

A.CED.A.2: Create and/or Graph Equations

EQUATIONS AND INEQUALITIES

A.CED.A.2: Create Equations in Two Variables

A. Create equations that describe numbers or relationships.

2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Overview of Lesson

- activate prior knowledge and review learning objectives (see above)
- explain vocabulary and/or big ideas associated with the lesson
- connect assessment practices with curriculum
- model an assessment problem and solution strategy
- facilitate guided discussion of student activity
- facilitate guided practice of student activity

Selected problem set(s)

- facilitate a summary and share out of student work

Homework – Write the Math Assignment

BIG IDEAS

Equations may have zero, one, two, three, or more variables. Generally, the more variables an equation has, the more difficult it is to solve.

Examples:

No Variable: $3 + 5 = 8$ or $8 - 5 = 3$
One Variable: $x + 5 = 8$ or $8 - x = 5$
Two Variables: $x + y = 8$ or $y = 8 - x$
Three Variables: $x + y = z$ or $x + y - z = 0$

An equation shows the mathematical relationship between variables, and a general rule is: the more variables in an equation, the more difficult the equation is to solve. When two or more variables are involved, it is often necessary to: 1) have the same number of equations as there are variables; and 2) solve the equations as a system of equations. This lesson is about equations with two variables that can be solved independently.

Typically, one variable is a dependent variable and the other variable is the independent variable. The value of the dependent variable “depends” on the value of the independent variable.

When graphing equations with two variables:

The independent variable is always shown on the x-axis of a coordinate plane.

The dependent variable is always shown on the y-axis of a coordinate plane.

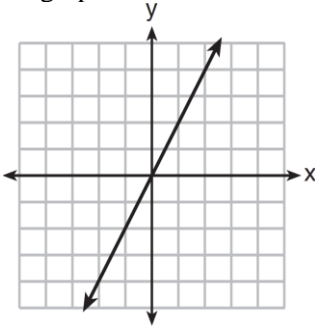
REGENTS PROBLEMS TYPICAL OF THIS STANDARD

Lesson Plan

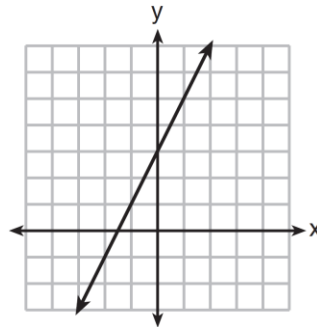
1. An airplane leaves New York City and heads toward Los Angeles. As it climbs, the plane gradually increases its speed until it reaches cruising altitude, at which time it maintains a constant speed for several hours as long as it stays at cruising altitude. After flying for 32 minutes, the plane reaches cruising altitude and has flown 192 miles. After flying for a total of 92 minutes, the plane has flown a total of 762 miles. Determine the speed of the plane, at cruising altitude, in miles per minute. Write an equation to represent the number of miles the plane has flown, y , during x minutes at cruising altitude, only. Assuming that the plane maintains its speed at cruising altitude, determine the total number of miles the plane has flown 2 hours into the flight.

2. Which graph shows a line where each value of y is three more than half of x ?

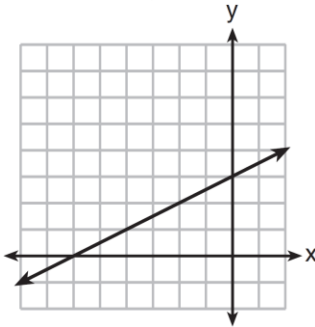
a.



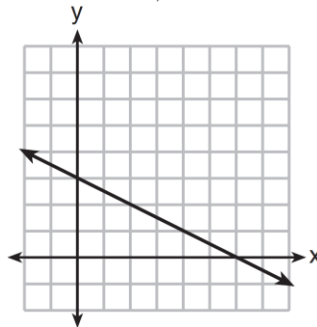
c.



b.

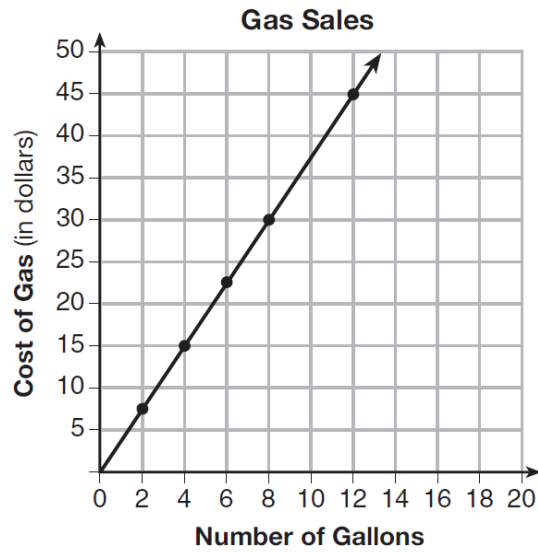


d.



