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Money Math

Lessons for Life

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Lesson Description	Students hear a story about Tom, a middle-school student who wants to redecorate his bedroom. They measure the classroom wall dimensions, draw a scale model, and incorporate measurements for windows and doors to determine the area that could be covered by wallpaper. Students then hear more about Tom's redecorating adventure, learning about expenses, budget constraints, and trade-offs. For assessment, students measure their rooms at home. This lesson requires that students know how to measure, or a review may be necessary before teaching.
Objectives	Students will be able to: <ol style="list-style-type: none">1. measure in feet and calculate square feet.2. define area.3. calculate the area of squares and rectangles.4. define trade-offs, budget constraint, and expenses.5. identify trade-offs.
Mathematics Concepts	measurement, dimension, height, width, length, area, average
Personal Finance Concepts	trade-offs, budget constraint, expenses
Materials Required	<ul style="list-style-type: none">• a sign for each wall in the classroom (labeled A, B, C, and D) and masking tape (Prior to class, tape a letter sign to each wall in the classroom.)• a yardstick or steel tape measure and a sheet of paper for each group of students• one sheet of graph paper, one ruler, and one protractor for each student• transparency of Visual 2-1• calculators (optional)• copy of Activity 2-1 for each student• book of wallpaper samples or allow students to visit Internet sites• 2-3 sheets of 8½" x 11" paper, crayons, markers, and/or colored pencils for each student• 9" x 12" piece of oak tag for each student• scissors and glue or glue sticks

Wallpaper Woes

Time Required 2 - 3 days

Procedure**Get Ready**

1. Ask students if they're happy with the way their rooms at home are decorated. (*Answers will vary.*) Discuss the following.
 - a. If you like your room, what do you like? (*color, wallpaper, furniture, posters, pictures*)
 - b. If you don't like your room, what would you change? (*color, wallpaper, posters, pictures*) Why? (*paper is for younger kids, tired of the color or the wallpaper pattern, want posters and pictures related to new things*)
2. Explain that they will learn about a middle-school boy, Tom, who's unhappy with the way his room looks. Read the following story to the class.

My room still looks EXACTLY the way it did when I was ten. Can you believe it? I just can't stand it any longer. So, over the weekend, I asked Mom if I could change my room. I told her that I wanted to rip down the race car wallpaper and put up something else. Mom said I could change my room, but I couldn't put up strange stuff like skull and crossbones wallpaper. She also said I would have to figure out how much wallpaper I needed before we could shop for wallpaper. I said, "That's easy, I need enough to cover all the walls. The person at the wallpaper store will know." Mom replied, "Tom, the person at the store needs some help. You have to measure the walls and have some idea about how much wallpaper you need before you ever go to the store. This is where all those important math skills you've learned at school will come in handy." Let's talk about what you need to know."

Maybe this redecorating idea wasn't such a great one after all. Maybe I can just stick some posters over the race cars.

3. Discuss the following.
 - a. Do you think Tom should give up on the wallpaper idea? (*Answers will vary.*)

- b. Have any of you ever helped someone in your family buy wallpaper? (*Answers will vary.*)
 - c. What math skills will Tom need to buy wallpaper? (*measurement skills, understanding of dimensions, addition, subtraction, multiplication, and division skills*)
 - d. If we wanted to buy wallpaper for the classroom, what dimensions would we need? (*the height and width of the walls*) Why? (*These measurements allow us to determine the amount of wall space to be covered with wallpaper.*)
 - e. What is a baseboard, and why do you measure only to the baseboard and not to the floor? (*A baseboard is a strip of plastic or wood that fits on top of the floor and along the bottom of the wall. The wallpaper will stop at the baseboard. It won't cover the baseboard.*)
4. Divide students into groups of 3 or 4, and distribute a yardstick or steel tape measure and a sheet of paper to each group. Draw the table below on the board, and ask a member of each group to draw the same table on the sheet of paper. Allow time for groups of students to measure the walls in the room and record the measurements.

Wall	Height of Wall in Feet	Width of Wall in Feet
A		
B		
C		
D		

Note: If there are large errors in measurement of any wall, have the groups measure again.

Get Going

1. Have each group report its measurements. As each reports, record the measurements in the table on the board as in the sample table below.

