Algebra I

Name Key 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

   C

2. systems with no solutions

   E

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

   B

4. systems with one or many solutions

   D

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

   A

a. system of linear equations

b. break-even point

c. substitution method

d. consistent systems

e. inconsistent systems

Problem Set

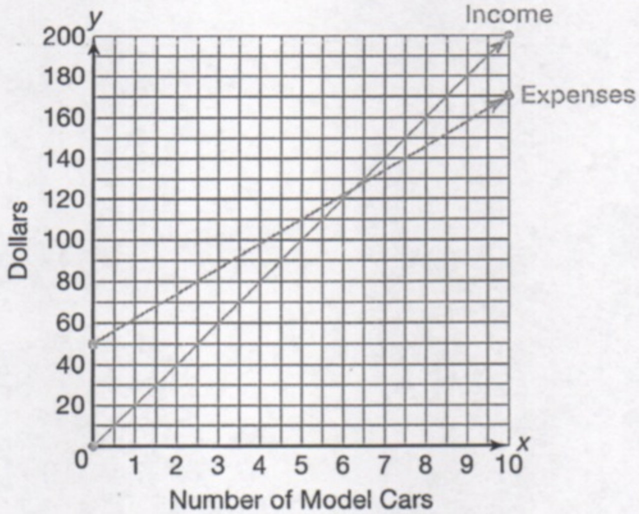
1. Write a system of linear equations to represent each problem situation. 2. Define each variable. Then, 3. graph the system of equations and 4. estimate the break-even point. Explain 5. what the break-even point represents with respect to the given problem situation.

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.

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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.

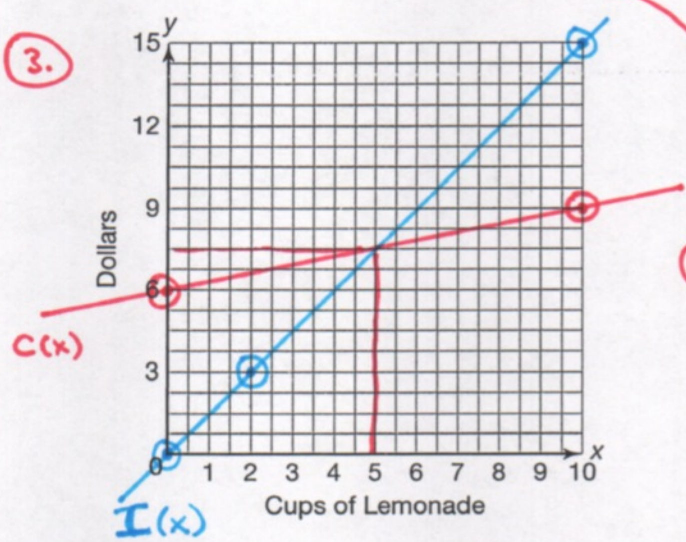
(2.) Let x = no. of cups of lemonade

(1.) $C(x) = 0.30x + 6$
$I(x) = 1.5x$

C = cost
I = income

$y = 0.30x + 6$ (cost)
$y = 1.5x$ (income)

(3.)



(3.) Cost

x	y
0	6
10	9

Income

x	y
0	0
2	3
10	15

(4.) Break-even point = (5, 7.5)

(5.) Ramona will sell enough at 5 cups of lemonade to just get back her start-up costs.

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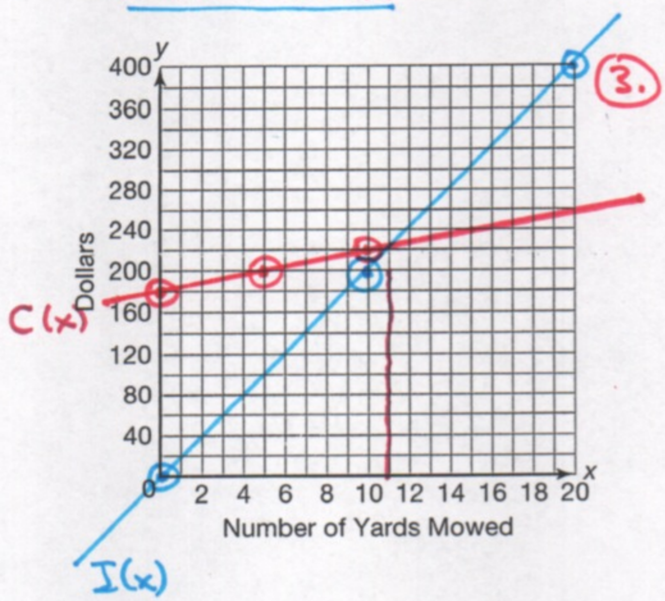
3. Chen starts his own lawn mowing business. He initially spends $180 on a new lawnmower. For each yard he mows, he receives $20 and spends $4 on gas.

