

#13 $-4x - 2y = 14$ — ① (20)
 $-10x + 7y = -25$ — ②

① × 5 $5(-4x - 2y) = 5(14)$
 $-20x - 10y = 70$ — ③
 ② × 2 $2(-10x + 7y) = 2(-25)$
 $-20x + 14y = -50$ — ④
 ⊖ $-20x - 10y = 70$ — ③

$$\begin{array}{r} 24y = -120 \\ \hline 24 \quad 24 \\ \hline y = -5 \end{array}$$

Sub $y = -5$ into ①
 $-4x - 2y = 14$
 $-4x - 2(-5) = 14$
 $-4x + 10 = 14$
 $\quad -10 \quad -10$

 $\frac{-4x}{-4} = \frac{4}{-4}$
 $x = -1$

The solution is $(-1, -5)$.

Achor/MFM2P

Name: _____

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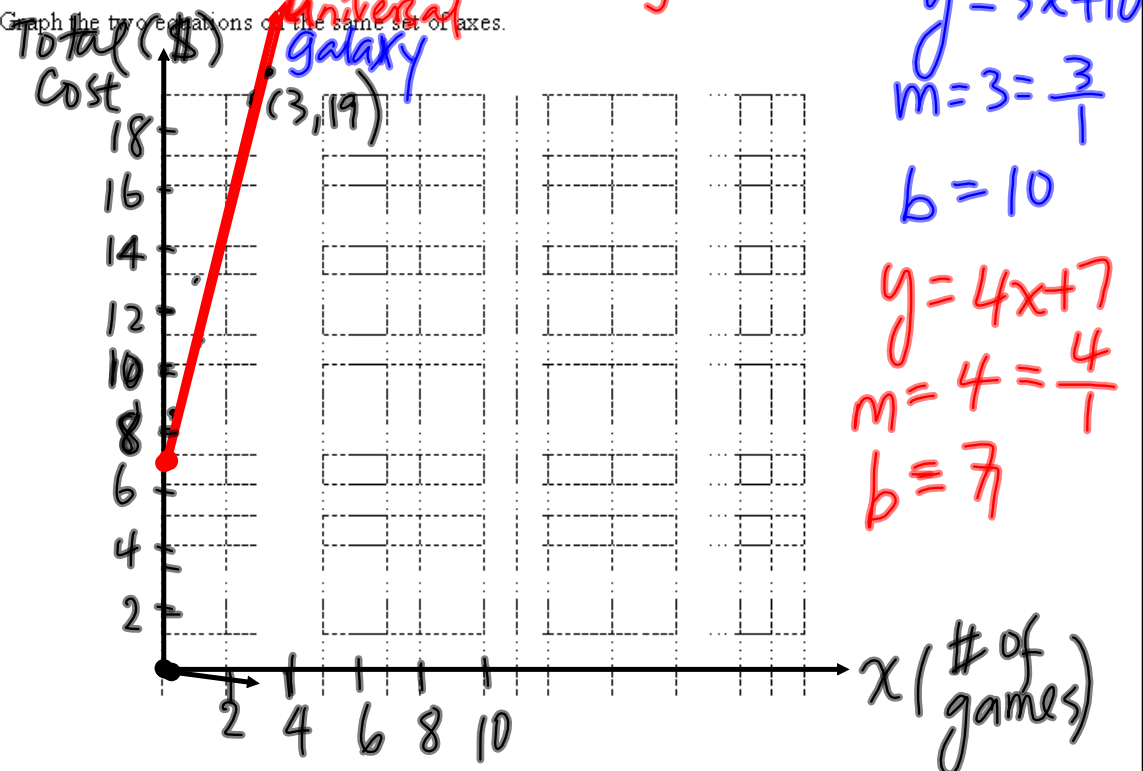
Worksheet 6-6: Applications of Solving Linear Systems

1. Galaxy Video and Game Rentals rents a game machine for \$10 and video games for \$3 each. Universal Video and Game Rentals rents a game machine for \$7 and video games for \$4 each. The total rental cost, y , in dollars, for one game machine plus x video games from either store can be compared using the following equations:

Galaxy: $y = 10 + 3x$ *$y = 3x + 10$*

Universal: $y = 7 + 4x$ *$y = 4x + 7$*

- (a) Graph the two equations on the same set of axes.



