Unit 1

Math Is...

Essential Question

What does it mean to do math?

Explore Through STEM

Global Human Footprint

We all leave footprints when we walk in the sand on the beach or on a sidewalk after stepping in water or mud. We also have global human footprints that measure how much our daily living impacts Earth's environment.

Think About It

How much do you and your family members travel each day or week? How do your travels impact Earth's environment?

Name _____ Date _____ Period _____

IGNITE!

Global Human Footprint

Many things that we do and choices that we make every day impact the environment. We use water and electricity. We throw things away or recycle them. This is our human footprint. We can decide how big our footprint is.

For exercises 1–4, answer the questions.

1. How much of your day do you spend going to and from different places? Of that time, how much of your travel is in a car? on a bus? on another form of public transportation? riding your bicycle? walking?

2. How much of your daily meals do you leave uneaten? How do you dispose of the uneaten food?

3. Which of your daily activities require electricity? What portion of your daily activities require electricity? During what part of your day do you use the most electricity?

4. What might be some ways to reduce the amount of electricity you use in a day?

Am I Ready?

For exercises 1–12, solve each equation.

1. $\frac{7}{8} + \frac{2}{3} = d$

2. $\frac{9}{10} - \frac{5}{6} = x$

3. $\frac{3}{4} \times \frac{2}{5} = s$

4. $2 \div \frac{1}{4} = n$

5. $\frac{1}{5} \div 7 = p$

6. $3{,}456 + 12{,}079 = t$

7. $11{,}005 - 8{,}586 = f$

8. $456 \times 78 = r$

9. $11{,}155 \div 23 = w$

10. $703.59 + 187.28 = d$

11. $850.03 - 78.25 = x$

12. $34.5 \times 17.28 = v$

What Do I Already Know?

Place a checkmark (✓) in each row that corresponds with how much you already know about each term and topic before starting this unit. At the end of the unit, place a checkmark in each row that corresponds with how much you know about each term and topic.

Terms	Before			After		
I don't know · I've heard of it · I know it						
perseverance						
arguments						
patterns						
collaboration						

Topics	Before			After		
I don't know · I've heard of it · I know it						
make sense of a problem before starting to solve it						
develop a solution strategy						
choose an appropriate tool to solve a problem						
look for repeated calculations						
determine whether the reasoning of a classmates makes sense						
construct an argument to explain my reasoning						
work productively with classmates						
listen respectfully to classmate's reasoning						
assess the reasonableness of a solution						
use precise terms in my explanations						

Math History Minute

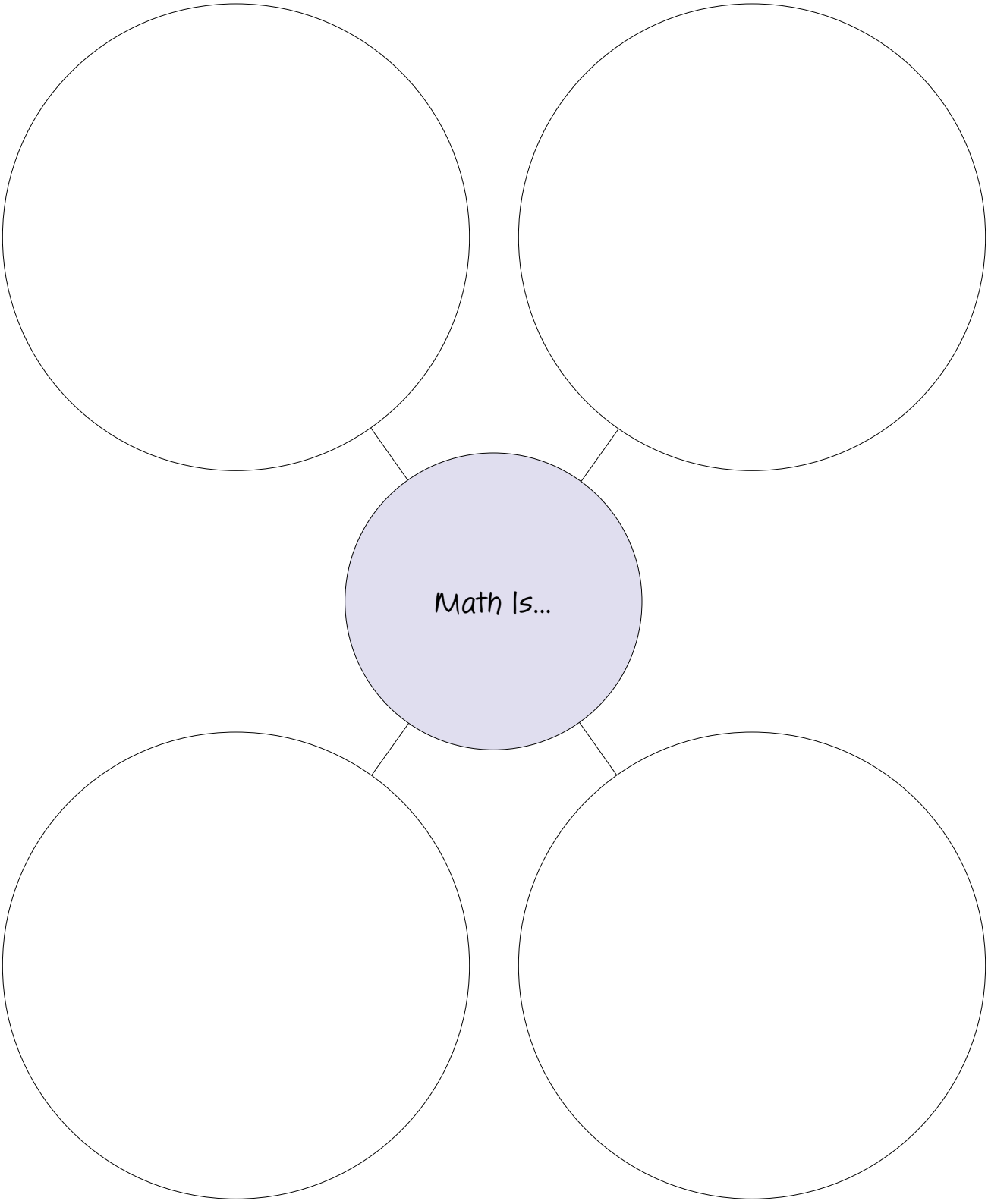
One of the oldest known forms of division is used by the Egyptians. For example, to divide 22 by 8, write multiplication sentences in which 8 is a factor. Find the numbers that create a sum of 22, the dividend. Because $16 + 4 + 2 = 22$, find the sum of the corresponding factors, $2 + \frac{1}{2} + \frac{1}{4}$, or $2\frac{3}{4}$. So, $22 \div 8 = 2\frac{3}{4}$.