Lesson Plan

3. The graph below was created by an employee at a gas station.



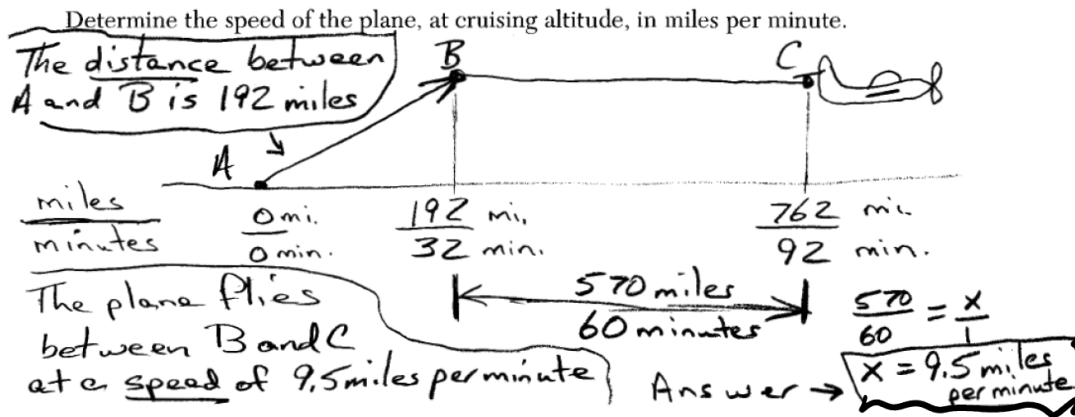
Which statement can be justified by using the graph?

- a. If 10 gallons of gas was purchased, \$35 was paid.
- b. For every gallon of gas purchased, \$3.75 was paid.
- c. For every 2 gallons of gas purchased, \$5.00 was paid.
- d. If zero gallons of gas were purchased, zero miles were driven.

A.CED.A.2: Create and/or Graph Equations
Answer Section

1. ANS:

Strategy: Draw a picture to model the problem.



At cruising altitude, the plane is flying at the speed of 9.5 miles per minute.

Write an equation to represent the number of miles the plane has flown, y , during x minutes at cruising altitude, only. (NOTE: This is line segment BC in the above picture.)

$$y = 9.5x$$

Assuming that the plane maintains its speed at cruising altitude, determine the total number of miles the plane has flown 2 hours into the flight.

Let M represent the total miles flown. Let t represent the number of minutes flown.

$$M(t) = 9.5(t - 32) + 192$$

$$M(120) = 9.5(120 - 32) + 192$$

$$M(120) = 9.5(88) + 192$$

$$M(120) = 836 + 192$$

$$M(120) = 1028$$

2 hours into the flight, the plane has flown 1,028 miles.

PTS: 4 REF: 061635ai NAT: A.CED.A.2 TOP: Speed

2. ANS: B

Strategy: Convert the narrative view to a function rule, then graph it.

STEP 1. Write the function rule.

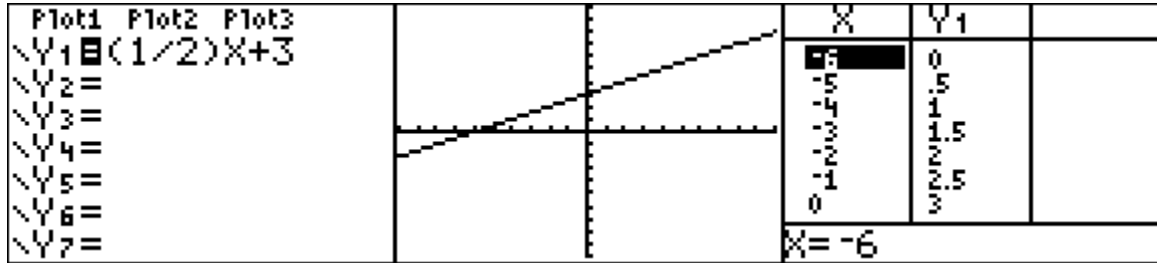
$$y = 3 + \frac{1}{2}x$$

(each value of y) is (three more) than (half of x)

$$y = \frac{1}{2}x + 3$$

Lesson Plan

STEP 2. Input the function rule in a graphing calculator and compare the graph view of the function to the answer choices.



Answer choice *b* is correct.

DIMS? Does It Make Sense? Yes. The x and y intercepts are reflected in both the graph and the table of values.

