Primary 6



MINISTRY OF EDUCATION AND TECHNICAL EDUCATION

Math Term 2

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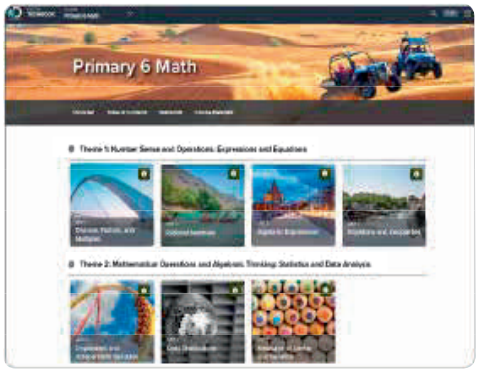
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Dear Parent/Guardian,



Welcome to Primary 6 Mathematics Techbook™! This comprehensive program inspires students to make sense of the world around them and to think and act like mathematicians. Throughout the digital and print program, students learn to reason mathematically, communicate using mathematical language, ask meaningful questions, solve complex problems, and work collaboratively with peers.

Primary 6 Mathematics Techbook was designed and written to teach to the Ministry of Education and Technical Education (MOETE) Primary 6 mathematics standards. The structure of Primary 6 Mathematics Techbook represents the Ministry's shifts in the Framework for Education 2.0, specifically focusing on accessing new and prior knowledge, building contextual understanding and procedural fluency, and making connections across mathematics to support application of skills and concepts. To help students make sense of mathematical content, the program also integrates a thematic approach and a variety of real-world scenarios.

Primary 6 Mathematics Techbook challenges students to build on what they learned in previous grades, applying concepts and skills in new ways. Students also learn new and complex concepts and skills that prepare them for the challenges of Preparatory 7 and beyond. Primary 6 students assume greater responsibility for their own learning and are encouraged to seek opportunities to apply the mathematics they are learning in the world around them.

The major work of Primary 6 includes ratios and proportional relationships, rational numbers (including operations with fractions and decimals), expressions and equations, geometry, statistics, and probability. Students also explore patterns, coordinate planes, statistical variability, and different ways to summarize and describe data distributions. Although these may seem like separate topics, students investigate and apply relationships among the topics to build a deeper understanding of each. They explore relationships between fractions and decimals, connect their understanding of two-dimensional figures to the Cartesian coordinate plane, and apply knowledge of mathematics to real-world situations through investigations. Students learned to think like mathematicians in previous years as they noticed patterns and rules and persevered to solve challenging problems. During this course, students are presented with lessons that elicit Classroom Practices that are aligned to thinking like a mathematician, such as representing and explaining their thinking, modeling their solutions, and striving for accuracy.

To inspire and motivate learning and curiosity, Primary 6 Mathematics Techbook features clear and engaging text, videos, digital tools, and Hands-On Activities. Hands-On Activities require students to investigate patterns and rules in mathematics and challenge them to communicate using mathematical language and models. The program also engages students in many kinds of writing and asks them to explain their reasoning and support their thinking using words, numbers, pictures, and symbols. When students engage in rich tasks that access prior knowledge and build reasoning, it is easier for them to make connections to the real world and to other mathematical learning.

Primary 6 Mathematics Techbook is divided into units. Each unit is divided into concepts, and each concept is divided into lessons. Each lesson has two main sections: ACCESS and BUILD AND CONNECT.

ACCESS Students activate their prior knowledge and begin to develop and express mathematical language.

BUILD AND CONNECT Students focus on communicating their understanding, reasoning, evidence, and mathematical strategies.
Students build deep conceptual understanding and a strong foundation for accessing knowledge in future lessons.

In addition, **WRAP-UP**, **PRACTICE**, and **CHECK YOUR UNDERSTANDING** features allow students to demonstrate their learning either verbally or in writing.



Within this Student Edition, you will find QR codes and Quick Codes that take you and your student to a corresponding section of Primary 6 Mathematics Techbook online.

We encourage you to support your student in using the print and online interactive materials on any device. Together, may you and your student enjoy a fantastic year of mathematics.

Sincerely,

The Math Team

UNIT

8

Theme 3 | Fractions, Decimals, and Proportional Relationships:

Operations on Fractions and Decimals



Operations on Fractions and Decimals

Unit Opener Video: Operations on Fractions and Decimals

Quick Code egm6159

Explore camping scenarios that model ways for using division to solve problems.

Key Vocabulary

decimal, denominator, dividend, divisor, estimate, fraction, numerator, operation, product, quotient, reciprocal

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LESSON 1

Modeling Division with fractions and Whole Numbers

Quick Code egm6162

Learning Target

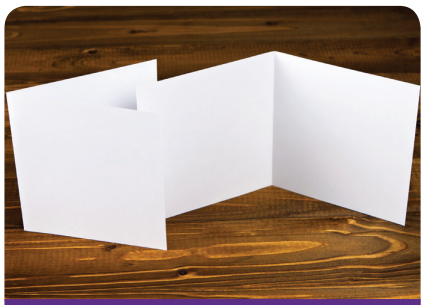
- I can model division with fractions.

Student Behaviors

- Construct viable arguments and critique the reasoning of others.
- Look for and make use of structure.

ACCESS

Modeling with Paper Folding In this lesson, you will model situations involving division with fractions by folding paper. Your teacher will distribute paper strips to you to use to model each problem.



Folding Paper

Let's Chat Have you used paper folding to model mathematical situations previously? How was it helpful?

BUILD AND CONNECT

Part A: Ribbons and Bracelets



Working with Ribbon

Problem 1 Suppose you have 2 meters of ribbon for an art project. You need to cut it into pieces that are $\frac{2}{3}$ of a meter. How many pieces will you have?

Represent the Situation Use the given values and symbols to create a division equation that models the ribbon problem.

3 , 2 , $\frac{2}{3}$, ÷ , =

Model and Solve Model the problem by folding paper.

Then, respond to these questions.

A. Explain how you folded paper to model the problem and how your model helped you to solve it.

B. How many pieces of ribbon will you have?

Check Your Answer Now that you solved the problem, which expression can you use to check your answer?

A. $\frac{2}{3} \div 3$ **B.** $2 \div \frac{2}{3}$ **C.** $2 \times \frac{2}{3}$ **D.** $\frac{2}{3} \times 3$

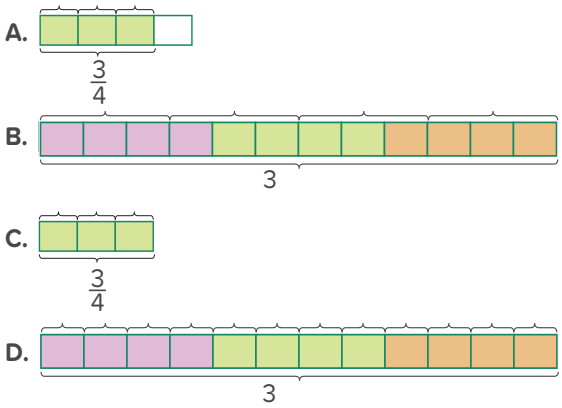
Problem 2 You have $\frac{3}{4}$ meter of string and need 3 pieces of string of equal length to make a friendship bracelet. Think about how you could determine the length of each piece of string.

Write an Expression Write an expression that represents the way you would determine how long each piece of string would be. Explain how you know your expression is correct.

Model Fold your paper strips to model this bracelet problem. When you are done, find the tape diagram that matches your model and record your model choice.



Making Friendship Bracelets



Solve and Analyze Use your model to answer these two questions.

A. How long is each piece of string?

B. What expression can you write and solve in order to check your answer?

Let's Chat Discuss with a partner how your responses in the previous task are related to whole-number division. Justify your reasoning about the following situations:

- Describe the quotient when the divisor is a whole number.
- Describe the quotient when the divisor is a fraction.

Part B: Robots and Paints

Problem 3 You have 6 small robots to make and $\frac{3}{4}$ of a meter of tubing to use. You want to use the same amount of tubing for each robot. How much tubing can you use for each robot?



Making Art Projects

Model the Problem and Solve Fold a paper strip to model this problem. Complete these tasks.

A. Write an expression that represents how much tubing you can use to make each robot.

B. How much tubing can you use for each robot? Explain how your model helped you find the answer.

C. Write and simplify an expression that you can use to check that your answer is correct.

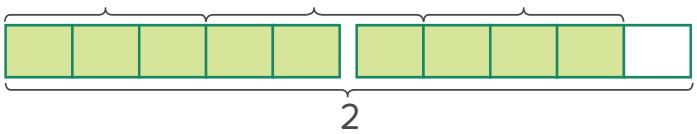
Problem 4 You have 2 liters of paint and need to divide the paint into $\frac{3}{5}$ L containers. How many containers can you divide the paint into?



Painting

Analyze Solutions If 2 liters of paint need to be divided so the paint is in $\frac{3}{5}$ portions for the containers, how many containers can be filled?

Here is how two students reasoned their answers. Two students wrote the same expression, $2 \div \frac{3}{5}$, for this problem. They also both folded identical paper strips to model the problem, as shown.



- The first student determined that the model showed that $3\frac{1}{3}$ containers could be filled with the paint.
- The second student determined that the model showed that $3\frac{1}{5}$ containers could be filled with the paint.

Respond to these questions.

A. Which student is correct? How do you know?

B. What mistake do you think the other student made?

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 2

Modeling Fraction Division with Tape Diagrams

Quick Code
egm6164

Learning Target

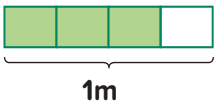
- I can use tape diagrams to model dividing a fraction by fraction.

Student Behaviors

- Make sense of problems and persevere in solving them.
- Construct viable arguments and critique the reasoning of others.
- Look for and express regularity in repeated reasoning.

ACCESS

Tape Diagrams One way to model dividing a fraction by a whole number or a whole number by a fraction is to fold paper. What if you divide a fraction by a fraction? Do you think you can model it by folding paper strips? To model dividing a fraction by a fraction, a tape diagram is a good representation. Tape diagrams can be used to model word problems.



Let's Chat Have you used tape diagrams to model problems previously? How were they helpful?

BUILD AND CONNECT

Model and Solve Using Tape Diagrams Utilize tape diagrams as you complete these problems.

Problem 1 You are fishing with your friends and have a kilogram of fishing bait. If you give each friend fishing $\frac{1}{6}$ kg of bait, how many friends receive bait? Before you model and solve this problem, **estimate** your answer. Discuss your estimate with a partner.



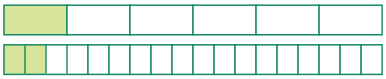
Fishing

Check Your Understanding Follow your teacher's instructions to complete this activity

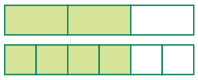
Write an Expression Write an expression that represents how a fisherman would share $\frac{2}{3}$ of a kilogram of bait, giving each friend $\frac{1}{6}$ kg. Explain how your expression supports this scenario.

Model Which model can you use to represent sharing $\frac{2}{3}$ kg of bait by giving each friend $\frac{1}{6}$ kg?

A.



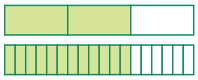
B.



C.



D.



How many friends receive bait?

Check Your Answer Complete the following tasks.

A. Prove that your answer is correct by writing a related multiplication statement using your dividend, divisor, and quotient.

B. Write a sentence that describes what each value represents in this real-world problem.

Problem 2 You have $\frac{9}{10}$ kilogram of clay. You want to make portions that are $\frac{2}{5}$ kg each. How many portions can you make? Before drawing a tape diagram for this situation, estimate your answer.



Modeling Clay

Model and Solve 2 Complete these three tasks by recording your expression and explanations.

A. Draw a tape diagram that would represent sharing $\frac{9}{10}$ kg of clay in $\frac{2}{5}$ kg portions.

B. Describe what each part of your tape diagram means.

C. How many portions can you make? Explain how you can use your tape diagram to find the answer.

Let's Chat

- Discuss with a partner your reasoning about how you determined the remainder.
- Explain how you used tape diagrams to model the original amount of clay and the portions of clay.
- How did you use these tape diagrams to determine the number of portions you could make?
- Explain how you determined the amount of clay that was left over, using the tape diagrams to support your mathematical reasoning.

Dried Fruit

Problem 3 You are helping a teacher prepare a hike for younger students. The teacher wants you to make a trail mix. The recipe calls for $\frac{5}{6}$ cup of dried fruit. You have one bag of dried fruit, which has $\frac{1}{2}$ cup in it.



Dried Fruit in a Jar

Do you have enough dried fruit to make a full recipe? Explain your answer.

Model and Solve 3 What portion of the full trail mix recipe can be made with the amount of dried fruit you have? Use a tape diagram to model the problem. Write which fraction describes the portion of the recipe that can be made.

$\frac{5}{3}$ $\frac{3}{5}$ $\frac{5}{12}$

A _____ portion of the trail mix recipe can be made.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 3

Connecting Fraction Multiplication to Fraction Division

Quick Code egm6166

Learning Target

- I can develop a rule for dividing fractions.

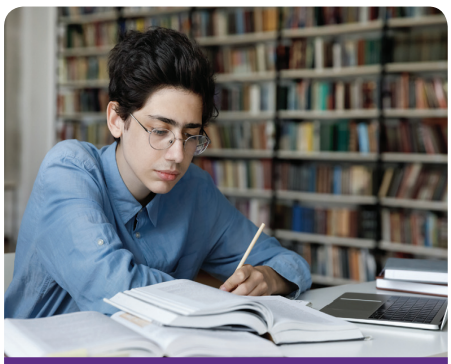
Student Behaviors

- Make sense of problems and persevere in solving them.
- Look for and express regularity in repeated reasoning.

ACCESS

Standard Algorithm.

Understanding the connection between multiplication and division will help you to discover the standard algorithm for dividing fractions.



Understanding the Standard Algorithm

Fraction Multiplication Example

$$\frac{3}{5} \times \frac{1}{3} = \frac{3}{15}$$

$$\frac{3}{15} = \frac{1}{5}$$

Fraction Division Example

$$\frac{1}{5} \div \frac{2}{5} =$$

$$\frac{1}{5} \times \frac{5}{2} = \frac{5}{10}$$

$$\frac{5}{10} = \frac{1}{2}$$

BUILD AND CONNECT

Relationship between Fraction Multiplication and Division

Let's Chat

- Think about what happens when you take half of something. What is $\frac{1}{2}$ of 2 Aish Baladi?
- What is $\frac{1}{2}$ of 12 eggs? What operation does the word *of* indicate?
- Now, think about dividing 2 by 2 and 12 by 2. How is taking half of something related to dividing by 2? Discuss your thoughts with a partner.

Explore the relationship between division and multiplication for another pair of numbers.

Create a Number Sentence Think about how you can write $\frac{1}{3}$ of 12 using division and using multiplication. Choose two of the given expressions to create a number sentence that represents a division expression equal to a multiplication expression in the form of _____ = _____.

$12 \div \frac{1}{3}$ $\quad 12 \div 3$ $\quad 3 \div 12$ $\quad 12 \times 3$ $\quad \frac{1}{12} \times 3$ $\quad 12 \times \frac{1}{3}$

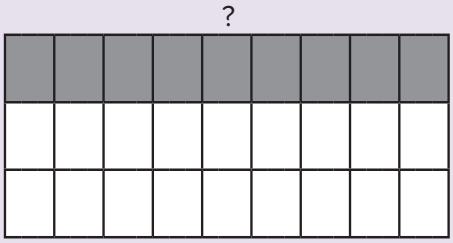
You learned the relationship between multiplication and division in previous math courses. You may remember it as *fact families*. This is what the relationship looks like algebraically.

$a \times b = c$ $\quad c \div b = a$ $\quad C \div a = b$

$(a \neq 0 \ , \ b \neq 0)$

Let's Chat

- With a partner, discuss how the two equations are related to each other. Then, share how you would interpret these equations. How could you put these two equations into your own words?
- If $9 \div \frac{1}{3} = ?$, then $\frac{1}{3} \times ? = 9$.
- Which of these equations relates to this tape diagram?



Tape Diagram 1 Write an explanation and then answer the question.

- Explain how the tape diagram models this question: $\frac{1}{3}$ of what number is 9?
- How does this model prove that $9 \div \frac{1}{3} = 9 \times 3$?

So far, you've explored the relationship between division and multiplication with fractions and whole numbers. What do you notice about the previous division operation?

Tape Diagram 2 Explain how your model of the expression shows the relationship between division and multiplication.

Model the expression $\frac{1}{2} \div \frac{1}{4}$ with a tape diagram. Since you know that $\frac{1}{2} \div \frac{1}{4} = n$ and $n \times \frac{1}{4} = \frac{1}{2}$, think of the expression as $\frac{1}{4}$ of what number is $\frac{1}{2}$?

As you create your explanation, consider these sample number sentences:

$12 \div 3 = 12 \times \frac{1}{3}$ $\qquad 9 \div \frac{1}{3} = 9 \times 3$ $\qquad \frac{1}{2} \div \frac{1}{4} = \frac{1}{2} \times 4$

Let's Chat Discuss with a partner any patterns that you see. In each statement.

Develop a Rule Use the patterns you observed to write a rule you can use to divide any two fractions.

Let's Chat Discuss with a partner the rule that you created. Explain the reasoning that you used and revise and resubmit your response as needed.

Let's see if this pattern works with non-unit fractions.

Baking Your recipe requires $\frac{2}{3}$ cup of flour, but you have $\frac{3}{4}$ cup of flour. How many batches can you make?

Work with a partner to model this situation using a tape diagram. Test the rule you created by writing a number sentence that sets a division expression equal to a multiplication expression for this scenario.

Whiteboard: Test Your Rule
Utilize the Whiteboard to complete the following questions. An example is done for you. Demonstrate your understanding by drawing.