2. Let x = number of lawns mowed

1. $C(x) = 180 + 4x$
$I(x) = 20x$



3.

x	C(x)
0	180
5	200
10	220

x	I(x)
0	0
10	200
20	400

4. Break-even point = (11, 225ish)

5. Chen must mow more than 11 lawns in order to make money.

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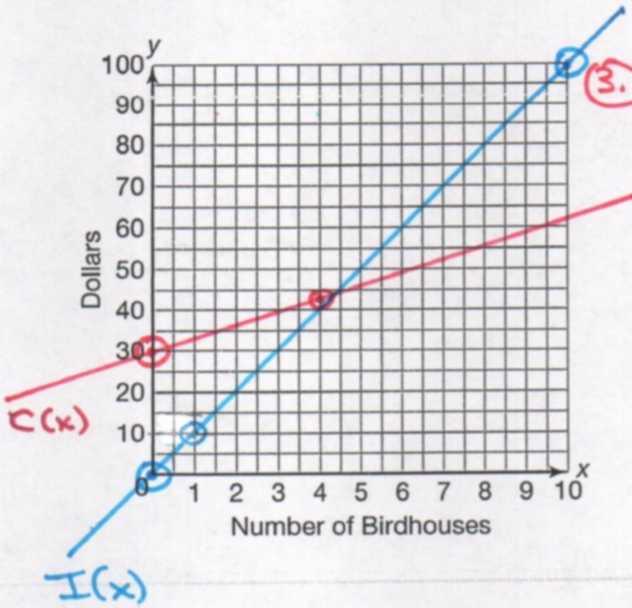
4. Olivia is building birdhouses to raise money for a trip to Hawaii. She spends a total of \$30 on the tools needed to build the houses. The material to build each birdhouse costs \$3.25. Olivia sells each birdhouse for \$10.

2. Let x = number of birdhouses built/sold

1. $C(x) = 30 + 3.25x$
$I(x) = 10x$



3.

x	$C(x)$
0	30
4	43

x	$I(x)$
0	0
1	10
10	100

4. Break-even point ≈ (4.5, 45)

5. Olivia needs to sell at least 5 birdhouses in order to make a profit.

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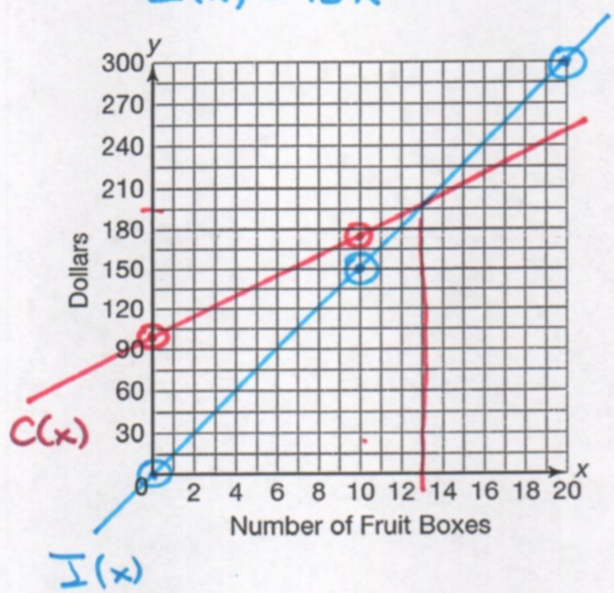
5. The Spanish Club is selling boxes of fruit as a fundraiser. The fruit company charges the Spanish Club \$7.50 for each box of fruit and a shipping and handling fee of \$100 for the entire order. The Spanish Club sells each box of fruit for \$15.

2. Let x = no. of boxes of fruit

1. $C(x) = 7.5x + 100$
   $I(x) = 15x$



3.

