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

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

   (a) f, g, and k
   (b) f only
   (c) f and k
   (d) f, h, and k
   (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 $f(x) = \sqrt{1-x}$.

   (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

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

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

(b) $g(x) = \dfrac{6x^2}{2-3x^2}$ (5)

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

(d) $k(x) = \dfrac{x^2+x}{4x}$ (6)

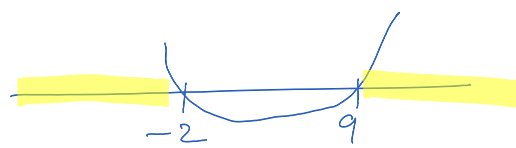
(1) $y = 0$	(2) $y = 1$	(3) $y = -1$
(4) $y = 2$	(5) $y = -2$	(6) no horizontal asymptote

Part II

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

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

$x^2 - 7x - 18 > 0$

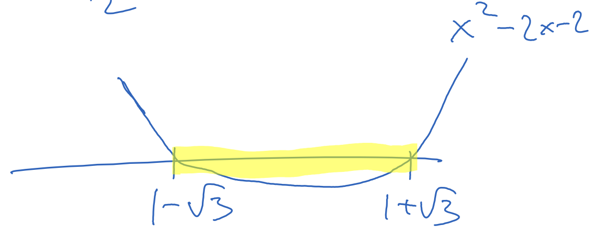


$$\boxed{(-\infty, -2) \cup (9, \infty)}$$

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

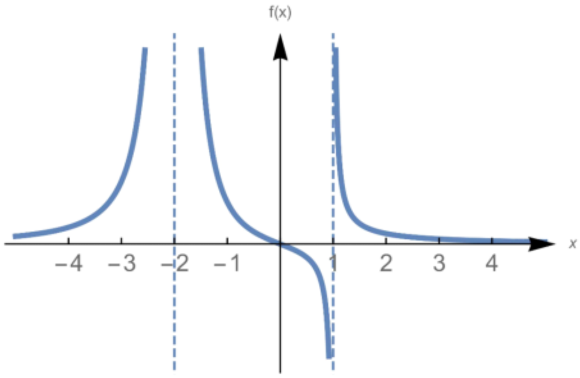
$x^2 - 2x - 2 \leq 0$

$$x = \frac{2 \pm \sqrt{4-4(-2)}}{2} = \frac{2 \pm \sqrt{12}}{2} = 1 \pm \sqrt{3}$$



$$\boxed{[1-\sqrt{3}, 1+\sqrt{3}]}$$

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



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

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 $\underbrace{\text{maximum}}_{}$ $= 8$ at $x = -6$.

a is negative

$\boxed{y = -6(x+6)^2 + 8}$

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

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

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

$4 = 4a \rightarrow a = 1$

$\boxed{y = (x-2)^2 - 6}$

10. Solve the inequality.

$$\frac{x^2+1}{2x^2+10x+8} \leq 0$$

$$\frac{x^2+1}{2(x^2+5x+4)} = \frac{x^2+1}{2(x+4)(x+1)}$$

	$(-\infty,-4)$	$(-4,-1)$	$(-1,\infty)$
pt	-5	-2	0
x^2+1	$+$	$+$	$+$
$x+4$	$-$	$+$	$+$
$x+1$	$-$	$-$	$+$
$f(x)$	$+$	$-$	$+$

-4 $\quad$ -1

$$\boxed{(-4,-1)}$$

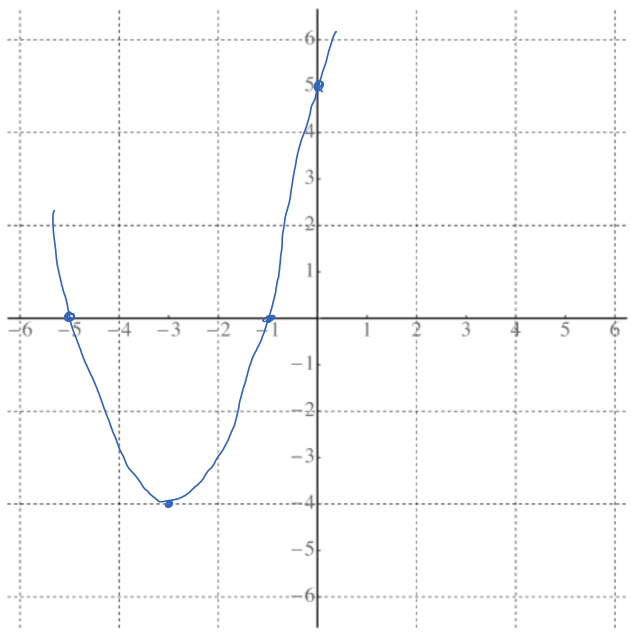
11. Find the equation of the parabola in the standard form. Graph the parabola with x-intercepts and find its vertex.

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

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

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

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



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

(a) Domain

$x \neq \pm 2$

(b) y–intercept $-2/-4 = \frac{1}{2}$ $\boxed{(0, 1/2)}$

(c) x–intercept

$x+1=0$

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

(d) Vertical asymptote(s)

$\boxed{x=-2}$

(e) Horizontal asymptote(s)

$\boxed{y=1}$

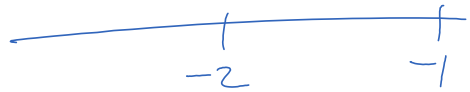
(f) Symmetries

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

neither

(g) Sign chart

	$(-\infty,-2)$ -3	$(-2,-1)$ -1.5	$(-1,\infty)$ 0
$x+1$	$-$	$-$	$+$
$x+2$	$-$	$+$	$+$
$f(x)$	$+$	$-$	$+$



(h) Graph