PTS: 2 REF: 081413ai NAT: A.CED.A.2 TOP: Graphing Linear Functions

KEY: bimodalgraph

3. ANS: B

Strategy #1: Use the slope of the line to determine the cost per gallon of gas. Select any two points that are on intersections of vertical and horizontal gridlines, then substitute them into the slope formula to determine the rate of change, which is the cost per gallon of gas.

Select (8, 30) and (4, 15)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{30 - 15}{8 - 4} = \frac{15}{4} = \$3.75$$

or

Select (12, 45) and (8, 30)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{45 - 30}{12 - 8} = \frac{15}{4} = \$3.75$$

For every gallon of gas purchased, \$3.75 was paid.

Strategy #2. Eliminate wrong answers.

Choice (a) is wrong because the chart shows that 10 gallons of gas costs \$37.50, not \$35.00.

Choice (b) is correct.

Choice (c) is wrong because the chart shows that 2 gallons of gas cost \$7.50, not \$5.00.

Choice (d) is wrong because the chart says nothing about the number of miles driven.

PTS: 2 REF: 011602ai NAT: A.CED.A.2 TOP: Graphing Linear Functions

Homework - Write the Math Assignment

START Write your name, date, topic of lesson, and class on your paper.

NAME: Mohammed Chen
 DATE: December 18, 2015
 LESSON: Missing Number in the Average
 CLASS: Z

PART 1a. Copy **the problem** from the lesson and underline/highlight key words.

PART 1b. State your understanding of **what the problem is asking**.

PART 1c. **Answer** the problem.

PART 1d. Explanation of **strategy** with all work shown.

PART 2a. Create **a new problem** that addresses the same math idea.

PART 2b. State your understanding of **what the new problem is asking**.

PART 2c. **Answer** the new problem.

PART 2d. Explanation of **strategy** used in solving the new problem with all work shown.

Clearly label each of the eight parts.

Grading Rubric

Each homework writing assignment is graded using a four point rubric, as follows:

Part 1. The Original Problem	Up to 2 points will be awarded for: a) correctly restating the original problem; b) explicitly stating what the original problem is asking; c) answering the original problem correctly; and d) explaining the math.
Part 2. My New Problem	Up to 2 points will be awarded for: a) creating a new problem similar to the original problem; b) explicitly stating what the new problem is asking; c) answering the new problem correctly; and d) explaining the math.

This assignment/activity is designed to incorporate elements of [Polya's four step universal algorithm](#) for problem solving with the idea that writing is thinking. Polya's four steps for solving any problem are:

1. Read and understand the problem.
2. Develop a strategy for solving the problem.
3. Execute the strategy.
4. Check the answer for reasonableness.

EXEMPLAR OF A WRITING THE MATH ASSIGNMENT

Part 1a. The Problem

TOP Electronics is a small business with five employees. The mean (average) weekly salary for the five employees is \$360. If the weekly salaries of four of the employees are \$340, \$340, \$345, and \$425, what is the salary of the fifth employee?

Part 1b. What is the problem asking?

Find the salary of the fifth employee.

Part 1c. Answer

The salary of the fifth employee is \$350 per week.

Part 1d. Explanation of Strategy

The arithmetic mean or average can be represented algebraically as:

$$\bar{X} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

I put information from the problem into the formula. The problem says there are 5 employees, so $n = 5$. The problem also gives the mean (average) salary and the salaries of 4 of the employees. These numbers can be substituted into the formula as follows:

$$360 = \frac{340 + 340 + 345 + 425 + x_5}{5}$$

$$1800 = 340 + 340 + 345 + 425 + x_5$$

$$1800 = 1450 + x_5$$

$$1800 - 1450 = x_5$$

$$350 = x_5$$

$$\text{Check: } 360 = \frac{340 + 340 + 345 + 425 + 350}{5} = \frac{1800}{5} = 360$$

Part 2a. A New Problem

Joseph took five math exams this grading period and his average score on all of the exams is 88. He remembers that he received test scores of 78, 87, 94, and 96 on four of the examinations, but he has lost one examination and cannot remember what he scored on it. What was Joseph's score on the missing exam?

Part 2b. What is the new problem asking?

Find Joseph's score on the missing exam.

Part 2c. Answer to New Problem

Joseph received a score of 85 on the missing examination.

Part 2d. Explanation of Strategy

I substitute information from the problem into the formula for the arithmetic mean, as follows:

$$88 = \frac{78 + 87 + 94 + 96 + x_5}{5}$$

$$440 = 355 + x_5$$

$$85 = x_5$$

$$88 = \frac{78 + 87 + 94 + 96 + 85}{5} = \frac{440}{5} = 88$$

The answer makes sense.