A.CED.A.1: Create Equations and Inequalities

EQUATIONS AND INEQUALITIES

A.CED.A.1: Create Equations and Inequalities in One Variable

A. Create equations that describe numbers or relationships.

1. Create equations and inequalities in one variable and use them to solve problems (linear, quadratic, exponential (integer inputs only)).

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

Translating words into mathematical symbols is an important skill in mathematics. The process involves first identifying key words and operations and second converting them to mathematical symbols.

Sample Regents Problem
Tanisha and Rachel had lunch at the mall. Tanisha ordered three slices of pizza and two colas. Rachel ordered two slices of pizza and three colas. Tanisha's bill was $6.00, and Rachel's bill was $5.25. What was the price of one slice of pizza? What was the price of one cola?
Step 1: Underline key terms and operations Tanisha ordered three slices of pizza and two colas. Rachel ordered two slices of pizza and three colas. Tanisha's bill was $6.00, and Rachel's bill was $5.25 **Step 2**.: Convert to mathematic symbolism Tanisha ordered $\underset{\text{three slices of pizza}}{3P}$ $\underset{\text{and}}{+}$ $\underset{\text{two colas.}}{2C}$ Rachel ordered $\underset{\text{two slices of pizza}}{2P}$ $\underset{\text{and}}{+}$ $\underset{\text{three colas}}{3C}$. Tanisha's bill was $\underset{\$6.00}{6}$, and Rachel's bill was $\underset{\$5.25}{5.25}$ **Step 3**.: Write the final expressions/equations

Tanisha: 3P+2C=6
Rachel: 2P+3C=5.25

NOTE: It is not always necessary to solve the equation.

Different Views of a Function

Students should understand the relationships between **four views of a function** and be able to move from one view to any other view with relative ease, The four views of a function are:

1) the description of the function in words
2) the function rule (equation) form of the function
3) the graph of the function, and
4) the table of values of the function.

REGENTS PROBLEMS TYPICAL OF THIS STANDARD

1. A landscaper is creating a rectangular flower bed such that the width is half of the length. The area of the flower bed is 34 square feet. Write and solve an equation to determine the width of the flower bed, to the *nearest tenth of a foot*.

2. A gardener is planting two types of trees:

   Type *A* is three feet tall and grows at a rate of 15 inches per year.

   Type *B* is four feet tall and grows at a rate of 10 inches per year.

   Algebraically determine exactly how many years it will take for these trees to be the same height.

3. Joe has a rectangular patio that measures 10 feet by 12 feet. He wants to increase the area by 50% and plans to increase each dimension by equal lengths, *x*. Which equation could be used to determine *x*?

   a. $(10+x)(12+x)=120$ c. $(15+x)(18+x)=180$

   b. $(10+x)(12+x)=180$ d. $(15)(18)=120+x^2$

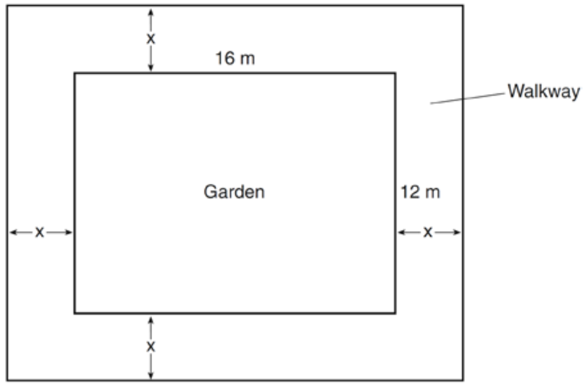
4. John has four more nickels than dimes in his pocket, for a total of $1.25. Which equation could be used to determine the number of dimes, *x*, in his pocket?
   a. $0.10(x + 4) + 0.05(x) = \$1.25$
   c. $0.10(4x) + 0.05(x) = \$1.25$
   b. $0.05(x + 4) + 0.10(x) = \$1.25$
   d. $0.05(4x) + 0.10(x) = \$1.25$

5. Sam and Jeremy have ages that are consecutive odd integers. The product of their ages is 783. Which equation could be used to find Jeremy's age, *j*, if he is the younger man?
   a. $j^2 + 2 = 783$
   c. $j^2 + 2j = 783$
   b. $j^2 - 2 = 783$
   d. $j^2 - 2j = 783$

