Name _____ Date _____

Prepping for the Robot Challenge
Solving Linear Systems Graphically and Algebraically

Vocabulary

Match each term to its corresponding definition.

1. a process of solving a system of equations by substituting a variable in one equation with an equivalent expression

a. system of linear equations

2. systems with no solutions

b. break-even point

3. the point when the cost and the income are equal

c. substitution method

4. systems with one or many solutions

d. consistent systems

5. two or more linear equations that define a relationship between quantities

e. inconsistent systems

6

Problem Set

Write a system of linear equations to represent each problem situation. Define each variable. Then, graph the system of equations and estimate the break-even point. Explain what the break-even point represents with respect to the given problem situation.

1. Eric sells model cars from a booth at a local flea market. He purchases each model car from a distributor for $12, and the flea market charges him a booth fee of $50. Eric sells each model car for $20.

Eric's income can be modeled by the equation $y = 20x$, where y represents the income (in dollars) and x represents the number of model cars he sells.

Eric's expenses can be modeled by the equation $y = 12x + 50$, where y represents the expenses (in dollars) and x represents the number of model cars he purchases from the distributor.
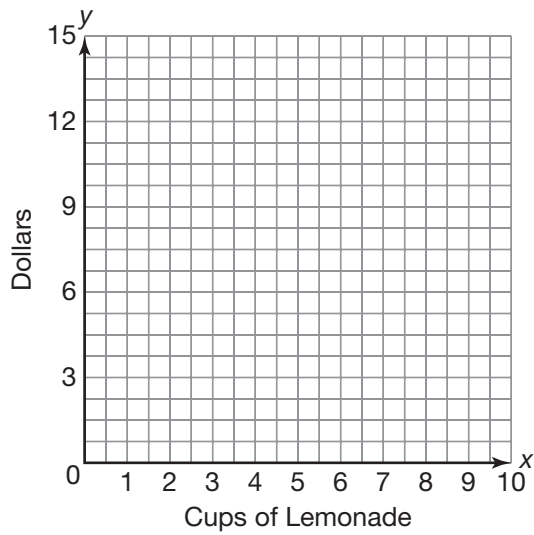
$$\begin{cases} y = 20x \\ y = 12x + 50 \end{cases}$$
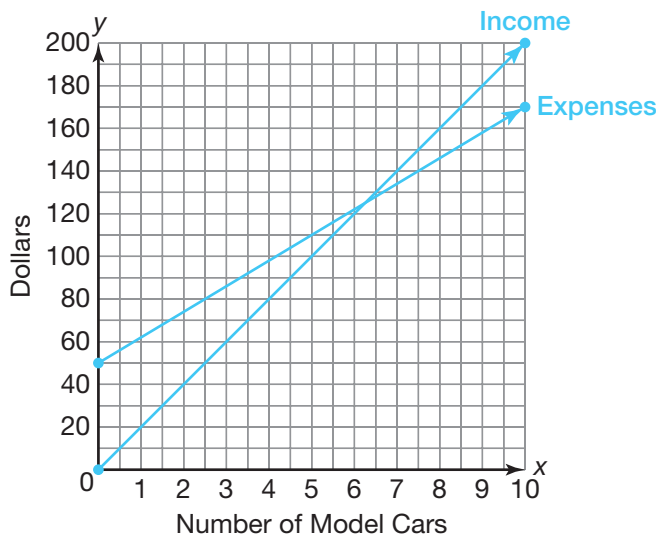
The break-even point is between 6 and 7 model cars. Eric must sell more than 6 model cars to make a profit.

Name _____ Date _____

2. Ramona sets up a lemonade stand in front of her house. Each cup of lemonade costs Ramona $0.30 to make, and she spends $6 on the advertising signs she puts up around her neighborhood. She sells each cup of lemonade for $1.50.
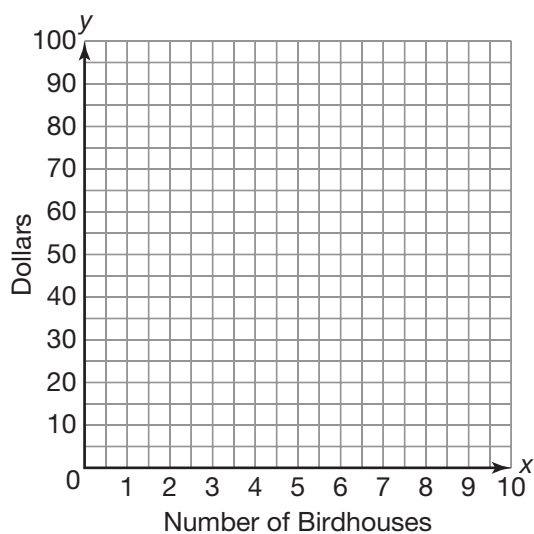
6

