MAT 1340 Week 8 Written Assignment
points Covers Sections 3.1 – 3.3

3.1 – Quadratic Functions and Models
3.2 – Polynomial Functions and their Graphs
3.3 – Dividing Polynomials

This week's assignment contains elements of old Writing Project #3's from previous semesters, with a few twists for better coverage with less work.

An Old Writing Project #3 – I run through an old Project #3, with many of the same type questions as you will encounter in this Assignment.

1. Notes
2. Video

There's extra material in the old Writing Project #3s that isn't covered in this assignment, but between Week 8 and Week 9 Written Assignments, we'll cover everything, and more, and do so in a more gentle manner.

1. Complete the square to write f in Standard Form and sketch the graph of f. Your graph should include the vertex and all x- and y-intercepts. Finally, state the domain and range of f.

   a. (5 pts) $f(x) = x^2 - 4x - 21$.

   b. (5 pts) $f(x) = -3x^2 - 42x - 72$.

2. Let $f(x) = x^6 + 11x^5 + 19x^4 - 115x^3 - 200x^2 + 500x$ and $p(x) = x - 2$

   a. (5 pts) Use synthetic division to find the quotient $q(x)$ and remainder $r(x)$ when f is divided by p. Use your work to write $f(x)$ in the form $f(x) = p(x)q(x) + r(x)$. This is called the Divison Algorithm, although I consider it a *result* of *performing* the division algorithm. When you divide 28 by 3, you get q = quotient = 9, with a remainder of $r = 1$ and we write

   $28 = f = pq + r = (3)(9) + 1$. An equivalent formulation is 28/3 = 9 + 1/3.

   b. (**Bonus 5 pts**) The original version of this question was poorly posed. Here's the patched-up version:

   Sneak preview of 3.6: Your work in part a also allows you to write the quotient $\frac{f(x)}{p(x)} = q(x) + \frac{r(x)}{p(x)}$. Now, as $|x| \to \infty$, $\frac{r(x)}{p(x)} \to 0$. What does this say about $R(x) = \frac{f(x)}{p(x)}$ as $x \to \pm\infty$?

   c. (5 pts) Based on your work in part a, what is $f(2)$?

d. (5 pts) According to the book, the *end behavior* of f is:
$y \to \infty$ as $x \to -\infty$ and $y \to \infty$ as $x \to \infty$, because it's controlled by $y = x^6$. That's a lot of words. Provide a simple graphic that sums this information up, visually.

e. (5 pts) Suppose I told you that f factors into $f(x) = x(x-2)^2(x+5)^3$ (It does!). Provide a rough sketch of the graph of f, based on the *x*- and *y*-intercepts, the end behavior of f, and the multiplicity of the zeros of f. Provide a SIGN PATTERN for f to help you in this.

f. (5 pts) Let $D(x) = x^2 - 3x - 15$. Use long division to find the quotient $Q(x)$ and remainder $R(x)$, when f is divided by D.

g. (5 pts) Find all real zeros of f and state their respective multiplicities.

h. (**Bonus 5 pts**) Solve the inequality $f(x) < 0$

i. (**Bonus 5 pts**) What is the domain of $g(x) = \sqrt{f(x)}$?