Example:

$2 \div \frac{1}{4}$

$2 \times \frac{4}{1} = 8$

check $\frac{1}{4} \times 8 = 2$

1) $\frac{1}{2} \div 4$

2) $\frac{1}{2} \div \frac{3}{4}$

3) $\frac{2}{3} \div \frac{1}{6}$

Test Your Rule Evaluate these three expressions, showing your work. Check your rule for each problem by multiplying your quotient times the divisor to see if you get the dividend.

A. $\frac{1}{2} \div 4$ **B.** $\frac{1}{2} \div \frac{3}{4}$ **C.** $\frac{2}{3} \div \frac{1}{6}$

When you write a fraction with the values in the **numerator** and **denominator** reversed, like $\frac{2}{5}$ and $\frac{5}{2}$, you are inverting the fraction. When you invert a fraction, you create its **reciprocal**. Here are two examples of fractions that are reciprocals of each other.

$\frac{1}{4}, \frac{4}{1}$ $\frac{2}{3}, \frac{3}{2}$

Think about how you could rewrite your rule using the terms dividend, divisor, quotient, *reciprc*

Update Rule Rewrite your division rule using the new vocabulary terms: *reciprocal*. Share you final version of the division rule with a small group designated by your teacher.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 4

Analyzing Multiplying and Dividing Fractions and Decimals

Quick Code
egm6172

Learning Targets

- I can use standard algorithm to multiply decimals and fractions.
- I can multiply by powers of 10 to make division with decimal divisors easier..

Student Behaviors

- Reason abstractly and quantitatively.
- Look for and express regularity in repeated reasoning.
- Make sense of problems and persevere in solving them.
- Construct viable arguments and critique the reasoning of others.

ACCESS

Standard Algorithm Show your work and enter final answers to the task and questions.

A. Show how you would multiply 32×14 using the standard algorithm. Indicate your final product.

B. If we changed the factors to 3.2 and 1.4, how would the value of the digits in your product change?

C. Where would you put the decimal point in the product? How do you know?

Let's Chat Discuss with a partner your answers to the previous task.

- When multiplying decimals, you can ignore the decimal point until what step of the process?
- How do you know where to place the decimal point in the product?

BUILD AND CONNECT

Part A: Fractions, Patterns, Money

Nabil thinks about the decimals as fractions.

$$3\frac{2}{10} \times 1\frac{4}{10}$$

He rewrote these mixed numbers as improper fractions to multiply.

$$\frac{32}{10} \times \frac{14}{10}$$

He knows that multiplying tenths by tenths would result in a product with a decimal to the hundredths, so that helps him figure out where to put the decimal point in the product.



Kilometer Markers

Fraction Reasoning Use fraction reasoning to place the decimal in 2.3×0.45. Show your multiplication and explain how you knew where to put the decimal point.

Patterns In the four multiplication problems, identify a pattern to determine where the decimal point is placed in the final product. Explain the pattern and why it works.

2.1	2.1	2.1	0.21
x 12	x 1.2	x0.12	x0.12
42	42	42	42
210	210	210	210
25.2	2.52	0.252	0.0252

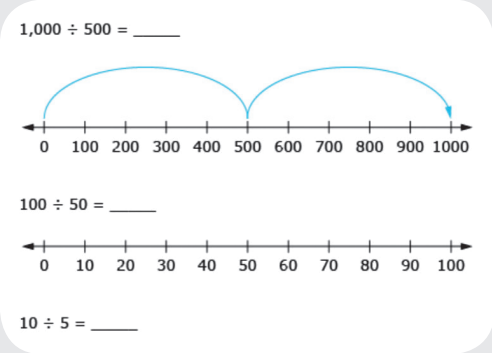
Multiplying Money If you need to buy 1.5 kilograms of apples for your mother at a cost of LE 40.50 per kilogram, how much would you pay? Show your calculation. Record your final answer choice.

A. 6,075 LE
B. 607.5 LE
C. 60.75 LE
D. 6.075 LE

Let's Chat Discuss with a partner the strategy you used to solve the last problem. Then, work together to solve it using a different strategy.

Part B: Powers of 10

Whiteboard: Number Lines The first division equation is modeled for you. Find the quotient using the model. Then, model each of the next division equations using the number lines to find each quotient. Demonstrate your understanding by drawing in your journal or using the digital tool.



Record Your Results Use the work you completed with the number line models to record the solution to each equation.

A. 1,000 ÷ 500 = _____

B. 100 ÷ 50 = _____

C. 100 ÷ 5 = _____

D. 1 ÷ 0.5 = _____

Let's Chat Discuss with a partner the patterns you see in the dividends, divisors, and quotients.

Make Observations Use each of the equations you recorded to write responses to these questions.

A. What could you do to both the divisor and the dividend in order to keep the value of the quotient the same?

B. How could you rewrite 1 ÷ 0.5 so that you do not have to divide by a decimal?

Make a Conjecture Suppose you want to find 3.75 ÷ 0.125. Which of these descriptions results in the correct quotient, using the smallest whole number divisor? Show your work and record your answer choice.

A. Multiply 3.75 by 100 and divide by 0.125.

B. Multiply 0.125 by 1,000 and divide 3.75 by 125.

C. Multiply both 3.75 and 0.125 by 100 and divide 375 by 12.5.

D. Multiply both 3.75 and 0.125 by 1,000 and divide 3,750 by 125.

E. Multiply both 3.75 and 0.125 by 10,000 and divide 37,500 by 1,250.

Test Your Conjecture Use the observations you've made so far in this lesson to complete this task. Rewrite the explanation by inserting the given words or phrases into the blanks.

divisor	decimal	power of 10	quotient	whole number	dividend

To divide by a decimal, I first multiply both the dividend and divisor by the same ___(A)___. This does not change the value of the quotient and maintains the equality of the expression. I can rewrite the problem so that I am dividing by a ___(B)___ instead of a ___(C)___. Then, I can divide as I normally would.

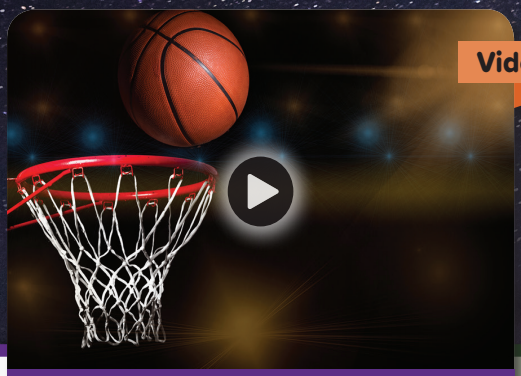
Use the Rule Now, consider this problem: 3.66 ÷ 0.3. Estimate the answer. Then, find the quotient and explain how you found your answer.

UNIT

9

Theme 3 | Fractions, Decimals, and Proportional Relationships:

Ratio and Its Applications



Ratios

Unit Opener Video: Ratio and Its Applications

Quick Code egm6139

View everyday situations in which ratio can be used to solve real-life problems.

Key Vocabulary

double number line, equivalent, equivalent ratio, number line, part-whole ratio, rate, ratio, ratio table, tape diagram

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LESSON 1

Exploring Ratio and Rate with Real-World Situations

Quick Code
egm6143

Learning Targets

- I can discover the meaning of ratio.
- I can write ratios in different forms.
- I can discover the meaning of rate.

Student Behaviors

- Model with mathematics.
- Look for and make use of structure.

ACCESS

Using Comparisons to Solve Problems Look at the image of the elephants. You can compare the quantity of small elephants to big elephants.



Compare Elephants

Let's Chat

- How do you compare two quantities?
- Let's start by looking at some examples of quantities in nature.

Comparing Quantities Use the elephant picture to make another comparison.

A. What two Quantities do you want to compare?

B. Use numbers and words to write a comparison statement about these Quantities.

Comparing Other Quantities Analyze the differences you see in the photo and then make different comparisons for the dogs.



Compare Dogs

Find three different comparisons that you can describe using words and numbers.

BUILD AND CONNECT

What Is a Ratio? Using the table, work with a partner to decide what it means for a comparison to be a ratio.

Comparisons That Are Ratios	Comparisons That Are Not Ratios
There are six students who like art compared to five students who like math.	Seven more students like art than math.
Seven out of twenty-eight students like adventure movies.	Fewer students like drama than adventure.
For every student who likes science, two students like math.	Five more students prefer fantasy than prefer drama.
The number of students who like art best compared to the number of students who like math best is twelve to five.	

The ratio can be expressed as the following :

$a : b$ $\quad \frac{a}{b} \quad$ a to b



Ratio Example

There are 6 apples and 8 oranges in a basket. What is the ratio of apples to oranges?

$6 : 8 \quad \frac{6}{8} \quad 6$ to 8

Simplify

Divide by the GCF of 6 and 8.

$3 : 4 \quad \frac{3}{4} \quad 3$ to 4

Define a Ratio Describe the meaning of the term *ratio* in your own words.

Let's Chat Discuss your findings with a partner. What are some ratios that you have seen in the real world? Express the folowing

- Is the ratio used to compare two quantities of the same kind?
- Does the ratio consist of two terms?

Ratios and Rates The ratio of the number of solid color marbles to the total number of marbles in a given collection is 3 to 8, which can also be written as $3 : 8$ or $\frac{3}{8}$. No matter which way you write the ratio, it is always read as "3 to 8."



Marbles

Write Ratio.

View the image of the marbles again. Write a new ratio that compares the results for two different quantities you see in the image. Write each ratio in three different forms, and explain the comparison you use.

Let's Chat Share the ratios you wrote with a partner. Which of the ratios you wrote is more like a fraction? Why?

Rate Sometimes we talk about ratio in a special way. You may have heard a ratio described like this: we need 3 eggs for every 1 cup of flour, or it costs 3 pounds per a pen. These types of comparisons are called rate.

In a **rate**, we compare two quantities in different units. Rate language often uses the words per and for every to describe the relationship. Other examples of rates include 18 liters for every 1 kilometer or 22 words per second.



Baking Ratios

Use Rate Language If the ratio of eggs to cups of flour is 3 to 1, which of these statements uses rate language to describe this ratio? Select all that apply.

A. There are 3 eggs for every 1 cup of flour.

B. The number of eggs compared to cups of flour is 3 to 1.

C. There is 1 cup of flour for every 3 eggs.

D. There are 3 eggs per cup of flour.

E. Eggs and cups of flour have a ratio of $\frac{3}{1}$.

Let's Chat Discuss the following with a partner:

- In each statement that you selected, what key words let you know that it was a rate?
- If a recipe calls for 2 liters of milk and 4 eggs, how can you express this using rate language?

Check Your Understanding Follow your teacher's instructions to complete this act

LESSON 2

Representing Ratio

Quick Code
egm6145

Learning Target

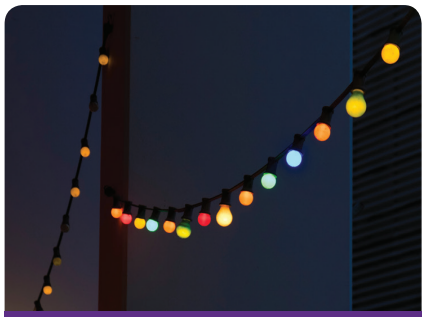
- I can use ratio to model and extend patterns.

Student Behaviors

- Model with mathematics.
- Look for and make use of structure.

ACCESS

Decorating with Strings of Lights Strings of colored lights are often used to decorate a party or an event. How might a company that manufactures lights on a string use ratios to produce them?



Lights on a String

Let's Chat

- For what events might a company produce colored lights on a string?
- How would the type of event affect the color patterns of the lights?
- What are some ratios the company might use to produce the patterns?

BUILD AND CONNECT

Using Ratios to Extend Patterns Ratios can be used to build patterns.

Whiteboard: Lights Design your own lights on a string. Start by modeling red and blue lights with the ratio of 2 red to 3 blue lights. Demonstrate your understanding by drawing in your journal or using the digital tool.

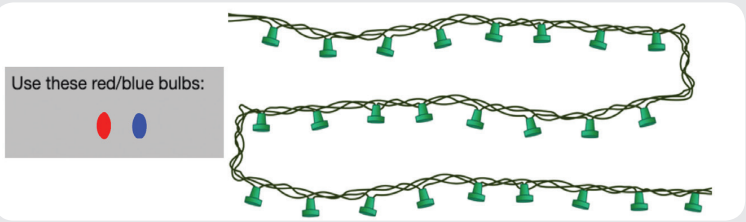


Light Design 1 Draw your lights on a string design.

Let's Chat Compare your design with a partner. Did your designs look the same or different?

Next, you're going to extend the string of lights while keeping the ratio of the colors the same.

Whiteboard: Extend Your Design Extend the lights on a string while keeping the ratio of the colors the same. Remember to keep the ratio of two red to three blue each time you extend it by five bulbs. Demonstrate your understanding by drawing in your journal or using the digital tool.



Light Design 2 Draw your lights on a string design.

Extend Your Design Use the data from your extended light strand to complete this table. Complete the table for a ratio of 2 red to 3 blue bulbs. Look for patterns as you complete your table.

Total Number of Bulbs	Number of Red Bulbs	Number of Blue Bulbs
5	2	3
10	(A)	(B)
15	(C)	(D)
(E)	10	(F)

Let's Chat What patterns do you see in the table? Discuss your observations with a partner.

Think About It What are some ways you can extend the pattern to a longer string of lights? Give an example.

Whiteboard: More Extending Now it's time for you to be creative. Design your own lights on a string. Start by using two colors of bulbs in a ratio of your choosing. You may choose to use less than the 6 given sockets for your ratio. Demonstrate your understanding by drawing in your journal or using the digital tool.



More Extending Keeping the same ratio that you have created, use the Whiteboard: More Extending or draw to extend your design to create light strings that are three different lengths. Then, use your strings to complete the table. Let A and B represent the bulb colors of your lights on a string.

Total Number of Bulbs	Total Number of Bulbs Color A	Total Number of Bulbs Color B	A to B

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 3

Exploring Equivalent Ratios

Quick Code
egm6149

Learning Target

- I can use ratio to investigate real-world relationships.

Student Behaviors

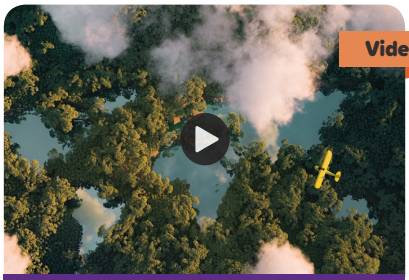
- Model with mathematics.
- Use appropriate tools strategically.
- Look for and make use of structure.

ACCESS

Population and Health of Animals.

Wild rabbits are found throughout Egypt. They often eat zygophyllum and can live mostly on water with a little food. If the rabbit population in an area is too large, they compete with each other and other small mammals for food and shelter. If the rabbit population in an area is too small, the animals that hunt them, will go hungry.

You can use ratio to explore the health of animal populations in different ecosystems.



Ecosystems

Let's Chat Why is it important for the populations of different species to stay around the same size over time?

BUILD AND CONNECT

Ratio of Rabbits Suppose that in a certain region, scientists determine that for every two square kilometers of land, there are approximately seven rabbits.


Rabbits

Complete a Table Determine how many rabbits scientists could expect to find on pieces of land with areas of 6, 10, and 20 square kilometers. Create a copy of the table and record your answers in the appropriate spaces.

Land Area	2	6	10	20
Number of Rabbits	7	(A)	(B)	(C)

Explain Your Method Describe the method you used to complete the table.

Let's Chat This type of table is called a ratio table. Can you tell why? Did you see any patterns in the table?

Equivalent Ratios Use what you know about the ratios of rabbits and land area to answer each question about equivalent ratios.

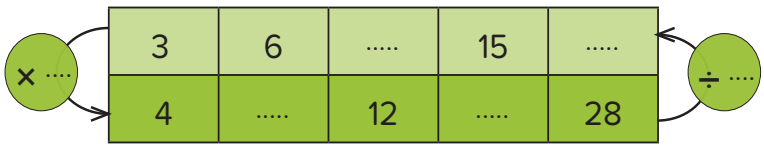
A. Are the ratios of rabbits to land area from each column of the ratio table equivalent? How do you know?

B. How do you think you define the term *equivalent ratios*?

More Equivalent Ratios:

Use what you know about the equivalent ratios to solve:

1. Complete the table:



2. In a juice shop 2 kilograms of guava were squeezed to provide 6 cups of juice to customers. If 5 kilograms were squeezed, how many cups can be served to customers? and how many kilograms of guava are needed to serve 27 cups of juice to customers?



Guava

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 4

Representing Ratios with Tape Diagrams

Quick Code
egm6151

Learning Targets

- I can model ratios using **tape diagrams**.
- I can solve problems involving equivalent ratios.

Student Behaviors

- Use appropriate tools strategically.
- Look for and make use of structure.

ACCESS

Understanding Tape Diagrams For a study, a scientist set up a wildlife camera in a park. One evening, the camera recorded four rabbits and one fox. What is the ratio of rabbits to foxes recorded by the camera?



Wildlife Camera

Exploring Tape Diagrams One way to model this ratio is by making a tape diagram, such as the one shown here.



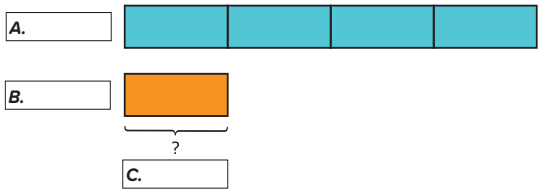
Let's Chat Discuss the following questions with a partner:

- How does the tape diagram model the ratio of rabbits to foxes recorded by the camera?
- What does each tape represent?
- What does each block of the tape diagram represent?

BUILD AND CONNECT

Using the Tape Diagram Now, suppose that over a longer period of time, the camera recorded three foxes. Assume that the ratio of rabbits to foxes recorded by the camera stays **equivalent** to 4 : 1.

Label the Tape Diagram Copy and complete the chart. Use the first two empty boxes to show what each tape represents. Use the third empty box to define the value that one block represents in the tape diagram to model the new situation.



