11th Grade Assignment – Week #13

Group Assignment:

For Tuesday

Completing the Square. At the end of lecture #1 this week, I showed how to use the method of "completing the square" for different situations. It will be helpful to practice it now.

1. Fill in the blanks in order to create a *perfect square trinomial*, and then factor it into a *binomial squared*:

   a) $x^2 + 22x +$ ___ $\rightarrow$ $(x$ ___$)^2$ c) $x^2 - 20x +$ ___ $\rightarrow$ $(x$ ___$)^2$

   b) $x^2 + 2x +$ ___ $\rightarrow$ $(x$ ___$)^2$ d) $x^2 + 7x +$ ___ $\rightarrow$ $(x$ ___$)^2$

2. Solve the equation by using the method of *Completing the Square*.
   (Hints: First, move the constant to the other side, then complete the square. Don't forget to balance both sides after completing the square!)

   a) $x^2 + 18x + 77 = 0$ b) $x^2 - 4x - 12 = 0$ c) $x^2 + 5x - 24 = 0$

3. Use *Completing the Square* to convert the equation from *standard form* into *graphing form*. (You can then graph it later.)

   a) $y = x^2 + 18x + 77$ b) $y = x^2 - 2x + 4$ c) *Challenge!* $y = x^2 + 7x - 3$

4. Graph each circle

   a) $x^2 + y^2 = 16$

   b) $(x + 3)^2 + (y - 2)^2 = 16$

   c) *Challenge!* $x^2 + 10x + y^2 - 8y + 32 = 0$

For Thursday

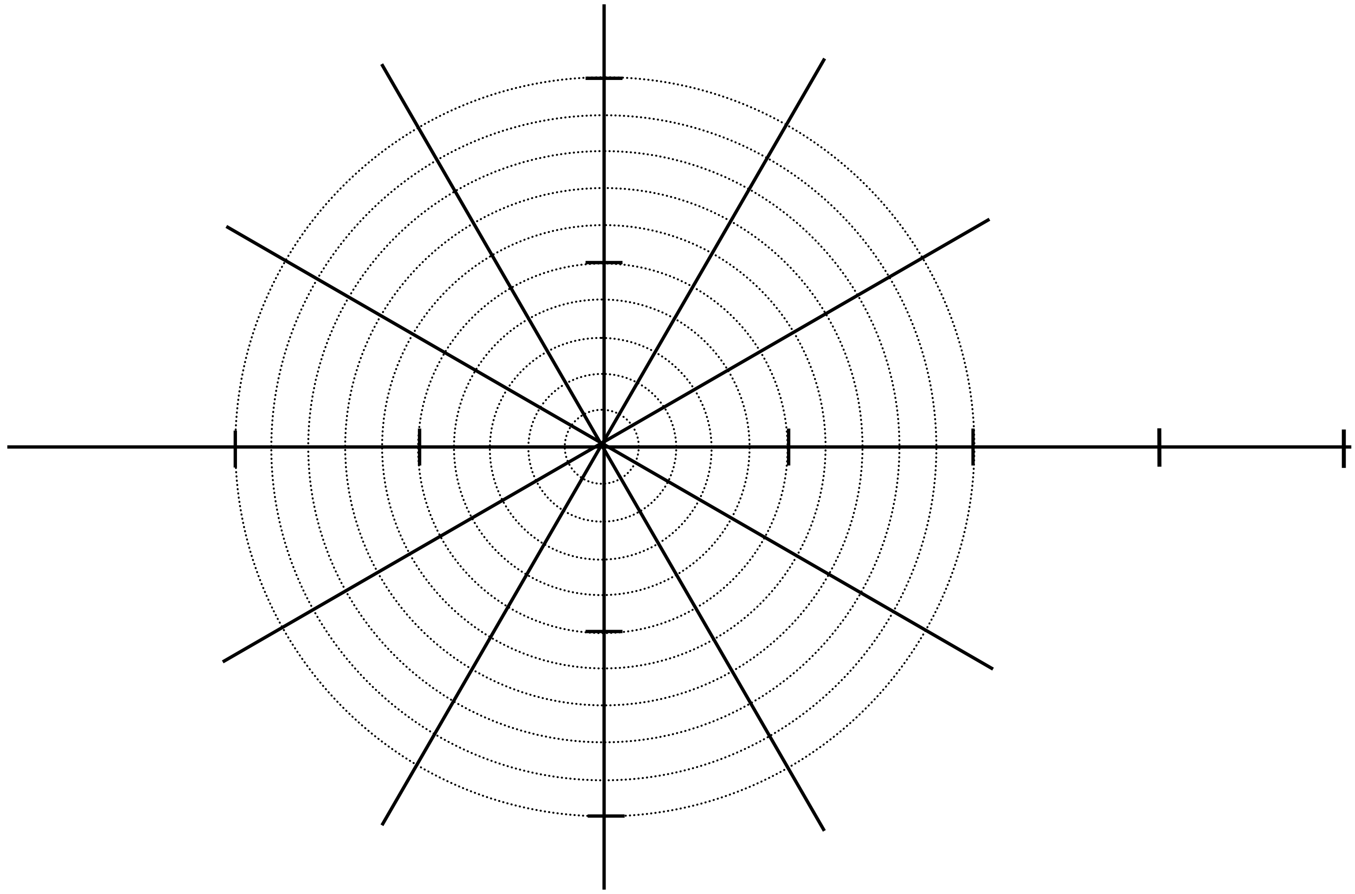
- From the new unit, *Cartesian Geometry – Part II*, do the *Polar Coordinate* problems #1 and #2 from **Problem Set #3**. (I gave some background for this in lecture #2.) The extra graphs on the next page should be helpful. Be sure to use these values for θ:
  $\frac{1}{6}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{5}{6}, 1, \frac{7}{6}, \frac{4}{3}, \frac{3}{2}, \frac{5}{3}, \frac{11}{6}, 2$