6. Connor wants to attend the town carnival. The price of admission to the carnival is $4.50, and each ride costs an additional 79 cents. If he can spend at most $16.00 at the carnival, which inequality can be used to solve for *r*, the number of rides Connor can go on, and what is the maximum number of rides he can go on?
   a. $0.79 + 4.50r \le 16.00$; 3 rides
   c. $4.50 + 0.79r \le 16.00$; 14 rides
   b. $0.79 + 4.50r \le 16.00$; 4 rides
   d. $4.50 + 0.79r \le 16.00$; 15 rides

7. The cost of a pack of chewing gum in a vending machine is $0.75. The cost of a bottle of juice in the same machine is $1.25. Julia has $22.00 to spend on chewing gum and bottles of juice for her team and she must buy seven packs of chewing gum. If *b* represents the number of bottles of juice, which inequality represents the maximum number of bottles she can buy?
   a. $0.75b + 1.25(7) \ge 22$
   c. $0.75(7) + 1.25b \ge 22$
   b. $0.75b + 1.25(7) \le 22$
   d. $0.75(7) + 1.25b \le 22$

8. A rectangular garden measuring 12 meters by 16 meters is to have a walkway installed around it with a width of x meters, as shown in the diagram below. Together, the walkway and the garden have an area of 396 square meters.



Write an equation that can be used to find x, the width of the walkway. Describe how your equation models the situation. Determine and state the width of the walkway, in meters.

9. New Clarendon Park is undergoing renovations to its gardens. One garden that was originally a square is being adjusted so that one side is doubled in length, while the other side is decreased by three meters. The new rectangular garden will have an area that is 25% more than the original square garden. Write an equation that could be used to determine the length of a side of the original square garden. Explain how your equation models the situation. Determine the area, in square meters, of the new rectangular garden.

10. A rectangular picture measures 6 inches by 8 inches. Simon wants to build a wooden frame for the picture so that the framed picture takes up a maximum area of 100 square inches on his wall. The pieces of wood that he uses to build the frame all have the same width. Write an equation or inequality that could be used to determine the maximum width of the pieces of wood for the frame Simon could create. Explain how your equation or inequality models the situation. Solve the equation or inequality to determine the maximum width of the pieces of wood used for the frame to the *nearest tenth of an inch*.

11. Natasha is planning a school celebration and wants to have live music and food for everyone who attends. She has found a band that will charge her $750 and a caterer who will provide snacks and drinks for $2.25 per person. If her goal is to keep the average cost per person between $2.75 and $3.25, how many people, *p*, must attend?

a. $225 < p < 325$
b. $325 < p < 750$
c. $500 < p < 1000$
d. $750 < p < 1500$

12. The acidity in a swimming pool is considered normal if the average of three pH readings, *p*, is defined such that $7.0 < p < 7.8$. If the first two readings are 7.2 and 7.6, which value for the third reading will result in an overall rating of normal?

a. 6.2
b. 7.3
c. 8.6
d. 8.8

A.CED.A.1: Create Equations and Inequalities
Answer Section

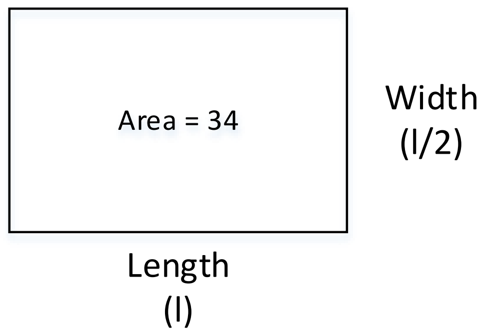
1. ANS:

   a) Equation $34 = l\left(\frac{1}{2}l\right)$

   b) The width of the flower bed is approximately 4.1 feet.

   Strategy: Draw a picture, then write and solve an equation based on the area formula, $\text{Area} = \text{length} \times \text{width}$.

   STEP 1. Draw a picture.



