

Painting a Room

Goals

- Apply reasoning about rates and percentages to calculate the material, cost, and time needed to complete a painting project, and explain the solution methods.
- Determine what information is needed to solve a problem about painting a room.

Learning Target

I can apply what I have learned about unit rates and percentages to predict how long it will take and how much it will cost to paint all the walls in a room.

Lesson Narrative

In this culminating lesson, students apply and integrate many concepts and skills from the past three units to estimate and calculate various quantities in a home improvement context.

In the *Warm-up*, students notice and wonder about features of the four walls of a bedroom. This is followed by an activity in which students calculate the paintable area of the walls. This activity is marked optional because area calculation is not the focus of the current unit. Next, students estimate the amount of paint needed to cover the walls and then compute the associated costs. In the final activity, students find the amount of time necessary to paint all the walls given information about the rate of painting.

Along the way, students reason about areas of two-dimensional figures, solve problems involving ratios and rates, and work with percentages. Though there is a single measurement for the total wall area to be painted, the amount of paint needed will depend on some assumptions and decisions that students make about the work involved. As students apply the mathematics that they know and make assumptions to solve real-world problems, they engage in aspects of mathematical modeling.

Depending on instructional choices made, this lesson could take one or more class meetings. For instance, more time would be needed if students calculate the wall area (rather than using a given area), research paint costs and deals in local stores, or create a display for sharing their solutions.

Access for Students with Diverse Abilities

- Representation (Activity 1)

Access for Multilingual Learners

- MLR6: Three Reads (Activity 1)

Required Preparation

Activity 2:

To give students a better sense of the units of volume used in this activity, consider bringing examples of quart-size and gallon-size paint containers, if available.

Lesson Timeline

5
min

Warm-up

25
min

Activity 1

20
min

Activity 2

15
min

Activity 3

Painting a Room

Student Learning Goal

Let's see what it takes to paint a room.

Warm-up

Getting Ready to Paint

5 min

Activity Narrative

This *Warm-up* familiarizes students with the context of painting the walls of a room, which is used throughout this lesson. Students are given drawings of the four walls of a bedroom. They are prompted to think about what information they would need if they were to paint all the walls and buy the paint.

Launch

Display the drawings of the four walls for all to see. (If possible, provide access to a color version of the drawings to support students in making sense of the features of the room.) Read aloud the statement and the question (or invite students to do so). Give students 1–2 minutes of quiet think time.

Inspire Math

Climbing Mount Everest video



Go Online

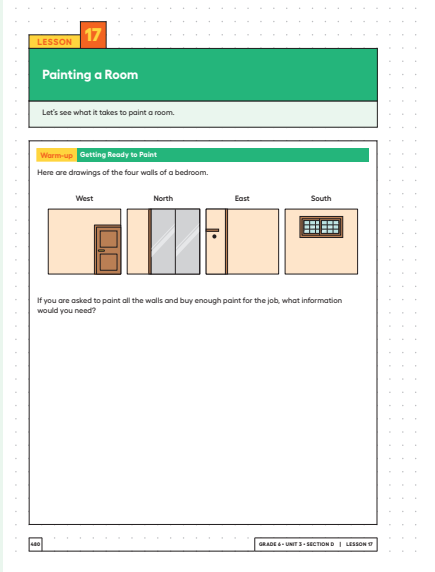
Before the lesson, show this video to introduce the real-world connection.

ilclass.com/1/614230

Please log in to the site before using the QR code or URL.

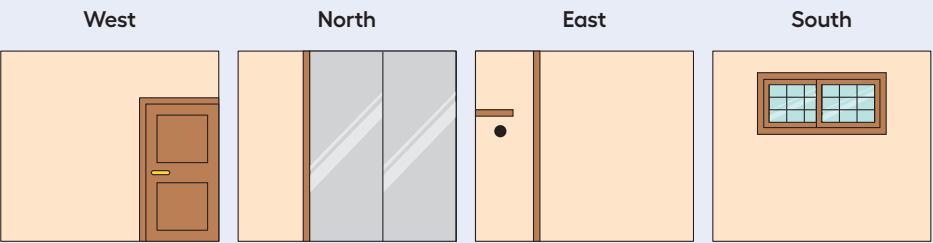


Student Workbook



Student Task Statement

Here are drawings of the four walls of a bedroom.