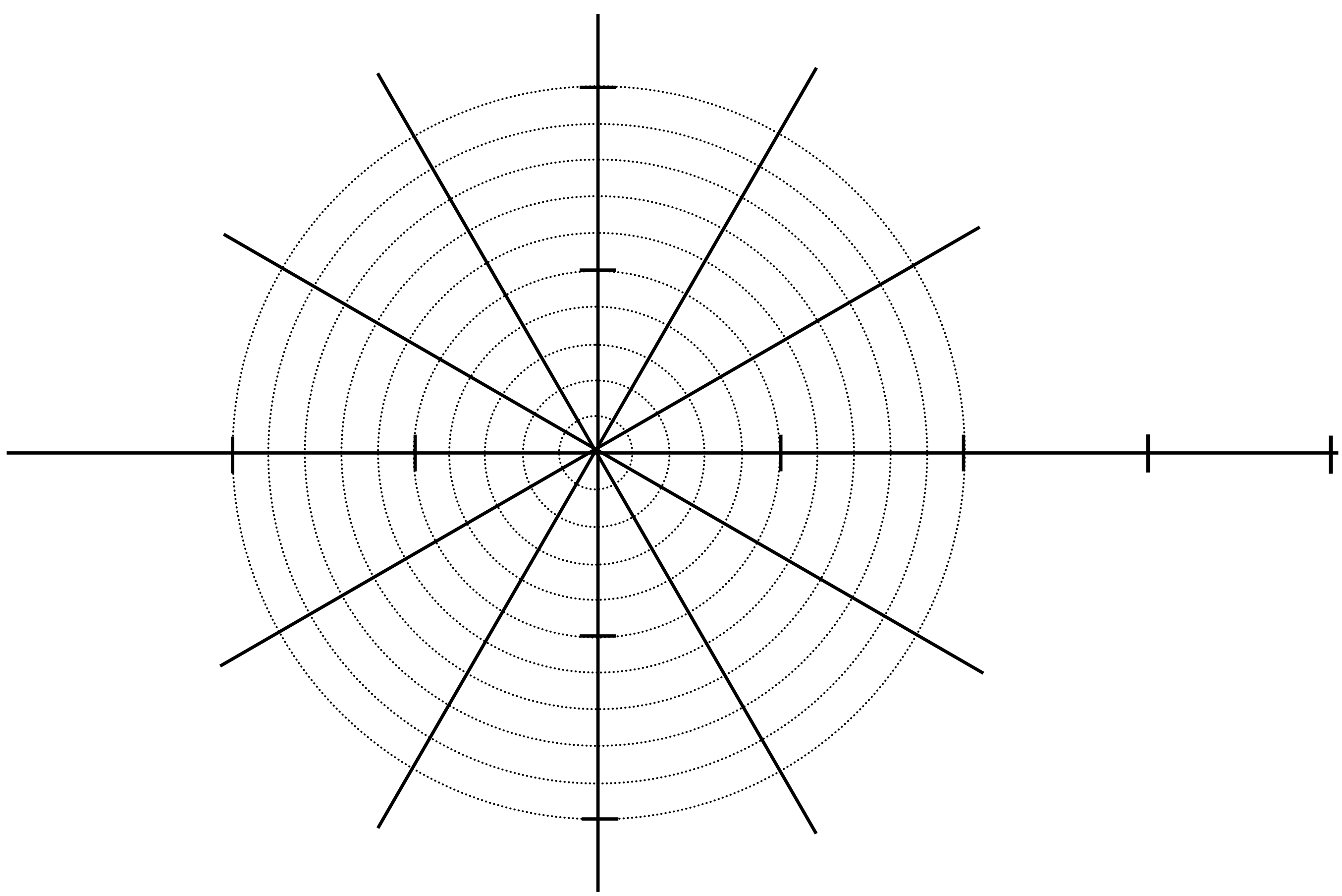
5. Recall that the Cartesian graph of $x = 3$ is a horizontal line, and $y = 4$ is a vertical line.
   What are the polar graphs of $\theta = \frac{1}{3}$ and $r = 2$?