3. Chen starts his own lawn mowing business. He initially spends $180 on a new lawnmower. For each yard he mows, he receives $20 and spends $4 on gas.
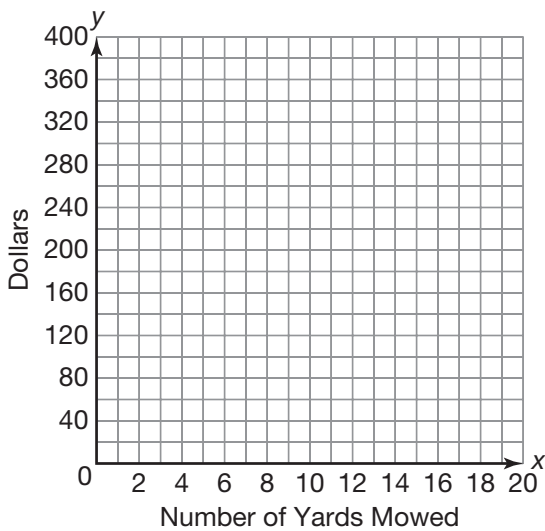
Name _____ Date _____

4. Olivia is building birdhouses to raise money for a trip to Hawaii. She spends a total of $30 on the tools needed to build the houses. The material to build each birdhouse costs $3.25. Olivia sells each birdhouse for $10.

5. The Spanish Club is selling boxes of fruit as a fundraiser. The fruit company charges the Spanish Club $7.50 for each box of fruit and a shipping and handling fee of $100 for the entire order. The Spanish Club sells each box of fruit for $15.

Number of Fruit Boxes
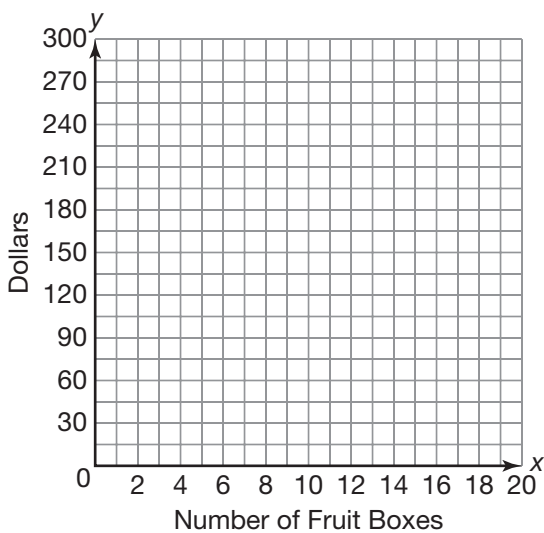
Name _____ Date _____

6. Jerome sells flowers for $12 per bouquet through his Internet flower site. Each bouquet costs him $5.70 to make. Jerome also paid a one-time fee of $150 for an Internet marketing firm to advertise his company.
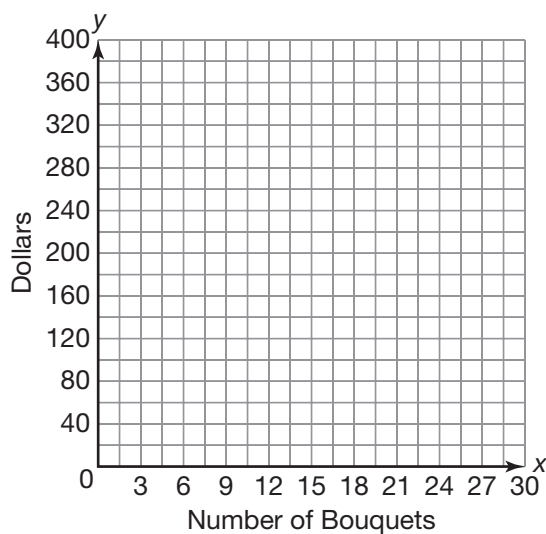
Transform both equations in each system of equations so that each coefficient is an integer.