   STEP 2: Write and solve an equation based on the area formula.

$$\text{Area} = \text{length} \times \text{width}.$$

$$34 = l\left(\frac{l}{2}\right)$$

$$34 = \frac{l^2}{2}$$

$$68 = l^2$$

$$\sqrt{68} = \sqrt{l^2}$$

$$8.2 \approx l$$

$$4.1 \approx w$$

   PTS: 2 REF: 061532ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

2. ANS:
   2.4 years

   Strategy: Convert all measurements to inches per year, then write two equations, then write and solve a new equation by equating the right expressions of the two equations.

   STEP 1: Convert all measurements to inches per year.
   Type *A* is 36 inches tall and grows at a rate of 15 inches per year.
   Type *B* is 48 inches tall and grows at a rate of 10 inches per year.

   STEP 2: Write 2 equations

$$G(A) = 36 + 15t$$
$$G(B) = 48 + 10t$$

STEP 3: Write and solve a break-even equation from the right expressions.

$$36 + 15t = 48 + 10t$$
$$15t - 10t = 48 - 36$$
$$5t = 12$$
$$t = \frac{12}{5}$$
$$t = 2.4 \text{ years}$$

DIMS? Does It Make Sense? Yes. After 2.4 years, the type A trees and the type B trees will both be 72 inches tall.

$$G(A) = 36 + 15(2.4) = 36 + 36 = 72$$
$$G(B) = 48 + 10(2.4) = 48 + 24 = 72$$

PTS: 2 REF: 011531ai NAT: A.REI.C.6 TOP: Modeling Linear Equations
NOT: NYSED classifies this problem as A.CED.1: Create Inequations and Inequalities

3. ANS: B
Strategy: STEP 1. First, determine the area of the current rectangular patio and increase its size by 50%, which will be the size of the new patio. STEP 2. Then, increase each dimension of the current rectangular patio by x, as follows:
STEP 1.

$$\text{Area} = \text{length} \times \text{width}$$
Current Patio
$$A = 10 \times 12$$
$$A = 120$$
New Patio
$$A = 120 \times 150\%$$
$$A = 120 \times 1.5$$
$$A = 180$$

The new patio will have an area of 180 square feet. Eliminate choice (a).
STEP 2.

$$(10 + x)(12 + x) = 180$$

Choose answer b.

PTS: 2 REF: 011611ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

4. ANS: B
Strategy: This is a coin problem, and the value of each coin is important.

Let x represent the number of dimes, as required by the problem.
Let .10x represent the value of the dimes. (A dime is worth $0.10)

The problem says that John has 4 more nickels than dimes.
Let $(x+4)$ represent the number of nickels that John has.
Let $.05(x+4)$ represent the value of the nickles. (A nickel is worth $0.05)

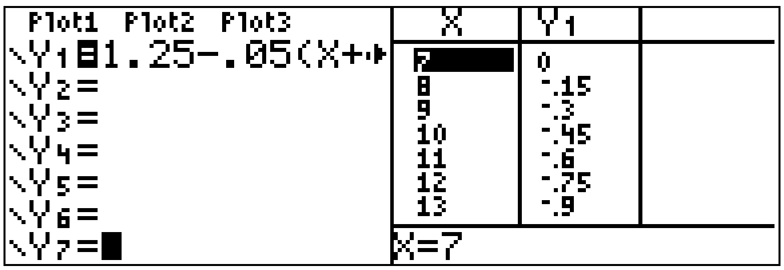
The total amount of money that John has is $1.25.
The total amount of money that John has can also be represented by $.10x + .05(x+4)$
These two expressions are both equal, so write:

$$.10x + .05(x+4) = \$1.25$$

This is not an answer choice, but using the commutative property, we can rearrange the order of the terms in the left expression $.05(x+4) + .10x = \$1.25$, which is the same as answer choice b.

DIMS? Does It Make Sense? Yes. Transform the equation for input into a graphing calculator as follows:
$.05(x+4) + .10x = \$1.25$

$0 = \$1.25 - .05(x+4) - .10x$



John has 7 dimes and 11 nickles. The dimes are worth 70 cents and the nickels are word 55 cents. In total, John has $1.25.

PTS: 2 REF: 061416ai NAT: A.CED.A.1 TOP: Modeling Linear Equations

5. ANS: C
Strategy: Deconstruct the problem to find the information needed to write the equation.

Let *j* represent Jeremy's age. The last sentence says *j* represents Jeremy's age.