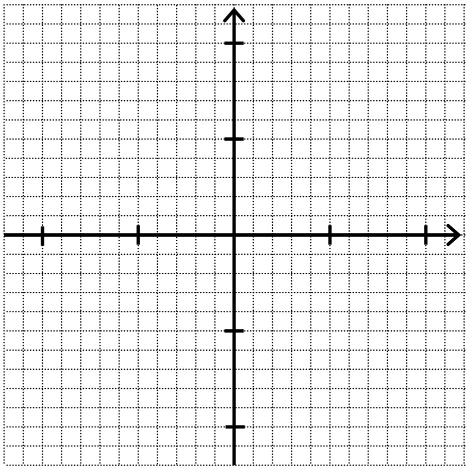
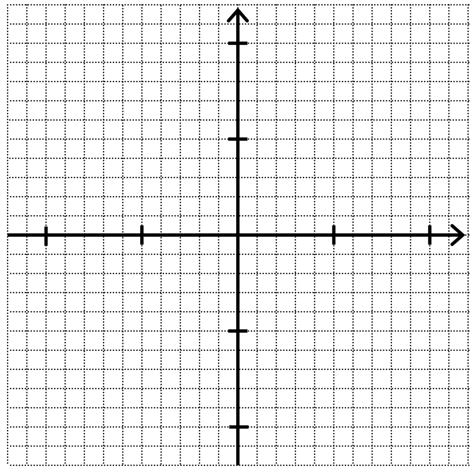
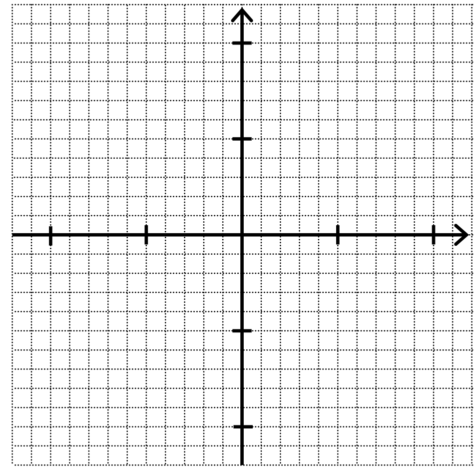
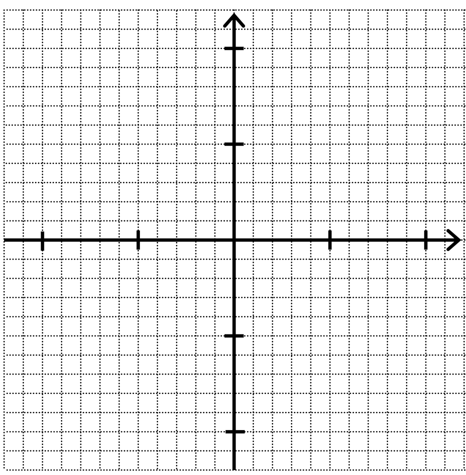
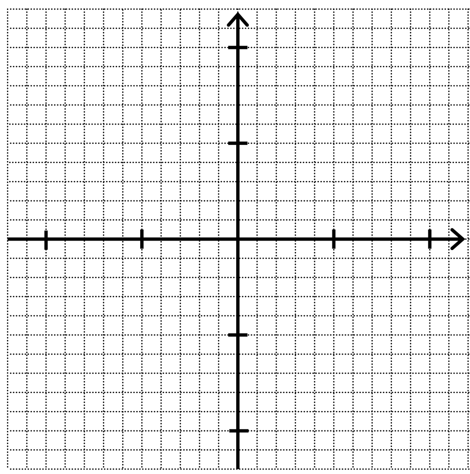
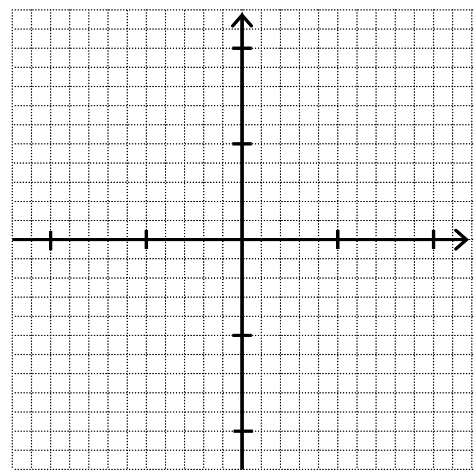