Wall	Heights of Wall in Feet	Widths of Wall in Feet
A	8', 8'6", 8'3", 7'9", 8'	10', 10'6", 10', 10'3", 10'3"

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2. Point out any differences in measurements. Given differences, ask for a way to calculate a single height and width for each wall, given the data. Guide students to recognize that they can calculate an average height and width for each wall. Ask how to calculate the average height of the wall. (*Add all height measurements and divide by the number of groups.*) Allow time for students to compute the average heights. Then ask how to calculate the average width for each wall. (*Add all width measurements for each wall and divide by the number of groups.*) Have students compute the average widths.
3. Record averages on the board, and explain that when determining how much wallpaper to buy, experts recommend that people round to the next highest half foot or foot as needed. If necessary, round the averages calculated.

Graph It

1. Distribute rulers and graph paper. Have students draw a scale model of the room using the averages and a scale of 1" = 1'.
2. Have one group measure the windows, another measure the chalkboard, and another measure the doors, then record the measurements on the board. Tell students to use this information to complete the drawing.

Students should notice they need measurements of doors, windows, chalkboards and other areas that wouldn't be covered with paper.

Keep Going

1. Discuss the following.
 - a. How can these measurements be used to determine the amount of wallpaper needed for the room? (*by determining the area of wall space that must be covered*)
 - b. What is "area"? (*the measure of the interior region of a two-dimensional figure*)
 - c. What type of figure is the wall? (*rectangle*)
 - d. How do we determine the area of a rectangle? (*Answers will vary. Guide students to recall that they must multiply the length of the rectangle by the width.*)
 - e. What is the length of the front wall of the classroom? (*Answer depends on the classroom.*)

- f. What is the width of the front wall of the classroom?
(Answer depends on the classroom.)
 - g. Using your drawing, how can you determine the area of the front wall? *(count the number of squares inside the rectangle)*
 - h. Why is area expressed in square units — in this case, square feet? *(It is the sum of the squares inside a two-dimensional figure.)*
 - i. Multiplying height by width, how can you determine the total wall area in the room? *(Multiply the height of each wall by the width of each wall and add the four products.)*
2. Have students think of another way to do this problem that might take less time. Guide them to recognize that they could first add the width of all four walls and then multiply that sum by the sum of the height of the four walls. Have them calculate in this way and compare answers. Of course, the answers will be the same.
 3. Ask if they still have a problem to solve before they could purchase wallpaper.
 - a. What is it? *(The measurement includes the doors, windows, and chalkboards that shouldn't be covered with paper.)*
 - b. How can the measurements be corrected? *(by subtracting the area of the doors, chalkboards, and windows from the total area)*
 - c. Point out that each single roll of wallpaper contains 30 square feet of paper. How can the number of single rolls of wallpaper to buy to paper the walls in the classroom be determined? *(divide the area of the wall space by 30)*
 4. Read the following scenario to the class.

My mom and I figured out the wall area of my room. Then we went shopping at a huge hardware store. It had everything — wallpaper, paint, lamps, blinds, rugs, picture, and posters. I found some great wallpaper for only \$36 per single roll!

Wallpaper Woes

I gave the store clerk the area that Mom and I calculated. She explained that I would need at least 15 single rolls of paper. I also found two posters, a basketball lamp, some great soccer posters, and paint for the baseboards in my room.

My room was going to look fabulous, but my mom spoiled the whole thing with, you guessed it, MATH! First she asked, "Tom, if the wallpaper is \$36 a roll and you need 15 rolls, how much will that cost?" I replied, "Oh, Mom. I don't know. Don't you have a calculator?"

5. Pause and have students help Tom with this calculation. ($15 \times \$36 = \540) Continue reading the story.

"Tom," my mom said anxiously, "that's \$540 just for wallpaper. How much is the gallon of paint?" "Uh, \$25," I answered. "And, you want pictures, posters, a lamp, a bedspread, and blinds?" I think you should know that there's a limit to what I will spend," Mom explained.

Well, that ended my shopping spree. My mom told me that she was willing to spend a total of \$700 on the project. She said that \$700 was my budget constraint. How am I supposed to get everything I want? If I spend \$540 for wallpaper, I'll only have, um Does anyone have a calculator?