If you are asked to paint all the walls and buy enough paint for the job, what information would you need?

Sample responses:

- What are the measurements of each wall?
- What are the measurements of the door and windows?
- How much area can one bucket of paint cover?
- How many coats of paint are needed?
- Will all the walls be the same color?
- What is the budget?

Activity Synthesis

Invite students to share the information they would need and questions they would ask. Consider recording and displaying their responses for all to see. If any students have had experience painting a room, invite them to share any considerations that may be important but have not been mentioned.

Tell students that they will think more about the area to be painted, the necessary amount of paint, and the time needed to paint the walls of a bedroom.

Access for Multilingual Learners
(Activity 1, Launch)
MLR6: Three Reads.

Keep books or devices closed. Display only the first sentence and the floor plan, without revealing other information about the room or the question. "We are going to read the given floor plan and information 3 times."

→ After the 1st read:

"Tell your partner what this situation is about."

→ For the 2nd read: Reveal and read the descriptions of the room and the job.

"List the quantities. What can be counted or measured?"

→ For the 3rd read: Reveal and read the question(s). Ask,

"What are some ways we might get started on this?"

Advances: Reading, Representing

Activity 1: Optional
All the Walls
25
min

Activity Narrative

In this activity, students apply their understanding of area from an earlier unit to find the total wall area to be painted. Later in the lesson, they will use this area to determine the amount of paint and the amount of time needed to apply two coats of paint.

To calculate the total wall area, students rely on a floor plan of a bedroom, a list of its features and measurements, and the drawings that show the view of each wall (from the *Warm-up*).

Because of the variations in the bedroom's walls and features, keeping track of the shapes to be included or excluded from the area calculation may be challenging to students. For example, students may need to be reminded to:

- Include the 3 square feet of wall space above the door.
- Account for the south face of the short wall on the west end of the closet (which accounts for 4 square feet of paintable surface area).
- Account for the area above or below the window.

As students work, notice those who organize their work methodically and those who may need organizational support.

Launch

Display the floor plan of the bedroom for all to see. Invite students to share what they know about floor plans. Clarify that it is a drawing that shows a view from above.

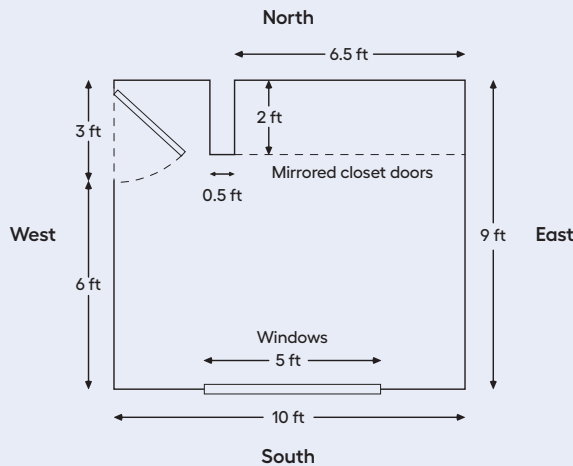
Next, display the drawings of the four walls, and direct students' attention to features such as the door, window, and closet. Invite students to look at where or how each feature is represented in the floor plan. Give students a minute to identify correspondences across the two representations of the bedroom. Invite students to share their observations afterward. Consider color coding corresponding features in the 12 two drawings as students explain.

Then, read aloud the information in the activity (or invite students to do so). Give students a minute to discuss their understanding of the task with a partner and to note anything they wish to clarify. Answer any questions that students might have.

Give students 6–8 minutes of quiet work time and then time to discuss their work with their partner. Encourage students to label the drawing of each wall with relevant measurements to support them in finding areas. Also urge them to organize their calculations so that all surfaces to be painted are accounted for and all non-painted surfaces are excluded.

Student Task Statement

Here is the floor plan for the bedroom that needs to be painted.



Here is some information about the room and the job:

- All the walls need to be painted, including inside the closet.
- The west wall has a door that is 3 feet wide and 7 feet tall.
- The north wall has a closet with floor-to-ceiling mirrored doors.
- The south wall has windows that are 5 feet wide by 3 feet tall.
- The doors and windows do not need to be painted.
- The short wall on one end of the closet needs to be painted on three sides.
- The ceiling in this room is 8 feet high.
- All of the corners are right angles.