1	8	$1 \times 8 = 8$
2	(16)	$2 \times 8 = 16$
$\frac{1}{2}$	(4)	$\frac{1}{2} \times 8 = 4$
$\frac{1}{4}$	(2)	$\frac{1}{4} \times 8 = 2$
$\frac{1}{8}$	1	$\frac{1}{8} \times 8 = 8$

Building the Language of Mathematics

Complete the graphic organizer as you work through the unit.

Math Is...



Math is Mine

Be Curious

What do you notice?
What do you wonder?

Math is All Around Us

We use math every day, at home, in school, and in our neighborhood.

How do you use math in your everyday actions?

Identify and describe three ways you use math in your life.

My first idea about how I use math is....

Math is... Mindset

What about math interests you the most?

My second idea about how I use math is....

Math is... Mindset

How do you use math during the day?

My third idea about how I use math is....

Math is... Mindset

When do you use math during the day?

Let's Explore More

a. How do you use math differently in the three different situations?

b. How do you use math in the same or similar way in each situation?

Math is Mine

We all have a math story. Sometimes, our math story excites us and sometimes it challenges us. Like any story, our math story continues to develop and has different chapters.

Ask a classmate about their math story.

How have you used math in the past? How have you felt about learning and doing math?

Math is... Mindset

What do you want to learn about math?

How do you use math now?

Math is... Mindset

What are your strengths in math?

What do you want math to be like this year? What can you do to make sure you do well in math this year?

Math is... Mindset

How can you stay positive when you do math?

Let's Explore More

a. How does the math story you heard compare to your own math story?

Summarize: **Math is Mine**

We are all doers of math and use math in our daily lives in ways that we may not realize. We all may do math differently. Sharing our math strengths with others helps us grow. Learning about the math strengths of others can help us grow, too.

Apply: **Strengths Inventory**

What we believe about ourselves, about others, and about what we are learning shape us.

Question What do you believe are your math strengths?

Fill in the table below with your math strengths and areas you want to grow in math.

My Math Strengths	Areas I Want to Grow

Name _____ Date _____ Period _____

Practice

For exercises 1 and 2, answer the questions.

1. What questions do you want to ask your teacher to learn about their math story?

2. What about your math biography do you want someone else to know?

For exercises 3 and 4, answer the questions.

3. What was your greatest accomplishment from last year?

4. What do you want your math teacher to know about you and math?

Reflect

What would you want to tell your 5-year-old self about math as you began school?

