NAME: This is a sample midterm to be used for practice. This is *not* a template for the midterm that will be given in class. Many of the questions on the Midterm will look quite different than those appearing here.

1. [4] TRUE/FALSE: Circle T in each of the following cases if the statement is *always* true. Otherwise, circle F. Let f be a function, and x, y, and z be real numbers with $z \neq 0$.

   T   F $\frac{3x+y}{3z} = \frac{x+y}{z}$

   T   F $(x+y)^2 = x^2 + y^2$

   T   F $|x| = x$

   T   F   The function $\sqrt{(x - \sqrt{2})}$ has the domain $[\sqrt{2}, \infty)$

   Show your work for the following problems. The correct answer with no supporting work will receive NO credit (this includes multiple choice questions).

2. [3] Given $3(7 + x)^{-2} - 4 = 2$, solve for x.

3. [4] Let the following describe the function α:

input:	○	★	Δ	★ + Δ
output:	4	-2	3	-4

Find the following if possible:

$\alpha(\star) + \alpha(\Delta)$ $\qquad\qquad\qquad\qquad\qquad$ $\alpha(\star + \Delta)$

$\alpha(\bigcirc) \times \alpha(\star + \Delta)$ $\qquad\qquad\qquad\qquad$ $\alpha(\Delta + \Delta)$

4. Consider $f(x) = \frac{x-1}{x}$ and $g(x) = 3x - 4$.

- [2] What is $f(z + \sqrt{2})$? Do *not* expand this.

- [3] Find the rule for $f \circ g$ and *simplify* as much as possible.

- [2] The function f is one-to-one, find it's inverse.

5. [4] Find the domain of f where $f(x) = \frac{2-\sqrt{5-2x}}{x+10}$.

6. [4] Consider the points $P = (3, 4)$ and $Q = (-1, -2)$. Find the equation to a line that goes through the point $(1, 1)$ and has a perpendicular slope to the line connecting P and Q.
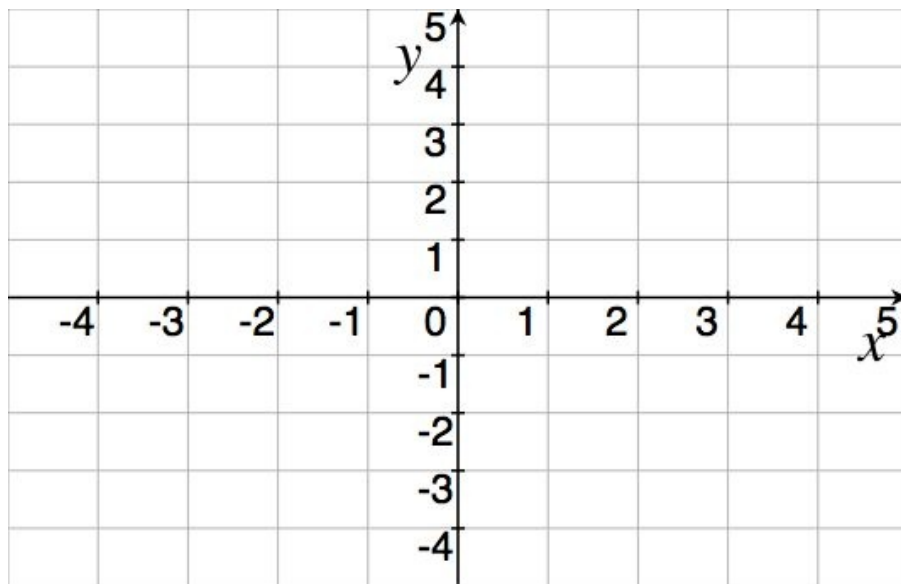
- [1] What is the y intercept of the line you found?

- [1] Find the zeros of the line you found above.

7. [4] Given that $f(x) = x^2 - 5x - 6$. Write f in vertex form.

8. Let f be the *function* defined by

$$f(x) = \begin{cases} \frac{1}{x} & x \leq 1 \\ (x-2)^2 & 1 < x \end{cases}$$

(a) [3] (§1.3) Graph f. (Explaining graph transformations is worth partial credit.)

(b) [2] (§1.2 #43) Find all possible input(s) so that $f(x) = 1$.

9. [4] Simplify the following as much as possible:

$$\frac{(2x^4y^3)^3(6xy^3)^{-3}}{x^4y^4}$$

10. [3] Find a cubic polynomial whose graph passes through the points $(-2, 0)$ and $(1, 0)$ and has a root at 6. Note: there are many correct answers possible here.

11. (Lecture 4/15) Let $m(x) = x^3 + x^2 - \frac{39}{4}x + 9$ and $n(x) = x + 4$. Use long division to find $G(x)$ and $R(x)$ so that $\frac{m(x)}{n(x)} = G(x) + \frac{R(x)}{n(x)}$

12. The height y (in feet) of a ball thrown by a child on the planet Gethen is

$$y = -x^2 + 15x + 3$$

where x is the horizontal distance in feet from the point at which the ball is thrown. Answer the following questions.

(a) [2] How high is the ball when it leaves the child's hand?

(b) [2] How far from the child does the ball hit the ground?