How many square feet need to be covered with paint?

300 square feet

Show your reasoning. Organize your work so that it can be followed by others.

Sample reasoning:

- West wall: 51 square feet. Area of the wall subtracted by area of the door: $(9 \cdot 8) - (3 \cdot 7) = 72 - 21 = 51$
- North wall: 76 square feet. Area of the back wall of closet and the wall between the door and short wall: $(6.5 \cdot 8) + (3 \cdot 8) = 52 + 24 = 76$
- Short wall: 36 square feet. Area of 2 wider sides and one narrow side of the wall: $2 \cdot (2 \cdot 8) + (0.5 \cdot 8) = 32 + 4 = 36$
- East wall: 72 square feet. $9 \cdot 8 = 72$
- South wall: 65 square feet. Area of the wall subtracted by area of the window: $(10 \cdot 8) - (5 \cdot 3) = 80 - 15 = 65$
- The sum of all areas: $51 + 76 + 36 + 72 + 65 = 300$

Access for Students with Diverse Abilities (Activity 1, Student Task)

Representation: Access for Perception.

Begin by discussing how to find the paintable area of one wall to support understanding of the context. As students may not have personal experience with painting, demonstrate thinking through which sections of the wall need to be painted and which do not.

Supports accessibility for: Conceptual Processing, Language

Student Workbook

All the Walls

Here is the floor plan for the bedroom that needs to be painted.

Here is some information about the room and the job:

- All the walls need to be painted, including inside the closet.
- The west wall has a door that is 3 feet wide and 7 feet tall.
- The north wall has a closet with floor-to-ceiling mirrored doors.
- The south wall has windows that are 5 feet wide by 3 feet tall.
- The doors and windows do not need to be painted.
- The short wall on one end of the closet needs to be painted on three sides.
- The ceiling in this room is 8 feet high.
- All of the corners are right angles.

How many square feet need to be covered with paint? _____

Show your reasoning. Organize your work so that it can be followed by others.

Activity Synthesis

Select a few students to share their strategies and solutions for the total wall area. If possible, record their calculations near the relevant parts of the drawings, and display them for all to see. Discuss any disagreements or questions about the calculations or approaches. Make sure that the class agrees on the total square feet before students proceed to think about the amount of paint and time needed for the job in upcoming activities.

Activity 2**Shopping for Paint****20**
min**Activity Narrative**

In this activity, students apply their understanding of rates and percentages to determine the amount of paint needed to paint a bedroom, the costs for buying paint in different-size containers, and how discounts affect the costs. Students use the area found in the “All the Walls” activity as the basis for their calculation. If the class did not complete that activity, the total wall area (300 square feet) will need to be provided.

There are several combinations of can sizes that would be enough for two coats of paint on all the walls. Some students might consider the possibility of spills or errors and opt to buy a larger quantity. This is perfectly valid as long as students can support and explain their choices. In making assumptions and connecting calculations to real-life considerations, students practice modeling with mathematics.

Launch

Tell students that if they are painting the bedroom, they would need to determine how much paint is needed and how much it would cost. Remind students (or tell them, if they did not do the “All the Walls” activity) that the paintable wall area of the bedroom is 300 square feet.

Explain that paint can be purchased in 1-quart or 1-gallon containers. Ask students how the two units of volume relate to one another. If needed, remind students that there are 4 quarts in a gallon.

Arrange students in groups of 2. Give students 5–6 minutes of quiet work time on the first two questions and then time to discuss their responses and reasoning with their partner. Then, pause for a brief whole-class discussion.

Invite students to share some possible combinations of container sizes to purchase to have enough paint for the project. Make sure students recognize that the wall area of 300 square feet needs to be doubled because two coats of paint are required. Then, ask students to share the cost of each option they mentioned.

Explain that hardware stores would sometimes have a sale on paint. Tell students that they will now look at how the paint costs would change when some discounts are applied. Give students a few minutes to work on the last question independently or with their partner.

