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Curriculum topics:

- Algebraic Linear Equations
- Mixture Word Problems
- Problem Solving
- Reason Abstractly and Quantitatively

Subject: Math

Grade range: 6 – 9

Who we are:

Resource Area for Teaching (RAFT) helps educators transform the learning experience through affordable "hands-on" activities that engage students and inspire the joy and discovery of learning.

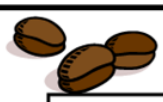
For more ideas and to see RAFT Locations

www.raft.net/visit-raft-location

BREWING COFFEE MIXTURES

Blend coffee beans and find the best retail price!

Use Algebra to figure out the price to charge for a one pound bag of mixed coffee beans.



Coffee Mixture Recording Sheet

Type of Coffee	Number of Pounds	Cost per Pound	Total Cost = pounds times cost
Kona Columbian Mixture			

List Knowns:

Define a Variable:

Solve for the Variable:

Check Your Answer:

Materials required

For each team of 2 to 4 students:

- Coffee Mixture Recording Sheet, 1, (page 5)
- Pony beads, brown & black 20 of each color
- Twenty-sided die with numbers 1 – 20
- Six-sided die with numbers 7 – 12
- Container for beads, 1

To do and notice

NOTE: Each of the following colored beads represent one pound of a type of coffee:
One brown bead = one pound of Columbian coffee
One black bead = one pound of Kona coffee

1 Roll the twenty-sized die to generate the number of pounds of Columbian coffee.
Record on the Coffee Mixture Recording Sheet.
Place the correct number of brown beads in a pile.
Repeat for the Kona coffee using the black beads.

2 Roll the 7 – 12 die to get a dollar amount per pound for the Columbian coffee, and record this amount in the "Cost Per Pound" column. Repeat for the Kona coffee.

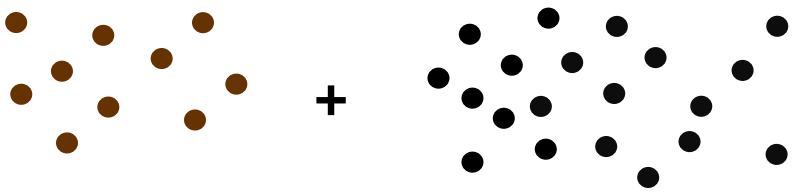
3 Discuss the cost per pound and amounts of each type of coffee.
Put all the beads in one container. Record the number of pounds for the total mixture.
Estimate the cost per pound of the mixture.

4 With the information from above, fill in the rest of the chart. Problem solve using algebraic equations to find the cost for a one-pound mixture. Round all amounts to the nearest cent.
Hints: 1) The number of pounds multiplied by the cost per pound equals the total cost for a type of coffee.
2) Let x = the cost per pound of the new mixture.

5 Check the answer by plugging the mixture cost back into the original equation. Record all findings and explain the results. Analyze the calculated cost to see if it makes sense.

If the calculation is correct, the cost per pound of the mixture will be between the cost per pound of each ingredient. If the cost of the Kona and Columbian coffee are equal to each other, then the cost of the mixture will be the same number.

Example:
If 10 pounds of Columbian coffee cost $7.00 per pound and 20 pounds of Kona coffee cost $10.00 per pound, solve for the cost of a one-pound blend.



Follow the steps below:

1. **List all that is known**: The total weight of the mixture is 10 + 20 = 30 pounds.
2. **Use a variable to represent what is unknown**: Let x = the cost per pound of the mixture
3. **Plan and organize information**:

Kind	Number of Pounds	Cost per pound	Total Cost = pounds x cost
Columbian	10	$ 7.00	(10)(7.00) = 70
Kona	20	$10.00	(20)(10.00) = 200
Mixture	30	x	30x

4. **Use algebraic linear equations to solve for x**:
   (10)(7.00) + (20)(10.00) = 30x
   Divide both sides by 10 to get → 7.00 + 2(10.00) = 3x
   7.00 + 20.00 = 3x
   27.00 = 3x
   This leads to x = 9.00

5. **Check Results**: (10)(7.00) + (20)(10.00) = 30(9.00)
   70 + 200 = 270
   270 = 270

   Answer →So, the cost of the mixture is $ 9.00 per pound!

6 Calculate the markup using a markup rate of 50%.

7 Calculate the retail price per bag by adding the markup to the net cost of the ingredients.

The Math behind the activity

In this activity, different types of coffee beans are blended to create a mixture that makes sense for the seller to make money. There are all types of situations that call for mixing different elements together to create an optimum blending: scientists mix chemicals in a lab; bakers and candy makers combine various ingredients in order to obtain a desired mixture (any change in the mixture may affect the final taste and could end up costing money); bankers and economists mix different investments to produce financial packages. In all these "mixture problems," people organize all the known and unknown information, and then use algebraic linear equations to solve for the unknown amount.

The random amounts and costs generated by the die rolls will give students a wide variety of coffee mixture scenarios to discuss. They will be able to observe how changes in the amount and cost of the ingredients will influence cost of the mixture.

Curriculum Standards:

Equations and Variables (Common Core Math Standards: Expressions and Equations, Grade 6, 2, 6, 7, & 9; Grade 7, 4)

Solving linear equations in one variable (Common Core Math Standards: Grade 8, Equations and Expressions, 7)

Creating equations, interpreting solutions (Common Core Math Standards: High School, Algebra – Creating Equations, 1)

Solving equations, (Common Core Math Standards: High School, Algebra – Reasoning with Equations & Inequalities, 1 & 3)

Problem Solving and Reasoning (Common Core Math Standards: Mathematical Practices Grades 6 - 9)

Learn more

- Have student teams share and compare coffee mixture scenarios. Have teams create viable arguments and critique the reasoning of others.
- Write the resulting problem as a word problem.
- Use different markup rates; compare resulting prices and discuss the advantages and disadvantages of different markup rates.
- Use a decimal die and the 7-12 number die to obtain a cost per pound that includes both dollars and cents.
- Create problems using other currencies and units of measure.
- Explore and discuss how mixtures problems and averages relate.
- Explore other scenarios that use mixtures and create new mixture problems. Exchange problems with other groups.

Related activities: See RAFT Idea Sheets:

Dive into Square Pools -
http://www.raft.net/ideas/Dive into Square Pools.pdf

Happy Trails Mix -
http://www.raft.net/ideas/Happy Trails Mix.pdf

Modeling Simple Equations -
http://www.raft.net/ideas/Modeling Simple Equations.pdf

Occasions for An Equation -
http://www.raft.net/ideas/Occasions for an Equation.pdf

Shape Up with Algebra -
http://www.raft.net/ideas/Shape Up with Algebra.pdf

Resources

Visit www.raft.net/raft-idea?isid=695 for “how-to” video demos & more ideas!

See these websites for more information on the following topics:

- **Other types of algebraic mixture problems:**
  http://www.purplemath.com/modules/mixture.htm

- **More about how to solve mixture problems:**
  http://mathforum.org/library/drmath/sets/select/dm_mixture.html

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