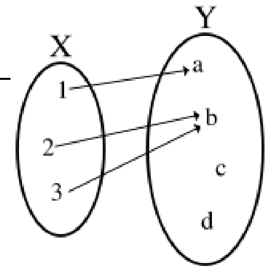
Math 1111 Journal Entries **Name ________________**
Unit III (Sections 3.1-3.2, 4.1, 4.3, 5.1 & 5.4-5.5)

Respond to each item, giving sufficient detail. Please print neatly! *Your portfolio should be a collection of your best work and should also be very helpful to you as you prepare for exams.*

1. A **relation** is a correspondence between two sets; the set of first elements is called the ________________ and the set of second elements is called the **range**.

   A **function** is a special relation in which each member of the domain is paired with ________________ member of the range.

   Refer to the mapping to the right. Is this a function? ________________

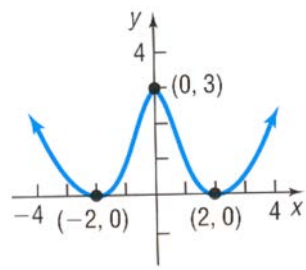
   Write this relation as a set of ordered pairs.

   { (1, a), ________________ }

   Complete. f(1) = _____ f(2) = f(3) = _____

   The domain of f is { 1, 2, 3 }. The range is { a, b }.

2. Refer to the following graph.

   (a) Find f(0). ________

   (b) What are the **x-intercepts**? ________________

   (c) What is the **domain** of this function? Use interval notation. ________

   (d) What is the **range** of this function? Use interval notation. ________

   (e) For what value(s) of x is f(x) = 0? _____________

3. A **linear function** is a function of the form f(x) = ________________ .

   In this form, m represents the average rate of change or ___________ which is constant for any linear function.

   $$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} \text{ or } \frac{y_1 - y_2}{x_1 - x_2}$$

   A linear function is increasing over its domain if its **slope**, m, is ________________ .

   It is ________________ over its domain if its slope, m, is negative. It is constant over its domain if its slope, m, is ___________ .

4. For a quadratic function, **vertex (or general) form** is ____________________ .

The coordinates of the vertex of the corresponding parabola are (h, k).

The axis (line) of symmetry is given by the equation __________ .

With this form, after setting y equal to 0, what technique is <u>most natural</u> for finding any x-intercepts? **The square root property**

For a quadratic function, **standard form** is ____________________ .

Give the formulas we use to find the vertex of the parabola. h = __________ k = f(h)

Using this form, the y-intercept is given by the ordered pair __________ .

After setting y equal to 0, two techniques that are <u>most natural</u> for finding x-intercepts are the zero product property (with factoring) and the quadratic formula (See Unit II.)

List 3 realistic **applications of quadratic functions**, along with corresponding examples of formulas. Everything is done below. Be familiar with these sorts of quadratic applications!

(1) ______<u>Projectile motion</u>____________________ $s = -16t^2 + 96t + 112$

(2) ______<u>Revenue from sales</u>__________________ $R(p) = -4p^2 + 4000p$

(3) ______<u>Stopping Distance</u>___________________ $d = 1.1v + 0.06v^2$

5. Complete the table below for each type of **polynomial function** (from degree 0 to degree 4). For each of your 5 polynomial function examples, give its leading term, leading coefficient, and degree.

Polynomial function	Leading term	Leading coefficient	Degree
	5	5	0
$y = -3x + 4$	$-3x$		1
$y = -x^2 + 3x + 8$		-1	2
$y = 2x^3 + 3x^2 - 4x + 7$	$2x^3$	2	
$y = x^4 - 7x^3 - x^2 + 3x + 8$	x^4		4

6. According to Ms. Melanie Partlow (from ABAC), solving **polynomial** (including quadratic) **and rational inequalities** involves two major steps.

Assuming that the algebraic expression is on one side of the inequality, and 0 is on the other side, . . .

First, find "________________" by finding zeros of the polynomial expression (for all polynomial inequalities) and by finding zeros of both the numerator and denominator in the rational expression (for all rational inequalities).

Then, use these values to separate a number line into intervals. Use "________________" in each of these intervals and check whether these values "work" in the original inequality. Also, check the borderline values in the original inequality.