Student Task Statement

1. An ad for paint reads: “Just 2 quarts covers 175 square feet!” If you need to apply two coats of paint on all the walls, how much paint do you need to buy?

7 quarts

Sample reasoning: The paint needs to cover $2 \cdot 300$ or 600 square feet. Since 2 quarts covers 175 square feet, 6 quarts covers 175 $\cdot 3$ or 525 square feet, which is not enough. Another quart is needed to cover 600 square feet.

2. Paint can be purchased in 1-quart or 1-gallon containers. The paint chosen for the room costs \$12 a quart and \$38 a gallon.

- a. Which container sizes and how many could you buy to have enough paint for the room? Name at least two options.

Purchasing options:

- 7 quart-size containers
- 2 gallon-size containers
- 1 gallon-size and 3 quart-size containers

- b. Which of your options would cost the least?

1 gallon-size and 3 quart-size containers

Show your reasoning.

Sample reasoning:

- 7 quarts: $7 \cdot (12) = 84$
- 2 gallons: $2 \cdot (38) = 76$
- 1 gallon and 3 quarts: $38 + 3 \cdot (12) = 38 + 36 = 74$

Pause for a whole-class discussion.

3. The hardware store is having a sale: 20% off of quart-size paint and 30% off of gallon-size paint.

- a. With the sale, how much would you save with each option?

The savings on each quart-size container is $(0.2) \cdot (12)$ or \$2.40.

The savings on a gallon-size container is $(0.3) \cdot (38)$ or 11.40.

- For 7 quarts, the savings is $7 \cdot (2.40)$ or \$16.80.
- For 2 gallons, the savings is $2 \cdot (11.40)$ or \$22.80.
- For 1 gallon and 3 quarts, the savings is $11.40 + 3 \cdot (2.40)$, or $11.40 + 7.20$, which is \$18.60.

- b. Would the option you chose earlier still be the cheapest?

Show your reasoning.

Sample response: No, with the discount, buying 2 gallon-size cans would be the cheapest. $76 - 22.80 = 53.20$, which is less than the other two discounted options, \$67.20 (for 7 quarts) and \$55.40 (for 1 gallon and 3 quarts).

Student Workbook

Shopping for Paint

1. An ad for paint reads: “Just 2 quarts covers 175 square feet!” If you need to apply two coats of paint on all the walls, how much paint do you need to buy?

2. Paint can be purchased in 1-quart or 1-gallon containers. The paint chosen for the room costs \$12 a quart and \$38 a gallon.



- a. Which container sizes and how many could you buy to have enough paint for the room? Name at least two options.

- b. Which of your options would cost the least? Show your reasoning.

Pause for a whole-class discussion.

Student Workbook

Shopping for Paint

3. The hardware store is having a sale: 20% off of quart-size paint and 30% off of gallon-size paint.

- a. With the sale, how much would you save with each option?

- b. Would the option you chose earlier still be the cheapest? Show your reasoning.

Student Workbook

2 Shopping for Paint

Are You Ready for More?

Check the prices for a quart and a gallon of interior paint at a local store or online. Look for discounts or deals, but also consider possible differences in quality. Some paints may be more expensive because they are of higher quality.

1

When would it make sense to pay more for better paint? When would it make sense to buy the least expensive paint?

2

What is the best deal you can find for putting 2 coats of paint on the walls of this bedroom?

GRADE 6 • UNIT 3 • SECTION D | LESSON 17

Are You Ready for More?

Check the prices for a quart and a gallon of interior paint at a local store or online. Look for discounts or deals, but also consider possible differences in quality. Some paints may be more expensive because they are of higher quality.

1. When would it make sense to pay more for better paint? When would it make sense to buy the least expensive paint?
- Sample response: It'd make sense to pay more for better paint if it is for the walls of an important room or if the paint needs to hold up for a long time. Cheaper paint would make sense for walls in less-important spaces or if we know it will be repainted frequently.
2. What is the best deal you can find for putting 2 coats of paint on the walls of this bedroom?

Answers vary.

Activity Synthesis

Focus the discussion on how students found the amounts of savings in each option given the discounts. Invite several students or groups to share their approaches. Highlight strategies that allow for efficient computation of 20% and 30% of the original prices.