6. Pause and have someone help Tom with the calculation. ($\$700 - \$540 = \$160$)
7. Explain that Tom has a budget constraint of \$700. A **budget constraint** is a limit to the amount that may be spent. Because of this constraint, Tom can't have everything he wants. He must limit his expenses to \$700 or less. Explain that **expenses** are payments for goods and services.
8. Explain that Tom must make some choices. His mom suggested that first he should make a list of the expenses for his room. Display Visual 2-1 and explain that this is Tom's list. Discuss the following.

- a. How much more are Tom's expected expenses than his budget constraint? ($\$935 - \$700 = \$235$)
 - b. Suggest some changes that Tom might make. (*only buy one lava lamp, only buy one soccer poster and frame, wait and ask for the black light and black light poster as a holiday gift, eliminate the basketball hoop*)
9. Point out that Tom must make some trade-offs. **Trade-offs** involve giving up some of one thing to get more of something else. If Tom buys more expensive wallpaper, he must give up some of the other things that he wants. Continue the story.

"Look, Mom," Tom said in a reasonable voice, "I'm perfectly willing to give up the blinds and the bedspread. After all, our apartment is on the second floor, so I don't need blinds. I hate to make my bed, so why have a bedspread?"

Sounding exasperated, Mom responded, "Tom, we need blinds or curtains on the windows. That's one of the landlord's rules, and I want the apartment to look nice. You may not like making your bed; however, I like it when your bed is made, so the bedspread is a must. Do you have other suggestions?"

Tom replied, "I could buy one lava lamp instead of two and one soccer poster and frame instead of two. I could wait and ask for the black light and black light poster for a holiday or birthday gift. I could do the same with the basketball hoop. I guess I have to have a trash can, right?" Tom's mother nodded. "Well then, that's all I can think of."

"Okay, Tom, how much would you save if you did all that?" Tom's mom asked.

"Gosh, Mom, are you sure you didn't bring a calculator?"

10. Pause and ask how much Tom would save with all those changes. ($\$22.50$ by eliminating a lava lamp, $\$37.50$ by eliminating one soccer poster and frame, $\$15$ by eliminating the basketball hoop, and $\$30$ by eliminating the black light and black light poster for a total of $\$105$) Discuss the following.

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- a. At first, what trade-off is Tom willing to make? (*He is willing to give up the bedspread and blinds in order to have the wallpaper.*)
- b. What does his mom think of this? (*She isn't willing to make the same trade-off.*)

11. Continue the story.

"Mom, I figured it out. If I make all the changes we discussed, I can save \$105, but that still isn't enough. Maybe I should just stick with the race cars," Tom said dejectedly.

"Tom, I have a better idea. You know, you chose a designer wallpaper," she said.

"Yes, isn't it great? The designer's name is Tom, too," Tom said.

"Well, that's not such a good reason to buy the paper, and that wallpaper is much more expensive than some others. Plus, that paper has a large pattern repeat. That's why you must buy 15 rolls of paper. You need more paper in order to match the pattern as the paper is hung. It would be a good idea if you were a wiser buyer. There are many other books containing wallpaper samples. Some might be just as nice but cost less. Why don't you spend a little more time looking? Perhaps you should think carefully about what's really important to you. Is the designer wallpaper more important than the other things you want for your room?"

12. Ask why Tom's mom was right. (*Tom hadn't considered all available options.*) Explain that after Tom looked for a while, he found wallpaper for only \$15 a single roll and the pattern repeat was smaller, so he only needed 14 rolls. He decided he would rather have the less expensive wallpaper in order to have more of the other items he wanted. Discuss the following.
 - a. What trade-off is Tom willing to make now? (*He's willing to give up the designer wallpaper in order to have the other items he wants for his room.*)

- b. How much would the new wallpaper selection cost?
(14 rolls x \$15 = \$210)

13. Display Visual 2-1 again, explaining that Tom's expenses have changed. Ask for alternative approaches to calculating a new total. Write student approaches in sentences on the board. Then have students convert the sentences as mathematical statements, using symbols and parentheses as needed.

Subtract \$540 from \$935 and add \$210 to the difference.

$$(\$935 - \$540) + \$210 = \$605$$

Add all numbers substituting \$210 for \$540.

$$(45 + 25 + 75 + 15 + 210 + 100 + 90 + 10 + 20 + 15) = \$605$$

Subtract \$210 from \$540 and subtract the difference from \$935.

$$\$935 - (\$540 - \$210) = \$605$$

Graph It

Using a computer or pencil, paper, protractor or ruler, have students create a bar or circle graph showing the portion of Tom's decorating budget represented by each expenditure.

