Name: _____ Date: _____

MODELING WITH SYSTEMS OF INEQUALITIES
COMMON CORE ALGEBRA I

There are many situations that arise in business and engineering that necessitate systems of linear inequalities. The **region** in the ***xy*-plane** that **solves the systems** often represents all of the **viable solutions** to the system, so being able to visualize this region can be extremely helpful. As always, with modeling, it is important to really read the problems and understand the physical quantities involved.

***Exercise* #1:** John mows yards for his father's landscaping business for $10 per hour and also works at a bakery for $15 per hour. He can work at most 52 hours per week during the summer. He needs to make at least $600 per week to cover his living expenses.

(a) If John works 14 hours mowing and 30 hours at the bakery, does this satisfy all of the problem's **constraints**?

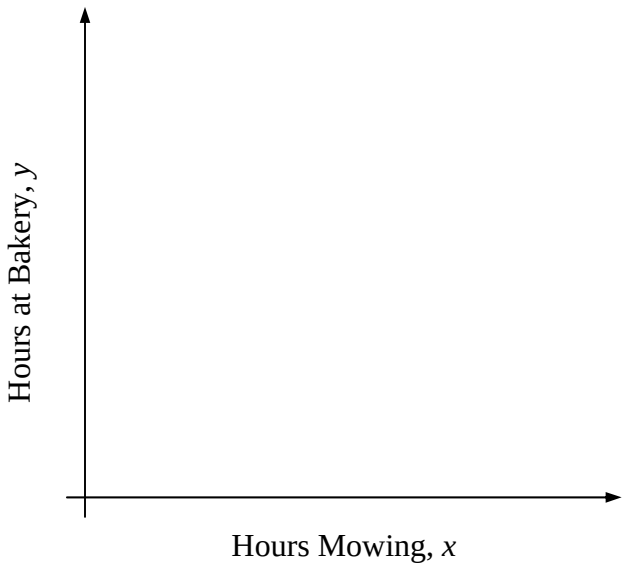
(b) If x represents the hours John spends mowing and y represents the hours he spends at the bakery, write a system of inequalities that describes this scenario.

(c) If John must work a minimum of 10 hours for his father, will he be able to make enough money to cover his living expenses? Show the work that leads to your answer.

(d) Graph the system of inequalities with the help of your calculator (if needed) on the axes below. Use the space below to think about how to graph these lines.

(e) John's father needs him to work a lot at the landscaping business. Show the point on the graph that corresponds to the greatest number of hours that he can work while still covering his expenses.

(f) Algebraically, find the greatest number of hours that John can work for his father and still cover his expenses. Explain how you found your answer or show your algebra below.



***Exercise* #2:** For each of the following, write a system of inequalities that models the problem. You do not need to solve the system.

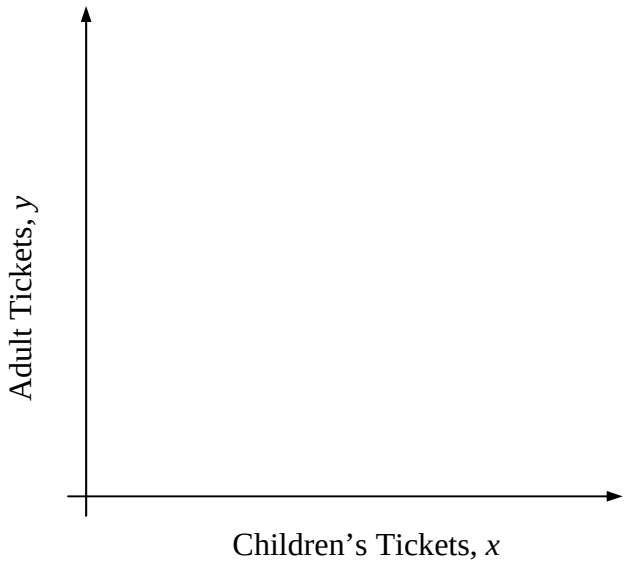
(a) Frank is putting together a bouquet of roses and daisies. He wants at least one rose and at least two more daisies than roses. Roses cost \$4 each and daisies cost \$2 each. Frank must spend \$40 or less on this bouquet. If r represents the number of roses he buys and d represent the number of daisies, write the system.

(b) A diet food company is attempting to create a non-carb brownie composed entirely of fat and protein. The brownie must weigh at least 10 grams but have no more than 100 calories. Fat has 9 calories per gram and protein has 4 calories per gram. If x represent the weight, in grams, of protein and y represents the weight, in grams, of fat, write the system.

***Exercise* #3:** The drama club at a local high school is trying to raise money by putting on a play. They have only 500 seats in the auditorium that they are using and are selling tickets for these seats at \$5 per child's ticket and \$10 per adult ticket. They must sell at least \$2000 worth of tickets to cover their expenses.

(a) If x represents the number of children's tickets sold and y represents the number of adult tickets sold, write a system of inequalities that models this situation.

