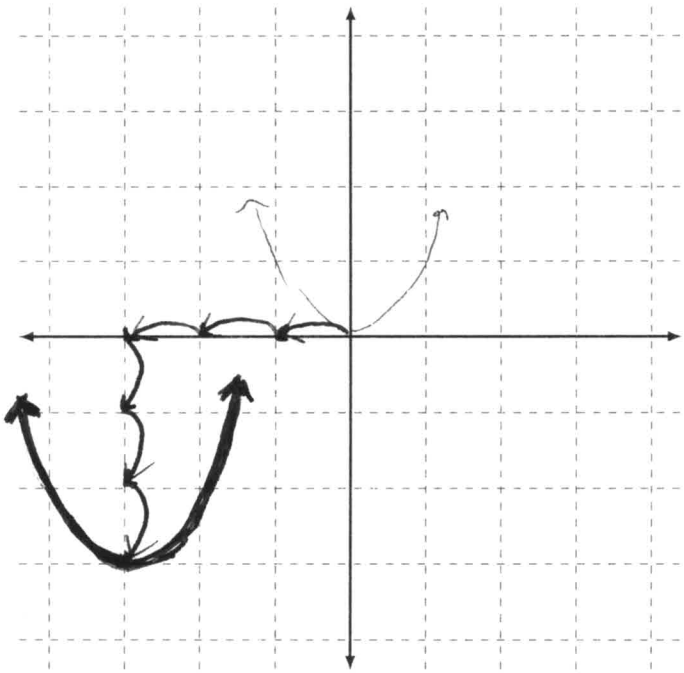
$y = x^2 + 6x + 6$

$y = [x^2 + 6x + \underline{9}] - \underline{9} + 6$

$= (x + \underline{3})(x + \underline{3}) - \underline{9} + 6$

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

9. $y = (x+3)^2 - 3$



10. [6 points] Determine the domains of the following functions **Remember to show all work!**

(a) Find the domain of $f(x) = \sqrt{2x+4}$, and write it in interval notation.

$f(x)$ is defined

$\Leftrightarrow$

$2x+4 \geq 0$

$\Leftrightarrow$

$2x \geq -4$

$\Leftrightarrow$

$x \geq -2$

(a) $[-2, \infty)$

(b) Find the domain of $g(x) = x - 1$, and write it in interval notation.

$g(x)$ is always defined

(b) $(-\infty, \infty)$

(c) Graph the domain of $\left(\frac{f}{g}\right)(x) = \frac{\sqrt{2x+4}}{x-1}$.

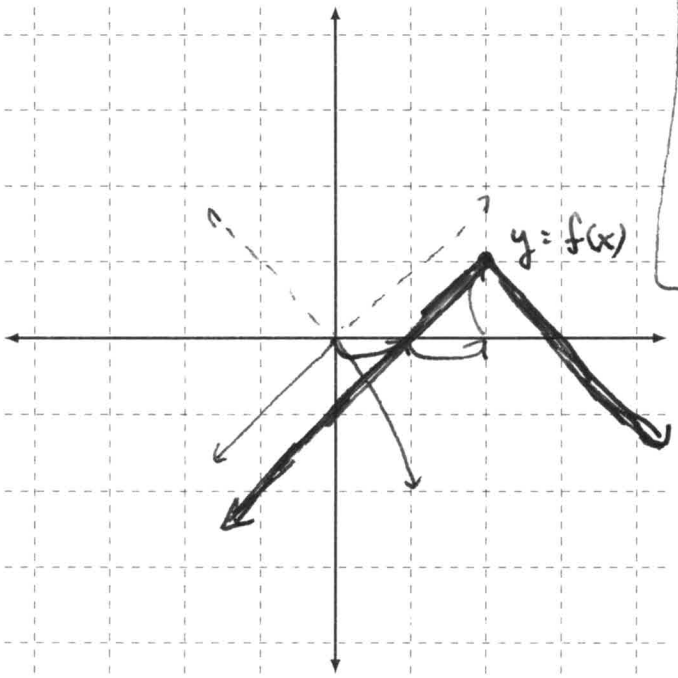
$\left(\frac{f}{g}\right)(x)$ is defined $\Leftrightarrow$ $f(x)$ is defined AND $g(x)$ is defined AND $g(x) \neq 0$ $\Leftrightarrow$ Both AND $x-1 \neq 0$ $\Leftrightarrow$ Both AND $x \neq 1$

$x \geq -2$ $x \geq 2$

(d) Write the domain of $\left(\frac{f}{g}\right)(x) = \frac{\sqrt{2x+4}}{x-1}$ in interval notation.

