6th Grade Unit 4: Ratios Real World Experience

Bake Sale Project (scenario)

The Student Council wants to raise money for charity; so, they decided to sell brownies during an upcoming lunch time. Each member will make brownies to sell. The recipe they have will make a batch of 12 brownies. Some members say they can't make that many, and others want to make more than one batch.

You will work in pairs to match the details of recipes that have been scaled up and down into larger and smaller batches, calculate missing quantities in those recipes, and determine quantitative relationships between the scaled recipes. You will then create a table of equivalent ratios for 12, 18 and 36 brownies, create a double line plot comparing the number of brownies made to the amount of sugar used, create a graph comparing the number of brownies made to the amount of sugar used, and reflect on these activities.

To help Student Council decide if this is something they should do, you will calculate the cost per brownie, the unit price, and profit per brownie. You will also calculate the amount of time it takes to bake various amounts of brownies. Lastly, you will determine the profit percentage and profit margin. Using these calculations and your own thoughts and ideas, you will make a recommendation to Student Council about whether they should move forward with this project?

Directions:

Students will work in pairs to match the details of recipes that have been scaled up and down into larger and smaller batches, calculate missing quantities in those recipes, and determine quantitative relationships between the scaled recipes. They will then create a table of equivalent ratios for 12, 18 and 36 brownies, create a double line plot comparing the number of brownies made to the amount of sugar used, create a graph comparing the number of brownies made to the amount of sugar used, and answer questions about these activities.

Task 1:

Part A (~20 minutes)

- Cut apart cards on page 3 and store in an envelope (each pair of students needs 1 set of cards)
- Assign pairs.
- Pass out student handout for Task 1 and explain. (students can cut arrow cards)
- Have students group the cards for the basic recipe: 12 brownies – cost: $2.35 – ingredients list begins with ½ cup butter. Groups should then continue the process of grouping cards and showing connections between recipes with arrow cards on their own.
- Be sure groups realize that the aim of the task is not to finish first, but to ensure that each person understands what they are doing and agrees with the placement of each card and arrow.
- Monitor progress. Discuss reflection questions.

Part B (~20 minutes)

- Have students create a table of equivalent ratios for the ingredients.
- Have students calculate the amount of each ingredient needed for 18 brownies.
- Have students calculate the amount of each ingredient needed for 36 brownies.
- Monitor progress.
- Discuss answers and various ways the students used to complete the table.

Part C (~20 minutes)

- Have students create a graph comparing the number of brownies made to the amount of sugar used.
- Have students create a double line plot comparing the number of brownies made to the amount of sugar used.
- Discuss reflection questions.

Task 2

- Share and review the handout to make sure that students understand the expectations.
- Have students work through answering the items on the handout.
- Review answers with a partner and have partners coach to the correct answer if needed.
- Debrief as a group about how they answered the items.

Task 3

- Share and review the handout to make sure that students understand the expectations.
- Have students work through answering the items on the handout.
- Review answers with a partner and have partners coach to the correct answer if needed.
- Debrief as a group about how they answered the items.

Task 4

- Share the handout and rubric with the students.
- Review the handouts to make sure that students understand the expectations.
- Have students work through answering the items on the handout.
- Assess the students using the rubric.

Bake Sale Project

(Student Handout)

The Student Council wants to raise money for charity, so they decided to sell brownies during an upcoming lunch time. Each member will make brownies to sell. They all want to make the same kind of brownies. The recipe they have will make a batch of 12 brownies. Some members say they can't make that many, and others want to make more than one batch.

Task 1: *(ratios)*

Part A:

- Match the number of brownies made, the cost of ingredients, and the recipe for each size batch.
- Use the arrow cards to show the relationships between cards.
- Complete the cards to accurately show how much of each ingredient is needed for each amount.
- Discuss reflection questions with partner.

Reflection Questions:

- ✓ Are there any arrows that you believe cannot be placed? Why or why not?
- ✓ Is there an amount of brownies which acts as a basis for the other calculations?
- ✓ Can you list the ways you scale the information for 12 brownies to 18 brownies?
- ✓ Which arrows have the same meaning?
- ✓ Which arrows have mathematically opposite meanings?