Math is Exploring and Thinking

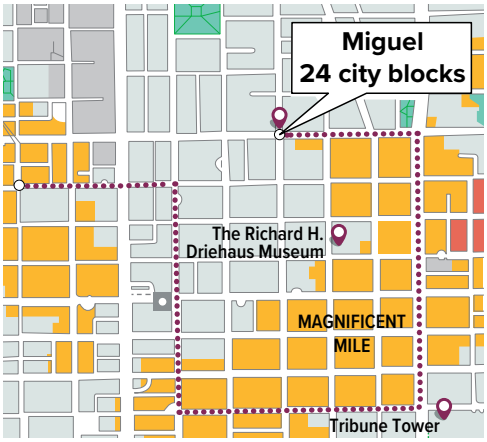
Be Curious

What do you notice?
What do you wonder?

Comparing Walks

Deon walked $\frac{2}{3}$ as far as Miguel. Evelyn walked $1\frac{1}{2}$ times as far as Miguel. Miguel walked 24 city blocks.

How can you determine how far Deon and Evelyn walked?



When we do math, we ask ourselves questions to make sense of the problem.

What do I know about the problem?

- Three students walked different distances.

What don't I know?

- How far each student walked
- Who walked the shortest distance
- Who walked the longest distance

Math is... Analyzing

What information do you have from the problem?

When we do math, we consider different solution strategies and develop a solution plan.

I can ask myself:

- How can I represent the distance each student walked?
- How are the distances related?
- How can I think about the relationship among the distances using different values?

Math is... Planning

What's a reasonable solution strategy?

When we do math, we check on our progress towards a solution and adjust our plan as needed.

I can ask myself:

- Which questions have I answered?
- Do my solutions make sense?

Math is... Perseverance

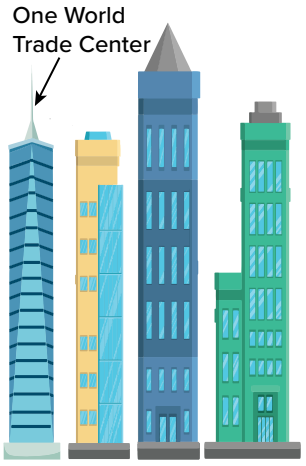
What can you do if you're stuck?

Let's Explore More

a. What are some strategies you can use when you feel stuck?

Which is the Tallest?

One World Trade Center in New York is 540 meters tall. A planned building in London will be $\frac{5}{6}$ as tall as One World Trade Center.
A planned building in Tokyo will be $1\frac{1}{5}$ as tall as One World Trade Center.
A building in Rio De Janeiro is going to be $\frac{9}{10}$ as tall as One World Trade Center.



How tall is each new planned building?

When we do math, we make sense of the numbers and quantities in a problem. We think about how the numbers and quantities relate.

I can compare each building to One World Trade Center.

- The planned building in London will not be as tall as One World Trade Center because $\frac{5}{6}$ is less than 1.
- The planned building in Tokyo will be taller than One World Trade Center because $1\frac{1}{5}$ is greater than 1.
- The planned building in Rio de Janeiro will be shorter than One World Trade Center because $\frac{9}{10}$ is less than 1.

Math is... Making Connections

How are the quantities in the problem related?

When we do math, we decide which operations are needed to show the relationships.

To compare quantities, I can use:

- 540 meters as the height to which I am comparing.
- multiplication to show how many times as tall a building is.

Math is... Representing

How can you represent the relationship between quantities?

When we do math, we make sense of the solution in the context of the problem.

I can use the relative heights of the buildings to make sense of my answer.

- I know that the London and Rio de Janeiro buildings will be less than 540 meters.
- I know that the Tokyo building will be taller than 540 meters.

Math is... Reasoning

What do the quantities in the solution refer to?

Let's Explore More

a. What are some other ways to think about the quantities in this problem?

Summarize: **Math is Exploring and Thinking**

When we do math,

- we make sense of problems and develop a solution plan to solve the problem.
- we check on our progress and adjust our solution plan as needed.
- we try other strategies when we come to dead ends.
- we make sense of the quantities and the relationships among the quantities.
- we determine which operations are needed based on the relationships.
- we make sense of our solution within the context of the problem.

Apply: **City Blocks**

In 12 city blocks, $\frac{3}{8}$ of the space is for apartments, $\frac{1}{3}$ of the space is for businesses, and $\frac{1}{4}$ of the space is for restaurants. The remaining area is for open space.

Question What fraction of the 12 city blocks is open space?

Answer the question in the space below.

Name _____ Date _____ Period _____

Practice

For exercises 1–3, answer the questions.

1. What helps you make sense of a problem? List two different strategies that you could use. Share your strategies with classmates and write down one additional strategy you heard.

2. How did you select your strategy?

3. What helps you know that your strategy is getting you to a solution?

For exercises 4 and 5, answer the questions.