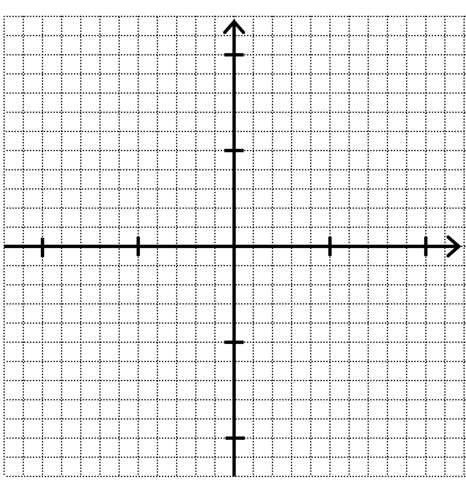
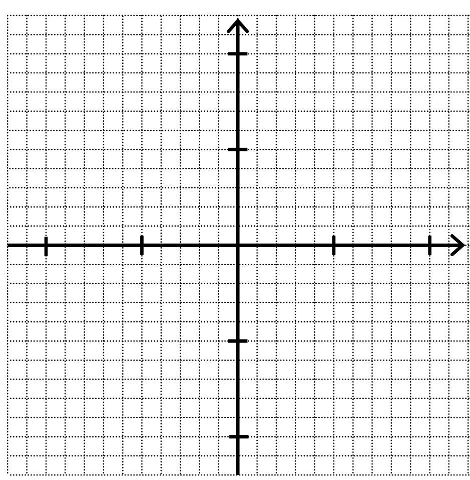
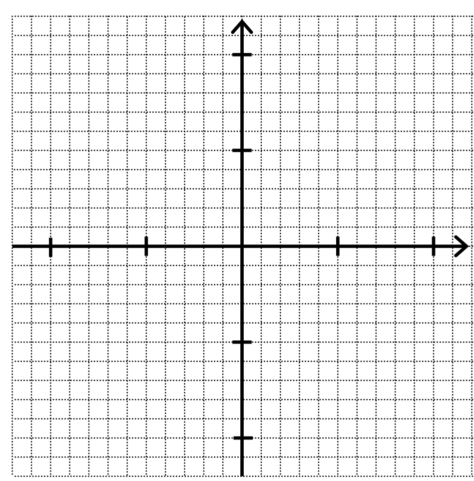
- Do the *car rental graph problem* (Problem #5) from **Problem Set #2** (Cartesian Geometry – Part II).