Let $(j+2)$ represent Sam's age. The problem tells us that Sam and Jeremy have ages that are **consecutive odd integers**. The consecutive odd integers that could be ages are $\{1, 3, 5, 7, 9, \ldots\ldots\}$ and each odd integer is 2 more that the odd integer before it. Thus, if Jeremy is 2 years younger than Sam, as the problem says, then Sam's age can be represented as $(j+2)$.

The second sentence says, "The product of their ages is 783." Product is the result of multiplication, so we can write $j(j+2) = 783$. Since this is not an answer choice, we must manipulate the equation:

$$j(j+2) = 783$$

$$j^2 + 2j = 783$$

Our equation is now identical to answer choice *c*, which is the correct answer.

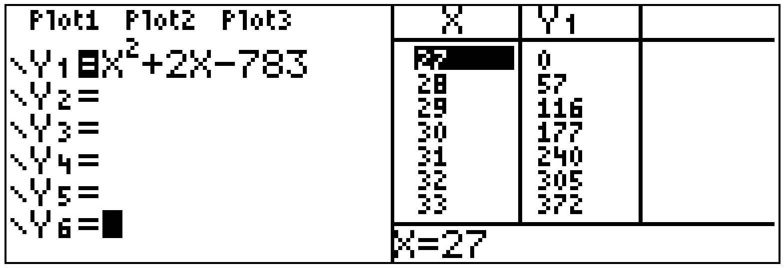
DIMS? Does It Make Sense? Yes. Jeremy is 27 and Sam is 29. The product of their ages is $27 \times 29 = 783$. In order to input this into a graphing calculator, the equation must be transformed as follows:

$$j^2 + 2j = 783$$

$$j^2 + 2j - 783 = 0$$

$$0 = j^2 + 2j - 783$$

$$y_1 = x^2 + 2x - 783$$



PTS: 2 REF: 081409ai NAT: A.CED.A.1 TOP: Modeling Quadratics

6. ANS: C

Strategy: Write and solve an inequality that relates total costs to how much money Connor has.

STEP 1. Write the inequality:
The price of admission comes first and is $4.50. Write +4.50
Each ride (r) costs an additional 0.79. Write +0.79r
Total costs can be expressed as: $4.50 + 0.79r$
$4.50 + 0.79r$ must be less than or equal to the $16 Connor has.
Write: $4.50 + 0.79r \le 16.00$

STEP 2: Solve the inequality.

Notes	Left Expression	Sign	Right Expression
Given	$4.50 + 0.79r$	$\le$	16.00
Subtract 4.50 from both expressions	$0.79r$	$\le$	11.50
Divide both expressions by 0.79	r	$\le$	$\frac{11.50}{.79}$
Simplify	r	$\le$	14.55696203
Interpret	r	$\le$	14 rides

The correct answer choice is c: $4.50 + 0.79r \le 16.00$; 14 rides

DIMS? Does It Make Sense? Yes. Admissions costs $4.50 and 14 rides cost $14 \times .79 = \$11.06$. After 14 rides, Connor will only have 45 cents left, which is not enough to go on another ride.

$$\$16 - (\$4.50 + \$11.05)$$

$$\$16 - (\$15.55)$$

$$\$0.45$$

PTS: 2 REF: 011513ai NAT: A.CED.A.1 TOP: Modeling Linear Inequalities

7. ANS: D

Strategy: Examine the answer choices and eliminate wrong answers.

Lesson Plan

STEP 1. Eliminate answer choices *a* and *c* because both of them have greater than or equal signs. Julia must spend less than she has, not more.

STEP 2. Choose between answer choices *b* and *d*. Answer choice *d* is correct because the term $0.75(7)$ means that Julia must buy 7 packs of chewing gum @ $0.75 per pack. Answer choice b is incorrect because the term $1.25(7)$ means that Julia will buy 7 bottles of juice.

DIMS? Does It Make Sense? Yes. Answer choice d shows in the first term that Julia will buy 7 packs of gum and the total of the entire expression must be equal to or less than $22.00.