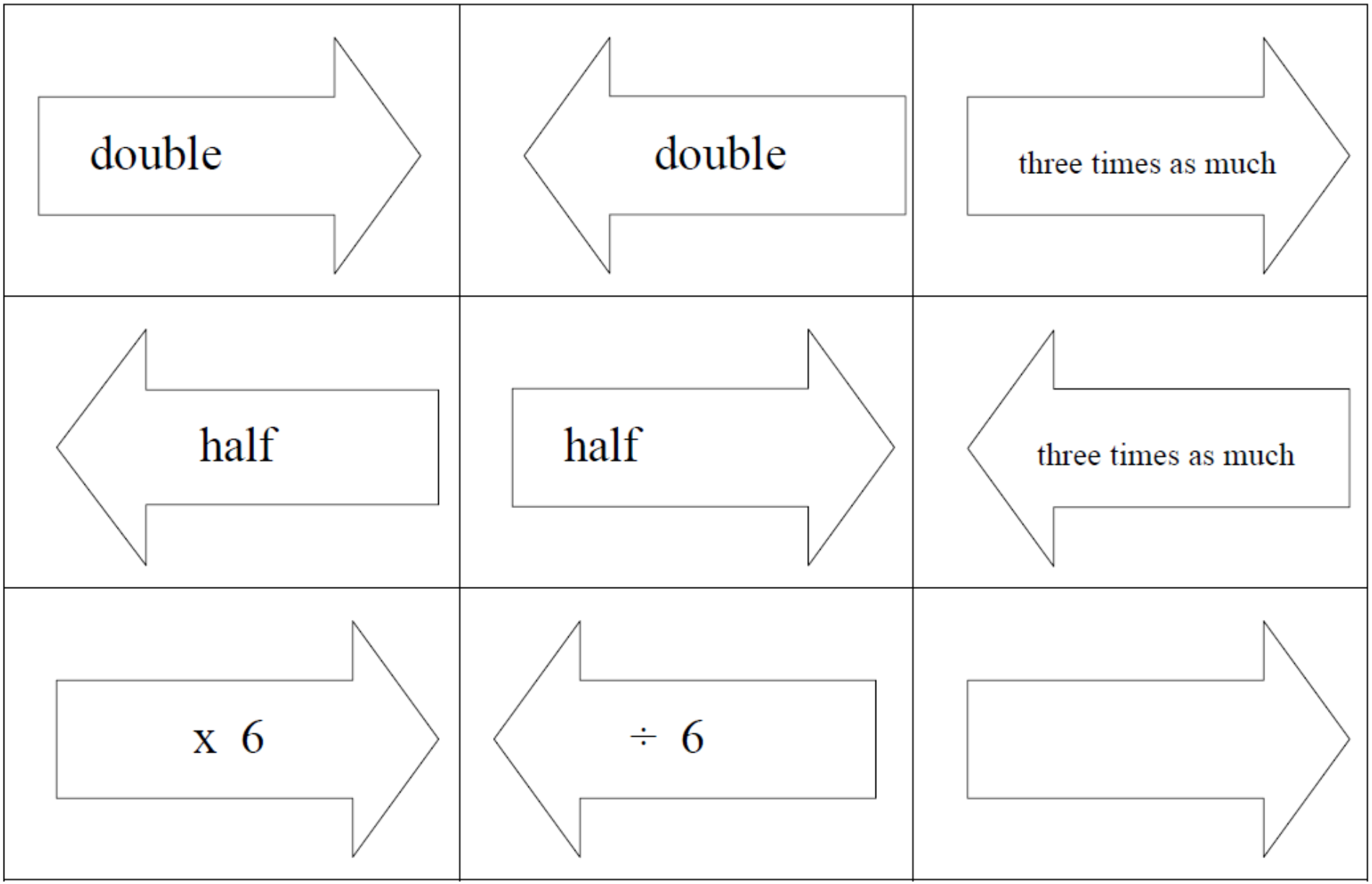
Part B: (Based on the original recipe for 12 brownies)

