Unit 4.3-4.5, 5.1 and 5.4-5.6 Quadratic and Polynomial Functions

x^2+7x-3
$4a^3+7a^2+a$
nm^2-m
$3x-2$
5

By the end of this unit, you should be able to:

- ☐ graph a quadratic function using transformations
- ☐ identify the vertex and axis of symmetry of a quadratic function
- ☐ graph a quadratic function from standard form and vertex form
- ☐ find the maximum or minimum of a quadratic function
- ☐ solve applied problems involving quadratic functions
- ☐ find a quadratic function of best fit using a graphing calculator
- ☐ identify polynomial functions and their degree
- ☐ graph polynomial functions using transformations
- ☐ identify the real zeros of a polynomial function and their multiplicity
- ☐ graph a polynomial function and analyze
- ☐ solve polynomial inequalities
- ☐ use the Remainder Theorem and the Factor Theorem
- ☐ use Descartes' Rule of Signs to Determine the number of positive and negative real zeros of a function
- ☐ use the Rational Zeros Theorem to the list the potential rational zeros of a polynomial function
- ☐ find the real zeros of a polynomial function
- ☐ solve polynomial equations
- ☐ use the Conjugate Pairs Theorem
- ☐ find a polynomial with specified zeros
- ☐ find the complex zeros of a polynomial

Assignments:

4.3 – pg. 302 #11-18, 23, 27, 29, 37, 41, 45, 53, 57
4.4 – pg. 310 #3, 5, 7, 9, 11, 13, 27, 29
4.5 – pg. 316 #3, 5, 7, 9, 13, 15, 17
5.1 – pg. 341 #11-21odd, 37, 39, 61-64, [67, 71, 73, 75, 81, 87 – exclude e]
5.4 – pg. 373 #3-15odd
5.5 – pg. 386 #11, 13, 15, 21, 23, 33, 35, 37, 45, 47, 49, 57, 59, 61
5.6 – pg. 394 #9, 17, 23, 25, 31, 33, 35, 37, 39

Review Problems

For #1-2, graph. Find the vertex, axis of symmetry, x-intercepts, and y-intercept.

1. $f(x)=-\frac{1}{2}(x+6)^2+10$

2. $f(x)=2x^2+12x+9$

3. Let $g(x)=-(x-1)^2(x+4)(x-2)^2$
   a) Find the zeros, their multiplicities, and whether they cross or touch the x-axis.
   b) Determine the degree.
   c) Find the maximum number of turning points.
   d) Find the y-intercept.
   e) Write the end behavior in limit notation.
   f) Sketch a graph.

4. Let $f(x)=3x(x-4)(x+1)^2$. Solve the inequality $f(x)\geq 0$. Write your answer in interval notation.

5. Given $f(x)=-2x^2$ and $g(x)=4x-6$.
   a) Find $f(x)>g(x)$
   b) Find $f(x)\leq g(x)$

6. Write a function in standard form with zeros of 3, -8, and 2 – *i*.

7. Find all the zeros of the function without a calculator given that 3*i* is a zero. $f(x) = 4x^4 - 7x^3 + 34x^2 - 63x - 18$

8. What is the remainder when $2x^{25} - 12x^{10} - 16$ is divided by $x - 1$? Is $x - 1$ a factor of $2x^{25} - 12x^{10} - 16$?

9. Let $f(x) = 2x^4 - 5x^3 - 33x^2 + 119x - 98$.
   a) Find the possible rational zeros.
   b) Find all complex zeros.
   c) Write the function in completely factored form.

10. A projectile is fired from the top of a building 150 feet above the ground at an inclination of 45° to the horizontal with a muzzle velocity of 30 ft/sec. The height *h* of the projectile above the ground is given by $h(x) = \frac{-32x^2}{30^2} + x + 150$ where *x* is the horizontal distance of the projectile from the edge of the building.
   a) At what horizontal distance from the edge of the building is the height of the projectile a maximum?
   b) Find the maximum height of the projectile.

11. The price *p* in dollards and the quantity *x* sold of widgets obey the demand equation $p = -\frac{1}{10}x + 150$.
   a) Express revenue *R* as a function of *x*.
   b) What is the revenue if 90 units are sold?
   c) What quantity *x* maximizes revenue?
   d) What is the maximum revenue?
   e) What price should the company charge to maximize revenue?

12. Cruella de Vil with 4000 meters of fencing needs to fence a rectangular piece of land for her stolen puppies. She is going to use the side of a barn for 1 side.
   a) Write an equation for the area.
   b) What is the largest area that can be enclosed?
   c) What are the dimensions of the enclosure?

13. A suspension bridge has twin towers that extend 150 meters above the road surface and are 600 meters apart. The cables are parabolic in shape and are suspended from the top of the towers. The cables touch the road surface at the center of the bridge.
   a) Find the equation of the parabola made by meters the cables.
   b) Find the height of the cables at a point 200 from the center. (Assume the road is level).

14. A study compared the speed *x* (in miles per hour) and the average fuel economy *y* (in miles per gallon) for cars. The results are shown in the table.

Speed, *x*	15	20	25	30	35	40
Fuel economy, *y*	22.3	25.5	27.5	29.0	28.8	30.0
Speed, *x*	45	50	55	60	65	70
Fuel economy, *y*	29.9	30.2	30.4	28.8	27.4	25.3

   a) Use a graphing calculator to find the best-fitting quadratic model for the data.
   b) Find the speed that maximizes a car's fuel economy.
   c) What is the maximum fuel economy at that speed?