- (c) When will the total rental cost be the same for both stores?
When renting 3 games, total cost will be the same for both stores.
- (d) When will the total rental cost of Galaxy be higher than that of Universal?
When renting less than 3 games, the total cost will be higher for Galaxy!
- (e) When will the total rental cost of Universal higher than that of Galaxy?
When renting more than 3 games, the total cost will be higher for Universal!

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Name: _____ WS3-5
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2. Office Depot ordered 80 cases of envelopes costing a total of \$1109. The order contained boxes of legal size envelopes costing \$14.95/box, and boxes of letter size envelopes costing \$11.95/box.

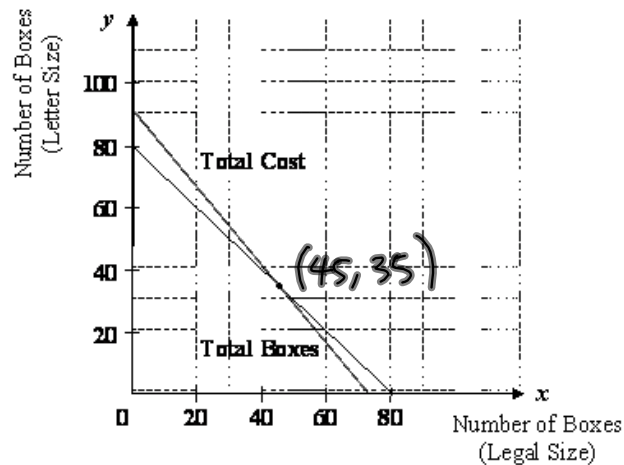
The total number of boxes ordered and the total cost of the boxes are represented by the following system of equations:

Total Boxes: $x + y = 80$

Total Cost: $14.95x + 11.95y = 1109$

where x is the number of boxes of legal sized envelopes and
 y is the number of boxes of letter size envelopes.

Examine the graph of the system to **approximate** the solution.



How many boxes of each type of envelopes were actually ordered?

Revenue > Cost → profit
 Revenue < Cost → loss

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In the business community, when the revenue (money earned) and costs (money spent) are equal, there is no profit or loss. This is called the "break-even point".

If fewer units than the break-even point are produced and sold, the business will lose money.
 If more units than the break-even point are produced and sold, the business will make a profit.

3. The student council is selling T-shirts. The cost of the T-shirts includes an \$800 design and set-up charge plus \$4 per T-shirt. The shirts will sell for \$20 each. The cost and revenue can be represented by the following equations:

Cost: $d = 800 + 4t$
 Revenue: $d = 20t$

Where t is the number of T-shirts and d is an amount in dollars

(a) Solve the system of equations by substitution.

$$\begin{array}{r}
 d = 800 + 4t \quad \text{--- (1)} \\
 d = 20t \quad \text{--- (2)} \\
 \text{Sub (2) into (1)} \quad 20t = 800 + 4t \\
 \quad \quad \quad \quad \quad - 4t \quad \quad \quad - 4t \\
 \hline
 16t = 800 \\
 \frac{16t}{16} = \frac{800}{16} \\
 t = 50 \quad \therefore \text{The solution is } (50, 1000)
 \end{array}$$

Sub $t = 50$
 into (2)
 $d = 20t$
 $d = 20(50)$
 $= 1000$

(b) How many T-shirts does the student council need to sell to break even?

The student council needs to sell 50 T-shirts to break even.