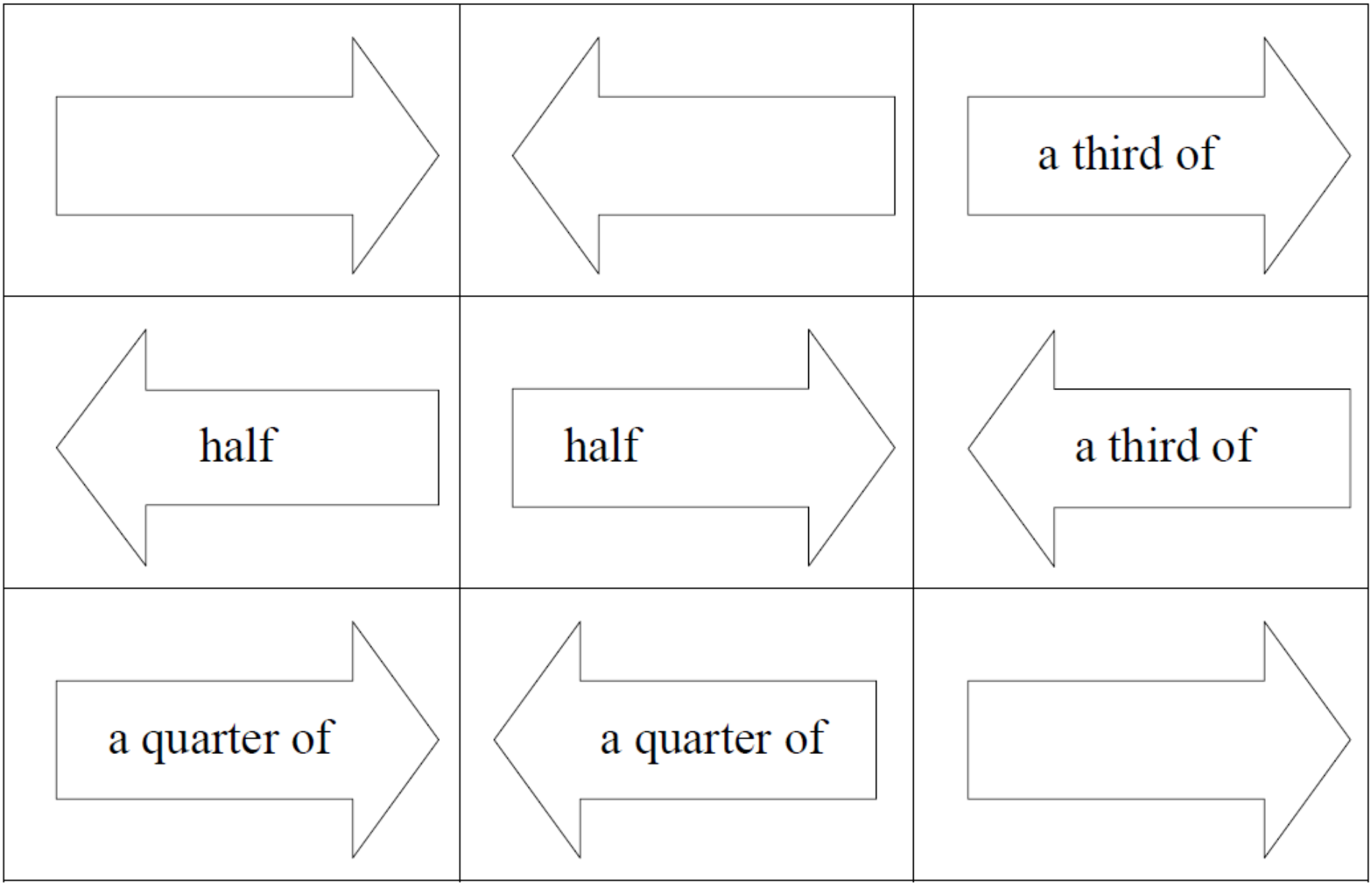
- Using the table below, create a table of equivalent ratios for the ingredients.
- Calculate the amount of each ingredient needed for 18 brownies.
- Calculate the amount of each ingredient needed for 36 brownies.