PTS: 2 REF: 081505ai NAT: A.CED.A.1 TOP: Modeling Linear Inequalities

8. ANS:

a) $396 = (16+2x)(12+2x)$.

b) The length, $16+2x$, and the width, $12+2x$, are multiplied and set equal to the area.

c) The width of the walkway is 3 meters.

Strategy: Use the picture, the area formula ($Area = length \times width$), and information from the problem to write an equation, then solve the equation.

STEP 1. Use the area formula, the picture, and information from the problem to write an equation.

$$Area = length \times width$$

$$396 = (16+2x)(12+2x)$$

STEP 2. Solve the equation.

$$396 = (16+2x)(12+2x)$$

$$396 = (16\times 12) + (16\times 2x) + (2x\times 12) + (2x\times 2x)$$

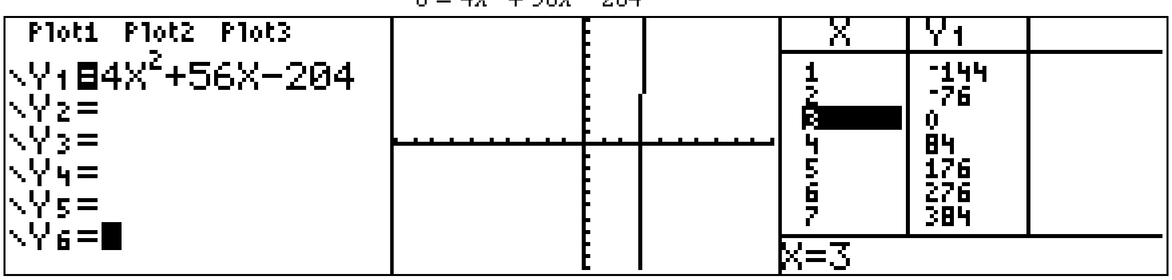
$$396 = 192 + 32x + 24x + 4x^2$$

$$396 = 192 + 56x + 4x^2$$

$$396 = 4x^2 + 56x + 192$$

$$0 = 4x^2 + 56x + 192 - 396$$

$$0 = 4x^2 + 56x - 204$$



The width of the walkway is 3 meters.

DIMS? Does It Make Sense? Yes. The garden plus walkway is $16+2(3)=22$ meters long and $12+2(3)=18$ meters wide. $Area = 22\times 18 = 396$, which fits the information in the problem.

PTS: 4 REF: 061434ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

9. ANS:

Lesson Plan

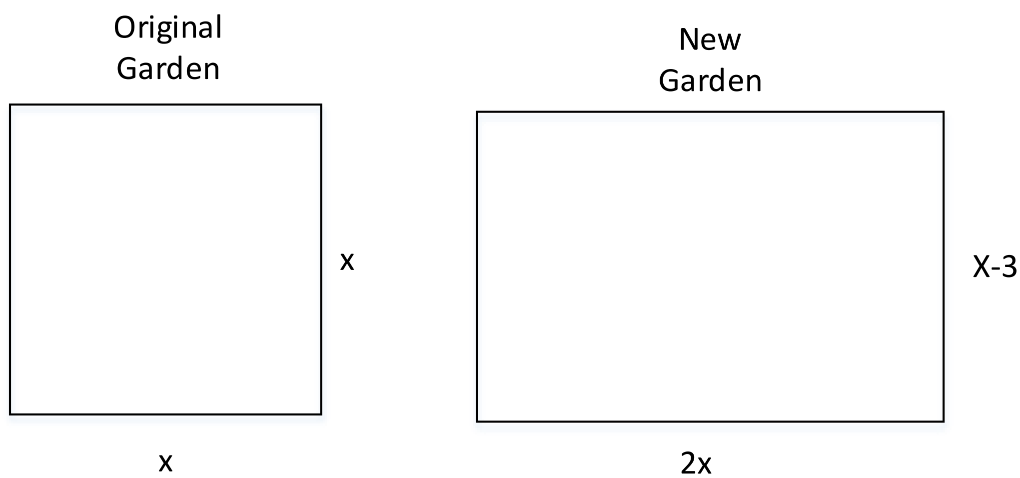
a) $1.25x^2=(2x)(x-3)$

b) Because the original garden is a square, x^2 represents the original area, $x-3$ represents the side decreased by 3 meters, $2x$ represents the doubled side, and $1.25x^2$ represents the new garden with an area 25% larger.

c) The length of a side of the original square garden was 8 meters.
The area of the new rectangular garden is 80 square meters.