7. $\begin{cases} \dfrac{1}{2}x + \dfrac{3}{2}y = 4 \\ \dfrac{2}{3}x - \dfrac{1}{3}y = 7 \end{cases}$

8. $\begin{cases} -\dfrac{1}{3}x + \dfrac{1}{2}y = 5 \\ \dfrac{3}{4}x - \dfrac{1}{4}y = 10 \end{cases}$

$\dfrac{1}{2}x + \dfrac{3}{2}y = 4 \qquad \dfrac{2}{3}x - \dfrac{1}{3}y = 7$

$2\left(\dfrac{1}{2}x + \dfrac{3}{2}y = 4\right) \qquad 3\left(\dfrac{2}{3}x - \dfrac{1}{3}y = 7\right)$

$x + 3y = 8 \qquad\qquad 2x - y = 21$

9. $\begin{cases} \dfrac{5}{4}x - 3 = \dfrac{1}{6}y \\ \dfrac{2}{5}x + \dfrac{1}{5}y = \dfrac{9}{5} \end{cases}$

10. $\begin{cases} 0.5x + 1.2y = 2 \\ 3.3x - 0.7y = 3 \end{cases}$

11. $\begin{cases} 0.2x - 0.4y = 2 \\ -0.1x - 0.5y = 1.1 \end{cases}$

12. $\begin{cases} 0.3y = 2 - 0.8x \\ 1.1x = 3y - 0.4 \end{cases}$

6

Name _____ Date _____

Solve each system of equations by substitution. Determine whether the system is consistent or inconsistent.

13. $\begin{cases} y = 2x - 3 \\ x = 4 \end{cases}$

$y = 2(4) - 3$

$y = 8 - 3$

$y = 5$

The solution is (4, 5).

The system is consistent.

14. $\begin{cases} 2x + y = 9 \\ y = 5x + 2 \end{cases}$

15. $\begin{cases} y = 3x - 2 \\ y - 3x = 4 \end{cases}$

16. $\begin{cases} \dfrac{1}{2}x + \dfrac{3}{2}y = -7 \\ \dfrac{1}{3}y = 2x - 10 \end{cases}$

6

17. $\begin{cases} 0.8x - 0.2y = 1.5 \\ 0.1x + 1.2y = 0.8 \end{cases}$

18. $\begin{cases} 0.3y = 0.6x + 0.3 \\ 1.2x + 0.6 = 0.6y \end{cases}$

Name _____ Date _____

There's Another Way?
Using Linear Combinations to Solve a Linear System

Vocabulary

Define the term in your own words.

1. linear combinations method

Problem Set

Write a system of equations to represent each problem situation. Solve the system of equations using the linear combinations method.

1. The high school marching band is selling fruit baskets as a fundraiser. They sell a large basket containing 10 apples and 15 oranges for $20. They sell a small basket containing 5 apples and 6 oranges for $8.50. How much is the marching band charging for each apple and each orange?

Let x represent the amount charged for each apple. Let y represent the amount charged for each orange.

$$\begin{cases} 10x + 15y = 20 \\ 5x + 6y = 8.50 \end{cases} \qquad \begin{matrix} 10x + 15y = 20 \\ -2(5x + 6y = 8.50) \end{matrix}$$

$$10x + 15y = 20$$
$$\underline{-10x - 12y = -17}$$
$$3y = 3$$
$$y = 1$$

$$10x + 15(1) = 20$$
$$10x + 15 = 20$$
$$10x = 5$$
$$x = 0.5$$

The solution is (0.5, 1). The band charges $0.50 for each apple and $1.00 for each orange.

6

2. Asna works on a shipping dock at a tire manufacturing plant. She loads a pallet with 4 Mudslinger tires and 6 Roadripper tires. The tires on the pallet weigh 212 pounds. She loads a second pallet with 7 Mudslinger tires and 2 Roadripper tires. The tires on the second pallet weigh 184 pounds. How much does each Mudslinger tire and each Roadripper tire weigh?

3. The Pizza Barn sells one customer 3 large pepperoni pizzas and 2 orders of breadsticks for $30. They sell another customer 4 large pepperoni pizzas and 3 orders of breadsticks for $41. How much does the Pizza Barn charge for each pepperoni pizza and each order of breadsticks?

6

Name _____ Date _____

4. Nancy and Warren are making large pots of chicken noodle soup. Nancy opens 4 large cans and 6 small cans of soup and pours them into her pot. Her pot contains 115 ounces of soup. Warren opens 3 large cans and 5 small cans of soup. His pot contains 91 ounces of soup. How many ounces of soup does each large can and each small can contain?