Individual Work

- Carefully select problems that you need to work on from **Problem Set #1 and #2** (Cartesian Geometry – Part II).
- Any of the problems from the above Group Assignments that were not completed during your group meetings, can be worked on individually.





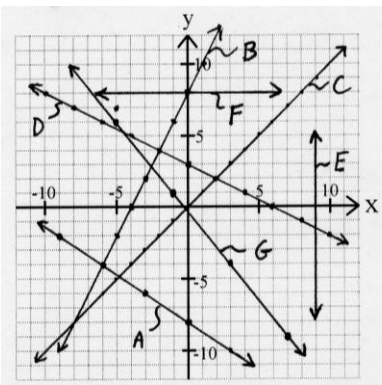
Cartesian Geometry – Part II

Problem Set #1

Review

1) Graph each equation.
   a) $y = 4x - 3$
   b) $y = \frac{2}{3}x + 1$
   c) $y = -2x$
   d) $y = 5$
   e) $2y + 3x = 18$
   f) $3y - 2x = 18$
   g) $2y + x = -5$

2) Give the equation of each line, both in slope-intercept form and in standard form.



3) Consider the equation
   $4x + 3y = 15$.
   a) What is the slope of its graph?
   b) What is the y-intercept?
   c) What is the x-intercept?
   d) Where is $x = 3$?
   e) Give three solutions to the equation.
   f) What solution does it have in common with $y = -\frac{1}{2}x - 5$

4) Give the equation of the line that…
   a) Has a slope of $\frac{1}{3}$ and a y-intercept of -2.
   b) Has a slope of -3 and passes through the point $(2,-4)$.
   c) Passes through the points $(2,1)$ and $(6,-9)$.
   d) Passes through the points $(-8,-4)$ and $(7,8)$.
   e) Passes through the point $(3,-3)$ and runs parallel to the line $3y + x = 12$
   f) Has a y-intercept of -2 and is perpendicular to the line $y = \frac{2}{3}x + 7$

5) Use the linear combination method to find the common solution to:
$$5x - 6y = 31$$
$$3x + 4y = -8$$

6) Use each of the three methods to find the common solution to
$$x + 2y = 2$$
$$4x - 3y = 30$$

7) Graph by making a table and then plotting points.
   a) $x + y = 1$
   b) $x^2 + y = 1$
   c) $x + y^2 = 1$
   d) $x^2 + y^2 = 1$

8) With the above equations, how did the exponent affect the graph?

Problem Set #2

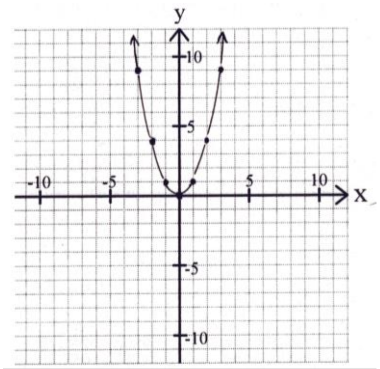
Graphing Parabolas

In our previous on *Cartesian Geometry* we learned a method for easily graphing lines. At this point, if the equation doesn't produce a linear graph, we have make a table and then plot points.

We will now learn an easier method for graphing parabolas.

1) How can we tell by quickly looking at an equation whether it is a parabola?

2) Look at the below graph of the equation $y = x^2$. Answer the following questions:



a) How would the graph of $y = x^2 + 3$ be different than $y = x^2$? Graph it.

b) How would the graph of $y = x^2 - 3$ be different than $y = x^2$? Graph it.

c) How would the graph of $y = (x+3)^2$ be different than $y = x^2$? Graph it.

d) How would the graph of $y = (x-3)^2$ be different than $y = x^2$? Graph it.

e) How would the graph of $y = -x^2$ be different than $y = x^2$? Graph it.

f) How would the graph of $y = 2x^2$ be different than $y = x^2$? Graph it.

g) How would the graph of $y = (x+3)^2 + 2$ be different than $y = x^2$? Graph it.

h) How would the graph of $y = (x-4)^2 - 6$ be different than $y = x^2$? Graph it.

i) How would the graph of $y = 2(x+1)^2-3$ be different than $y = x^2$? Graph it.