(b) Using technology, sketch the region in the coordinate plane that represents solutions to this system of inequalities.



(c) If the students want to sell exactly 500 tickets and make exactly \$2000, how many of each ticket should they sell? Why is this answer not realistic?

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MODELING WITH SYSTEMS OF INEQUALITIES
COMMON CORE ALGEBRA I HOMEWORK

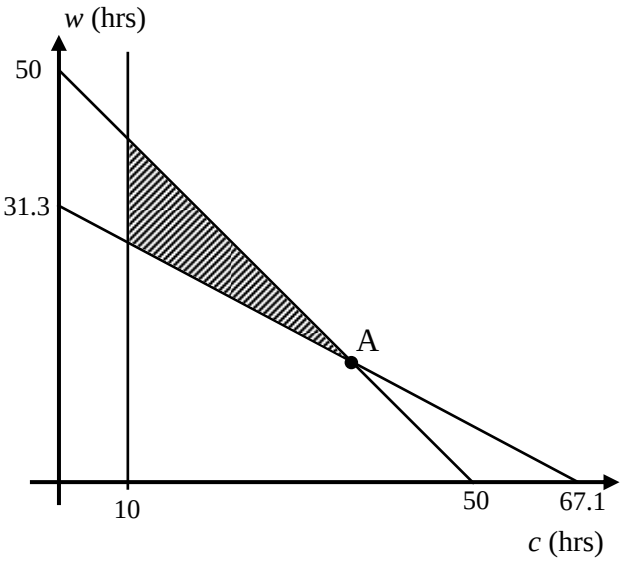
APPLICATIONS

1. Jody is working two jobs, one as a carpenter and one as a website designer. He can work at most 50 hours per week and makes $35 per hour as a carpenters and $75 an hour as a website designer. He wants to make at least $2350 per week but also wants to work at least 10 hours per week as a carpenter. Let *c* represent the hours he works as a carpenter and let *w* represent the hours he works as a website designer.

   (a) Write a system of inequalities that models this scenario.

   (b) What is the maximum amount of money that Jody can make in a week given the system in (a)? Explain your reasoning.

   (c) The graph of the system is shown below with its solutions shown shaded. Three lines are graphed. Label each with its equation.



   (d) Find the coordinates of point *A* by solving a system of equations by Elimination.

   (e) What does the value of *c* that you found in the solution to part (d) represent about the number of hours Jody can work as a carpenter. Explain your thinking.

2. For each of the following, create a system of inequalities that models the scenarios presented. You do not need to solve the systems.

   (a) Two pumps at a local water facility can only run individually. They will run for at least 18 hours in a day but obviously no more than 24 hours in a day. Pump 1 can move 120 gallons per hour while Pump 2 can move 200 gallons per hour. In total the two pumps must move at least 3,000 gallons of water per day. If x represents the number of hours that Pump 1 runs and y represents the number of hours that Pump 2 runs, write a system of inequalities that models all conditions.

   (b) Dave is buying popcorn and sodas for his son and his three friends that he brings to the movies (four kids total). He needs to buy at least one of the two items for each of the four. Popcorn costs \$2.50 per bag and sodas cost \$4.00 each. Dave can spend at most \$20. If s represents the number of sodas he buys and p represents the number of bags of popcorn, then write a system that models this scenario.

REASONING

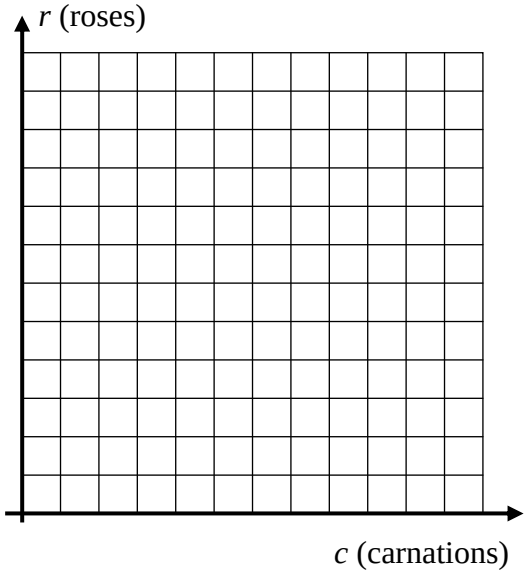
3. Systems of inequalities can also come in **discrete versions** where the two variables involved can only take on **integer values**. Let's look at a simple example of this.

   Jennifer is putting together a selection of flowers that has at most 12 flowers in it. She is choosing either roses or carnations. She wants to pick at least three roses and at least two carnations. Let r be the number of roses she uses and let c be the number of carnations she uses.

   (a) Write a system of inequalities that models this scenario.

   (b) If Jennifer used the minimum number of carnations, what is the maximum number of roses she could use?

   (c) What is the fewest flowers Jennifer will use and in what combination?



   (d) Graph the solution set to the system. Be careful, this should be a collection of points, not a shaded region.