Use the Tape Diagram to Solve a Problem How many rabbits did the camera record during the time period it recorded 3 foxes? Explain how you found your answer using the tape diagram.

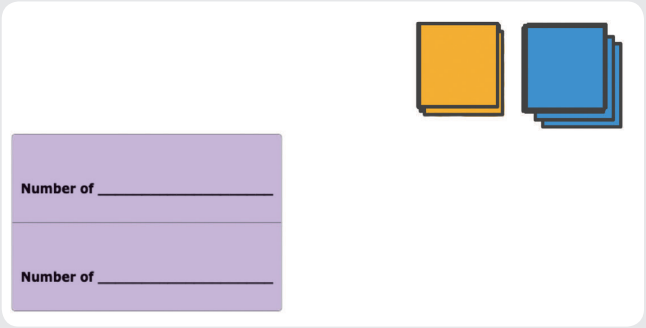
Let's Chat Can you use the same tape diagram to complete the table that follows?

Complete a Table The camera recorded 5, 15, and then 30 foxes. Assuming the ratio of rabbits to foxes is equivalent to 4 : 1, how many rabbits will the camera record? Create this table and then enter values for the expected number of rabbits.

Number Rabbits	(A)	(B)	(C)
Number of foxes	5	15	30

Drawing Tape Diagrams Now, think about how tape diagrams might be used to model other ratios. Suppose the scientist set up a wildlife camera in a different state park. this camera recorded 3 rabbits and 2 foxes. What is the ratio of rabbits to foxes recorded by the camera?

Whiteboard: Tape Diagram Draw, a tape diagram for this ratio. Demonstrate your understanding by drawing.



Interpret the Tape Diagram The camera recorded 3 rabbits and 2 foxes. What is the ratio of rabbits to foxes recorded by the camera? Write your response. Include a drawing of your tape diagram model.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 5

Analyzing Equivalent Ratios with A Number Line

Quick Code
egm6153

Learning Target

- I can find equivalent ratios using **double number line** diagrams.

Student Behaviors

- Model with mathematics.
- Look for and make use of structure.
- Attend to precision.

ACCESS

Understanding Double Number Lines Look at the picture of the rabbit. It is a wild rabbit and it can run fast.


Rabbit

Speed of a Rabbit A scientist is interested in learning how fast a rabbit can run. She recorded the measurements shown in the table.

Time (seconds)	Distance (meters)
2	12
4	24
5	30

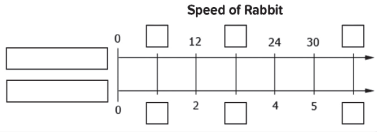
The scientist determines that the ratios of distance to time for the rabbit are equivalent. She uses the equivalent ratios to make a double number line diagram.

BUILD AND CONNECT

Interpret the Double Line Graph The scientist determines that the ratios of distance to time for the wild rabbit are equivalent. She uses the equivalent ratios to make a double number line diagram.

Whiteboard: Wild Rabbit Use the equivalent ratios to make a double number line diagram. Demonstrate your understanding by drawing in your journal or using the digital tool.

Time (seconds)	Distance (meters)
2	12
4	24
5	30



Interpret the Double Number Line Sketch your double number line and describe how you completed it. What is the relationship between the numbers on the top number line and the numbers on the bottom number line?

Let's Chat How can you show the number of meters a rabbit can run in 7 seconds?

Rabbit Problem Solving Use the double number line to find how far the rabbit can run in 1.5 seconds. Explain how you found your answer.

Let's Chat Discuss your response with a partner.

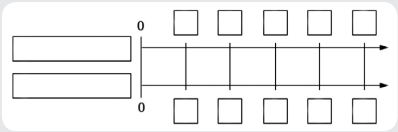
- What is the ratio of the rabbit's distance in meters to the rabbit's time in seconds?
- What does the ratio tell you?
- How can a double number line help you find equivalent ratios?

Drawing Double Number Lines Is the foxes faster than the rabbit? Suppose the scientist found that the speed of a foxes is 6.5 meters per second.



Fox

Whiteboard: foxes Suppose the scientist found that the speed of a foxes is 6.5 meters per second. Draw and label a double number line diagram that compares the distance in meters the foxes runs to the time in seconds that it runs. Demonstrate your understanding by drawing.



foxes Speed Explanation Sketch your double number line and record your responses to these tasks.

A. Explain how you labeled your number line.

B. What is the relationship between the numbers on the top number line and the numbers on the bottom number line?

Let's Chat Can you name three ratios that are the equivalent to the fox's speed? Discuss with a partner how you know that the ratios are equivalent.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 6

Comparing and Analyzing Ratios

Quick Code
egm6157

Learning Target

- I can determine whether ratios are equivalent.

Student Behaviors

- Use appropriate tools strategically.
- Look for and make use of structure.

ACCESS

Ratios Amany has red, blue, yellow, and green paint. In order to get the correct shade each time she mixes two colors, she needs to make sure she uses the same ratio. Sometimes she needs to mix different size batches. Use the interactive to help Amany determine different units of paint she can mix to produce the same color. Explore different ratios to see how it affects the color of the paint.



Paint Buckets

Let's Chat Discuss with a partner: Why do you think it is important to have equivalent ratios to get the same shade for each mixture?

BUILD AND CONNECT

Comparing and Analyzing Ratios Enter amounts of paint to make a color. Is there more than one way to make the same color?

Paint Mixer

Quick Code
egm6157

Paint Mixer Interactive — Interactive

Go online to explore this interactive activity.

Equivalent Ratios
Simplification Examples

$\frac{8}{10}, \frac{24}{30}$ $\qquad$ $\frac{1}{5}, \frac{2}{12}$ $\qquad$ $\frac{1}{10}, \frac{3}{30}, \frac{2}{20}$

$\frac{4}{5} = \frac{4}{5}$ $\qquad$ $\frac{1}{5} \neq \frac{1}{6}$ $\qquad$ $\frac{1}{10} = \frac{1}{10} = \frac{1}{10}$

Multiplication and Division Examples

$$\frac{8}{10} = \frac{24}{30}$$
$$8 \times 30 = 24 \times 10$$
$$240 = 240$$

$$\frac{1}{5} \neq \frac{2}{12}$$
$$1 \times 12 \neq 2 \times 5$$
$$12 \neq 10$$

Solving for Missing Value

Solve for x:

$$\frac{1}{6} = \frac{x}{18}$$
$$1 \times 18 = 6 \times x$$
$$18 = 6x$$
$$x = \frac{18}{6}$$
$$x = 3$$

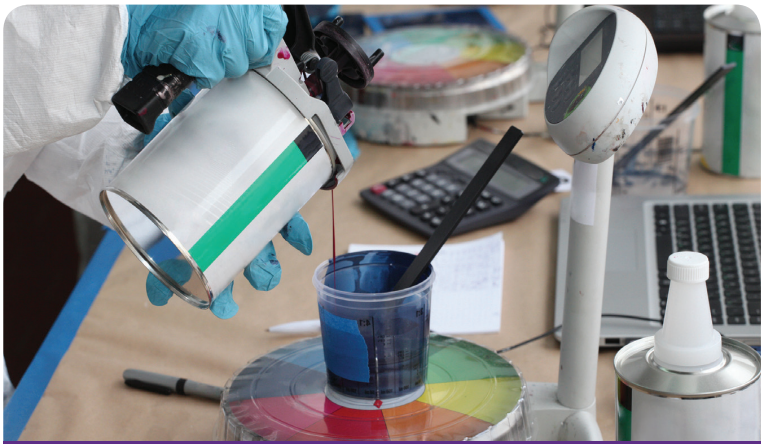
Check:

$$\frac{1}{6} = \frac{3}{18}$$
$$1 \times 18 = 3 \times 6$$
$$18 = 18$$

Comparing Ratios Tarek and Hashem each made a batch of paint in the Paint Mixer.

Hashem's batch was in the ratio 6 yellow to 4 red. Tarek wants to have the same color as Hashem, so he used a ratio of 9 yellow to 6 red.

Are their paint batches the same color? Explain how you know.



Paint Mixing

Comparing Ratios without Paint Mixer A worker is colorblind and cannot see whether the paint colors are the same in the paint mixer. He knows the ratios of colors used to mix two different batches of paint are 8 red to 5 green and 5 red to 2 green.

Show how the worker can determine whether the paint colors are the same. Then, write your answers to these questions.

A. Are the ratios the same?

B. How do you know?

Analyze Reasoning Amany claims that the ratio 5 parts red paint to 4 parts blue paint is equivalent to 7 parts red paint to 6 parts blue paint because she can add 2 to each term of the ratio and obtain a new, equivalent ratio: $5 + 2 = 7$ and $4 + 2 = 6$.

Is Amany correct? Explain your reasoning using words or other examples.

Let's Chat Discuss your responses to the previous tasks with a partner and revise as needed.

Find Equivalent Ratios Identify all of the ratios that are equivalent to the ratio of 8 : 12.

A. 6 : 10

B. 12 : 18

C. 2 : 3

D. 12 : 8

E. 6 : 9

Check Your Understanding Follow your teacher's instructions to complete this activity

UNIT

10

Theme 3 | Fractions, Decimals, and Proportional Relationships:

Unit Rate and Percent



Unit Rates and Percents

Unit Opener Video: Unit Rate and Percent

Quick Code egm6176

Everyday activities such as shopping, eating, and exercising offer opportunities to make mental calculations using unit rates and percentages.

Key Vocabulary

conversion factor, number line, percent, rate, ratio table, tape diagram, unit rate

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION
وزارة التربية والتعليم والتعليم الفني

LESSON 1

Exploring Unit Rate

Quick Code
egm6177

Learning Targets

- I can develop a definition of *unit rate*.
- I can explore how to use unit rates to solve **rate** problems.

Student Behaviors

- Make sense of problems and persevere in solving them.
- Construct viable arguments and critique the reasoning of others.
- Look for and express regularity in repeated reasoning.

ACCESS

Unit Rate When making online purchases or buying in bulk, it is important to understand unit rates. Sometimes the unit price is cheaper when you buy multiple items.



Shopping Online

Let's Chat What are some recent everyday activities in which you might have used unit rates?

BUILD AND CONNECT

Running How far will the jogger run in 3 hours if his speed remains the same?

_____ kilometers



6 Kilometers per Hour

Baking How much flour would you need to make 20 Aish Baladis?

_____ cups



2 Cups of Flour for 15 Aish Baladi

Buying How much would you pay for 3 kilograms of cheese?

_____ pounds



400 Pounds for 2 Kilograms of Cheese

Driving How many kilometers can the driver of this car travel with 3 liters of gas?

_____ kilometers



360 Kilometers for Every 12 Liters of Gasoline

Let's Chat Consider all four of the problems you just solved. Which of the four problems is different from the other three? How is it different? Discuss your answer with a partner.

Unit Rate There is a special type of rate called a *unit rate between units of different measurement systems*. The following chart gives examples of some rates that are unit rates and some that are not.

Rate Examples	
Unit Rates	**Not Unit Rates**
• 9 kilometers per hour • 50 grams of peanuts for every 1 gram of walnuts • 7 cards for each player • 6 teaspoons of butter for 1 loaf of bread	• 36 kilometers in 4 hours • 250 grams of peanuts for every 5 grams of walnuts • 42 cards for 6 players • 30 teaspoons of butter for 5 loaves of bread

Use Your Own Words How would you define a unit rate in your own words?

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 2

Determining Unit Rate

Quick Code
egm6179

Learning Targets

- I can utilize a variety of models, including **tape diagrams**, **number lines**, and **ratio tables**, to determine unit rate.
- I can make predictions using unit rates.

Student Behaviors

- Model with mathematics.
- Use appropriate tools strategically.

ACCESS

Jumping Rope Your school holds a field day competition in which students compete in multiple track and field events. One of the events is the jump rope event. Each student has 1 minute to jump rope as many times as possible.



Jumping Rope

Three friends have been practicing for the event. The table shows the results of their most recent practice.

Practice Results		
Name	**Number of Jumps**	**Time (minutes)**
Basma	570	6
Rana	456	4
Tahani	545	5

You want to determine which friend is most likely to win the jump-rope event based on the practice results.

Let's Chat If you know that two quantities have a proportional relationship, how do you think you could use that relationship to make predictions?

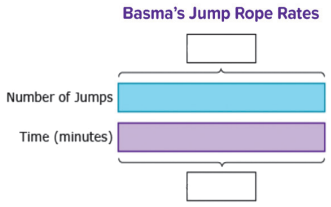
BUILD AND CONNECT

Methods of Finding a Unit Rate

Using a Tape Diagram First, look at Basma's practice results in the table.

Whiteboard: Basma's Unit Rate Use the table to fill in the blank labels in the diagram. Use the tape diagram to help you find Basma's unit rate. Demonstrate your understanding by drawing .

Name	Number of Jumps	Time (minutes)
Basma	570	6
Rana	456	4
Tahani	545	5

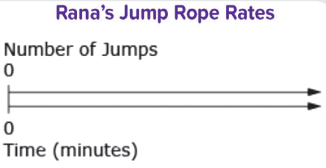


Basma's Unit Rate Explain how you labeled and divided your tape diagram and how you can use it to find Basma's unit rate.

Using a Double Number Line Now, look at Rana's practice results in the table of the three girls' jumping rates.

Whiteboard: Rana's Unit Rate Draw and label tick marks on the double number line to represent Rana's results. Use the diagram to help you find Rana's unit rate. Demonstrate your understanding by drawing.

Name	Number of Jumps	Time (minutes)
Basma	570	6
Rana	456	4
Tahani	545	5



Rana's Unit Rate Explain how you used the double number line to find Rana's unit rate.

Using a Ratio Table Finally, use Tahani's practice results from the table to find her unit rate using a ratio table.

Complete a Ratio Table Draw the table and then use Tahani's practice results to complete as much or as little of the table as needed to find the unit rate.

Time (minutes)					5
Number of Jumps					545

Tahani's Unit Rate Explain how you completed the ratio table and used it to find Tahani's unit rate.

Let's Chat Consider each of the models you just used. Did you prefer to use one over the others? Why?

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 3

Using The Unit Rate

Quick Code
egm6183

Learning Target

- I can use unit rates to determine the best buy for a product.
- I can apply the unit rate to solve story problems.

Student Behaviors

- Make sense of problems and persevere in solving them.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.

ACCESS

Popcorn People can purchase popcorn when they go to the movie theater. There are many sizes from which to choose.



Popcorn

Let's Chat

- How can you determine which size container of popcorn will give you the most value for your money?
- What do you consider to be the best buy when making a purchasing decision, particularly with two different brands of the same product?

BUILD AND CONNECT

Determine the Best Buy A movie theater offers three sizes of popcorn.

Movie Theater Popcorn		
Size	**Number of cups**	**Cost (L.E.)**
Small	7	70
Medium	16	120
Large	20	140

What's Important? Which of the sizes represents the best buy? Select all correct answers.

A. The size with the lowest cost per cup.

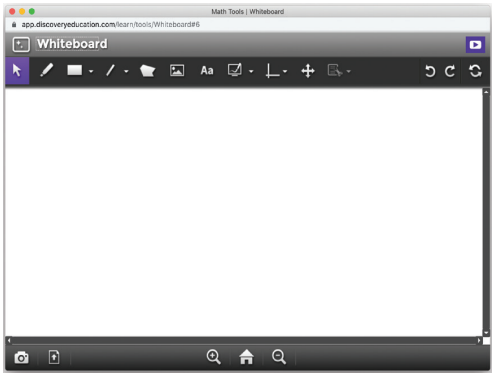
B. The size with the highest cost per cup.

C. The size with the least number of cups per token.

D. The size with the greatest number of cups per token.

Let's Chat Discuss with a partner a visual model or diagram that you could create to represent the relationship between the volume and cost for each of the sizes of popcorn.

Whiteboard: Popcorn Model each of the popcorn size options to compare volume to cost ratios using your choice of models, such as a tape diagram, double number line, or ratio table. Demonstrate your understanding by drawing.



Determine the Best Buy Create an ordered list of the popcorn sizes from the best buy to the worst buy.

Small Medium Large

Best Buy		Worst Buy

Explain Your Reasoning Explain how you determined which size container of popcorn is the best buy.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 4

Exploring Conversion Factor

Quick Code
egm6187

Learning Target

- I can explore conversion factors as ratios between equivalent quantities in different units of measure.

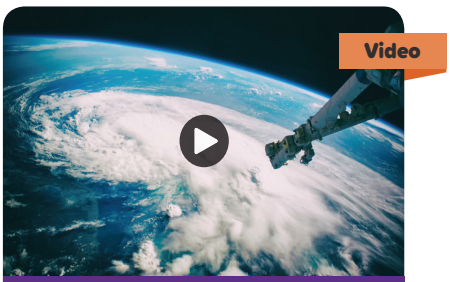
Student Behaviors

- Make sense of problems and persevere in solving them.
- Attend to precision.
- Look for and express regularity in repeated reasoning.

ACCESS

Conversion Factors Have you ever had to convert from one unit to another? Why is it important to know how to convert units correctly?

You may have had to convert units when following a recipe or measuring a length. Scientists, contractors, and medical technicians all need to be able convert units, but is it really a big deal if they don't convert correctly? Watch the video to find out.



Mars Climate Orbiter

Have you ever thought of a conversion factor as a ratio?

BUILD AND CONNECT

Comparing Units Consider how ratios can help you to compare quantities with different units.

Compare Millimeters and Centimeters The ruler shows metric units at the top. Which of the following statements are true? Select all that apply.



A. There are 10 millimeters per centimeter.

B. The ratio of millimeters to centimeters is 1 : 10.

C. For every 1 cm, there are 10 mm.

D. The equivalency between measures can be written as 10 cm = 1 mm.

E. For every 10 mm, there is 1 cm.

F. The ratio of millimeters to centimeters is 10 to 1.

Conversion Factor A conversion factor is a ratio between two equal amounts expressed in different units within the same measurement system.. Choose the ratios that represent conversion factors from among the given choices. Select all that apply.