(c) How much money will the student council have raised if 200 T-shirts are made and sold?

$$\begin{array}{l}
 \text{Cost} = 800 + 4t \quad (t = 200) \\
 = 800 + 4(200) \\
 = 1600 \\
 \text{Revenue} = 20t \quad (t = 200) \\
 = 20(200) \\
 = 4000 \\
 \text{Profit} = 4000 - 1600 \\
 (\text{Raised}) = \$2400
 \end{array}$$

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4. Julia's annual salary in dollars, S , can be represented by the equation $S = 30500 + 500n$, where n is the number of years she has worked for the company. Aysha works for another company. Her annual salary can be represented by the equation $S = 26000 + 1000n$.

Use the method of elimination to determine after how many years the two women will have the same salary and what that salary will be?

Elimination

$$\begin{array}{r} S = 30500 + 500n \\ S = 26000 + 1000n \\ \hline \end{array}$$

Substitution

$$26000 + 1000n = 30500 + 500n$$

5. KC Fitness Club charges a flat fee of \$25 per month plus \$5 per visit. Workout Zone charges a flat fee of \$35 per month plus \$3 per visit. For how many visits per month is the total cost the same for both fitness clubs? (Hint: Write an equation for each club then solve.)

Let Statements:

Let v be the # of visits in a month.
Let C be the cost for using the club facilities in a month.

$$KC: C = 5v + 25$$

$$WZ: C = 3v + 35$$

$$\begin{array}{r} 0 = 2v - 10 \\ +10 \quad \quad +10 \\ \hline 10 = 2v \end{array}$$

$$10 = 2v$$

$$\boxed{5 = v}$$

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6. Rachelle is an economist. She evaluates the effect of changing the price on the supply and demand for a product. The selling price in dollars, y , of a product is related to the number of units sold, x , according to these equations:

Demand (D): $y + 0.4x = 10$

Supply (S): $y = 0.6x + 2$

Solve this system algebraically. What does the solution represent?

$$\begin{array}{r}
 y + 0.4x = 10 \quad \text{--- (1)} \\
 y = 0.6x + 2 \quad \text{--- (2)} \\
 \text{Sub. (2) into (1)} \\
 y + 0.4x = 10 \\
 (0.6x + 2) + 0.4x = 10 \\
 0.6x + 2 + 0.4x = 10 \\
 x + 2 = 10 \\
 \underline{-2 \quad -2} \\
 x = 8
 \end{array}$$

The solution is (8, 6.8)

$$\begin{array}{r}
 \boxed{x = 8} \\
 \text{Sub } x = 8 \text{ into (1)} \\
 y + 0.4(8) = 10 \\
 y + 3.2 = 10 \\
 \underline{-3.2 \quad -3.2} \\
 \boxed{y = 6.8}
 \end{array}$$

7. Kevin is selling T-shirts to raise money for diabetes research. The supplier charges a \$210 design fee plus \$3 per T-shirt. Kevin plans to sell the T-shirts for \$10 each. In order to **break even**, how many T-shirts does Kevin need to sell?

Let Statements: t be the # of t-shirts
 d be the dollar amount

Revenue: $d = 10t$
Cost: $d = 210 + 3t$

$$\begin{array}{r}
 d = 10t + 0 \\
 \ominus \quad d = 3t + 210 \\
 \hline
 0 = 7t - 210 \\
 +210 \quad +210 \\
 \hline
 210 = 7t \\
 \frac{210}{7} = \frac{7t}{7} \\
 \boxed{30 = t}
 \end{array}$$

$$\begin{array}{r}
 d = 10t \quad \text{--- (1)} \\
 d = 210 + 3t \quad \text{--- (2)} \\
 \text{Sub } d = 10t \text{ into (2)} \\
 10t = 210 + 3t \\
 \underline{-3t \quad -3t} \\
 7t = 210 \\
 \frac{7t}{7} = \frac{210}{7} \\
 \boxed{t = 30}
 \end{array}$$

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8. Jemma is making 120 kg of a new blend of coffee that will sell for \$15/kg. The blend is made from two kinds of coffee: one that sells for \$18/kg, and another that sells for \$10/kg. How many of each type of coffee should Jemma use to make the new blend?