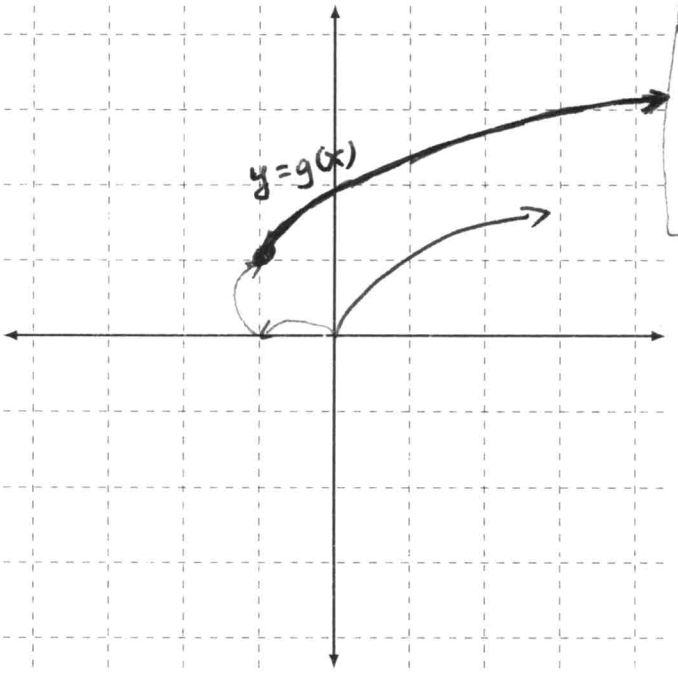
(d) $[-2, 1) \cup (1, \infty)$

11. [3 points] Sketch the graph of $f(x) = -|x-2|+1$



this is
$y = |x|$
flipped across x-axis,
moved right 2
and up 1

12. [3 points] Sketch the graph of $g(x) = \sqrt{x+1}+1$



this is
$y = \sqrt{x}$
moved left 1
and
up 1

13. [10 points] Graphing the polynomial

$$f(x) = (x+1)(x-1)(x-3) = x^3 - 3x^2 - x + 3$$

leading term

① eventual behavior:

x big $\Rightarrow$ $f(x) \approx x^3$

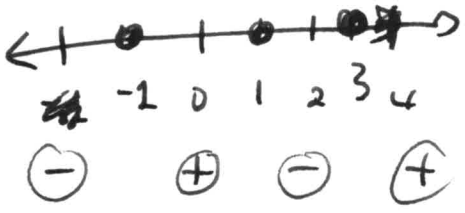
② $f(x) = 0$

$\Leftrightarrow$

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

$\Leftrightarrow$

$x = -1$ or $x = 1$ or $x = 3$



③ check intervals

$x = -2 \Rightarrow (-2+1)(-2-1)(-2-3)$

$= (-1)(-3)(-5)$

$\ominus$

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

$= (1)(-1)(-3)$

$\oplus$

$x = 2 \Rightarrow (2+1)(2-1)(2-3)$

$= (3)(1)(-1)$

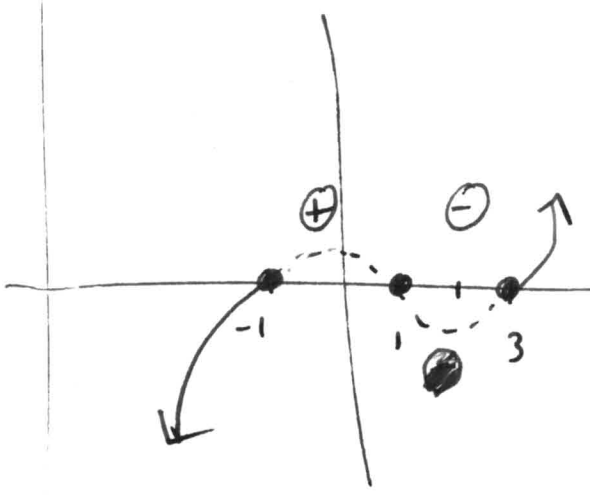
$\ominus$

$x = 4 \Rightarrow (4+1)(4-1)(4-3)$

$= 5 \cdot 3 \cdot 1$

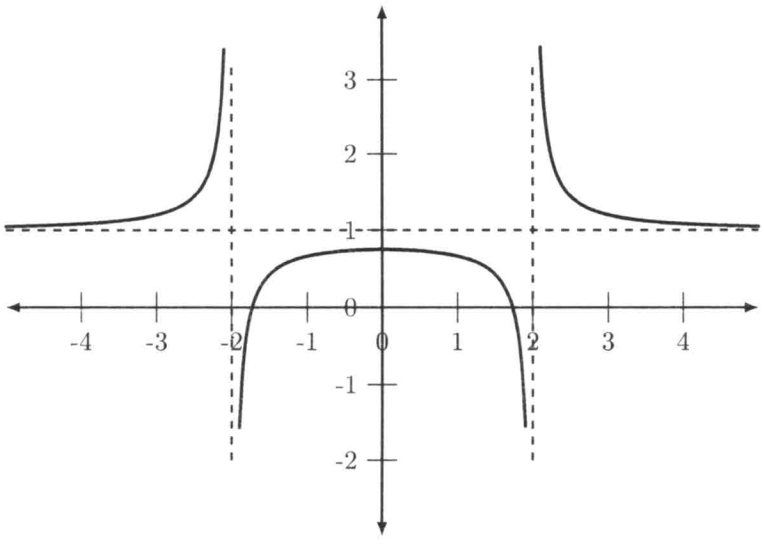
$\oplus$

Graphing:



14. [4 points] The graph of this function is given below

$$f(x) = \frac{x^2 - 3}{x^2 - 4}$$



(a) What are the horizontal asymptote(s) of $f(x)$?

(a) $y = 1$

(b) What are the vertical asymptote(s) of $f(x)$?

(b) $x = -2$ and $x = 2$

15. [6 points] Consider the following function:

$$f(x) = \frac{3x}{(x-2)^2} = \frac{3x}{x^2 - 4x + 4}$$

(a) Find the zero's of $f(x)$.

$f(x) = 0$

$\Leftrightarrow$

$3x = 0$

$\Leftrightarrow$

$x = 0$

(a) $x = 0$

(b) Find the horizontal asymptotes of $f(x)$.

when x is big

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

when x is big $f(x)$ is small

$\Rightarrow$ asymptote at $y = 0$

(b) $y = 0$

(c) Find the vertical asymptotes of $f(x)$.

x is undefined

$\Leftrightarrow$

$(x-2)^2 = 0$

$\Leftrightarrow$

$x - 2 = 0$

$\Leftrightarrow$

$x = 2$

(c) $x = 2$