A. 100 m = 1 km

B. $\frac{1\text{ m}}{100\text{ cm}}$

C. 3 m = 4 m

D. $\frac{1{,}000\text{ mm}}{1\text{ kg}}$

E. $\frac{60\text{ min}}{1\text{ hr}}$

F. $\frac{2\text{ cm}}{5\text{ m}}$

G. 1 day : 24 hr

H. $\frac{90\text{ km}}{1\text{ hr}}$

I. $\frac{1\text{ m}}{1{,}000\text{ mm}}$

Compare Terms How is a conversion factor similar to and different from a unit rate? Give examples to support your reasoning.

Each of the correct statements that you just chose is a conversion factor. The table shows examples of more conversion factors and also some examples that are not conversion factors.

Conversion Factor	Not a Conversion Factor
100 centimeters in 1 meter	3 m for every 5 m
1 day = 24 hours	21 projects = 3 days
$\frac{1{,}000\text{ kg}}{1\text{ ton}}$	$\frac{3\text{ days}}{2{,}000\text{ km}}$
$1\text{ mL} = \frac{1}{1{,}000}\text{ L}$	$\frac{2.5\text{ m}}{1\text{ km}}$

Let's Chat

- Discuss your observations with a partner, and together develop a definition for *conversion factor*.
- Additionally, discuss how the expressions 1 m : 100 cm and 21 days : 3 weeks are related to conversion factors. Be prepared to share your thoughts with the class.

Define Conversion Factor Use your experiences in this lesson to write your own definition for *conversion factor*.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 5

Using Conversion Factor

Quick Code
egm6189

Learning Target

- I can use conversion factors to convert between different units of measure.

Student Behaviors

- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Look for and express regularity in repeated reasoning.

ACCESS

Giza Pyramids The Great Pyramid of Giza is the oldest and largest pyramid in a group of pyramids that stand in Giza, Egypt. This massive pyramid was built in fewer than thirty years as a tomb for the Pharaoh Khufu. It is the last remaining wonder of the original Seven Wonders of the World.



Height: Approximately 14,600 Centimeters

About how many meters tall is the Great Pyramid?

The photo shows the approximate height of the Great Pyramid in centimeters. Suppose you want to find the approximate height of the Great Pyramid in meters.

You will need to use a conversion factor to solve this problem and others. You can use the list of equivalent units to determine the conversion factors you need.

HANDS-ON ACTIVITY

Conversion Chart Consult the list of equivalent units as needed throughout this lesson.

Let's Chat Do you think the height of the Great Pyramid will be greater than or less than 1,460 millimeters? Why?

BUILD AND CONNECT

Find the Height in Meters Calculate the height of the Great Pyramid in meters using either a double number line or a ratio table. Then, write an explanation for how you found the height in meters.

Before each of the next tasks, first consider whether the converted value will be greater than or less than the given measurement. Be prepared to discuss how you know.

Stone Blocks More than two million stone blocks were used to build the Great Pyramid of Giza. Each stone block in the Great Pyramid has a mass of about 2,300 kilograms.

About how much is the mass of one block in grams? Show your calculations.



Stone Blocks

Camels Egypt is home to many camels, which makes sense because camels are well suited for life in the desert. A camel's hump holds a store of fat, and its body temperature can vary up to 10 degrees. On most summer days, camels drink about 20,000 milliliters of water. How many liters of water is that?

Show your calculations.



Camels

Caracal Caracals are wild cats found in the deserts of the Middle East, Asia, and Africa. They are known for their leaping abilities and their tufted black ears. Suppose a particular caracal weighs 30.5 kilograms. How many grams does the caracal weigh?
The caracal weighs _____ gm.



Caracal

Sphinx The Great Sphinx of Giza is a very large limestone sculpture of a creature with a human head and the body of a lion. The Sphinx is 584 centimeters wide. How many meters wide is it?

Show your work.



The Great Sphinx

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 6

Applications on the Conversion Factor

Quick Code
egm6193

Learning Target

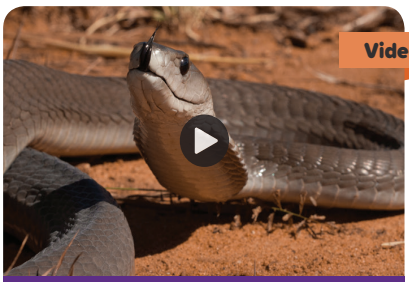
- I can apply multiple conversion factors to compare speeds given in different units of measure.

Student Behaviors

- Make sense of problems and persevere in solving them.
- Model with mathematics.
- Look for and express regularity in repeated reasoning.

ACCESS

Which Is the Fastest Animal? Many animals can travel faster than you might think. The black mamba snake is one of the fastest snakes in the world. Watch the video to find out just how fast the black mamba is. Could you outrun a black mamba?



Black Mamba

The typical top speeds of four animals are given here. Discuss with a partner.



Black Mamba Speed:
5.6 Meters per Second



Coyote Speed:
69 Kilometers per Hour



Roadrunner Speed:
889 Centimeters per Second



Great White Shark Speed:
0.93 Kilometers per Minute

Let's Chat

- Can you determine which animal is fastest or slowest just by looking at the given speeds? Why or why not?
- Which units of measure would you use to compare the four speeds?
- Why is it difficult to predict which animal is fastest from the given speeds?

BUILD AND CONNECT

Converting to Compare Animal Speeds For the following tasks, convert each speed to kilometers per hour. Which animal's speed do you already know in those units?

Animal	Speed
Black Mamba	5.6 meters per second
Coyote	69 kilometers per hour
Roadrunner	889 centimeters per second
Great White Shark	0.93 kilometers per minute

Shark Speed Write your explanations for parts A and B.

A. What conversion factor do you need to write the shark's speed in kilometers per hour? Explain how it will help you.

B. Use your conversion factor to convert the shark's speed to kilometers per hour. Include all units in your expressions.

Snake Factors The black mamba's speed is 5.6 meters per second. Which two factors are necessary to convert the snake's speed to kilometers per hour?

A. $\frac{3{,}600 \text{ sec}}{1 \text{ hr}}$

B. $\frac{1{,}000 \text{ km}}{1 \text{ m}}$

C. $\frac{1 \text{ km}}{1{,}000 \text{ m}}$

D. $\frac{1{,}000 \text{ m}}{1 \text{ km}}$

E. $\frac{60 \text{ hr}}{1 \text{ min}}$

F. $\frac{1 \text{ hr}}{3{,}600 \text{ sec}}$

Black Mamba Speed Use the conversion factors you identified to convert the black mamba's speed of 5.6 meters per second to an equivalent speed in kilometers per hour.

Compare your black mamba conversion factors and expressions with a partner's, and make corrections as necessary. Be prepared to discuss with the class how you can determine which conversion factors to use when you need to convert units multiple times.

Let's Chat

- Do the factors need to be used in a specific order? Why or why not?
- How can you combine the separate steps into one expression?

Roadrunner Convert the roadrunner's given speed of 889 centimeters per second to kilometers per hour. Show your calculations.

And the Winner Is . . . Create a copy of the chart, including the labels shown. Then, order the animals by speed from slowest to fastest.

Slowest			Fastest

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 7

Exploring Percent

Quick Code
egm6195

Learning Targets

- I can explore what *percentage* means.
- I can relate percent to fractions and decimals.

Student Behaviors

- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

ACCESS

Percents in Everyday Life You probably see and use percentages often in your everyday life. Can you think of some situations where you might have seen or used the percent of a number?



Phone Charging

Let's Chat

- Share with a partner what you already know about percentages.
- What symbol is used to represent the percent of a number?

BUILD AND CONNECT

Part A:

Describe 100% One of the most common percentages that is used in everyday life is 100 percent. Think about what 100 percent means.

Write your responses for each task.

A. A student answered 100 percent of the problems correctly on her math test. How many problems did she answer correctly?

B. Describe what 100 percent means in any context.

Represent 100% A math teacher said that 100 percent of the students in her class were present at school today. Therefore, which of these statements could be true?

Select all that apply.

A. All of the students in math class were present today.

B. Most of the students in math class were present today.

C. Fewer than half of the students in math class were present today.

D. If there are 20 students altogether in math class, then exactly 10 of them were present today.

E. If there are 24 students altogether in math class, then 24 of them were present today.

Describe 50% Another common percentage that is used in everyday life is 50 percent. Think about what 50 percent means.

A. There are 10 boys on the playground and 50 percent of them are wearing a blue shirt. How many boys are wearing a blue shirt? How do you know? Record your response.

B. Describe what 50 percent means in any context.

Compare to 50% Consider how you described the meaning of 50 percent. Then, choose from the given phrases to complete each statement.

greater than less than exactly

A. If 65 percent of the glass is full, then _____ half of the glass is full.

B. If 20 percent of the glass is full, then _____ half of the glass is full.

Make a Connection

Let's Chat Consider what you have previously learned about ratios and rates. Then, discuss the following with a partner: How are percentages related to ratios and rates?

Let's Chat Discuss your definition with a partner. Were your definitions the same?

Part B: Fractions, Decimals, Percents

In this interactive, you will be exploring the relationship between percents, decimals, and fractions.

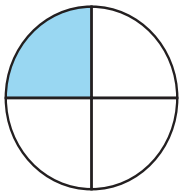
Quick Code egm6195

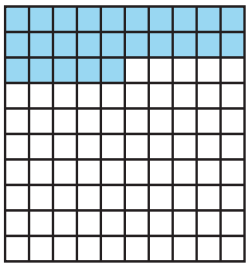
Fractions, Decimals, and Percents Interactive — Interactive

Go online to explore this interactive activity.

Connections What do you notice about the relationship between percents, fractions, and decimals? Record your observations about this relationship, supporting your explanation with examples.

Equivalent Fraction, Decimal and Percent Example





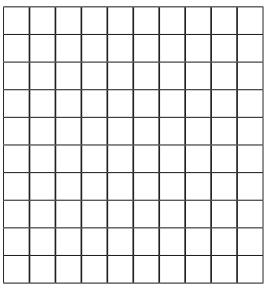
Fraction	Decimal	percentage
$\frac{1}{4}$	$\frac{25}{100} = 0.25$	= **25** %

Let's Chat Discuss with a partner the observations you made about the relationships between the different forms.

Fractions to Percents The fractions in the interactive are written as hundredths. Make a copy of the table. Then, use your knowledge of equivalent fractions to complete your table.

Fraction	Equivalent Fraction with a Denominator of 100	Decimal	Percent
$\frac{1}{4}$			
$\frac{1}{2}$			
$\frac{7}{10}$			
$\frac{2}{5}$			
$\frac{3}{20}$			

More Grids notice the 10 × 10 grid then answer:.



A. Shade parts of the grid then write the fraction, decimal, and percentage for the shaded part.

B. Seif noticed that when he moved the slider to create models with 2, 20, and 25 regions, the resulting percents were all whole numbers. Respond to the two questions.

1. Find the percentage of parts formed by Seif?

2. Why do they give us whole number percents?

LESSON 8

Finding the Part , the Whole and the Percent

Quick Code egm6197

Learning Targets

- I can identify the part, whole, and percent of a problem and what is unknown.
- I can utilize models to find the part of a whole in a percent problem.

Student Behaviors

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Model with mathematics.
- Look for and express regularity in repeated reasoning.

ACCESS

Identify Part, Whole, or Percent When solving a percent problem, it is important to understand and identify what you are trying to find. Ask yourself, "What information is given in this problem? What do I need to find out?" Always identify whether you are finding the part, the whole, or the percent before you begin to solve the problem.



Equal Parts

Problem 1 Some analysts estimate that up to 75 % of students wear eyeglasses or contact lenses. In a lecture hall, 50 college students are wearing either glasses or contact lenses. About how many students are in the hall?

Use the given descriptions for the values in this scenario.

whole part percent

75 represents the ____(A)____ .

50 represents the ____(B)____ .

The unknown value is the ____(C)____ .

Problem 2 A travel agent booked 1,500 historic tours of Egypt. Of those tours, 60 % were for the Pyramids of Giza. How many tours did the agent book for the Pyramids of Giza?

Use the given values to identify the whole, part, and percent.

1,500 60 unknown

Whole	Part	Percent

Problem 3 Ezz paid 200 LE for a pair of jeans that was on sale. The original price of the pair of jeans was 600 LE. What percent of the price did Ezz pay?

Label which values are the part, whole, or percent.

Whole	Part	Percent

BUILD AND CONNECT

Part A:

Classifying Percent Problems Write the description from the given options that is represented by each percent problem.

Finding the Percent Finding the Part Finding the Whole

A. 10% of the students in a class are wearing red. There are 30 students in the class. How many are wearing red?

B. Five out of 10 pieces of banana were eaten. What percent of the banana was eaten?

C. Of the students in a school, 300 have pets. If 30% of all students have pets, how many students are there in the school?

D. If 37% of the people in Egypt were under 18. Suppose 700 people lived in an Egyptian neighborhood. How many were most likely under 18?

E. If 40% of people that were surveyed liked wrestling and there were 80 surveys that favored wrestling, how many people were surveyed?

Write Your Own Problem Use what you know about identifying types of percent problems to create a problem of your own.

Then, swap your creation with a partner to determine what type of problem each of you made.

Let's Chat Discuss with your partner the problems that you created. Share with one another a positive comment about each problem as well as one way to improve the problem. Then, revise and resubmit your answers as needed.

Part B: Using a Tape Diagram

If a zoo goes through 800 kilograms of browse a day, and the animals all eat a certain percentage of it, how can you find the number of kilograms of browse that each animal eats?

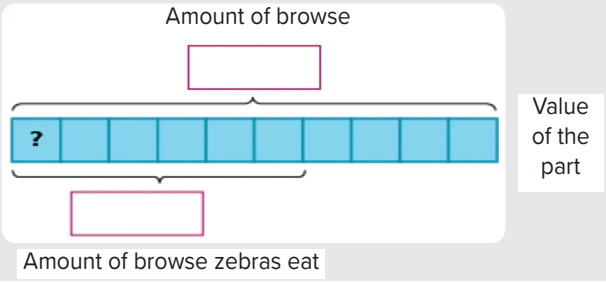


Zebras Eating Browse

Zebras Suppose that the zebras eat 60% of the 800 kg of browse the zoo goes through each day. How many kilograms of browse do the zebras eat each day at the zoo?

Whiteboard: Using a Tape Diagram

Utilize the Whiteboard to determine how many kilograms of browse the zebras eat each day at the zoo. Demonstrate your understanding by drawing .



Amount of Browse Zebras Eat How did you use the tape diagram to find the number of kilograms of browse the zebras eat?

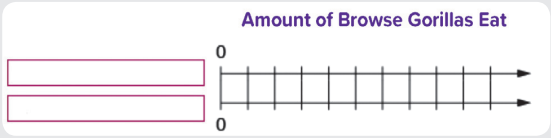
Let's Chat Compare your estimate with your final answer to see if your answer is reasonable.

Part C: Using the Double Number Line

Gorillas Now, suppose that the gorillas eat 25% of the 800 kg of browse the zoo goes through each day.

First, estimate how many kilograms of browse you think the gorillas eat each day.

Whiteboard: Using a Double Number Line Use the Whiteboard and the double number line to help you find the amount of browse the gorillas eat. Demonstrate your understanding by drawing.



Amount of Browse Gorillas Eat How did you use the double number line to find the amount of browse the gorillas eat?

Let's Chat Compare your estimate with your final answer to see if your answer is reasonable.

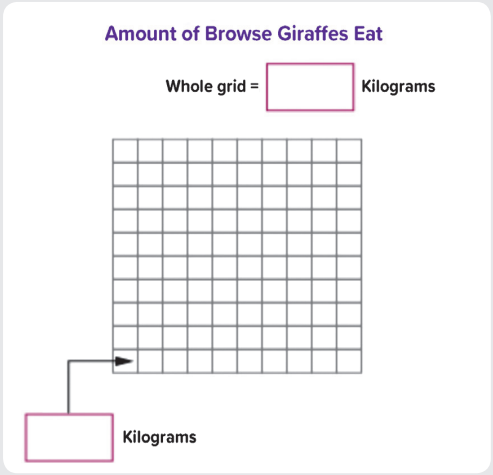
Part D: Using a 10 by 10 Grid

Giraffes Giraffes also eat browse every day at the zoo. Out of the total 800 kg of browse, suppose the giraffes eat 15%.

First, estimate how many kilograms of browse you think the giraffes eat each day.

Whiteboard: Using a 10 by 10 Grid

Use the Whiteboard and fill in the blank labels in the 10 by 10 grid to help you model the amount of browse the giraffes eat. Then, shade in the grid to help you find the amount of browse the giraffes eat. Demonstrate your understanding by drawing.



Amount of Browse Giraffes Eat How did you use the grid to find the amount of browse the giraffes eat?

Let's Chat

- Compare your estimate with your final answer to see if your answer is reasonable.
- Explore an algorithm to find value of the part knowing the whole and the percentage?

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 9

Using Models to Find the Whole

Quick Code
egm6199

Learning Targets

- I can use a variety of methods to solve problems that involve finding the whole.
- I can develop an algorithm to find the whole.

Student Behaviors

- Reason abstractly and quantitatively.
- Model with mathematics.
- Use appropriate tools strategically.
- Look for and express regularity in repeated reasoning.

ACCESS

At the Store You will probably encounter percent problems when you go shopping.



Buying Produce

Suppose you stored 40 boxes of merchandise , which is 80% of the boxes. What is the total number of boxes?

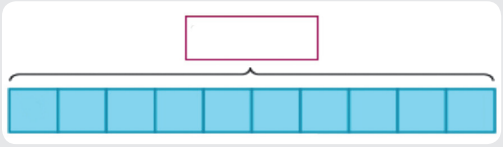
Let's Chat Have you solved problems like this previously? How might you go about trying to solve it?

