**Algebra 2**

**Lesson 3-3: Systems of Inequalities**

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A **linear inequality** divides a graph into two regions – one that will contain only true solutions and one that will contain only false solutions. The **boundary line** that divides both regions may, at times, be a part of the solution.

**Review:**

Rules to remember when graphing inequalities and absolute values:

First and foremost: ALWAYS SOLVE FOR Y AND THEN GRAPH USING SLOPE INTERCEPT!!!

1. Inequalities with a $<or>$ is drawn as a dotted line.
2. Inequalities with a $\leq or\geq $ is drawn as a solid line.
3. Inequalities with a $<or\leq $ are shaded downward.
4. Inequalities with a $>or\geq $ are shaded upward.

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| **Example:**  Graph$ y<x+1$This line is dotted and shaded down. Check: Pick (0,0); and plug values in. You get$ 0<1$, a true statement. | **Example:** Graph $x\geq 3$This line is solid and shaded right. Check: Pick (0,0); plug into equation. You get $ 0\geq -3 ,$ a false statement, thus, you shade on the other side of the line. Pick a point there and check.  |

A simple way to check a graph is to pick a point (x,y) not on the line, but found in the shaded region. Plug it into the given equation. If the result is a true statement, then you have shaded the graph correctly.

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| Now consider two inequalities in the same coordinate grad. The solution in such cases is the area that both equations have in common – overlap. Graph: $\left\{\begin{array}{c}y\geq \frac{2}{3}x-3\\x+y<2\end{array}\right.$$y\geq \frac{2}{3}x-3$ $y<-x+2$

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| **Example:** Graph: $ m=\frac{2}{3}$ | $$b=-3$$ | $$m=-1$$ | $$b=2$$ |
| equal sign: solid line | >/=shade up | no equaldashed | <shade down |

 A *table helps to organize facts so you don’t mess up!*Notice that one line is solid and the other is dotted. Also notice the common solution area is double shaded.  |  |

You can graph as many linear inequalities on a single graph as you need. Notice: the common area shrinks or gets “shaved” by succeeding inequalities. A system of four linear inequalities is sometimes called a linear programming problem. More on this idea in Section 3-4!!

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| **Example:** Graph the system of inequalities$$x\geq 3$$$$ y\leq -1$$$$ y\leq 2x-6$$$$ y<-x+4$$*What happens to the solution area when you add more equations?*To check the system you pick a point inside the common area. Put these (x,y) coordinates into each of the four equations. You should get four true statements. |  |

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| Solve:$$\left\{\begin{array}{c}2x+y\geq 5\\-x+y<y\end{array}\right.$$ |  |
| $$\left\{\begin{array}{c}x+3y>2\\3x+3y\leq 2\end{array}\right.$$ |  |