5. Taylor and Natsumi are making block towers out of large and small blocks. They are stacking the blocks on top of each other in a single column. Taylor uses 4 large blocks and 2 small blocks to make a tower 63.8 inches tall. Natsumi uses 9 large blocks and 4 small blocks to make a tower 139.8 inches tall. How tall is each large block and each small block?

6

6. Dave has 2 buckets that he uses to fill the water troughs on his horse farm. He wants to determine how many ounces each bucket holds. On Tuesday, he fills an empty 2000 ounce water trough with 7 large buckets and 5 small buckets of water. On Thursday, he fills the same empty water trough with 4 large buckets and 10 small buckets of water. How many ounces does each bucket hold?

Solve each system of equations using the linear combinations method.

7. $\begin{cases} 3x + 5y = 8 \\ 2x - 5y = 22 \end{cases}$

$3x + 5y = 8$

$\underline{2x - 5y = 22}$

$5x = 30$

$x = 6$

$3(6) + 5y = 8$

$18 + 5y = 8$

$5y = -10$

$y = -2$

The solution is $(6, -2)$.

8. $\begin{cases} 4x - y = 2 \\ 2x + 2y = 26 \end{cases}$

6

Name _____ Date _____

9. $\begin{cases} 10x - 6y = -6 \\ 5x - 5y = 5 \end{cases}$

10. $\begin{cases} 2x - 4y = 4 \\ -3x + 10y = 14 \end{cases}$

11. $\begin{cases} 3x + 2y = 14 \\ 4x + 5y = 35 \end{cases}$

12. $\begin{cases} x + 6y = 11 \\ 2x - 12y = 10 \end{cases}$

13. $\begin{cases} 1.5x + 1.2y = 0.6 \\ 0.8x - 0.2y = 2 \end{cases}$

14. $\begin{cases} \dfrac{3}{4}x + \dfrac{1}{2}y = -\dfrac{3}{4} \\ \dfrac{2}{3}x + \dfrac{2}{3}y = \dfrac{2}{3} \end{cases}$

Name _____ Date _____

What's For Lunch?
Solving More Systems

Problem Set

Write a system of equations to represent each problem situation. Solve the system of equations using any method. Then, answer any associated questions.

1. Jason and Jerry are competing at a weightlifting competition. They are both lifting barbells containing 200 pounds of plates (weights). Jason's barbell has 4 large and 10 small plates on it. Jerry's barbell has 6 large and 5 small plates on it. How much does each large plate and each small plate weigh?

   Let x represent the weight (in pounds) of a large plate. Let y represent the weight (in pounds) of a small plate.

   $$\begin{cases} 4x + 10y = 200 \\ 6x + 5y = 200 \end{cases}$$

   One possible solution path:
   Linear Combinations Method:

   $$4x + 10y = 200$$
   $$-2(6x + 5y = 200)$$

   $$\begin{array}{r} 4x + 10y = 200 \\ \underline{-12x - 10y = -400} \\ -8x = -200 \\ x = 25 \end{array}$$

   $$4(25) + 10y = 200$$
   $$100 + 10y = 200$$
   $$10y = 100$$
   $$y = 10$$

   The solution is (25, 10). Each large plate weighs 25 pounds. Each small plate weighs 10 pounds.

6

2. Rachel needs to print some of her digital photos. She is trying to choose between Lightning Fast Foto and Snappy Shots. Lightning Fast Foto charges a base fee of $5 plus an additional $0.20 per photo. Snappy Shots charges a base fee of $7 plus an additional $0.10 per photo. Determine the number of photos for which both stores will charge the same amount. Explain which store Rachel should choose depending on the number of photos she needs to print.

Name _____ Date _____

3. Raja is trying to decide which ice cream shop is the better buy. Cold & Creamy Sundaes charges $2.50 per sundae plus an additional $0.25 for each topping. Colder & Creamier Sundaes charges $1.50 per sundae plus an additional $0.50 for each topping. Determine the number of toppings for which both vendors charge the same amount. Explain which vendor is the better buy depending on the number of toppings Raja chooses.

6

4. Marcus is selling t-shirts at the State Fair. He brings 200 shirts to sell. He has long-sleeve and short-sleeved T-shirts for sale. On the first day of the fair, he sells $\frac{1}{2}$ of his long-sleeved T-shirts and $\frac{1}{3}$ of his short-sleeved T-shirts for a total of 80 T-shirts sold. How many of each type of T-shirt did Marcus bring to the fair?