BUILD AND CONNECT

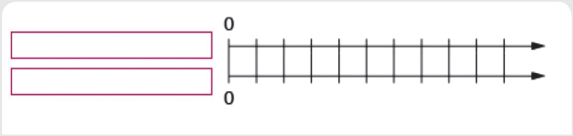
Solving the Problem Start by identifying the part, whole, and percent. Estimate the total number of boxes you started with.

Let's Chat Should this number be bigger or smaller than 40 boxes? Will it be far from or close to 40?

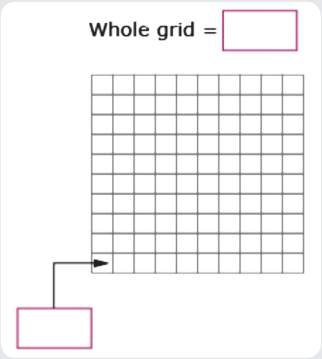
Whiteboard: Tape Diagram Utilize the tape diagram to determine how many boxes you will need to start. Demonstrate your understanding by drawing.



Whiteboard: Double Number Line Utilize the double number line to determine how many boxes you will need to start. Demonstrate your understanding by drawing .



Whiteboard: Grid Utilize the grid to determine how many boxes you will need to start. Demonstrate your understanding by drawing .

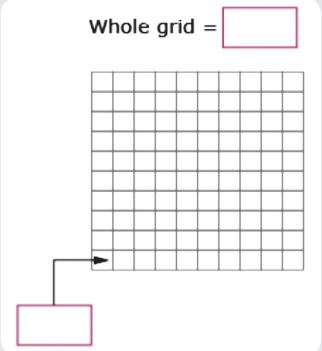


Model and Solve In the previous example; choose the model you prefer to determine an answer and explain how you used your chosen model to solve the problem.
Compare your estimate with your final answer to see if your answer is reasonable.

Solve Another Problem You are stocking apples at the store. You have stocked 80 apples, which is 16% of the number of apples that you need to stock.

create a 10 × 10 grid to model and solve this problem.

Whiteboard: Apple Grid Utilize Whiteboard: Apple Grid to determine how many apples you will need to start. Demonstrate your understanding by drawing.



Drawing Conclusions Think about a number sentence you could write that would represent the situation that you modeled on the grid.

Determine a Method Look back on the grid you used to solve the last problem. Use your grid to complete these tasks.

A. What expression did you use to find the value of one grid square? What expression did you use to find the number of apples you need to stock in all?

B. Try to solve the following problem using the same type of expression. Think about what the part was and what the percent was in your expressions. Show your work.

Suppose a coworker is stocking pears. She has stocked 36 pears, which is 36% of the total number of pears she needs to stock. How many more pears does she still need to stock?

Let's Chat Explore an algorithm to find value of the whole knowing value of the part and percentage.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 10

Using Models to Find Percentage

Quick Code
egm6201

Learning Target

- I can use a model to calculate the percent when given the part and the whole.

Student Behaviors

- Reason abstractly and quantitatively.
- Model with mathematics.
- Look for and express regularity in repeated reasoning.

ACCESS

Daily Exercise The right amount of exercise is important. Too little, and you won't see the benefits. Too much, and you risk overworked, tired muscles.



Exercising

Farouk wants to start an exercise program that involves karate and swimming. His coach has defined a weekly exercise program for beginners. Suppose Farouk exercised on Monday so far this week.

Farouk's Exercise Chart

	Karate (min)	Swimming (min)
Weekly Exercise	160	60
Monday Exercise	32	18

Let's Chat On which sport did Farouk spend a higher percent of his weekly exercise time on Monday? Before you solve the problem, work with a partner to predict the answer using estimation.

BUILD AND CONNECT

Finding Percent

Karate You can start by finding the percent of Farouk's weekly karate exercise that he did on Monday. View the three different models that you can choose from to help predict the sport with the higher percent of Farouk's exercise on Monday. Then, use the model of your choice to solve the problem. Write your reasoning and prediction.



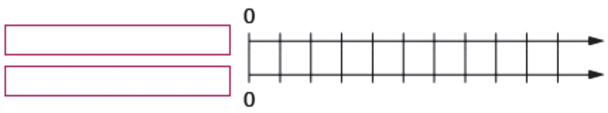
Karate

Whiteboard: Karate Tape Diagram Utilize the tape diagram to determine the percentage Farouk spent on karate exercise on Monday. Demonstrate your understanding by drawing.



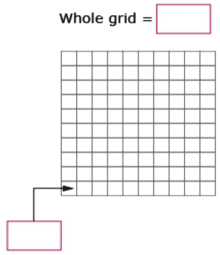
Farouk's Exercise Chart	
	Karate (min)
Weekly Exercise	160
Monday Exercise	32

Whiteboard: Karate Double Number Line Utilize the double number line to determine the percentage Farouk spent on karate exercise on Monday. Demonstrate your understanding by drawing.



Farouk's Exercise Chart	
	Karate (min)
Weekly Exercise	160
Monday Exercise	32

Whiteboard: Karate Grid Utilize the grid to determine the percentage Farouk spent on karate exercise on Monday. Demonstrate your understanding by drawing.

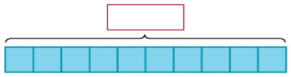


Farouk's Exercise Chart	
	Karate (min)
Weekly Exercise	160
Monday Exercise	32

Model and Solve How did you use the model to find the percent of weekly karate that Farouk did on Monday?

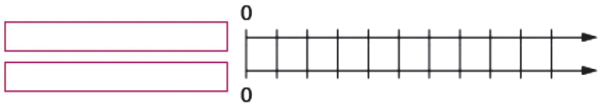
Swimming Find the percent of Farouk's weekly swimming exercise that he did on Monday.

Whiteboard: Swimming Tape Diagram Utilize the tape diagram to determine the percentage Farouk spent on swimming exercise on Monday. Demonstrate your understanding by drawing .



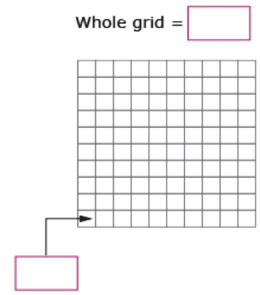
Farouk's Exercise Chart	
	Swimming (min)
Weekly Exercise	60
Monday Exercise	18

Whiteboard: Swimming Double Number Line Utilize the double number line to determine the percentage Farouk spent on swimming exercise on Monday. Demonstrate your understanding by drawing.



Farouk's Exercise Chart	
	Swimming (min)
Weekly Exercise	60
Monday Exercise	18

Whiteboard: Swimming Grid Utilize the grid to determine the percentage Farouk spent on swimming exercise on Monday. Demonstrate your understanding by drawing .



Farouk's Exercise Chart	
	Swimming (min)
Weekly Exercise	60
Monday Exercise	18

Percent of Swimming Complete these two tasks.

A. Explain how you chose and labeled your model.

B. How did you use the model to find what percent of his weekly swimming Farouk did on Monday?

Let's Chat With a partner,

- discuss the answers you just found to determine which sport Farouk spent a higher percentage of on Monday. Did Farouk spend a higher percentage of his weekly exercise time on Monday on karate or swimming?
- Explore an algorithm to find percentage knowing the whole and value of part .

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 11

Applications on Percentage

Quick Code
egm6203

Learning Target

- I can use mental math to determine the percent values of items on sale.

Student Behaviors

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Model with mathematics.

ACCESS

White Friday Sales A quick and useful way to determine the price of items on sale or determining tax or tip is to take advantage of benchmark percents like 10% and 1%.



White Friday

Many sales will be based on some percentage of the retail value, and sometimes the values are easy to calculate because we associate them with familiar fractions.

Let's Chat What percents do you know of that you can calculate quickly because you know the related ratio and can calculate that fraction of the value quickly?

Not all sales are always so clear. Sometimes the sale price will be based on other percentages like 15%, 30%, 35%, 40%, or even 60%.

How might you use 10% of any value to calculate any percentage off, or calculate the final sale price?

BUILD AND CONNECT

Using Mental Math to Find Percent Values

Determine 10% Record your responses for each of these three tasks.

A. Determine 10% of each price. Make a copy of the table and fill in the amounts.

Original Price	30 LE	45 LE	23 LE	124 LE	6,000 LE
10% of price					

B. What do you notice about the relationship between the original price and 10% of the price?

C. What generalizations can you make about calculating 10% of any number?

Let's Chat With a partner, discuss and verify your answers, revising as necessary. Then, continue your discussion with the following questions. Be prepared to share your reasoning in a large group discussion.

- How can you use the generalization to find 10 percent of 80 LE quickly, without a calculator?
- How could you use your value of 10 percent to find 20 percent of 80 LE?

Warming Up with 10% Make a copy of each table and calculate the described amounts to complete it.

A. Determine 10 % for each of the given values in column one and three.

Original Price	10% of the Price	Original Price	10% of the Price
50 LE	_____ LE	42 LE	_____ LE
140 LE	_____ LE	320 LE	_____ LE
9 LE	_____ LE	5.3 LE	_____ LE

B. Now, use the values you found for 10 % to find these percents.

What is 20% of 42 LE?	_____ LE
What is 30% of 320 LE?	_____ LE

Shopping Spree! Here is a list of sale items, each with its own percent off. Copy and complete the table, using tickets as the defined currency.

- Determine the 10 % value, and then use mental math to compute the related savings for the discount percentage that is listed for each item.
- Compute the sale price of the item after applying the discount.

Item and Price	Percent Off	Savings	Sale Price
Shoes: 1,400 LE	20%	_____ LE	_____ LE
T-shirt: 900 LE	30%	_____ LE	_____ LE
Jeans: 500 LE	40%	_____ LE	_____ LE

Out for Lunch You stop for lunch after shopping. The lunch bill for you and a friend is 34 tickets. Use your reasoning of 10 percent to determine the sales tax and the minimum tip. Make a copy of each table and complete it with the appropriate amounts. Keep in mind that tax and tip are each typically calculated using the original lunch bill.

Lunch Bill	10% Value	Tax (5%)	Tip (15%)
340 LE	_____ LE	_____ LE	_____ LE

Total Spent on Lunch:	_____ LE

Let's Chat Discuss with a partner these questions related to each of the tasks you just completed:

- If a 360 LE pair of shorts is on sale for 25 % off, what are two different ways you could reason this percentage to determine the amount of savings?
- How would you reason the price of jeans that cost 500 LE if there were another 15 % discount applied to the new sale price after the original 40 % discount?
- If sales tax were 7 %, how could you extend your reasoning to determine this value?

Whiteboard: Gift Choices Utilize the Whiteboard to determine the sale price of each item by calculating the discount for the following question. Demonstrate your understanding by drawing.

Price and Discount	Sale Price	Price and Discount	Sale Price
Gift A: 20% off 420 LE		Gift D: 5% off 330 LE	
Gift B: 60% off 740 LE		Gift E: 15% off 350 LE	
Gift C: 40% off 480 LE		Gift F: 3% off 320 LE	

Birthday Gift Budget Apply your new reasoning for determining percent values by using benchmark percents.

Which gifts in Gift Choices fall within your budget of spending less than 300 LE? Select all that apply.

A. Gift A
B. Gift B
C. Gift C
D. Gift D
E. Gift E
F. Gift F

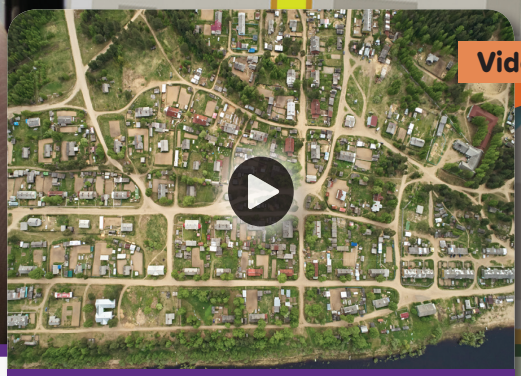
Check Your Understanding Follow your teacher's instructions to complete this activity

UNIT

11

Theme 4 | Applications of Geometry and Measurement

Coordinate Plane



Coordinate Plane

Unit Opener Video: Coordinate Plane

Quick Code egm6205

Explores how coordinate planes and grid systems are used to communicate relative locations in mathematical terms.

Key Vocabulary

area, coordinate plane, coordinates, horizontal axis, line segment, ordered pair, perimeter, quadrant, rectangle, reflection, square, trapezium, triangle, x-axis, x-coordinate, y-axis, y-coordinate

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION
وزارة التربية والتعليم والتعليم الفني

LESSON 1

Exploring the Coordinate Plane

Quick Code egm6206

Learning Targets

- I can review locations of points in the first **quadrant** of the coordinate plane.
- I can discover the need for other quadrants.

Student Behavior

- Look for and express regularity in repeated reasoning.

ACCESS

Archaeological Dig 1 Artifacts have been found at the latest archaeological dig. Archaeologists have roped off the **area** and set up a grid system so that they can accurately record the locations of the artifacts that they discover.



Archaeological Dig

Let's Chat Discuss your answer with a partner.

- What do you think archaeologists dig for?
- What do you think a strategy would be for deciding where to excavate?

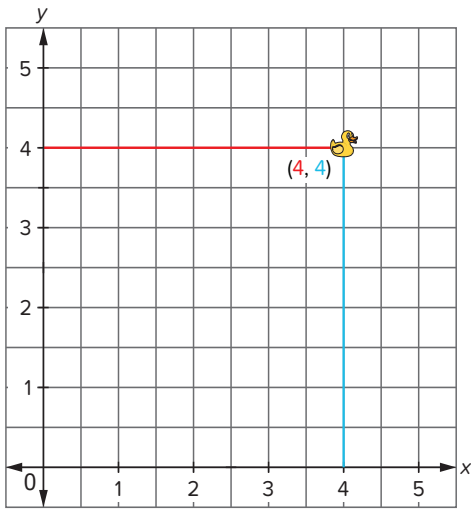
BUILD AND CONNECT

Understand the Coordinate Plane Explore this interactive to discover the relationship between **ordered pairs** and the locations. Explore the coordinate plane to find three pieces of an ancient artifact.

Quick Code egm6206

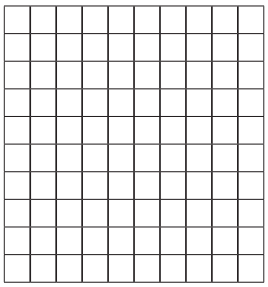
Archaeological Dig I Interactive — Interactive

Go online to explore this interactive activity.



Can you label the point *(-4 , 2) in the above* coordinate plane?

Whiteboard: Plotting Points Demonstrate your understanding by drawing:



- Draw and label the *x*-axis.
- Draw and label the *y*-axis.
- Label the origin (0,0).
- Plot and label points $A\,(3,0)$, $B\,(0,3)$, and $C\,(5,4)$.

Coordinate Plane Review Along with your graph, explain how points *A* and *B* are similar and different.

Ordered Pairs An ordered pair is generally shown as (x , y) . Explain what the *x* variable tells us about where to plot the point. Then, explain what the *y* variable tells us about where to plot the point.

Analyzing Coordinates Identify which statements are true:

A. The larger the value of the *x*-coordinate, the closer the point is to the origin.

B. The smaller the value of the *y*-coordinate, the closer the point is to the *x*-axis.

C. The smaller the value of the *x*-coordinate, the closer the point is to the *y*-axis.

D. Making the values of the *x*- and *y*-coordinates larger moves the point farther away from the origin.

E. To move a point 2 spaces up and 1 space to the right, increase the *y*-coordinate by 2 and the *x*-coordinate by 1.

F. To move 2 spaces up and 1 space to the right, increase the *x*-coordinate by 2 and the *y*-coordinate by 1.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 2

Analyzing The Coordinate Plane

Quick Code egm6208

Learning Target

- I can discover how to plot points for each quadrant of the coordinate plane.
- I can discover how to plot point by reflection in x-axis or y-axis..

Student Behavior

- Look for and express regularity in repeated reasoning.

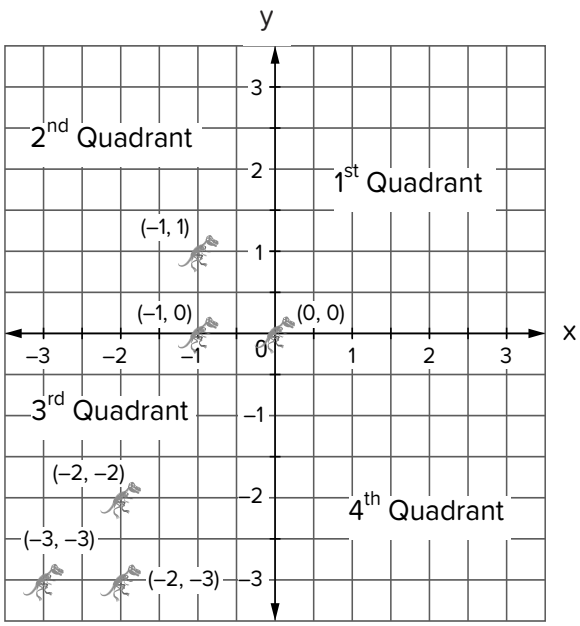
ACCESS

Archaeological Dig 2 A new coordinate plane has been provided for the archaeological dig. Play this game to help you see the relationship between the signs of the ordered pairs and the quadrants where they are located.

Quick Code egm6208

Archaeological Dig II Interactive — Interactive

Go online to explore this interactive activity.



Match Them Up A coordinate plane is separated into four parts by a horizontal line called the *x*-axis, and a vertical line called the *y*-axis. Each part is called a quadrant

Create a list with the ordered pairs shown. Look back at Archaeological Dig 2 to determine which quadrant can you plot the ordered pair, (x, y).

(positive, positive)	(negative, negative)	(positive, negative)	(negative, positive)
x-coordinate is 0	*y*-coordinate is 0	the origin	

G. 1st Quadrant
H. 2nd Quadrant
I. 3rd Quadrant
J. 4th Quadrant
K. Point is on *y*-axis
L. Point is on *x*-axis

Plot the Points Plot the points listed on a coordinate plane.

