MAC 1105, Fall 2017.

Exam #3

November 14, 2017

Name _____

- You will be told when to begin the work and when to terminate work on the examination. You must stop when instructed. Points may be deducted in case of violations.
- Please show your work to support your answers that require calculations. Correct but unsupported answers may not be given full credit.
- The use of a cell phone or other electronic communication devices during the examination is not allowed. The exam will be canceled and a grade of "0" will be assigned to anyone who uses a cell phone during the examination or if one is found within hands reach.
- Calculators are not allowed on this exam.
- The exam consists of two parts. Part I contains five multiple choice questions worth 5 points each if not stated otherwise. Part II contains 7 open ended questions worth 10 points each if not stated otherwise.

Honor Code: *On my honor, I have neither received nor given any aid during this examination.*

Signature: _____

Part I

Choose your answer from five available choices. No partial credit will be given for wrong answers.

1. Which is the following functions are rational functions

   - $f(x) = \dfrac{x^2 - x}{x}$
   - $g(x) = \dfrac{2 - x}{x - 1}$
   - $h(x) = \dfrac{2x^{1/2} - 5}{3x + 1}$ NO
   - $k(x) = \dfrac{x + 4}{x^2 + 2x + 3}$

   (a) f only
   (b) f and k
   (c) f, k, and h
   (d) f, k, and g
   (e) None of the above

2. The parabola $y = -2(x - 1)^2 + 3$ has the vertex at

   (a) (1,3)
   (b) (-1,3)
   (c) (-1,-3)
   (d) (1,-3)
   (e) None of the above

3. Find the domain of $f(x) = \sqrt{x - 1}$.

   (a) $(-\infty, 1]$
   (b) $(-\infty, 1)$
   (c) $(+1, \infty)$
   (d) $[+1, \infty)$
   (e) None of the above

4. Find the vertical asymptote(s) of the rational function

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

   (a) $y = -2$ and $y = 3$
   (b) $x = -2$ and $x = 3$
   (c) $x = -2$
   (d) $x = 3$
   (e) None of the above

5. Match each function with its horizontal asymptote(if it exists). [Hint: One asymptote can be used multiple times.]

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

(b) $g(x) = \dfrac{6x^3}{2-3x^2}$ (6)

(c) $h(x) = \dfrac{8x^2-2x^2+x}{4x^3+x^2+4}$ (1)

(d) $k(x) = \dfrac{4x^2+x}{1-2x^2}$ (5)

(1) $y = 0$ (2) $y = 1$ (3) $y = -1$

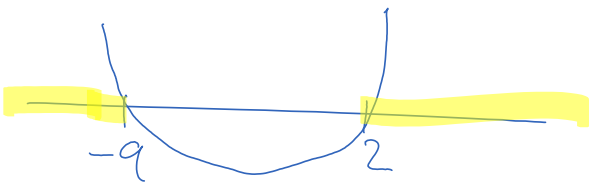
(4) $y = 2$ (5) $y = -2$ (6) no horizontal asymptote

Part II

6. (10 points each) Solve the following inequality.

(a) $(x-2)(x+9) > 0$

$x^2+7x-18 \geq 0$



$(-\infty, -9) \cup (2, \infty)$

(b) $x^2 \geq 2x+2$

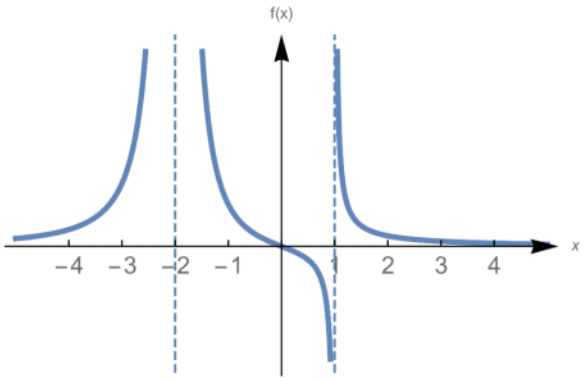
$x^2-2x-2 \geq 0$

$x = \dfrac{2 \pm \sqrt{4-4(-2)}}{2} = \dfrac{2 \pm \sqrt{12}}{2}$

$= 1 \pm \sqrt{3}$

$(-\infty, 1-\sqrt{3}] \cup [1-\sqrt{3}, \infty)$

7. (5 points) Use the graph below to solve the inequality, $f(x) \geq 0$.



$(-\infty, -2) \cup (-2, 0] \cup (1, \infty)$

8. Write an equation in standard form of the parabola that has the same shape as the graph of $f(x) = 6x^2$ or $g(x) = -6x^2$, but with has the minimum $= 8$ at $x = -6$.