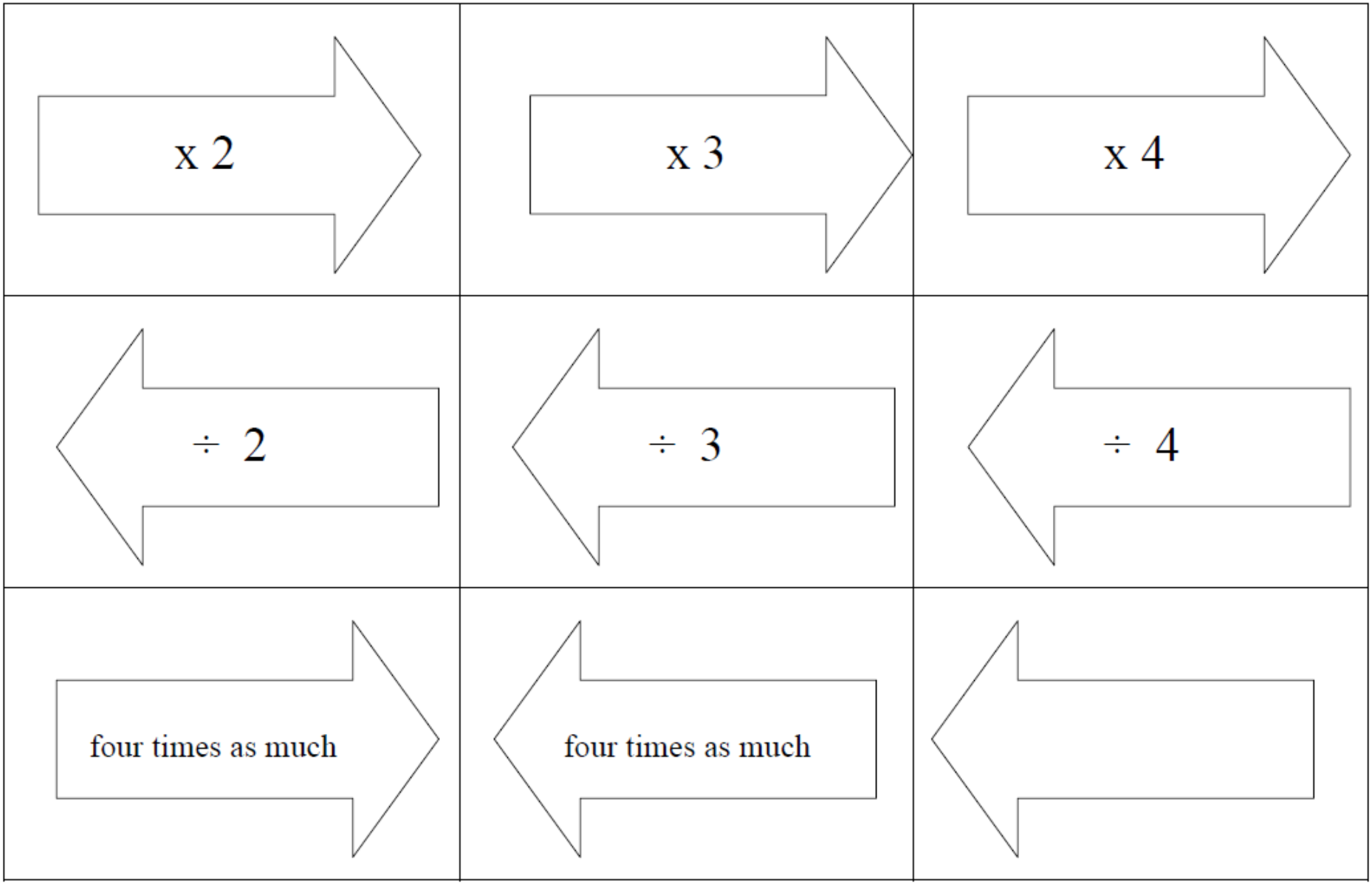
Ingredients	12 Brownies	18 Brownies	36 Brownies
Butter			
White sugar			
Egg			
Self-rising flour			
Unsweetened cocoa powder			
Salt			
Vanilla extract			

6 brownies	Cost: $7.10	Cost: $4.70	Ingredients: ___ cup(s) butter ___ cup(s) white sugar 1 eggs ___ cup(s) self-rising flour 2 Tablespoons and 2 teaspoons unsweetened cocoa powder ___ teaspoon salt ___ teaspoon vanilla extract
Cost: $2.35	12 brownies	Ingredients: 1/2 cup butter 1 cups white sugar 2 eggs 1/2 cup self-rising flour 1/3 cup unsweetened cocoa powder 1/4 teaspoon salt 1 teaspoon vanilla extract	Ingredients: 1 cup butter ___ cup(s) white sugar ___ egg(s) 1 cup self-rising flour ___ cup(s)unsweetened cocoa powder ___ teaspoon salt ___ teaspoon vanilla extract
36 brownies	Ingredients: ___ cup(s) butter ___ cups white sugar ___ egg(s) ___ cup(s) self-rising flour 1 cup(s) unsweetened cocoa powder 3/4 teaspoon salt ___ teaspoon vanilla extract	24 brownies	Cost: $1.18