Make sure students see that the cheapest option after discount may vary, depending on which purchasing options students listed initially. (For example, if students listed 7 quart-size containers and 1 gallon container plus 3 quarts as two purchasing options, the latter would be the cheaper of the two. If they also included 2 gallon-size containers, this would be the cheapest after discount.)

Activity 3: Optional
Time to Paint

15 min

Activity Narrative

In this activity, students solve problems about the amount of time to paint an area, using their understanding of ratio, rate, and percentage along the way. Each problem can be approached in a number of ways, giving students additional opportunities to model with mathematics.

The last question requires students to consider the rate of painting of one person, determine the time needed to complete the painting at that rate, and find the difference between that amount of time and 150 minutes (the time it takes 2 people to do the work). No scaffolding is given, prompting students to make sense of problems and persevere in solving them.

Launch



Keep students in groups of 2. Give students 2–3 minutes of quiet work time for the first question. Ask them to discuss their response and reasoning with their partner before moving on to the second question.

Student Workbook

3 Time to Paint

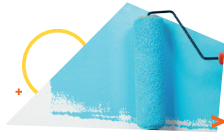
After buying the supplies, you start painting the east wall. It takes you 96 minutes to put two coats of paint on that wall (not including a lunch break between the two coats). A friend stops by to see how you are doing.

1 Your friend comments that you are 25% finished with the painting. Are they correct? Explain your reasoning.

2 Your friend offers to help you with the rest of the painting. It takes the two of you 150 more minutes of painting time to finish the entire room. How much time did your friend save you? Show your reasoning.

Learning Targets

1 I can apply what I have learned about unit rates and percentages to predict how long it will take and how much it will cost to paint all the walls in a room.



Student Task Statement

After buying the supplies, you start painting the east wall. It takes you 96 minutes to put two coats of paint on that wall (not including a lunch break between the two coats). A friend stops by to see how you are doing.

1. Your friend comments that you are 25% finished with the painting. Are they correct? Explain your reasoning.

They are incorrect but only slightly off.

Sample reasoning:

- 25% of 300 square feet is 75 square feet. The east wall is 72 square feet in area. This is 3 less than 75, so the painting is less than 25% done. (3 is 1% of 300, so the painting is 24% done.)
- $\frac{72}{300} \cdot 100 = 24$, so the painting is 24% done, not 25%.

Building on Student Thinking

Some students may use approximation when answering the first question (saying that the east wall does account for about 25% of the painting job), which would affect their calculations for the second question. Ask these students if the area of the east wall is exactly 25% of the total area. If they say that it is less than 25%, urge them to find out precisely how much less.

2. Your friend offers to help you with the rest of the painting. It takes the two of you 150 more minutes of painting time to finish the entire room.
How much time did your friend save you?

154 minutes

Show your reasoning.

Sample reasoning:

- If 72 square feet takes 96 minutes to paint, then 300 square feet takes 400 minutes to paint.

wall area (square feet)	time (minutes)
72	96
6	8
300	400

$400 - 96 = 304$, so the unpainted area will take 304 minutes to paint. Doing it in 150 minutes means saving 154 minutes.

- To paint 72 square feet in 96 minutes is to paint each square foot in $1\frac{1}{3}$ minutes. $300 - 72 = 228$, so there are 228 square feet left to be painted. This would take $228 \cdot 1\frac{1}{3}$ or 304 minutes. $304 - 150 = 154$
- It takes 96 minutes to paint 24% of the wall area, which means 4 minutes for 1% and $76 \cdot 4$ or 304 minutes for 76% of the wall area. 150 is 154 less than 304.

Activity Synthesis

Invite students who thought their partner used a particularly efficient strategy on the first question to share. If most students reasoned that 3 square feet is 1% and then scaled it to 72 square feet to correspond to 24%, discuss how the problem can be solved more directly by calculating $\frac{72}{300} \cdot 100$.

Then, discuss the strategies used to answer the last question, in particular how students found the amount of painting time if they were painting the remaining walls on their own. Students are likely to start with one of two rates:

- 96 minutes to paint 72 square feet of area
- 96 minutes to paint 24% of the total area

Select students who used each rate to share. If one of these rates is not mentioned, ask students to discuss how it might be used to solve the problem.