Wrap It Up

Review lesson content with the following questions.

1. What is area? (*the measure, in square units, of the interior region of a two-dimensional figure*)
2. What's the formula for calculating the area of a rectangle?
($A = lw$)

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3. Sue's parents told her that she could buy new clothes, but her budget constraint was \$125. What does that mean? (*Sue must limit the amount that she spends to \$125 or less.*)
4. What is an expense? (*an amount spent to purchase goods or services*) Give an example of an expense you had this week. (*lunch, video rental, candy*)
5. Trade-offs involve giving up a little of one thing in order to get a little more of something else. If your parents said that you could have \$5 more allowance a week for watching your younger brother after school on Fridays for one hour, what trade-off are they asking you to make? (*give up one hour of free time on Fridays in order to have \$5 extra to spend/save*)

Check It — Assessment

1. Have students draw a scale model of their bedroom or another room in their homes, using graph paper and a ruler. The scale should be 1" = 1'. The model should illustrate walls, doors, and windows. Using the scale model, students should determine the amount of wallpaper needed to paper the room.
2. Distribute Activity 2-1 to each student, review instructions, and have students complete the worksheet.

Going Beyond — A Challenge Activity

1. Ask what a pattern repeat is. After a few answers, explain that on most wallpaper, there is something called a pattern repeat. This is the vertical distance between one point on a pattern design to the identical point vertically. This pattern repeat is an integral part of the design. If the pattern repeat is large, the consumer must buy extra paper to match the pattern. If the pattern is random or the repeat pattern is small, the consumer won't need to buy as much extra paper.
2. Tell students that they will design their own wallpaper. The paper must have a straight-across or a drop-match pattern. They must design enough paper so that another student can cut the paper into strips and cover a 9" x 12" area with it.

Have students visit a web site to see examples of: drop match, straight-across match, and random match.

www.wallcovering.org/patterns.html

or search for wallpaper pattern examples

As an alternative, bring in a book of sample wallpaper so students can look at different types of pattern repeats.

3. Distribute 2-3 sheets of $8\frac{1}{2}$ " x 11" paper, crayons, scissors, markers, and colored pencils. Tell students to draw patterns, using a landscape orientation. Have them carefully cut the sheets into $2\frac{3}{4}$ " x $8\frac{1}{2}$ " strips. When finished, have students trade designs. Give each student a piece of 9" x 12" oak tag (or an $8\frac{1}{2}$ " x 11" sheet of paper) and a glue stick or glue. Tell them to match the strips as though they were hanging paper by gluing the strips on the oak tag with a portrait orientation.

Assessment

Read the paragraphs below and answer the questions that follow.

Kristen wants to buy a new video game with a price of \$65. Kristen receives \$15 for an allowance each week. She has been trying to save \$5 each week for the last 5 weeks. So far, she has \$5. Kristen is very frustrated. She can't figure out what she is doing wrong.

She must use her allowance for school lunches as well as for any entertainment or activities during the week. Last week Kristen paid \$1.50 each school day for lunch. Kristen's neighbor said that he would pay Kristen \$10 to rake leaves on Saturday afternoon, but Kristen wanted to go to the movies with her friends. The ticket for the matinee was \$4.00, and she spent another \$2.50 on popcorn and soda. While she and her friends waited for their ride home, she spent \$1.00 playing video games at the arcade in the theater.

1. What are expenses? In the space below, write a list of Kristen's expenses for last week.

2. Kristen chose to go to the movies with her friends rather than rake leaves. She gave up earning some extra money to spend more time with her friends. What is this called?

3. Recommend some simple changes Kristen could make to save more of her allowance.

4. Kristen and her family are going on vacation. Her mother told her that she could spend \$30 on souvenirs, video games, and miniature golf during the week. What is Kristen's budget constraint for the trip?

Tom's Expenses

2 lava lamps	\$ 45
one gallon of high-quality paint	25
2 soccer posters with frames	75
over-the-door basketball hoop	15
15 single rolls of wallpaper	540
bedspread	100
2 blinds for windows	90
one black light poster	10
one black light	20
black-light trash can	15
	<hr/>
TOTAL	\$ 935