6 brownies	12 brownies	24 brownies	36 brownies
Cost: $1.18	Cost: $2.35	Cost: $4.70	Cost: $7.10
Ingredients: ____ cup butter ____ cup white sugar 1 egg ____ cup self-rising flour 2 tablespoons and 2 teaspoons unsweetened cocoa powder ____ teaspoon salt ____ teaspoon vanilla extract	Ingredients: ½ cup butter 1 cup white sugar 2 eggs ½ cup self-rising flour 1/3 cup unsweetened cocoa powder ¼ teaspoon salt 1 teaspoon vanilla extract	Ingredients: 1 cup butter ____ cups white sugar ____ eggs 1 cup self-rising flour ____ cup unsweetened cocoa powder ____ teaspoon salt ____ teaspoons vanilla extract	Ingredients: ____ cups butter ____ cups white sugar ____ eggs ____ cups self-rising flour 1 cup unsweetened cocoa powder ¾ teaspoon salt ____ tablespoon vanilla extract

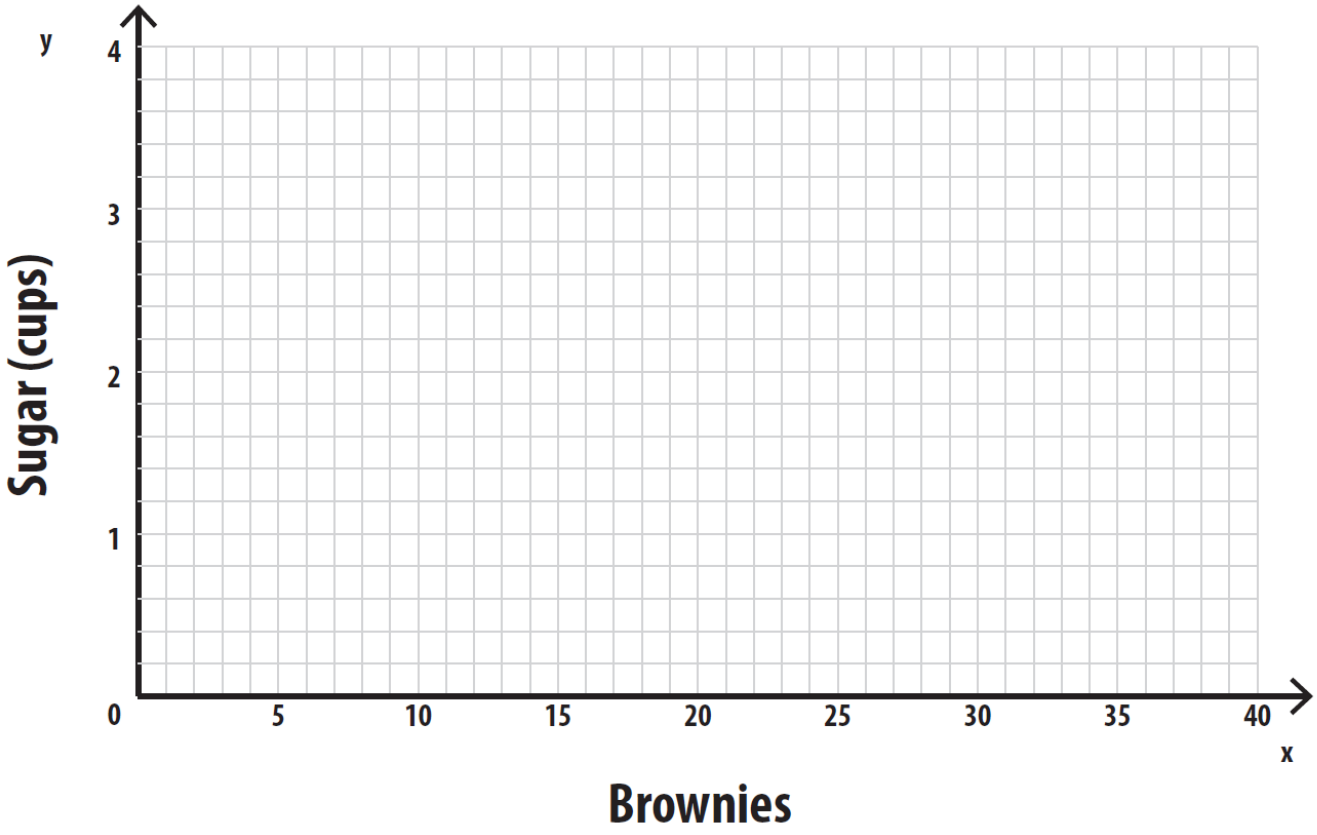

double
double
three times as much
half
half
three times as much
x 6
÷ 6


a third of
half
half
a third of
a quarter of
a quarter of


x 2
x 3
x 4
÷ 2
÷ 3
÷ 4
four times as much
four times as much

Part C: (Use information from *Parts A and B*)

- Using the grid below, create a graph comparing the number of brownies made to the amount of sugar used.



Reflection questions:

- ✓ Looking at your graph, how could you determine how many cups of sugar would be required to make 30 brownies?

- ✓ On the graph, which variable is the independent variable?

- ✓ Which is the dependent variable? How do you know?

- Create a double line diagram comparing the number of brownies made to the amount of sugar used.

Bake Sale Project

The Student Council wants to know how much money this venture will make for them. They need to know the unit cost per brownie and the unit price if they charge $4 per dozen of brownies. Using this information, you will have to calculate the amount of profit made on the sale of one brownie.

Task 2: *(unit rates)*

- Calculate the unit rate for the total cost of making a brownie. (unit cost)

- If Student Council charges $4 per dozen of brownies, calculate the unit price.

- Calculate the profit per brownie for student council. (unit profit)

- Should student council consider doing this project? Why or why not?

Bake Sale Project

Members of the student council want to know how long it will take to make several batches of brownies. It takes 17 minutes to prepare one batch (12 brownies) and 30 minutes to cook them.