Strategy: Draw two pictures: one picture of the garden as it was in the past and one picture of the garden as it will be in the future. Then, write and solve an equation to determine the length of a side of the original garden.

STEP 1. Draw 2 pictures.



Area of original garden is x^2. Area of new garden is $1.25x^2$.

STEP 2: Use the area formula, $A = \text{length} \times \text{width}$, to write an equation for the area of the new garden.

$$A = \text{length} \times \text{width}$$

$$1.25x^2=(2x)(x-3)$$

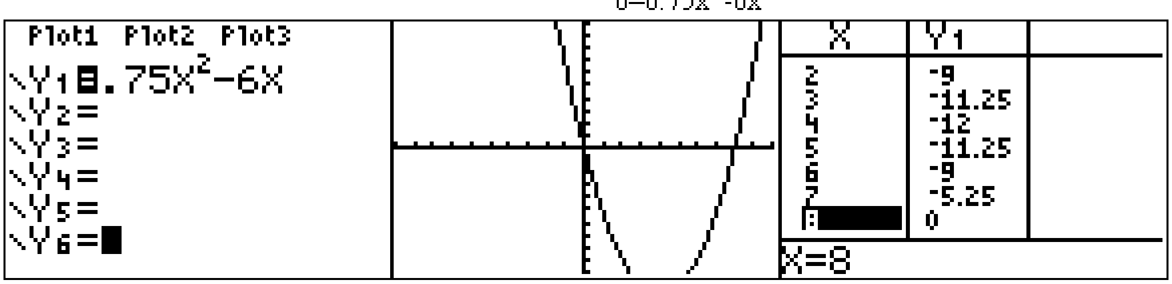
STEP 3: Transform the equation for input into a graphing calculator and solve.

$$1.25x^2=(2x)(x-3)$$

$$1.25x^2=2x^2-6x$$

$$0=2x^2-1.25x^2-6x$$

$$0=0.75x^2-6x$$



The length on a side of the original square garden was 8 meters.

The area of the new garden is $1.25(8)^2 = 1.25(64) = 80$ square meters.

DIMS? Does It Make Sense? Yes. The dimensions of the original square garden are 8 meters on each side and the area was 64 square meters. The dimensions of the new rectangular garden are 16 meters length and 5 meters width. The new garden will have area of 80 meters. The area of the new garden is 1.25 times the area of the original garden.

PTS: 6 REF: 011537ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

10. ANS:
The maximum width of the frame should be 1.5 inches.

Strategy: Write an inequality, then solve it.

STEP 1: Write the inequality.
The picture is 6 inches by 8 inches. The area of the picture is (6×8) square inches.
The width of the frame is an unknown variable represented by x.

Two widths of the frame (2x) must be added to the length and width of the picture. Therefore, the area of the picture with frame is $(6+2x)(8+2x)$ square inches
The area of the picture with frame, $(6+2x)(8+2x)$ square inches, must be less than or equal $(\leq)$ to 100.
Write $(6+2x)(8+2x) \leq 100$

STEP 2: Solve the inequality.

Notes	Left Expression	Sign	Right Expression
Given	$(6+2x)(8+2x)$	$\leq$	100
Use Distributive Property to Clear Parentheses	$48+12x+16x+4x^2$	$\leq$	100
Commutative Property	$4x^2+12x+16x+48$	$\leq$	100
Combine Like Terms	$4x^2+28x+48$	$\leq$	100
Subtract 100 from both expressions	$4x^2+28x-52$	$\leq$	0