3) Graph each of the following:

a) $y = 2x - 4$

b) $y = \frac{x}{3} + 1$

c) $6x - 5y = 10$

4) Give the equation of the line that…

a) Passes through the points (3,2) and (–1,1).

b) Passes through the point (–4,–2) and runs parallel to the line $2y - 3x = 12$

5) Jack needs to rent a car for one day. Happy Rent-a-Car is offering a special on economy cars for \$25 for the day, plus 3¢/mile. The best deal at Ken's Car Rental is for \$15/day plus 7¢/mile. For each of the two companies, give a function of the total cost with respect to miles driven, then graph these functions (up to 500 miles driven). Under what circumstances should Jack choose each of the two rental companies?

Problem Set #3

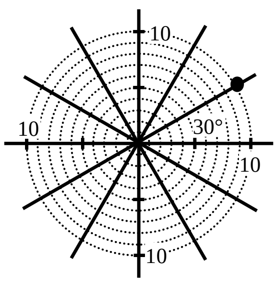
$y = x^2$ isn't a parabola!!

…not necessarily anyhow. The essence of $y = x^2$ is a relationship of numbers. We can make these numbers (i.e., the solutions) visible by graphing them, but we should be aware of the fact that we could have chosen any number of coordinate systems other than the Cartesian coordinate system. We chose the Cartesian coordinate system because it is the convention today. However, we should not fall into the trap of thinking that there is only one way to graph a given equation.

We will now look at other ways to graph $y = x^2$.

Using Polar Coordinates

The *polar coordinate system*, which is well known in calculus, uses circles as its basis. We imagine a circle with a radius line stretching to the right of the circle's center. The coordinate of a point is given by the degree measure formed by the radius line and the right side of the
x-axis, and the length of the radius line. For example, the point (10, 30°) is graphed below.

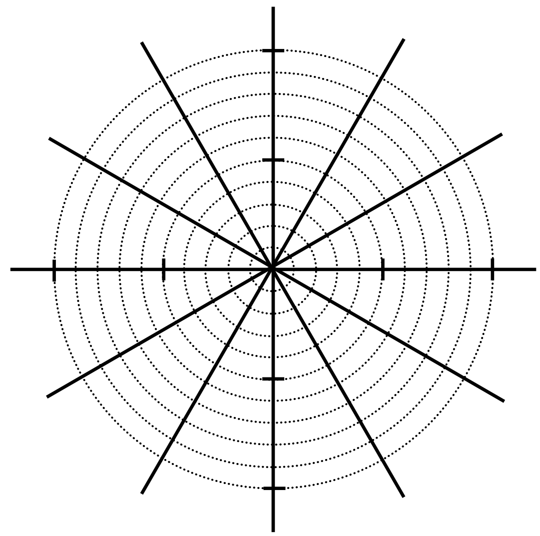


The same point in rectangular Cartesian coordinates is $(5\sqrt{3}, 5)$.

For our purposes here, however, we will use a modified polar coordinate system in order to make the graph of $r = \theta^2$ more manageable. We will let the θ value represent the number of 180° rotations. This would make the coordinates of the point just shown $(10, \frac{1}{6})$.

1) Plot each point, (r, θ), on a polar coordinate system.

a) $(3, \frac{1}{2})$	e) $(6, \frac{4}{3})$
b) $(8, \frac{3}{4})$	f) $(6, -\frac{2}{3})$
c) $(7, 1.5)$	g) $(-6, \frac{1}{3})$
d) $(4, \frac{7}{4})$	h) $(10, 5)$



2) Graph $r = \theta^2$ using this polar coordinate system. Use the large graph on the previous page, and use these values for θ:
$\frac{1}{6}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{5}{6}, 1, \frac{7}{6}, \frac{4}{3}, \frac{3}{2}, \frac{5}{3}, \frac{11}{6}, 2$.