A $(-3,0)$
B $(0,-3)$
C $(-2,-3)$
D $(2,-3)$
E $(-2,3)$
F $(2,3)$
G $(5,5)$
H $(-6,-6)$
I $(0,0)$

J. Which point(s) are plotted on the *y*-axis? _____

BUILD AND CONNECT

Reflection Think about your **reflection** in a mirror, lake, or window.



Mirror

Let's Chat Discuss the following with a partner:

- If you put your right hand up, which hand appears to be up in your reflection?
- How would you describe your reflection?
- How do you think this is related to the reflection of opposite numbers on a number line?

Reflect Across the y-axis Using graph paper, plot a point in the 1st quadrant. Let the *y*-axis act as the "mirror."

A. Write the ordered pairs of the two points you plotted.

B. What do you notice about the coordinates of the ordered pairs by reflection across y-axis?

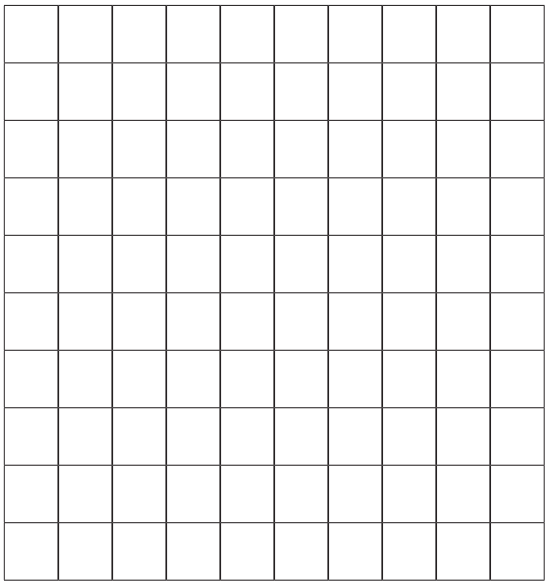
C. If you use the point (3, 4) and you want to reflect it in y-axis, then you will need to change x to its opposite value and keep the value of y as it is, then the image will be (... , ...)

Reflect Across the x-axis Plot a different point in the 1st quadrant.. Let the *x*-axis act as the "mirror." Now, reflect that point across the *x*-axis and plot the new point.

A. Write the ordered pairs of the two points you plotted.

B. What do you notice about the coordinates of the ordered pairs by reflection across x-axis?

C. If you use the point (3, 4) and you want to reflect it in x-axis, then you will need to change y to its opposite value and keep x as it is, then the image will be (... , ...)



Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 3

Analyzing Points on The Coordinate Plane

Quick Code
egm6210

Learning Targets

- I can expand understanding of ordered pairs and the four quadrants on the coordinate plane.
- I can describe the location of points that do not lie at the intersection points of the lines of the coordinate plane..

Student Behaviors

- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

ACCESS

Plotting and Naming Points Previously, you explored how to plot and name points in all four quadrants of the coordinate plane.



Points Plotted

Let's Chat Think about what you have discovered as you discuss the following with a partner:

- How would you describe each of the ordered pairs that have been used in the previous activities?
- Name a point that would not fall directly on the intersection of the grid lines in a coordinate plane.
- How would you describe each of the ordered pairs that are not located directly on the intersection of the grid lines?

BUILD AND CONNECT

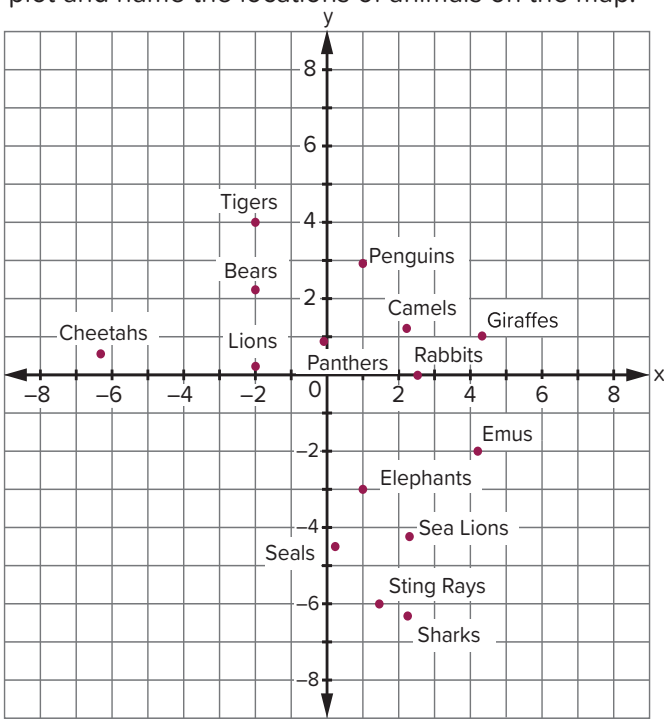
Part A: Mapping Classroom Objects

HANDS-ON ACTIVITY

Mapping Classroom Objects Explore how to plot and name points with rational number coordinates in this classroom activity.

Let's Chat Now that you have investigated how to plot points with rational number coordinates, think about other situations in which this skill might be helpful. Discuss your ideas with a partner.

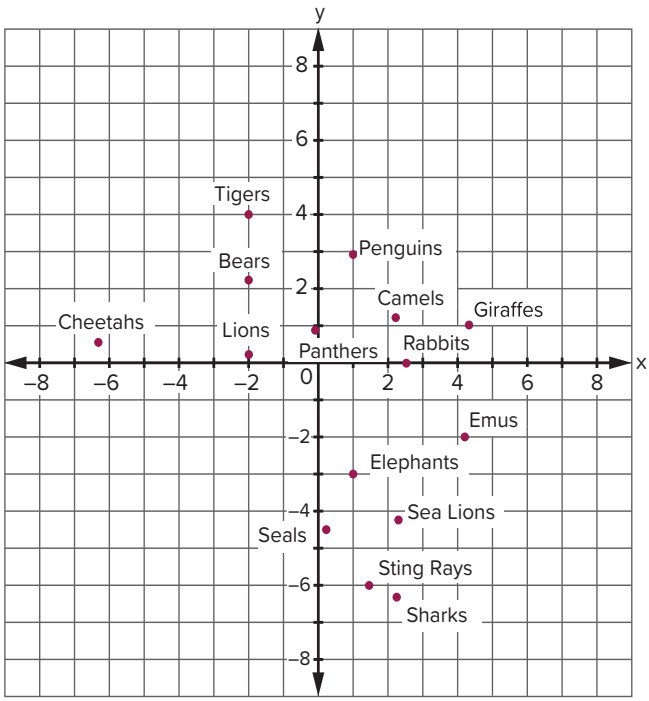
Part B: Locate and Plot Points at a Zoo There are plans to create a new zoo in town. Think about how you would plot and name the locations of animals on the map.



Analyze Errors Identify the error that each student made in estimating the coordinates of the sting ray enclosure shown on the map. Explain their mistake and how to correct it.

Hossam says that sting rays are located at $(2.5,-6)$.

Marwa says that sting rays are located at $(-6,1.5)$.



Animal Enclosure Coordinates Using the coordinate plane in Analyze Errors, write the coordinates of each animal enclosure listed as an ordered pair using decimals.

Mark each location with coordinates to the nearest $\frac{1}{4}$ of a unit.

Tigers (A)

Emus (B)

Bears (C)

Lions (D)

Giraffes (E)

Locate Animal Enclosures Using the coordinate plane in Analyze Errors, write the name of the animal that is located nearest to each of the coordinates listed.

$(-6.25, 0.5)$ (A)

$(2.25, -6.25)$ (B)

$\left(\frac{1}{4}, -4\frac{1}{2}\right)$ (C)

$(2.25, -4.25)$ (D)

$\left(2\frac{1}{2}, 0\right)$ (E)

Reflection Using the coordinate plane in Analyze Errors, write the coordinates animal enclosures then choose pairs which are reflections of each other over one of the axes on the map.

A. Cheetahs and Lions
B. Giraffes and Emus
C. Tigers and Bears
D. Panthers and Rabbits
E. Penguins and Elephants

LESSON 4

Exploring the Distance between Points on a Line

Quick Code
egm6214

Learning Target

- I can find the distance between points on a horizontal and vertical number line using understanding of absolute value.

Student Behavior

- Look for and express regularity in repeated reasoning.

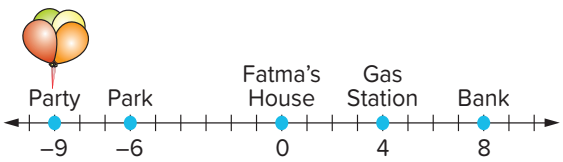
ACCESS

Birthday Party Fatma has been invited to her friend's birthday party. She is waiting at home for a ride to the party. The driver's car only has enough gas to travel 5 kilometers from Fatma's house. Will she be able to get to the party? Let's find out.



Birthday Party

The number line shows the locations of some important places in town. Each tick mark on the number line represents 1 km.



Let's Chat

- What do you notice about the number line?
- How can you find distance when there are negative values?

BUILD AND CONNECT

Find Distance on a Number Line

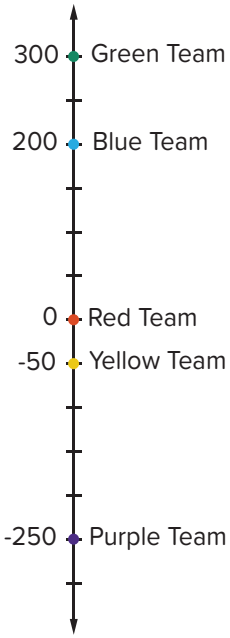
Explain Using your knowledge of absolute value and how it is used to find distances, explain how Fatma can get to the party.

How many kilometers will she travel to get there? Explain your response and provide the total number of kilometers she traveled to get there.

Let's Chat Share your reasoning in Explain with peers, revising your answers if needed. Then, discuss the following questions.

- How did you include absolute value in your thinking?
- Would it be necessary to use absolute value if the locations were both to the right of your house?

Game Points At the party, the friends play a game in teams. In the game, teams can either gain or lose points on each turn depending on their performance. Each team's score has been recorded on a scoreboard.



Find the Score Spread How many more points would the team in last place have to earn to catch up with the team in first place? Explain your reasoning.

A. 250 **B.** 450 **C.** 550 **D.** 600

Investigate Other Teams Now, calculate the number of points that each different team would need to earn to catch up to the leader. Which calculations were the easiest? What features of the point values made the calculations easier?

Let's Chat Share with a partner your answers in Find the Score Spread and Investigate Other Teams. Revise your responses as needed. Be prepared to share your findings with your peers.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 5

Exploring Distance between Points on a Coordinate Plane

Quick Code
egm6216

Learning Target

- I can develop strategies for finding distance between points when **x-coordinates** or **y-coordinates** have different signs.

Student Behaviors

- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

ACCESS

Fundraising You are raising money for a new computer lab by selling wrapping paper. You are able to keep 15% of your total sales.

You plan to ask your neighbors if they are interested in buying wrapping paper to support your fundraiser. You will visit only the homes of the neighbors you and your family know.



Selling Wrapping Paper

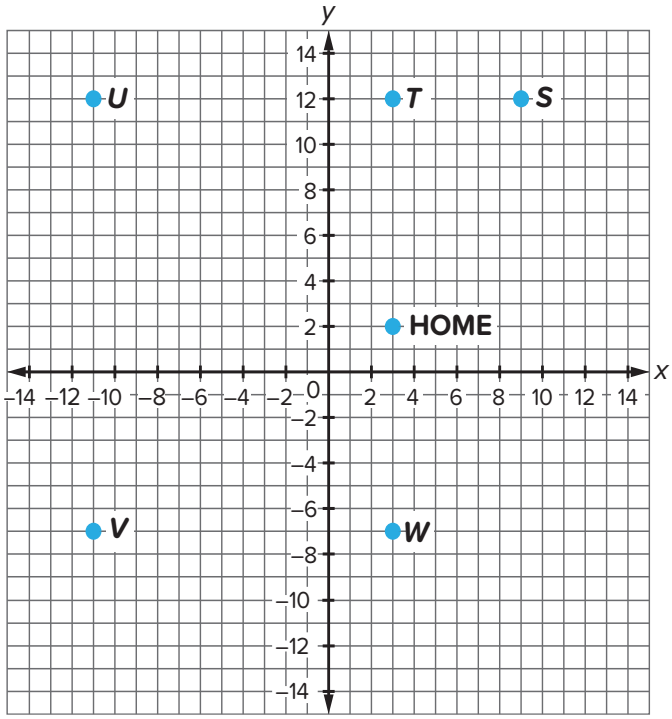
Let's Chat

- Have you ever been involved in fundraising activities?
- Did you discuss how to keep track of the people you visited?
- Did you plan out a route for your fundraising? How did you do that?

BUILD AND CONNECT

Find Distances on the Coordinate Plane

Suppose the following map shows your neighborhood and the homes you plan to visit. Each **square** on the grid represents one block. Use the map to complete the following exercises.



Find a Distance Answer each of the following questions.

A. Suppose you started at Home and went to House *T* first.

a. What are the coordinates of both your Home and House *T*?

b. What do you notice about the coordinates for your Home and House *T*?

B. Besides counting grid squares, how can you find the distance between your Home and House *T*?

C. What is the distance between your Home and House *T*?

Select a Statement Think about how you would find the distance between your Home and House *W* using absolute value. Then, select the true statement.

A. The absolute value of the *y*-coordinates can be added together for a distance of 9 blocks.

B. The absolute value of the *x*-coordinates can be added together for a distance of 6 blocks.

C. The absolute value of the *y*-coordinates can be subtracted for a distance of 5 blocks.

D. The absolute value of the *x*-coordinates can be subtracted for a distance of 0 blocks.

Look at the locations of Houses *S*, *T*, and *U*. Write your explanation for each of the questions.

A. Explain how you can use absolute value to find the distance between House *S* and House *T*.

B. Explain how you can use absolute value to find the distance between House *T* and House *U*.

Map Your Route Now, plan a route that starts at your Home, goes directly to *W*, visits all five Houses, and then ends at your Home. You stay on the path of the Houses and you only travel along the grid lines. Each unit on the map represents one block.

Create a chart similar to the one shown and fill it in with the appropriate information in each column.

Starting House	Coordinates	Next Stop	Coordinates	Distance (Number of blocks)
Home				
		Home		
			Total Distance	

Let's Chat Share the route you took with your peers. Did they take the same route? Discuss how you found each distance.

Points on the Same Vertical and Horizontal Lines Look back on the distances you calculated between the Houses. Which Houses are on the same horizontal line? Which Houses are on the same vertical line? How could you use the coordinate points to determine which Houses are on the same horizontal or vertical line?

Find Locations Suppose you are at House *V*, which has coordinates $(-11,-7)$. The following coordinates give the locations of other Houses in the neighborhood.

Which of the following locations would be on the same vertical line as House *V*? Select all that apply.

A. $(-11,-7)$ **C.** $(-11,0)$ **E.** $(0,-7)$

B. $(11,-7)$ **D.** $(4,-7)$ **F.** $(-11,-1)$

Find More Locations Suppose you are back at Home with the coordinates of $(3,2)$. The following coordinates give the locations of other Houses in the neighborhood.

Without plotting the points, which of these point locations would be on the same horizontal line as your Home? Select all that apply.

A. $(10,2)$ **C.** $(3,6)$ **E.** $(-13,2)$

B. $(-6,2)$ **D.** $(2,6)$ **F.** $(-3,6)$

Drawing Conclusions

Let's Chat With a partner, discuss how you can find the following:

- the distance between two points on the same horizontal line with *x*-coordinates that are different signs
- the distance between two points on the same horizontal line with *x*-coordinates that are the same sign
- the distance between two points on the same vertical line with *y*-coordinates that are different signs
- the distance between two points on the same vertical line with *y*-coordinates that are the same sign

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 6

Create Geometric Shapes in The Coordinate Plane

Quick Code
egm6218

Learning Target

- I can draw a geometric shape in a coordinate pane knowing the coordinates of its vertices..

Student Behaviors

- Use appropriate tools strategically.
- Look for and make use of structure.

ACCESS

Geometry in Art Graphing geometric shapes on the coordinate plane gives artists, architects, and people in many other careers a way to use calculations to find geometric properties.



Geometry in Architecture

Let's Chat

- What geometric shapes did the artist use to create this building?
- Would a coordinate plane be helpful in drawing some of these shapes? Why?

BUILD AND CONNECT

Identify Shapes on the Coordinate Plane



Shapes

Identify Shapes Each set of points can be connected with lines to create a shape on a coordinate plane.

Using graph paper, plot each set of points, calculating side lengths to aid in correctly identifying each shape.

Then, match each set of vertices to the shape it represents.