Task 3: *(measurement conversion)*

- Calculate how many minutes it takes to make one batch (12 brownies).

- Someone wants to make two batches (24 brownies), and only has one pan. Calculate how many minutes it takes to make 24 brownies.

- Use ratio reasoning to convert the amount of minutes in the previous step to hours.

- Someone wants to make three batches (36 brownies), and only has one pan. Calculate how many minutes it takes to make 36 brownies.

- Use ratio reasoning to convert the amount of minutes in the previous step to hours.

- Display your findings in the table below.

Amount Brownies	Amount of Time in Minutes	Amount of Time in Hours
12 Brownies		
24 Brownies		
36 Brownies		

- Is it practical, make sense, for one person to bake more than three dozen brownies if they only have one pan? Explain your answer on the back.

Bake Sale Project

Student Council now wants to know how much money they will be making from the sales of the brownies. They are looking for this information in the form of a percent. Look back at the calculated profit amount in Task 2.

Task 4: *(percent)*

- Calculate the percentage of the profit made on each brownie compared to the cost. (profit percentage)

- Calculate the percentage of the profit made on each brownie compared to the price. (profit margin)

You are the president of the Student Council. You have to present the idea of making and selling brownies to the Council. In order to prepare for the meeting, you need to write notes that explain the math calculations used to determine the feasibility or reasonableness of this project.

Think through each bullet point to be sure you have all the information you need to clearly present this proposal to the Student Council.

- How did you use ratios and proportional thinking to determine the amount of each ingredient required for the different scaled recipes?
- Compare and contrast the line graph and the double line diagram.
- How did you calculate the unit cost and unit price?
- How did you use ratios and proportional thinking to convert the time measures?
- How did you determine if it was or was not practical for members to make more than three batches?
- How did you calculate the profit percentage and profit margin?