x	C(x)
10	175
0	100

x	I(x)
0	0
10	150
20	300

4. Break-even point ≈ (13, 195)

5. The Spanish club must sell over 13 boxes of fruit in order to make money.

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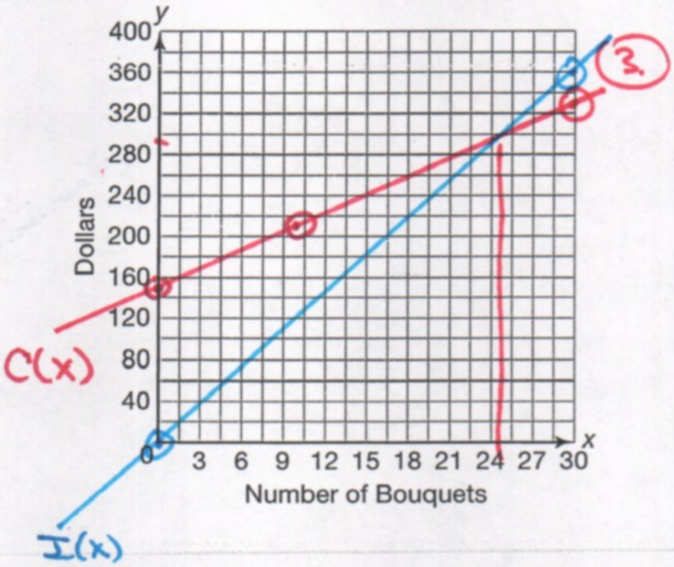
6. Jerome sells flowers for $12 per bouquet through his Internet flower site. Each bouquet costs him $5.70 to make. Jerome also paid a one-time fee of $150 for an Internet marketing firm to advertise his company.

2. Let x = number of bouquets

1. $C(x) = 5.7x + 150$
$I(x) = 12x$



x	C(x)
0	150
10	207
30	322

x	I(x)
0	0
10	120
30	360

4. Break-even point ≈ (24.5, 290)

5. Jerome must sell at least 25 bouquets in order to turn a profit.

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Transform both equations in each system of equations so that each coefficient is an integer.

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

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

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

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

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

$\left(-\frac{1}{3}x + \frac{1}{2}y = 5\right)6 \rightarrow \boxed{-2x + 3y = 30}$

$\left(\frac{3}{4}x - \frac{1}{4}y = 10\right)4 \rightarrow \boxed{3x - y = 40}$

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

$\left(\frac{5}{4}x - 3 = \frac{1}{6}y\right)12 \rightarrow \boxed{15x - 36 = 2y}$

$\left(\frac{2}{5}x + \frac{1}{5}y = \frac{9}{5}\right)5 \rightarrow \boxed{2x + y = 9}$

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

$(0.5x + 1.2y = 2)10 \rightarrow \boxed{5x + 12y = 20}$

$(3.3x - 0.7y = 3)10 \rightarrow \boxed{33x - 7y = 30}$

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

$(0.2x - 0.4y = 2)10 \rightarrow \boxed{2x - 4y = 20}$

$(-0.1x - 0.5y = 1.1)10 \rightarrow \boxed{-x - 5y = 11}$

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

$(0.3y = 2 - 0.8x)10 \rightarrow \boxed{3y = 20 - 8x}$

$(1.1x = 3y - 0.4)10 \rightarrow \boxed{11x = 30y - 4}$

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

$2x + (5x+2) = 9$

$2x + 5x + 2 = 9$

$7x + 2 = 9$

$-2 \quad -2$

$\frac{7x}{7} = \frac{7}{7}$

$x = 1$

$y = 5(1) + 2$

$= 7$

(1,7)
Consistent

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

$(3x-2) - 3x = 4$

$3x - 2 - 3x = 4$

$-2 = 4$

Untrue

NO SOLUTION (inconstent)

16. $\left(\begin{cases} \frac{1}{2}x + \frac{3}{2}y = -7 \end{cases}\right)2 \rightarrow x + 3y = -14$

$\left(\begin{cases} \frac{1}{3}y = 2x - 10 \end{cases}\right)3 \rightarrow y = 6x - 30$

$x + 3(6x - 30) = -14$

$x + 18x - 90 = -14$

$19x - 90 = -14$

$+90 \quad +90$

$\frac{19x}{19} = \frac{76}{19}$

$x = 4$

$y = 6(4) - 30$

$= 24 - 30$

$= -6$

(4, -6)
consitent

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17. $\begin{cases} 0.8x - 0.2y = 1.5 \\ 0.1x + 1.2y = 0.8 \end{cases}$ $)10 \rightarrow$ $8x - 2y = 15 \longrightarrow 8x - 2y = 15$
$)10 \rightarrow$ $x + 12y = 8 \longrightarrow x = 8 - 12y$

$8(8-12y) - 2y = 15$
$64 - 96y - 2y = 15$
$64 - 98y = 15$
$-64 \quad\quad -64$

$\frac{-98y}{-98} = \frac{-49}{-98}$

$y = \frac{1}{2} = 0.5$

$x = 8 - 12(0.5)$
$= 8 - 6$
$= 2$

(2, 0.5)
Consistent

18. $\begin{cases} 0.3y = 0.6x + 0.3 \\ 1.2x + 0.6 = 0.6y \end{cases}$ $)10 \rightarrow$ $3y = 6x + 3 \rightarrow$ divide by 3 $\rightarrow$ $y = 2x + 1$
$)10 \rightarrow$ $12x + 6 = 6y$

$12x + 6 = 6(2x + 1)$
$12x + 6 = 12x + 6$

ALWAYS true, so all solutions work (that is, an infinite number of solutions)

Consistent

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