$\{(1,2),(1,-4),(-3,-4),(-3,2)\}$ $\{(0,0),(4,1),(8,0)\}$

$\{(5,-2),(5,1),(3,3),(3,4)\}$ $\{(3,-3),(-1,-3),(-1,6)\}$

$\{(-2,1),(-2,-4),(3,-4),(3,1)\}$

A. Square

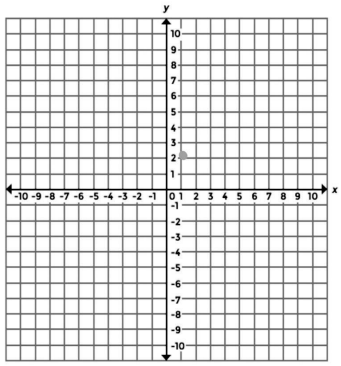
B. Rectangle

C. Right Triangle

D. Trapezium

E. Non-right Triangle

Whiteboard: Square Coordinates The point $(1,2)$, plotted on the coordinate plane, is one vertex of a square with sides 3 units long. Plot three additional points on the grid to complete this square. Demonstrate your understanding by drawing



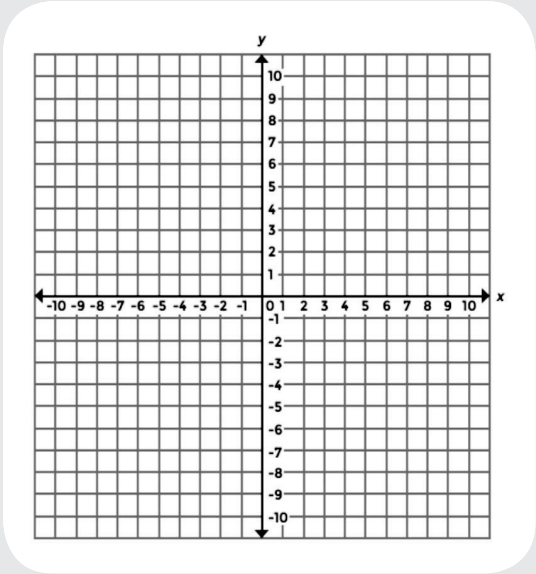
Write the Coordinates of the Vertices Write the coordinates of the vertices of the square you created on graph paper or in the Whiteboard.

Let's Chat Compare the square you made with a partner's square and discuss the following questions:

- What patterns do you notice about the ordered pairs?
- How did you use distance or absolute value to make your square?
- Suppose someone created a figure with the coordinates $(1,2)$, $(5,2)$, $(5,-1)$, and $(1,-2)$. How could you use the coordinates to determine whether he or she made a square?

Check Your Understanding Follow your teacher's instructions to complete this activity

Whiteboard: Rectangle Coordinates The point $(-3,-2)$ is one vertex of a rectangle with a length of 6 units and a width of 1 unit. Using graph paper, plot 3 additional points to complete the rectangle. Demonstrate your understanding by drawing.



Rectangle Coordinates Complete these two tasks by logging your coordinates and explanation.

A. Write the coordinates of the vertices of the 3 other points you plotted to complete the rectangle you just created using graph paper or in the Whiteboard.

B. Explain how the coordinates of the ordered pairs of the vertices are related.

Triangle Coordinates Suppose you used the point $(-2, 2)$ as a vertex to create a right triangle with leg lengths of 3 units and 5 units.

Which sets of coordinates could represent the other vertices? As needed, sketch the figures formed by the given coordinates. Then, record your choices. Select all that apply.

A. $(-2,5), (-7,2)$

B. $(-2,-3), (3,-3)$

C. $(1,2), (-2,7)$

D. $(-2,-7), (1,-7)$

Right Angles You have just explored coordinates of the vertex points of rectangles and right triangles. Complete each of these tasks that compare rectangles, right triangles, and right angles.

A. Using graph paper, plot the points $(4,-6)$, $(4,1)$, and $(3,-6)$, and connect them using line segments. Does this figure form a right angle? If yes, what are the coordinates of the vertex of the right angle?

B. Describe how you can analyze the coordinates to help you decide whether these 3 points would form a right angle.

C. What additional point can you include to make a rectangle using the points $(4,-6)$, $(4,1)$, and $(3,-6)$?

Use What You Know

Let's Chat Now that you have explored several shapes on the coordinate plane, work with a partner to use the patterns you have noticed to explain the following:

- How can you decide if a polygon is a square if you know the coordinates of the vertices?
- How can you describe the coordinates of the vertices of a rectangle? How are they different from the vertices of a square?
- What conclusions can you make about the vertices of other polygons, such as a right triangle or trapezium?

Check Your Understanding Follow your teacher's instructions to complete this activity

UNIT

12

Theme 4 | Applications of Geometry and Measurement

Area of Some Polygons



Area of Some Polygons

Unit Opener Video: Area of Some Polygons

Quick Code egm6222

Explore ways to break down several everyday three-dimensional objects into their component parts.

Key Vocabulary

acute triangle, area, base, congruent, formula, height, kite, obtuse triangle, parallelogram, perimeter, polygon, rhombus, right triangle, trapezium, vertices

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION

LESSON 1

Area of Parallelogram

Quick Code
egm6225

Learning Target

- I can practice finding **height** and **base length**, and then use a **formula** to calculate the area of parallelograms.

Student Behaviors

- Model with mathematics.
- Attend to precision.

ACCESS

Mosaics Mosaic designs often use many different shapes, including rectangles and other types of parallelograms.



Mosaics

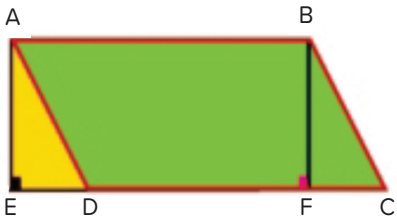
Let's Chat

- What shapes do you see in the mosaics?
- What are the attributes of those shapes?

BUILD AND CONNECT

Parallelograms

So far, you have discovered the relationship between the area of a rectangle and the area of parallelogram ABCD.

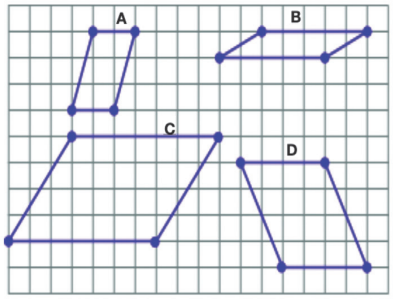


Let's Chat

- What is the relation between the two sides AE and DF?
- What is the name of each of them in the parallelogram?
- What is the relation between the two sides AD and BC?
- What is the name of each of them in the parallelogram?
- Can you determine other heights for the parallelogram?

The area *A* of any parallelogram with base *b* and height *h* can be represented by the formula A = b × h. You need to know the height and base in order to use this formula.

Whiteboard: Parallelograms Draw a line to show the height for each parallelogram. Determine and label the heights and bases for each parallelogram. Use **A=bh** to calculate the areas. Demonstrate your understanding by drawing .



Areas

A = _____

B = _____

C = _____

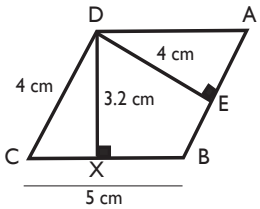
D = _____

Analyze Parallelograms

1. Explain how finding the area of parallelograms is different from finding the area of rectangles.
2. Then, find the area of each parallelogram.

Parallelogram A	Parallelogram B	Parallelogram C	Parallelogram D
(A)	(B)	(C)	(D)

Try This! Analyze this parallelogram and consider what values could be defined as base and height. There is more than one way to define these measures. The resulting area of the parallelogram should be the same when the correct combination of base and height are chosen. Round the final value of area to the nearest whole number.



Base	Height	Area
(A)	(B)	(C)

Let's Chat Discuss with a partner the dimensions you found for the parallelogram. Explain why there could be more than one way to define the base and height.

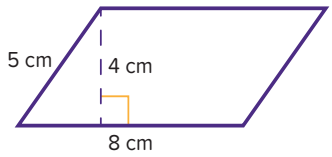
Determine Dimensions A rectangle has an area of 91 cm^2. What is one possible pair of integers that define this rectangle's dimensions? (Do not use 1 and 91.)

Base	Height
(A)	(B)

Area of a Parallelogram Draw a rectangle with the dimensions you chose in the last task. Then, draw and label the dimensions of a non-rectangular parallelogram so that both shapes have the same areas.

How did you use the dimensions of the rectangle to create a parallelogram that had the same area as the rectangle?

Analyze Ezz and Mohab are debating whether they can use the following tile in a mosaic design. Their teacher requires that any tile used must have an area that is at least 40 square centimeters. Ezz says that the tile is too small, but Mohab says it is just the right size.

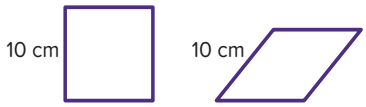


Decide who is correct and explain why.

Rhombus

The **rhombus** is a special case of parallelogram with sides that are all equal in length Therefore, the formula of finding area of parallelogram can be used to find the area of rhombus..

Area of a Square A square is a rhombus with 4 right angles. Consider the given square and rhombus.



Complete these two tasks.

A. Explain why you can use the formula A = S x S where *s* is the side length instead of **A=bh** to find the area of the square?

B. Can you use A = S x S to find the area of the rhombus? If so, explain why. If not, explain how you can find the area.

Let's Chat Discuss with a partner your reasoning in the previous tasks, revising your responses as needed.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 2

Area of the Right-Angled Triangle

Quick Code
egm6227

Learning Targets

- I can determine the areas of **right triangles** using a formula.
- I can explore how the formula used to calculate the areas of right triangles can be used on any triangle.

Student Behaviors

- Model with mathematics
- Attend to precision.
- Look for and make use of structure.

ACCESS

Skate Ramp

Take a look at the skate ramp. What shapes are the sides of the skate ramp?



Skate Ramp

Let's Chat Suppose you and your friends wanted to build a similar ramp. How could you determine the quantity of wood you would need to build the two faces of the ramp?

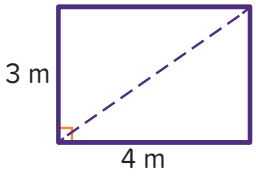
BUILD AND CONNECT

Area of a Right-Angled Triangle

Area Relationships The diagram shows a piece of wood that is to be cut into the two triangular faces of the skate ramp.

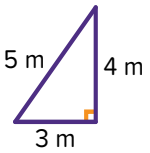
A. What is the area of of each triangular piece of wood?

B. what is the relation between area of each triangle and the area of the rectangle?

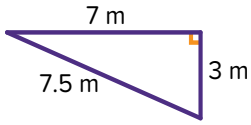


Calculating Area Two other students are designing their own skate ramps using the subsequent dimensions. They only need to buy the wood for the 2 triangular sides of their skate ramps. Note: The actual ramp and support beams are being provided.

Taher's Design



Diaa's Design



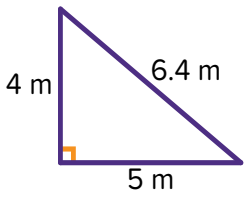
Answer the following:

A. what is the area of wood will Taher need? Explain your reasoning.

B. what is the area of wood will Diaa need? Explain your reasoning.

C. Each person has budgeted 1000 LE for wood. wood costs 60 LE per square meter. Justify whether Taher and Diaa is each within budget.

Analyze Methods Suppose some students found the area of the given triangle using the methods described in the answer choices. Which students used an appropriate method? Choose all that apply.



A. Aya multiplied the base and the height.

B. Gamila multiplied the base, the height, and the length of the hypotenuse and then divided by 2.

C. Maha multiplied the base and the height and then multiplied by one half.

D. Ola divided the length of the base by 2 and then multiplied by the height.

E. Dalal multiplied the base by the height and divided by 2.

F. Jana divided the height by 2 and then multiplied by the base.

Expressions Write an algebraic expression for each student's method listed in this table. Use *b* for base and *h* for height.

Description	Algebraic Expression
Maha multiplied the base by the height and then multiplied by one half.	(A)
Ola divided the base by 2 and then multiplied by the height.	(B)
Dalal multiplied the base by the height and divided by 2.	(C)
Jana divided the height by 2 and then multiplied by the base.	(D)

Now, evaluate each expression if **b=2** and **h=3**.

What do you notice about the expressions? (E)

Let's Chat Discuss your answers with a partner and then answer the question.

Which of the expressions could you use as the formula for the area of a right triangle?

A Formula for the Area of a Triangle

Do you think that the formula you wrote for the area of a right triangle can also be used for acute and **obtuse triangles**?

Exploring Area of Triangles Complete the activity to explore the area of acute and obtuse triangles.

Areas of Acute and Obtuse Triangles Use what you discovered in the Hands-On Activity to answer the following questions.

A. What new shape were you able to make?

B. Can you use $A = \frac{1}{2}bh$ to find the area of any type of triangle? Explain.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 3

Area of Acute and Obtuse Triangles

Quick Code
egm6229

Learning Targets

- I can explore heights and bases of acute and obtuse triangles
- I can discover the area of acute and obtuse triangles by using a formula.

Student Behaviors

- Make sense of problems and persevere in solving them.
- Model with mathematics.

ACCESS

Triangular Houses

Finding the height of a triangle is not always easy. Look at the house and think about how to find its height.



Triangular House

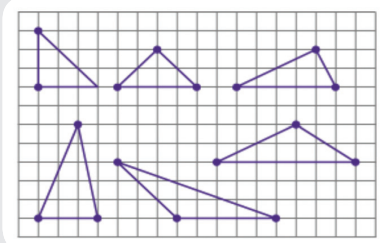
Let's Chat

- Where is the height of the triangle in this photo?
- How can it be measured?

BUILD AND CONNECT

Base, Height, and Area of Triangles

Whiteboard: Triangles Draw a line to show the height of each of the triangles. Then, determine and label the heights of each triangle. Demonstrate your understanding by drawing.



Heights of Triangles What did you notice about each of the heights that you drew? Were any heights more challenging to identify than others?

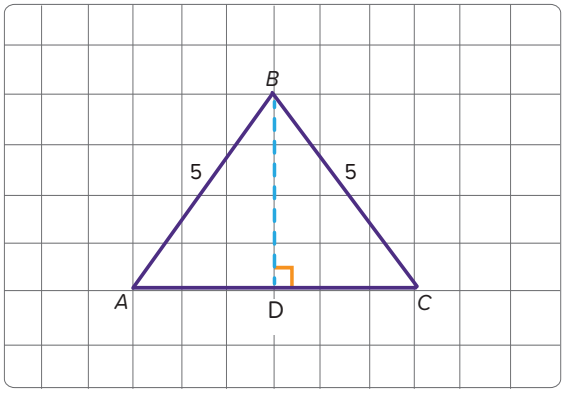
Think about what would happen if you were to use different sides of the triangle for the base. Would you get different areas?

Exploring Base and Height Use the formula $A = \frac{1}{2}bh$ to explore this situation.

Let's Chat Talk with a partner about what you discovered during the activity.

- Is the area of a triangle affected by changing the base and its corresponding height??

Area of an Acute Triangle Use a formula to find the area of $\triangle ABC$. Show your work, and answer this question. How is finding the area of the triangle using a formula similar to evaluating an expression?

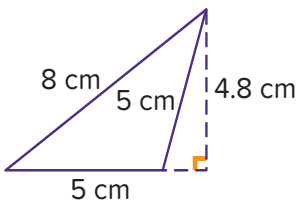


Area of an Obtuse Triangle Two students found the area of the following obtuse triangle. Answer these two questions for each student's method. Does each method work?

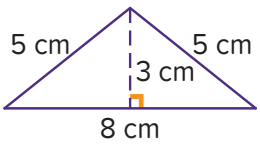
A. Rami sketched the triangle and found the height as shown. To find the area, he multiplied the product of 4.8 cm and 5 cm by one half.

B. Baher sketched the triangle and found the height as shown. To find the area, he multiplied one half by 8 cm and then multiplied by 3 cm.

Rami's Sketch



Baher's Sketch



Let's Chat Discuss with a partner the different methods that can be used to find the area of any triangle Explain the number of heights of the triangle (right-angled, acute-angled, obtuse-angled?.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 4

Exploring Area of Trapezium

Quick Code
egm6235

Learning Target

- I can discover the area of a trapezium using composition and decomposition.

Student Behaviors

- Make sense of problems and persevere in solving them.
- Look for and make use of structure.

ACCESS

Tiling and Irregularly-Shaped Areas

When installing floor or wall tiles in a garden, people have to calculate the area of irregularly-shaped. This way, they can determine how many boxes of tiles they will need to buy.



Tiling

Let's Chat

- What would you do to estimate how many boxes of tiles you would need to buy?
- What would you need to know?
- What could possibly cause a problem with your estimation?

HANDS-ON ACTIVITY

Trapezium Area Utilize the activity for hands-on learning and practice.

BUILD AND CONNECT

Exploring Trapeziums and Area

Use the interactive to explore the relationship between trapeziums and other shapes. Use the relationships and formulas for area that you already know to help you calculate the area of a trapezium.

Area Architect 1

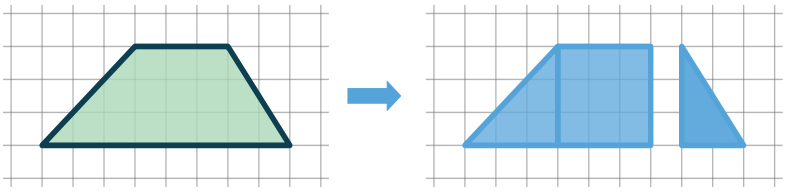
Quick Code egm6235

Area Architect 1 Interactive

Interactive

Go online to explore this interactive activity.

Area of Trapezium Example



Area of Each Composite Piece



$A = \frac{1}{2}bh$

$\frac{1}{2} \times 3 \times 3 = \frac{9}{2}$ cm²

$A = lw$

$3 \times 3 = 9$ cm²

$A = \frac{1}{2}bh$

$\frac{1}{2} \times 2 \times 3 = \frac{6}{2}$

$\frac{6}{2} = 3$ cm²

Total:

$= \frac{9}{2} + 9 + 3$

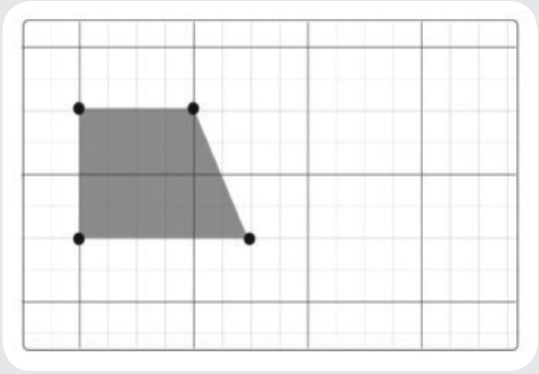
$= \frac{9}{2} + \frac{9}{1} + \frac{3}{1}$

$\frac{9}{2} + \frac{18}{2} + \frac{6}{2} = \frac{33}{2}$

$\frac{33}{2} = 16\frac{1}{2}$ cm²

Let's Chat Did you decompose (break apart) the trapezium to find the area? Did you compose (put together) more than one trapezium to create another familiar figure? Discuss with a partner.