Complete the following examples of a polynomial and a rational inequality, along with all the steps toward a solution. You may write your final answer in either set notation or interval notation.

Polynomial $(x + 2)(x - 4) > 0$

Cut points: x = ___________

Check points: -3 (-)(-) = (+) ☺
0 (+)(-) = (-) ☹
5 (+)(+) = (+) ☺

Solution: ______________________________________

Rational $\boxed{\dfrac{x+2}{x-4} \le 0}$

Cut points: x = -2, 4

Check points: -3 (-)(-) = (+) ☹
0 (+)(-) = (-) ☺
5 (+)(+) = (+) ☹

The cut point -2 checks because $0 \le 0$; the cut point 4 fails to check since division by 0 is undefined.

Solution: ______________________________________

7. If f(x) and g(x) denote polynomial functions and if g(x) is a polynomial whose degree is greater than zero, then there are unique polynomial functions q(x) and r(x) such that

$$\frac{f(x)}{g(x)} = q(x) + \frac{r(x)}{g(x)} \qquad \text{or, equivalently,} \qquad f(x) = \underline{\hspace{6cm}},$$

where f(x) is the dividend, q(x) is the quotient , g(x) is the divisor, and r(x) is the remainder.

Give an example of the use of **long division** and **synthetic division** for $\frac{f(x)}{g(x)}$.

$f(x) = x^4 - 2x^2 + 3x - 5$ $\qquad$ $g(x) = x - 2$

Long Division:

$$\begin{array}{rl}
 & \quad\;\; x^3 + 2x^2 + 2x + 7 \\
x-2 & \overline{)\, x^4 \qquad\quad - 2x^2 + 3x - 5} \\
 & \underline{x^4 - 2x^3} \\
 & \qquad 2x^3 - 2x^2 \\
 & \qquad \underline{2x^3 - 4x^2} \\
 & \qquad\qquad 2x^2 + 3x \\
 & \qquad\qquad \underline{2x^2 - 4x} \\
 & \qquad\qquad\qquad 7x - 5 \\
 & \qquad\qquad\qquad \underline{7x - 14} \\
 & \qquad\qquad\qquad\qquad 9
\end{array}$$

Solution : ____________________________

Synthetic Division: $\underline{2}\,|$ $\quad$ 1 $\quad$ 0 $\quad$ -2 $\quad$ 3 $\quad$ -5

The **Remainder Theorem** states that "if a polynomial function f(x) is divided by x – c, then the remainder (from long division or synthetic division) is f(c)".

In your example, this means that f(2) = ________

The **Factor Theorem** states that "x – c is a factor of f(x) if and only if f(c) = 0".

In your example, is x – 2 a factor of f(x)? ________

8. Give one example (with a polynomial function of degree 3 or more) clearly showing the correct use of the **rational zeros (p/q) theorem**. Factor the polynomial function completely, and show all of the steps in the process.

$g(x) = x^4 - x^3 - 6x^2 + 4x + 8$

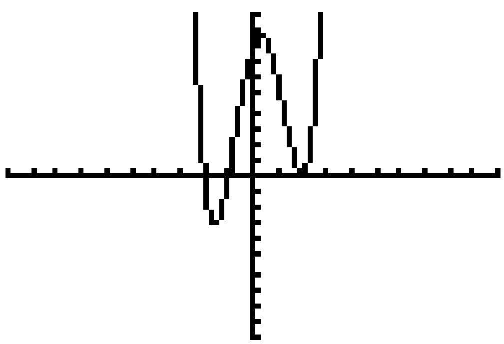
$p = \pm1, \pm2, \pm4, \pm8$ p/q = ___________________________

$q = \pm1$

-1| 1 -1 -6 4 8 The zeros are ___________________

g(x) = __________________________

9. The graph of the function you worked with in #8 is shown below. In the table, clearly show any x-intercepts and y-intercepts and two other points on the curve. Use your graphing calculator to find any turning points (relative extrema) with two decimal place precision.



x	y
0	
	0
	0
	0
1	
3	

The relative minimum is (_____ , ______),
and the relative maximum is (_____ , _____).

10. Write a few sentences describing something you learned that was new for you in class this unit. You may include a favorite activity, an interesting application, a teaching and learning technique, or a specific concept that you better understand as a result of this unit.

Do your best! Rise to the challenge! Live and learn!