Use the Quadratic Formula: a=4, b=28, c=-52

Lesson Plan

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-28 \pm \sqrt{28^2 - 4(4)(-52)}}{2(4)}$$

$$x = \frac{-28 \pm \sqrt{1616}}{8}$$

$$x = \frac{-28 \pm \sqrt{1616}}{8}$$

$$x = \frac{-28 \pm 40.1995}{8}$$

$$x = \frac{-28 + 40.1995}{8}$$

$$x = \frac{12.1995}{8}$$

$$x = 1.5 \text{ inches}$$

DIMS? Does It Make Sense? Yes. If the frame is 1.5 inches wide, then the total picture with frame will be

$$(6 + 2 \times 1.5)(8 + 2 \times 1.5)$$

$$(9)(11)$$

$$99 \text{ square inches}$$

PTS: 6 REF: 081537ai NAT: A.CED.A.1 TOP: Geometric Applications of Quadratics

11. ANS: D

Strategy:

STEP1. Use the definition of average cost.

$$\text{Average Cost} = \frac{\text{total costs}}{\text{number of persons sharing the cost}}$$

Total costs for the band and the caterer are: $\$750 + \$2.25p$

If the average cost is \$3.25, the formula is $\$3.25 = \dfrac{\$750 + \$2.25p}{p}$

Solve for p

$$\$3.25p = \$750 + \$2.25p$$

$$p = 750$$

If the average cost is \$2.75, the formula is $\$2.75 = \frac{\$750 + \$2.25p}{p}$

$$\text{Solve for } p$$

$$\$2.75p = \$750 + \$2.25p$$

$$.50p = 750$$

$$p = 1500$$

DIMS? Does It Make Sense? Yes. If 750 people attend, the average cost is \$2.25 per person. If 1500 people attend, the average cost is \$3.25 per person. For any number of people between 750 and 1500, the average cost per person will be between \$2.25 and \$3.25.

PTS: 2 REF: 061524ai NAT: A.CED.A.3 TOP: Modeling Linear Inequalities

12. ANS: B

Step 1. Recognize that the problem is asking you to identify one pH reading that will result in an average of three readings that is greater than or equal to 7.0 and less than or equal to 7.8.
Step 2. Use algebraic notation to represent the average of three pH readings, then find the answer that gives an average within the required interval.
Step 3.

$$pH_{(average)} = \frac{pH_1 + pH_2 + pH_3}{3}$$

$$pH_{(average)} = \frac{7.2 + 7.6 + pH_3}{3}$$

$$pH_{(average)} = \frac{14.8 + pH_3}{3}$$

Choice a) $pH_{(average)} = \frac{14.8 + pH_3}{3} = \frac{14.8 + 6.2}{3} = \frac{21}{3} = 7$. This average is not in the required interval, so choice a) is not a correct answer.

Choice b) $pH_{(average)} = \frac{14.8 + pH_3}{3} = \frac{14.8 + 7.3}{3} = \frac{22.1}{3} = 7.3\bar{6} \approx 7.4$. This average is in the required interval, so choice b) is a correct answer.

Choice c) $pH_{(average)} = \frac{14.8 + pH_3}{3} = \frac{14.8 + 8.6}{3} = \frac{23.4}{3} = 7.8$. This average is not in the required interval, so choice c) is not a correct answer.

Choice d) $pH_{(average)} = \frac{14.8 + pH_3}{3} = \frac{14.8 + 8.8}{3} = \frac{23.6}{3} = 7.8\bar{6} \approx 7.9$. This average is not in the required interval, so choice d) is not a correct answer.

Step 4. Does it make sense? Yes.

$$7.0 < p < 7.8$$

$$7.0 < 7.4 < 7.8$$

$$7.0 < \text{choice b} < 7.8$$

PTS: 2 REF: 061607ai NAT: A.CED.A.1 TOP: Modeling Linear Inequalities

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. <u>The Problem</u>

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. <u>What is the problem asking?</u>

Find the salary of the fifth employee.

Part 1c. <u>Answer</u>

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

Part 1d. <u>Explanation of Strategy</u>

The arithmetic mean or average can be represented algebraically as:

$$\overline{X} = \frac{x_1 + x_2 + ... + x_n}{n}$$

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:

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

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

$$1800 = 1450 + x_5$$

$$1800 - 1450 = x_5$$

$$350 = x_5$$

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

Part 2a. <u>A New Problem</u>

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 <u>What is the new problem asking?</u>

Find Joseph's score on the missing exam.

Part 2c. <u>Answer to New Problem</u>

Joseph received a score of 85 on the missing examination.

Part 2d. <u>Explanation of Strategy</u>

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.