Whiteboard: Composing or Decomposing Use the grid to show how you could find the area of this trapezium by composing or decomposing the figure. Demonstrate your understanding by drawing in your journal or using the digital tool.

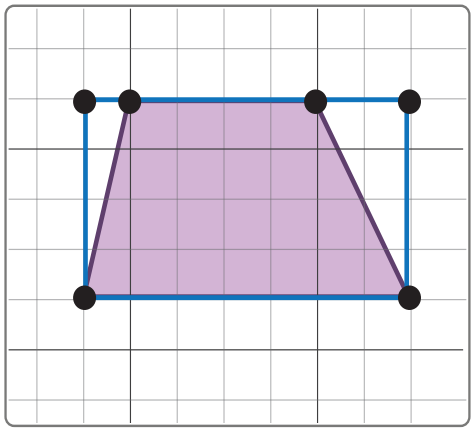


Show What You Learned Explain how you used what you know about the area of triangles, rectangles, or parallelograms to find the area of a trapezium.

Let's Chat Compare the strategies you used with a partner. Then, discuss these questions:

- Did you find the area using composition or decomposition?

Thinking Outside the Box Afaf used subtraction to correctly find the area of this trapezium. Which expression would represent what she did?



A. $(7\times 4)-(4\times 1)-(4\times 2)$

B. $(7+4)-\left[\frac{1}{2}(4\times 1)\right]-\left[\frac{1}{2}(4\times 2)\right]$

C. $(7\times 4)-\left[\frac{1}{2}(4\times 1)\right]-\left[\frac{1}{2}(4\times 2)\right]$

D. $(4\times 4)-\left[\frac{1}{2}(4\times 1)\right]-\left[\frac{1}{2}(4\times 2)\right]$

Let's Chat Share with your partner your explanation and methods for determining the area of this trapezium. Revise your answers as necessary. Be prepared to share with the class.

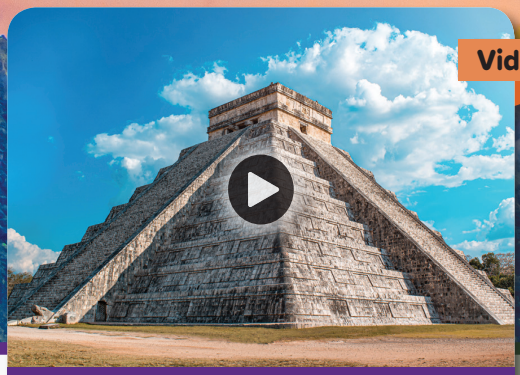
Check Your Understanding Follow your teacher's instructions to complete this activity

UNIT

13

Theme 4 | Applications of Geometry and Measurement

Surface Area and Volume



Surface Area and Volume

Unit Opener Video: Surface Area and Volume

Quick Code egm6239

Explore how to break down several everyday three-dimensional objects into their component parts.

Key Vocabulary

base, cube, formula, net, prism, pyramid, ratio, rectangular prism, square pyramid, surface area, triangular prism, volume

MINISTRY OF EDUCATION AND TECHNICAL EDUCATION
وزارة التربية والتعليم والتعليم الفني

LESSON 1

Surface Area of Cuboid

Quick Code
egm6242

Learning Target

- I can use models to find surface area of the cuboid.

Student Behaviors

- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.

ACCESS

Part A: Decomposing a Box

HANDS-ON ACTIVITY

Decomposing a Box In this activity, you will cut a box apart in order to explore how much cardboard you need to make the box.

Analyze The amount of cardboard you need to make the box is called the surface area of the box. How could you figure out how much cardboard you need to make the box?

Let's Chat

- What do you think the definition of *surface area* is?
- Why do you think it might be good to know the surface area of a three-dimensional figure?
- How can nets help you find the surface area of a figure? For example, suppose a student is wrapping a present for her friend. How can the student determine the area of gift wrap she will need?

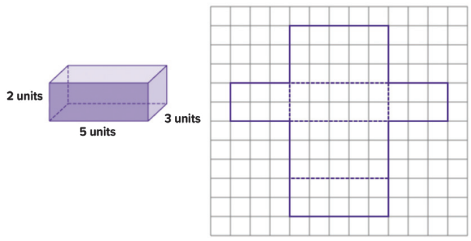


Gift Wrap

BUILD AND CONNECT

Part A: Cuboid and Nets

Whiteboard: Cuboid The box that the student has to wrap and its net are shown. Compare the box and its net., label each face of the net with the following descriptions: front, back, top, bottom, right side, and left side. Demonstrate your understanding by drawing.



Find Areas Complete the table to show the area of each side of the cuboid, in square units.

Face of the cuboid	Area
Top	(A) _____ units^2
Bottom	(B) _____ units^2
Front	(C) _____ units^2
Back	(D) _____ units^2
Left Side	(E) _____ units^2
Right Side	(F) _____ units^2

Analyze Areas How did you find the areas of the faces of the cuboid? What do you notice about the areas?

Find Surface Area Use your answers to the last exercise to complete the questions.

A. What is the surface area of the cuboid? Include units in your answer and explain how you found the surface area.

B. Write a numerical expression you could use to find the surface area of the cuboid.

Analyze Methods Choose all of the methods that are valid for finding the surface area of a cuboid.

A. Sum the area of each face.

B. Add the areas of the top, right side, and left side and multiply the sum by 2.

C. Multiply the area of the top by 2, the area of the right side by 2, and the area of the front by 2, and add the products.

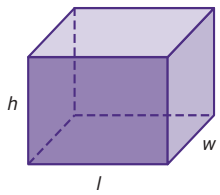
D. Add the areas of the bottom, front, and right side, and multiply the sum by 2.

E. Add the areas of the bottom, back, and left side.

Let's Chat Discuss your answers with a partner. Did you each use the same method to find the surface area of the cuboid? How did the net help you?

Develop a Formula for Surface Area Think about how you could use what you have learned to write a **formula** to find the surface area of any cuboid.

Develop a Formula Write a formula for the following cuboid that you could use to find the surface area of the cuboid given that **l** is the length, **w** is the width, and **h** is the height. Record your expression.



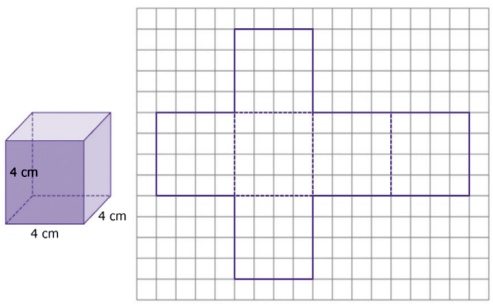
Let's Chat Discuss the formula you developed with a partner. Were your formulas the same or different? If different, do they both work?

Solve a Problem A painter paints a door before he installs it. The door is 178 centimeters high, 80 cm long, and 5 cm wide. Find the surface area of the door so that the painter can figure out how much paint to buy. Explain how you found your answer.

Part B: Cubes and Nets

A **cube** is a special case of the cuboid. Use what you know about the surface area of the cuboid to explore the surface area of a cube.

Whiteboard: Cubes Compare the cube and its net. Label each face of the net with the following descriptions: front, back, top, bottom, right side, and left side. Demonstrate your understanding by drawing.



Cube Surface Area What is the surface area of the cube? Include units in your answer and explain how you found the surface area.

Cube Surface Area Formula Suppose you know that the side length of a cube is s units. Which of these expressions could be used as a formula for the surface area of the cube? Choose all that apply.

A. $6s^2$

B. $6 \times s \times s$

C. $s^2 + s^2 + s^2$

D. $12s$

E. $2(s)(s) + 2(s)(s) + 2(s)(s)$

F. $s + s + s + s + s + s$

Use Your Formula Use your formula to solve this problem. Nada made a cubical box out of sheet metal for an art project. The side length of the box is 8 centimeters. What is the surface area of the sheet metal did she use?

_____(A)_____ cm^2

Let's Chat Discuss with a partner your method for finding the surface area of a cube.

- How is this method similar to finding the surface area of a cuboid?
- How is it different?

LESSON 2

Exploring Surface Area of Prism and Pyramid

Quick Code
egm6244

Learning Target

- I can use nets to find the surface area of **triangular prisms** and **square pyramids**.

Student Behaviors

- Use appropriate tools strategically.
- Look for and make use of structure.

ACCESS

Camping As you have seen, some shapes have faces that are triangular, such as triangular prisms and pyramids.



Tent

Let's Chat

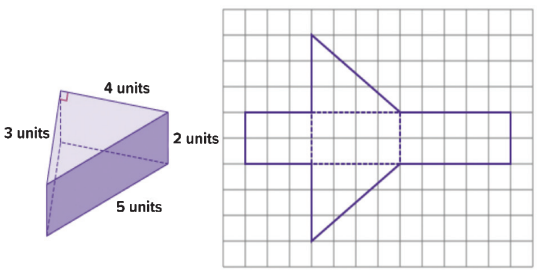
- Have you been camping in a tent?
- Did your tent resemble this one? How was it the same or different?
- How would you describe the shape of this tent?
- How could you find its surface area?

BUILD AND CONNECT

Find Surface Area

Whiteboard: Triangular Prisms

Compare the triangular prism and its net. Label each face of the net with the following descriptions: top, bottom, back, right side, and left side. Demonstrate your understanding by drawing.



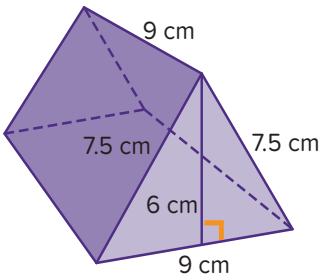
Find Areas Complete the table to show the area of each side of the triangular prism, in square units.

Face of Prism	Area
Top	(A) _____ units^2
Bottom	(B) _____ units^2
Back	(C) _____ units^2
Left Side	(D) _____ units^2
Right Side	(E) _____ units^2

Find the Surface Area What is the surface area of the triangular prism? Include units in your answer and explain how you found the surface area.

Analyze The triangular prism you just explored had no congruent rectangular faces. When would a triangular prism have two congruent rectangular faces? When would a triangular prism have three congruent rectangular faces?

Solve a Problem A student is making a miniature representation of a camping scene, using fabric to make a small enclosed tent as shown. How much fabric is needed?



A. 54 cm^2
B. 175.5 cm^2
C. 189 cm^2
D. 202.5 cm^2
E. 270 cm^2

Let's Chat Share with a partner your answers from the previous problem. Revise your answers as needed. Be prepared to share your findings with your peers.

HANDS-ON ACTIVITY

Exploring Surface Area Follow the instructions in this activity to explore the surface area of another figure.

Surface Area of Pyramid Use what you learned in the activity to answer each of these questions.

A. Was the figure you explored in the activity a net for a prism or a pyramid? Explain your reasoning.

B. What is the shape of the base of your figure?

C. What did you notice about the faces and base of the pyramid?

D. What is the surface area of the pyramid? Include units in your answer and explain how you found the surface area.

Let's Chat Discuss how you found the surface area of the three-dimensional figure formed by the net with a partner. Did you use the same methods?

Pyramid Problem The pyramid of Menkaure is the smallest of the pyramids of Giza. The square base has a side length of about 104 meters. The height of each triangular face is about 84 m. What is the surface area of the pyramid ?

_____ m^2



Pyramid

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 3

Applications on Volume

Learning Target

- I can use formulas to calculate the volume of cuboids with fractional side lengths.

Student Behaviors

- Use appropriate tools strategically.
- Attend to precision.

ACCESS

Mixing Cement When creating the foundation for a building, the people who mix the concrete need to know the dimensions of the foundation as well as the required depth for the concrete. This allows them to determine the volume of concrete required.



Pouring Cement

Let's Chat

- What do you know about cement mixing? Have you ever mixed cement for a project or helped mix it?
- What are some projects for which you might want to mix cement?

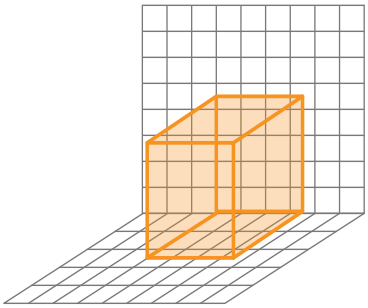
BUILD AND CONNECT

Find Volume

HANDS-ON ACTIVITY

Finding Volume Try the Hands-On Activity to explore the formula for value of $V=bh$ or $V=lwh$ (where : **b** base area , **l** length of base , **h** height and **w** width of base) to calculate the volume of a cuboid that includes fractional sides of dimensions.

Building with Concrete A builder is filling a 3.5 meter by 4.5 m by 2.5 m mold with concrete to make the base for a sculpture. In this sketch of the mold, each square represents 1 m.



Estimate How can you estimate the volume of the mold?

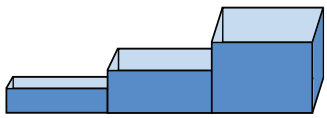
The builder said that she knows that the volume has to be at least 24 cubic meters by just looking at the dimensions. Is he right? How did you know?

Show Your Work Show how you calculated the volume for the concrete sculpture base using both of the formulas you explored in the Hands-On Activity.

The Volume A student estimates that the volume of a 4 m $\times$ 3 m $\times \frac{3}{4}$ m cuboid would be at least 12 cubic meters, since 4 m $\times$ 3 m = 12 square meters. Is she correct? Discuss this with a partner, and then justify your reasoning as to whether she is correct or not.

Let's Chat Share with a partner your answers from the previous task. Revise as needed.

A contractor is building a frame for three steps that will lead up to the front door. Each frame will have the same length and width, but each height will be different. He needs to determine the total volume in order to know how much concrete to buy.



The length of each step is 40 centimeters. The width of each step is 20.25 cm. The height of the first step is 20.25 cm, and each step adds 20.25 cm to the previous step's height.

Concrete Steps A builder tells the contractor that he would use the formula V=bh in this situation to figure out the volume of each step quickly. Do you agree with him? Why or why not?

Total Volume Complete the following questions:

A. The builder estimates the first step to have a volume of 16,000 cubic centimeters. Do you think the actual volume will be more or less than that? Explain why.

B. How would you estimate the volume of the next 2 steps?

Calculation What is the actual total volume of the 3 steps?

Let's Chat Share with a partner your answers from the previous task. Revise as needed.

Check Your Understanding Follow your teacher's instructions to complete this activity

LESSON 4

Volume of Cuboid with Known Ratios

Quick Code
egm6252

Learning Target

- I can change the dimensions of a cuboid to see how the volume is impacted.

Student Behaviors

- Make sense of problems and persevere in solving them.
- Look for and make use of structure.

ACCESS

Cooler Size The class trip to the museum has been planned. Lunches are provided in boxes shaped like cuboid, but the museum has asked you to provide a cooler to hold them until lunchtime. You know the volume of each box lunch but need to determine what size cooler you will need to fit all of them. How would changing the dimensions affect the overall volume?



Lunchbox

Let's Chat

- What would you need to know to solve the problem?
- How do you think changing one dimension would change the overall volume? Two dimensions? Three dimensions?

BUILD AND CONNECT

Dimension Doubling Create a table like the one shown. Then, follow the directions to change dimensions and calculate resulting volumes by using $V=lwh$ or $V=bh$.

- Double only one dimension: length, width, or height.
- Double two of the original dimensions: length and width, length and height, or width and height.
- Double all three of the original dimensions.

Check Your Understanding Follow your teacher's instructions to complete this activity

Object	Length (cm)	Width (cm)	Height (cm)	Volume (cm^3)
Lunch in Box	20	15	10	(A)
1 Dimension Doubled	(B)	(C)	(D)	(E)
2 Dimensions Doubled	(F)	(G)	(H)	(I)
3 Dimensions Doubled	(J)	(K)	(L)	(M)

Ratios Answer the questions using the calculations you displayed in the table.

A. What is the ratio of the new volume to the original volume when you doubled one dimension? Write this ratio in two ways: using the table values and as a ratio **(V : 1)** .

B. What is the ratio of the new volume to the original volume when you doubled two dimensions? Write this ratio in two ways: using the table values and as a ratio **(V : 1)**.

C. What is the ratio of the new volume to the original volume when you doubled all three dimensions? Write this ratio in two ways: using the table values and as a ratio **(V : 1)**.

Let's Chat Discuss with a partner why the ratio between the original volume and the volume when all three dimensions are doubled makes sense.

Predictions Now that you have seen what happens to the volume when you double the dimensions of a right cuboid, analyze the following statements about tripling and halving the dimensions of a right cuboid. Choose all of the true statements.

A. If you triple one dimension, the ratio of the new volume to the original will be **3 : 1**.

B. If you triple all 3 dimensions, your original volume will triple.

C. If you divide one dimension in half, the ratio of the new volume to the original volume will be **2 : 1**.

D. If you divide one dimension in half, the ratio of the original volume to the new volume will be **2 : 1**.

Let's revisit our original problem.

How Many Fit? If the interior dimensions for length, width, and height of a cooler are all twice the measure of each dimension of the boxed lunch, how many boxed lunches will the cooler hold? Explain how you found your answer.

What Size Cooler? There are 24 students going to the museum and you need a cooler large enough to fit all of the boxed lunches. How could you determine the interior dimensions of the large cooler? How do the dimensions of the original box lunch compare to the interior dimensions of a cooler large enough to hold all the lunches?

Let's Chat Discuss with a partner your responses in How Many Fit? and What Size Cooler?. Revise as needed. Be prepared to share findings with peers.

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مقاس الكتاب	ورق المتن	ورق الغلاف	ألوان الكتاب	عدد الصفحات	رقم الكتـاب
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