see #2
 Let x be the amount of \$18/kg coffee.
 Let y be the amount of \$10/kg coffee.

$$\begin{aligned}
 x + y &= 120 \quad \text{--- (1) (in kg)} \\
 18x + 10y &= 15(120) \quad \text{(in \$)} \\
 18x + 10y &= 1800 \quad \text{--- (2)}
 \end{aligned}$$

From (1), $x + y = 120$

$$\begin{array}{r}
 x + y = 120 \\
 -y \quad \quad -y \\
 \hline
 x = 120 - y \quad \text{--- (3)}
 \end{array}$$

Sub (3) into (2)

$$\begin{aligned}
 18x + 10y &= 1800 \\
 18(120 - y) + 10y &= 1800 \\
 2160 - 18y + 10y &= 1800 \\
 2160 - 8y &= 1800 \\
 -2160 \quad \quad -2160 \\
 \hline
 -8y &= -360 \\
 \frac{-8y}{-8} &= \frac{-360}{-8} \\
 y &= 45
 \end{aligned}$$

9. Naomi invests \$3000 in two funds. The education savings plan pays interest at a rate of 7% per year and the guaranteed investment certificate (GIC) pays interest at 5% per year. At the end of the year, she has earned \$190 in interest. How much did Naomi invest at each rate?

Let Statements:

Sub $y = 45$ into $x + y = 120$

$$\begin{array}{r} x + 45 = 120 \\ -45 \quad -45 \\ \hline x = 75 \end{array}$$

There are 75 kg of \$18/kg and
45 kg of \$10/kg.

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10. Students hold a car wash to raise money for a school trip to New York. They charge \$7 per car and \$10 per van. If they earned \$457 for washing a total of 52 cars and vans, how many cars and how many vans did they wash?

Let Statements:

11. Harry drives 400 km in 5.5 hours. For the first part of his trip, his average speed is 80 km/h. For the second part of his trip, his average speed is 60 km/h. How far does Harry drive at 60 km/h?

Let Statements:

Distance = time \times speed

with
the
wind $216 = 2(s + w)$

Against
the wind $216 = 3(s - w)$

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12. Charlie has a jar of coins. He tells his sister that the jar has 45 quarters and dimes altogether, and the total value of the coins is \$6.30. Find the number of each type of coin in the jar.

Let Statements:

13. Joshua invests \$8000 for his children's education. He invests part of the money in a high-risk bond that pays 5% interest per year, and the rest of the money in a low-risk bond that pays 3.25% interest per year. After one year, he has a total of \$312.50 in interest. How much did Joshua invest at each rate?

Let Statements:

Answers: 1. (b) renting 3 games, (c) renting < 3 games, (d) renting > 3 games; 2. 35 boxes (letter)/45 boxes (legal); 3. (a) (50, 1000), (b) 50, (c) Cost = \$1600, Revenue = \$4000, Raised \$2400; 4. 9 years, Salary = \$35000; 5. $y = 25 + 5x$, $y = 35 + 3x$, 5 visits; 6. (8, 6.8), when the price is \$6.80, S = D and 8 units are sold; 7. $C = 210 + 3n$, $C = 10n$, 30 t-shirts; 8. $x + y = 120$, $18x + 10y = 1800$, \$18/kg = 75 kg, \$10/kg = 45 kg; 9. $e + g = 3000$, $0.07e + 0.05g = 190$, \$2000 in 7%, \$1000 in 5%; 10. $c + v = 52$, $7c + 10v = 457$, 21 cars, 31 vans; 11. $\frac{x}{80} + \frac{y}{60} = 5.5$, $80x + 60y = 400$, 280 km at 80 km/h, 120 km at 60 km/h; 12. $q + d = 45$, $0.25q + 0.1d = 6.3$, 12 quarters, 33 dimes; 13. $h + l = 8000$, $0.05h + 0.0325l = 312.5$, \$3000 at 5%, \$5000 at 3.25%