6

Name _____ Date _____

5. Alicia has a booth at the flea market where she sells purses and wallets. All of her purses are the same price and all of her wallets are the same price. The first hour of the day, she sells 10 purses and 6 wallets for a total of $193. The second hour, she sells 8 purses and 10 wallets for a total of $183. How much does Alicia charge for each purse and each wallet?

6

6. Weston wants to buy a one-year membership to a golf course. Rolling Hills Golf Course charges a base fee of $200 and an additional $15 per round of golf. Majestic View Golf Course charges a base fee of $350 and an additional $10 per round of golf. Determine the number of rounds of golf for which both golf courses charge the same amount. Explain which golf course Weston should become a member at depending on the number of rounds he intends to play.

6

Name _____ Date _____

Which Is the Best Method?
Using Graphing, Substitution, and Linear Combinations

Problem Set

Write a system of equations to represent each problem situation. Solve the system of equations using any method and answer any associated questions.

1. Jun received two different job offers to become a real estate sales agent. Dream Homes offered Jun a base salary of $20,000 per year plus a 2% commission on all real estate sold. Amazing Homes offered Jun a base salary of $25,000 per year plus a 1% commission on all real estate sold. Determine the amount of real estate sales in dollars for which both real estate companies will pay Jun the same amount. Explain which offer Jun should accept based on the amount of real estate sales he expects to have.

   Let x represent the amount of Jun's real estate sales in dollars. Let y represent the yearly income when Jun has x dollars in real estate sales.

   $$\begin{cases} y = 0.02x + 20{,}000 \\ y = 0.01x + 25{,}000 \end{cases} \quad \begin{array}{l} \text{Dream Homes} \\ \text{Amazing Homes} \end{array}$$

   One possible solution path:

   Substitution Method:

   $0.02x + 20{,}000 = 0.01x + 25{,}000$ $\qquad y = 0.02(500{,}000) + 20{,}000$

   $0.01x + 20{,}000 = 25{,}000$ $\qquad\qquad\quad y = 10{,}000 + 20{,}000$

   $\qquad\quad 0.01x = 5000$ $\qquad\qquad\qquad\quad y = 30{,}000$

   $\qquad\qquad\quad x = 500{,}000$

   The solution is (500,000, 30,000). Both real estate companies will pay Jun $30,000 per year for $500,000 in real estate sales. If Jun expects to sell less than $500,000 of real estate per year, then he should accept the offer from Amazing Homes. If Jun expects to sell more than $500,000 of real estate per year, then he should accept the offer from Dream Homes.

6

2. Stella is trying to choose between two rental car companies. Speedy Trip Rental Cars charges a base fee of $24 plus an additional fee of $0.05 per mile. Wheels Deals Rental Cars charges a base fee of $30 plus an additional fee of $0.03 per mile. Determine the amount of miles driven for which both rental car companies charge the same amount. Explain which company Stella should use based on the number of miles she expects to drive.

6

Name _____ Date _____

3. Renee has two job offers to be a door-to-door food processor salesperson. Pro Process Processors offers her a base salary of $15,000 per year plus an additional $25 for each processor she sells. Puree Processors offers her a base salary of $18,000 per year plus an additional $21 for each processor she sells. Determine the number of food processors Renee would have to sell for both companies to pay her the same amount. Explain which job offer Renee should accept based on the number of food processors she expects to sell.

6

4. Alex needs to rent a bulldozer. Smith's Equipment Rentals rents bulldozers for a delivery fee of $600 plus an additional $37.50 per day. Robinson's Equipment Rentals rents bulldozers for a delivery fee of $400 plus an additional $62.50 per day. Determine the number of rental days for which both rental companies charge the same amount. Explain which company Alex should choose based on the number of days he expects to rent a bulldozer.

6

Name _____ Date _____

5. Serena has job offers from two car dealerships. Classic Cars offers her a base salary of $22,000 per year plus an additional 1% commission on all sales she makes. Sweet Rides offers her a base salary of $13,000 per year plus an additional 2.5% commission on all sales she makes. Determine the amount of car sales in dollars for which both dealerships will pay Serena the same amount. Explain which offer Serena should accept based on the amount of car sales she expects to have.

6

6. Dominique is trying to choose a satellite Internet service provider. Reliable Satellite charges customers a monthly fee of $26 plus an additional $0.30 per hour of online time. Super Satellite charges customers a monthly fee of $18 plus an additional $0.50 per hour of online time. Determine the number of hours of online time for which both providers charge the same amount. Explain which provider Dominique should choose based on the number of hours she expects to spend online each month.