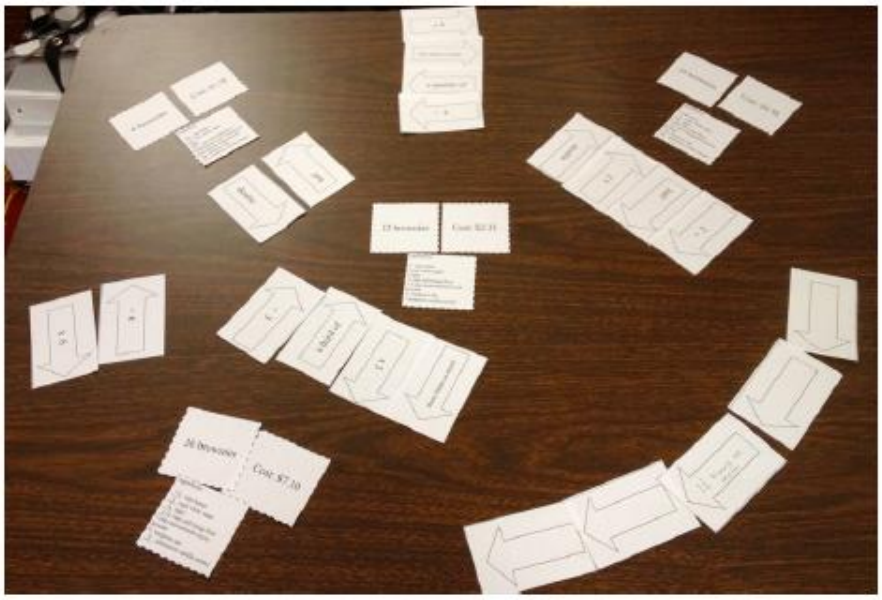
Answer Key

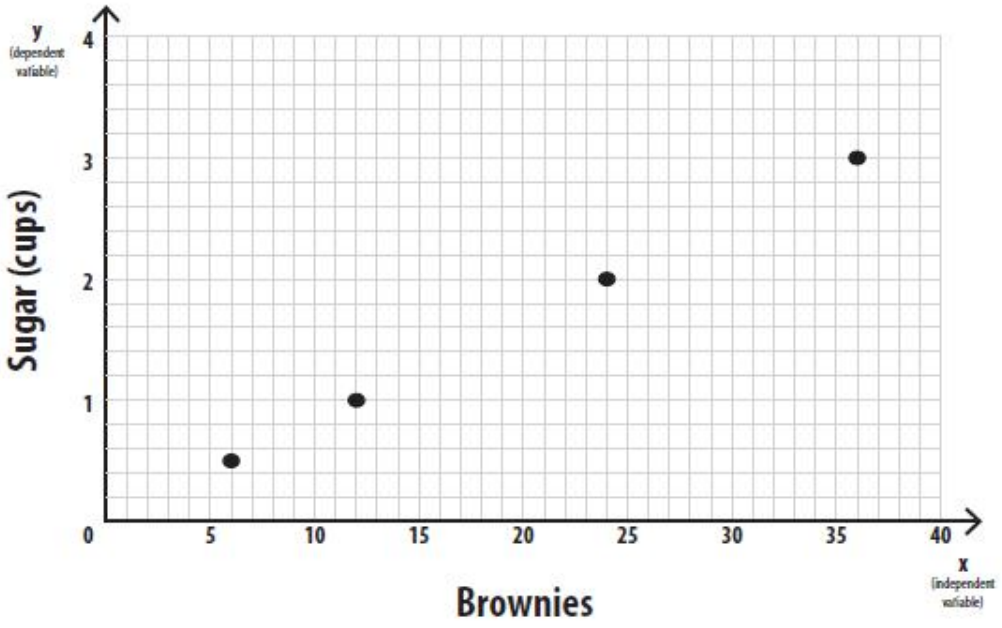
Task 1: Scaling Recipe

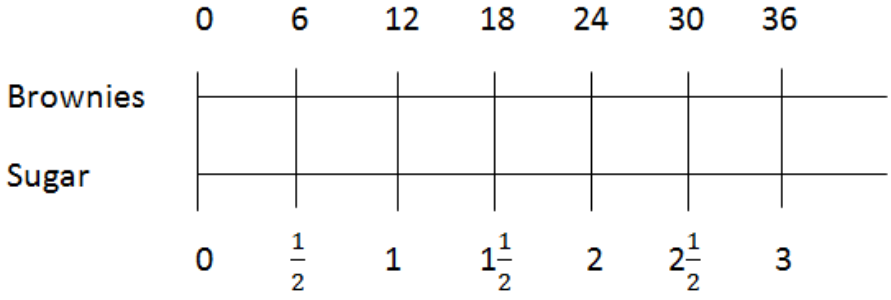
Solutions:

Size of batch	Cost	Ingredients
6 brownies	$1.18	1/4 cup butter 1/2 cup white sugar 1 egg 1/4 cup self-rising flour 2 tablespoons and 2 teaspoons unsweetened cocoa powder 1/8 teaspoon salt 1/2 teaspoon vanilla extract
12 brownies	$2.35	1/2 cup butter 1 cup white sugar 2 eggs 1/2 cup self-rising flour 1/3 cup unsweetened cocoa powder 1/4 teaspoon salt 1 teaspoon vanilla extract
24 brownies	$4.70	1 cup butter 2 cups white sugar 4 eggs 1 cup self-rising flour 2/3 cup unsweetened cocoa powder 1/2 teaspoon salt 2 teaspoons vanilla extract
36 brownies	$7.05	1½ cups butter 3 cups white sugar 6 eggs 1½ cups self-rising flour 1 cup unsweetened cocoa powder 3/4 teaspoon salt 1 tablespoon vanilla extract **OR** 3 teaspoons
18 brownies	$3.53	3/4 cup butter 1½ cups white sugar 3 eggs 3/4 cup self-rising flour 1/2 cup unsweetened cocoa powder $\frac{3}{8}$ teaspoon salt 1½ teaspoons vanilla extract
30 brownies	$5.86	1¼ cups butter 2½ cups white sugar 5 eggs 1¼ cups self-rising flour 3/4 cup + 1 tablespoon + 1 teaspoon unsweetened cocoa powder 1/2 teaspoon salt 2½ teaspoons vanilla extract

Below is a sample of possible arrangements of cards. Note that there are many possible arrangements. The teacher should closely monitor student work to be sure that the relationships identified are accurate.







Task 2: Unit Rates

Unit cost = $\frac{cost}{amount}$ = $\frac{\$2.35}{12}$ ~ \$.20 Costs ~ \$.20 per brownie

Unit price = $\frac{price}{amount}$ = $\frac{\$4.00}{12}$ ~ \$.33 Price ~ \$.33 per brownie

Profit = price – cost = \$4.00 - \$2.35 = \$1.65

Unit profit = $\frac{profit}{amount}$ = $\frac{\$1.65}{12}$ ~ \$.14

Task 3: Time Conversions

17 min + 30 min = 47 min 47 min x $\frac{1\,h}{60\,min}$ = $\frac{47}{60}$ h

(work may vary) 47 min + 47 min = 94 min 94 min x $\frac{1\,h}{60\,min}$ = $1\,\frac{34}{60}$ h

(work may vary) 47 min x 3 = 141 min 141 min x $\frac{1\,h}{60\,min}$ = $2\,\frac{21}{60}$ h

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(alternate interpretation)

17 min + 30 min = 47 min 47 min x $\frac{1\,h}{60\,min}$ = $\frac{47}{60}$ h

(work may vary) 47 min + 30 min = 77 min 77 min x $\frac{1h}{60\,min}$ = $1\,\frac{17}{60}$ h

(work may vary) 77 min + 30 min = 107 min 107 min x $\frac{1h}{60\,min}$ = $1\,\frac{47}{60}$ h

Amount brownies	Amount of time in minutes	Amount of time in hours
12 brownies	47	$\frac{47}{60}$
24 brownies	94	$1\,\frac{34}{60}$
36 brownies	141	$2\frac{21}{60}$

Task 4: Profit Calculations

profit = sales price – cost profit = \$4 – \$2.35 profit = \$1.65

profit percentage = $\frac{profit}{cost}$ profit percentage = $\frac{\$1.65}{\$2.65}$ = .6226 = 62.26%

profit margin = $\frac{profit}{price}$ profit margin = $\frac{\$1.65}{\$4.00}$ = .4125 = 41.25%
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Task 4 Scoring Guide

Meeting

- Explained completely how to use ratios and proportional thinking to determine the amount of each ingredient required for the different scaled recipes
- Accurately compared and contrasted the line graph and the double tape diagram
    - Which is better to use in which situations
    - What information can you get from each
- Explained how to calculate the unit cost
- Explained how to calculate the unit price
- Explained how to use ratios and proportional thinking to convert the time measures
- Explained how to determine if it was or was not practical for members to make more than three batches
- Accurately calculated profit percentage
- Explained how to calculate the profit percentage
- Accurately calculated profit margin
- Explained how to calculate the profit margin

Developing

- Meets 8 out of 10 proficient criteria

Beginning

- Meets fewer than 8 of the proficient criteria
- Task to be repeated after re-teaching

Comments: