Weekly Focus: two-variable equations
Weekly Skill: application

LESSON 25: Two-Variable Linear Equations part 2

Lesson Summary: For the warm-up, students will solve a problem about plumbing repair cost. In Activity 1, they will practice problems in the student book. In Activity 2, they will work on word problems in the workbook. Activity 3 is an application activity with systems of equations. There is an extra word problem at the end. Estimated time for the lesson is 2 hours.

Materials Needed for Lesson 25:

- *Mathematical Reasoning Test Preparation for the 2014 GED Test* Student Book (pages 62 – 63)
- *Mathematical Reasoning Test Preparation for the 2014 GED Test* Workbook (pages 82 – 85)
- Application activity and answers (attached)

Objectives: Students will be able to:

- Solve the review word problem and write equations
- Solve problems with systems of equations with the substitution and elimination methods
- Solve the problems in the application activity about going to a sports game

ACES Skills Addressed: N, CT, LS
CCRS Mathematical Practices Addressed: Building Solution Pathways, Mathematical Fluency
Levels of Knowing Math Addressed: Intuitive, Abstract, and Application

Notes:
You can add more examples if you feel students need them before they work. Any ideas that concretely relate to their lives make good examples.

For more practice as a class, feel free to choose some of the easier problems from the worksheets to do together. The "easier" problems are not necessarily at the beginning of each worksheet. Also, you may decide to have students complete only part of the worksheets in class and assign the rest as homework or extra practice.

The GED Math test is 115 minutes long and includes approximately 46 questions. The questions have a focus on quantitative problem solving (45%) and algebraic problem solving (55%).

Students must be able to understand math concepts and apply them to new situations, use logical reasoning to explain their answers, evaluate and further the reasoning of others, represent real world problems algebraically and visually, and manipulate and solve algebraic expressions.

This computer-based test includes questions that may be multiple-choice, fill-in-the-blank, choose from a drop-down menu, or drag-and-drop the response from one place to another.

The purpose of the GED test is to provide students with the skills necessary to either further their education or be ready for the demands of today's careers.

Lesson 1 Warm-up: Solve the plumbing problem	**Time: 10 Minutes**

Write on the board: Bethany calls two plumbers to fix her broken sink. Plumber A charges a $50 fee and $22 an hour. Plumber B charges $0.49 a mile each way to and from his shop and $35 an hour.

Basic Questions:

- If Plumber A charges $116 total, how many hours does it take to fix the sink? Write an equation, then solve.
  - *$50 + $22x = $116*
    -$50 -$50
    $22x = $66
    x = 3
- Would Plumber B be less expensive if Bethany lives 5 miles from the shop?
  - *Yes. 3 hours x $35 = $105 for labor, 10 miles (round trip) x $0.49 = $4.90, total $105 + $4.90 = $109.10.*

Extension Question:

- Write an equation for Plumber B's charges. Solve.
  - *$35 (3 hours) + $0.49 (10 miles) = x*
  - *$105 + $4.90 = $109.90*

Lesson 25 Activity 1: Solve Systems of Equations	**Time: 20 Minutes**

1. Do the problems in the **student book pages 62-63** together.
2. Review both the substitution method and the elimination/combination method with the example on page 62.
3. Use both methods to solve #1. Students may find they have a preference of one method over the other or it may depend on the numbers in the equations.
4. Have volunteers at the board working on #2 – #6 while others work at their desks.
5. Students should write their answers as (x,y) and should plug their numbers into both equations to make sure their answers are correct.

Lesson 25 Activity 2: Independent Practice	Time: 45 Minutes

1. Students can work independently on the problems in the **workbook pages 82-85.**
2. Circulate to help.
3. Have student volunteers do some of the more challenging problems on the board.

Lesson 25 Activity 3 Application: Going to the Game	Time: 25-30 Minutes

1. Students will practice writing and solving systems of equations related to buying items at a sports events.
2. Give students about 5 minutes to try #1 on their own and then do it together on the board.
3. Let students work independently or in groups to solve the rest.
4. Note:
    a. Question 7 is different in that they create their own ideas.
    b. The answer sheet has a chart, but we want students to solve the problems with variables in equations.
5. Have volunteers write answers on the board and give them time to share their ideas for #7.

Lesson 25 Extra Time? Finish Early?	Time: 10 Minutes

Write an equation and solve this challenge problem:

Alan deposited $175 cash in his bank account. There were no $1 bills, but he had 3 times as many $5 bills as $10 bills, and the number of $20 bills was 1 less than twice the number of $10 bills. How many of each bill did he deposit?

Hint: Use $10 bills as x

Number of $5 bills = 3x
Number of $20 bills = 2x – 1

5(3x) + 10x + 20(2x – 1) = 175
15x + 10x + 40x – 20 = 175
65x = 195
x = 3
He deposited 3 $10 bills, 9 $5 bills, and 5 $20 bills.

Lesson 25 Application: Going to the Game

Professional sports such as MLB, the NBA, NFL and NHL make millions of dollars every year on souvenirs and concessions sold at their stadiums. There is typically only one or two days a year that there is not a single game being played in one of these leagues. This is typically the day before and/or after the MLB All-Star Game held in July. Three of the leagues are currently playing now with the NHL and NBA each nearing their championships. Let's try some algebra problems around concessions and souvenirs sales at professional sports stadiums. Try to write and solve algebraic equations to determine the solution for each problem. Each problem represents a different stadium; so finding the cost of a soda in one problem does not mean that a soda is that price in another problem.

1. Write an algebraic equation for each purchase. I bought an ice cream treat and a bottle of water for $10. Pam purchased an ice cream treat and two bottles of water for $14. Use your equations and reasoning skills to find the price of a bottle of water and an ice cream treat.

2. Betty purchased two hotdogs and one soda for $11. Jose and his family purchased two hotdogs and three sodas for $17. Write an equation for Betty's purchase using "h" for the price of a hotdog and "d" as the price of a soda. Do the same for Jose's purchase. Determine the cost of a hotdog and a soda.

3. Lucy's family purchased one sweatshirt and four tee shirts for a total of $110. Mark's family picked up three sweatshirts and four tee shirts for a total of $200. Write algebraic equations for each purchase in the same way you did in problem one. Use your equations to find the cost of a tee shirt and a sweatshirt.

4. Keith bought a hat and a poster for $26. Sarah's family purchased four hats and two posters for $88. Write equations for each purchase. Solve your equations to find the cost of a hat and a poster.

5. Zach bought a cheeseburger and bottle of water for $9. Jasmine got an order of nachos and a bottle of water for $8. Mr. Johnson purchased five bottles of water for his family for $15. Write equations for each purchase. Solve your equations to find the cost of a bottle of water, order of nachos and a cheeseburger.

6. Louis bought a burger and soda for $8. Kate purchased a slice of pizza and soda for $9. Biff purchased a burger, a slice of pizza and a soda for $13.50. Write equations for each purchase. Solve your equations to find the cost of a burger, slice of pizza and a soda. This one is a little tougher, you may need to play around with the equations a little and see what you can logically figure out.

7. Michael and Dwight went to see the playoff game. They each purchased some food. The equation below models what they bought. Write up a short story about what they purchased and how much these two items cost. Make sure to describe what each variable could stand for and what the numbers in the equation stand for.

$$3b + d = 17$$
$$5b + d = 27$$

Lesson 25 Application Answers

Professional sports such as MLB, the NBA, NFL and NHL make millions of dollars every year on souvenirs and concessions sold at their stadiums. There is typically only one or two days a year that there is not a single game being played in one of these leagues. This is typically the day before and/or after the MLB All-Star Game held in July. Three of the leagues are currently playing now, with the NHL and NBA each nearing their championships. Lets try some algebra problems around concessions and souvenirs sales at professional sports stadiums. Try to write and solve algebra equations to determine the solution for each problem. Each problem represents a different stadium; so finding the cost of a soda in one problem does not mean that a soda is that price in another problem.

1. Write an algebra equation for each purchase. I bought an ice cream treat and a bottle of water for $10. Pam purchased an ice cream treat and two bottles of water for $14. Use your equations and reasoning skills to find the price of a bottle of water and an ice cream treat.

I + W = $10
I + 2W = $14 So a water must cost $4 and then an ice cream must cost $6

Or, subtract the first equation from the second equation to get 1W = $4 and then plug in for W and solve for I.

Or, use our charts.

+	0	1	2	3	4	5	6	water
0								
1		$10	$14	+ $4				
2								
3								
4								
5								
6								

ice cream

2. Betty purchased two hotdogs and one soda for $11. Jose and his family purchased two hotdogs and three sodas for $17. Write an equation for Betty's purchase using "h" for the price of a hotdog and "d" as the price of a soda. Do the same for Jose's purchase. Determine the cost of a hotdog and a soda.

2h + 1d = $11
2h + 3d = $17
So 2 drinks is all that is different about what they bought. 2 drinks must cost $6. 1 drink must cost $3. Then 2 hot dogs must cost $8 or 1 hot dog costs $4.

Or, subtract the first sentence from the second sentence to find that 2d = $6.
d = $3
Substitute d = $3 into either of the first sentences to find that h = $4

Or use one of our charts.

+	0	1	2	3	4	5	6	hot dogs
0								
1			$11					
2			+ $3					
3			$17					
4								
5								
6								

drinks

3. Lucy's family purchased one sweatshirt and four tee shirts for a total of $110. Mark's family picked up three sweatshirts and four tee shirts for a total of $200. Write algebra equations for each purchase

in the same way you did in problem one. Use your equations to find the cost of a tee shirt and a sweatshirt.

1S + 4T = $110
3S + 4T = $200
Students will notice that the only difference in their two purchases was 2 sweatshirts and the price differed by $90. So each sweatshirt must cost $45. Then each tee shirt must have cost $16.25.

4. Keith bought a hat and a poster for $26. Sarah's family purchased four hats and two posters for $88. Write equations for each purchase. Solve your equations to find the cost of a hat and a poster.

1H + 1P = $26
4H + 2P = $88

+	0	1	2	3	4	5	6	hats
0								
1		$26						
2			$52		$88			
3				$78	+ 8			
4					$104			
5								
6								

posters

I knew that 1 hat and 1 poster cost $26 so than 2 hats and 2 posters must cost double that amount. I filled in a few more values in my chart. At 4 hats and 4 posters I was able to see the trend. Each poster must have cost $8. Then a hat must have cost $18.

5. Zach bought a cheeseburger and bottle of water for $9. Jasmine got an order of nachos and a bottle of water for $8. Mr. Johnson purchased five bottles of water for his family for $15. Write equations for each purchase. Solve your equations to find the cost of a bottle of water, order of nachos and a cheeseburger.

1C + 1W = $9
1N + 1W = $8 So, nachos cost $1 less than a cheeseburger.
5W = $15 So, water must cost $3 for a bottle.
Students can now calculate that a cheeseburger costs $6 and nachos cost $5.
1W + 1N + 1C = $3 + $5 + $6 = $14

6. Louis bought a burger and soda for $8. Kate purchased a slice of pizza and soda for $9. Biff purchased a burger, a slice of pizza and a soda for $13.50. Write equations for each purchase. Solve your equations to find the cost of a burger, slice of pizza and a soda. This one is a little tougher, you may need to play around with the equations a little and see what you can logically figure out.

Louis 1B + 1D = $8
Kate 1P + 1D = $9 So students will know that pizza cost $1 more than a hamburger.
Biff 1B + 1P + 1D = $13.50
Kate's purchase is almost like Biff's except that he also got a hamburger. So a burger must cost the difference = $13.50 - $9 = $4.50. And then they know that pizza must cost $5.50 and a drink costs $3.50.

7. Michael and Dwight went to see the playoff game. The each purchased some food. The equation below models what they bought. Write up a short story about what they purchased and how much these two items cost. Make sure to describe what each variable could stand for and what the numbers in the equation stand for.

3b + d = 17
5b + d = 27

Student's answers will certainly vary. They should all speak about having 3 of something and 1 of something costing or weighing 17 and 5 of that first thing + 1 of the second thing = 27.

Brought to you by **Yummymath.com**