$a < 0$

$y = -6(x+6)^2 + 8$

9. Find the equation (in standard form) of the parabola with the vertex at $(2, 6)$ and the y-intercept at $(0, 2)$

$y = a(x-2)^2 + 6$

$2 = a(-2)^2 + 6$

$-4 = 4a \rightarrow a = -1$

$y = -(x-2)^2 + 6$

10. Solve the inequality.

$$\frac{x^2+1}{2x^2+10x+12} \leq 0$$

$2x^2+14$

$$\frac{x^2+1}{2(x^2+7x+6)}$$

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

	$(-\infty,-6)$	$(-6,-1)$	$(-1,\infty)$
x^2+1	+	+	+
$x+6$	−	+	+
$x+1$	−	−	+
$f(x)$	+	−	+

$(-6,-1)$

11. Find the equation of the parabola in the standard form. Graph the parabola with x-intercepts and find its vertex.

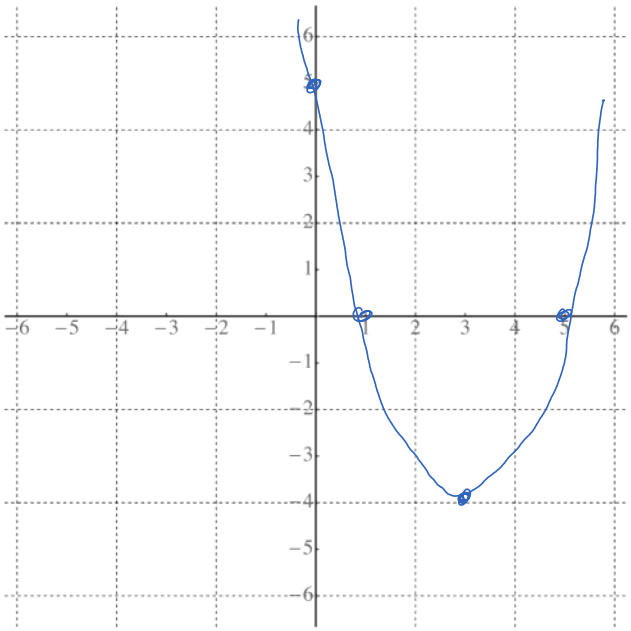
$$f(x) = x^2 - 6x + 5$$

$$= (x^2-6x+3^2)+5-3^2$$

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

$$x^2-6x+5=0$$

$$(x-5)(x-1)=0$$



12. (20 points) Graph the function $f(x) = \dfrac{x^2 - 1}{x^2 + 3x - 4}$ $= \dfrac{(x-1)(x+1)}{(x-1)(x+4)} = \dfrac{x+1}{x+4}$

(a) Domain

$x \neq 1, -4$

(b) y–intercept $y = \frac{-1}{-4}$ $\boxed{(0, \frac{1}{4})}$

(c) x–intercept

$x = -1$ $\boxed{(-1, 0)}$

(d) Vertical asymptote(s)

$\boxed{x = -4}$

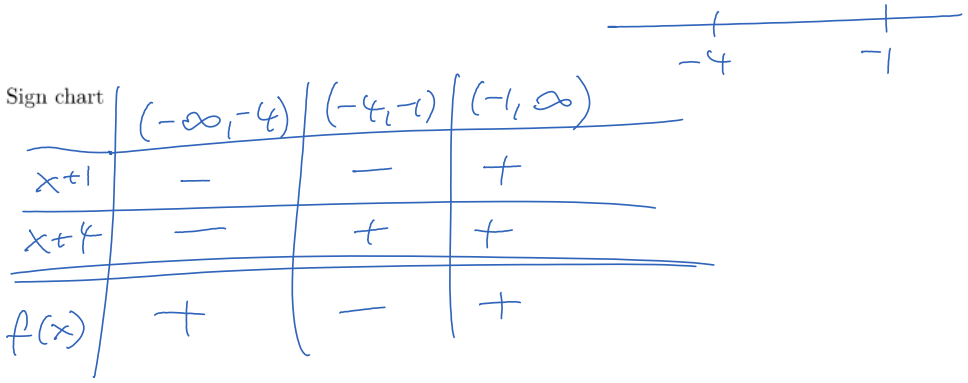
(e) Horizontal asymptote(s)

$\boxed{y = 1}$

(f) Symmetries

$f(-x) = \dfrac{-x+1}{-x+4}$ neither

(g) Sign chart



(h) Graph