4. How did you make sense of the quantities in the Apply problem on page 16?

5. How do the quantities in the Apply problem relate to one another?

Reflect

Tell about a time when you had a problem, and you didn't give up. It might be a math problem or it might be a problem you had at home, playing a game, playing a sport, playing an instrument, drawing a picture, or doing a puzzle.

Math is In My World

Be Curious

What do you notice?
What do you wonder?

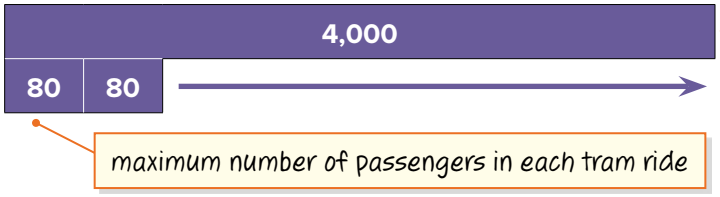
Aerial Tramway

The Palm Springs Aerial Tramway is the largest rotating aerial tram in the world. During the $12\frac{1}{2}$-minute one-way ride, the tram makes two full rotations so passengers can see in all directions without moving. The maximum capacity is 80 passengers. There are two tram cars so one car is always in flight.

How long would it take to transport 4,000 passengers?

When we do math, we create models or representations to visualize the math needed to solve the problem.

I can use a tape diagram to visualize the number of tram rides needed.



Math is... Using Representations

How can you visualize the problem?

When we do math, we think about the structure of the problem and strategies and operations that can help solve it.

I use different operations for different parts of the problem.

- I use division to determine the number of tram rides needed.
  $4{,}000 \div 80 = 50$
- I use multiplication to determine the number of minutes 50 tram rides take.

Number of Tram Rides	1	10	50
Minutes	12.5	125	625

× 12.5

- I use division to determine the number of hours 50 tram rides take.
  $625 \div 60 \approx 10.42$

Math is... Applying

What mathematics can you use to solve this problem?

Let's Explore More

a. How does the answer change if you need to transport 2,000 passengers? 6,000 passengers? 10,000 passengers?

Beautiful Vista

It takes 35 minutes for one tram car to make the 5-mile round trip, from valley to mountain top and back down. This includes time for passengers to disembark and embark at each station.

How many round trips would a single tram car complete in 10 hours?

When we do math, we use tools, such as tables, graphs, and calculations, to help us see the relationships among quantities.

A table of values can help show the relationship between the quantities.

Time (minutes)	Round Trips
35	1
175	5
350	10
525	15
700	20

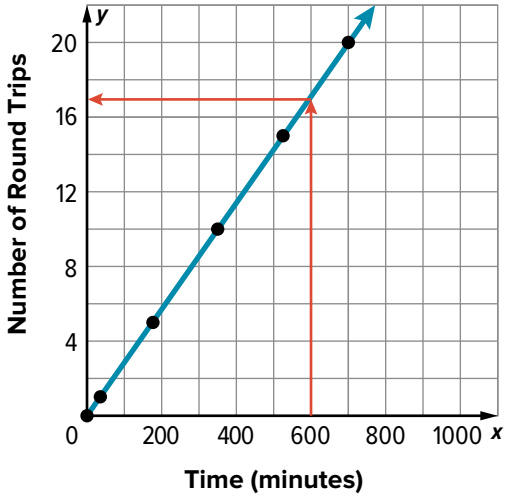
÷ 35

Math is... Choosing Tools

What tool can you use to represent the problem?

When we do math, we use tools to help us solve problems and make predictions.

I can use a graph to plot the ordered pairs and look for the *y*-value when *x* is 600.



Let's Explore More

a. What might be another tool to solve this problem?

Summarize: **Math is In My World**

When we do math,

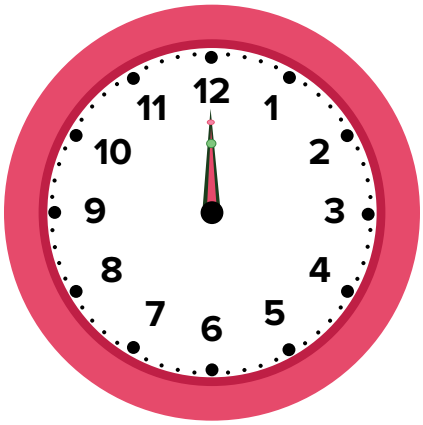
- we visualize and represent problems and apply our math knowledge to solve new and unfamiliar problems.
- we use tools to show the relationship among quantities.
- we make strategic decisions about which tool to use for a problem.

Apply: **What Time Is It?**

The start of a new year is always at midnight on January 1st.

Question What time will it be after 2,022 minutes after midnight? Use a tool or strategy to come up with your answer and be ready to explain your reasoning.

Answer the question in the space below.



Name _____ Date _____ Period _____

Practice

For exercises 1–3, use the description to answer the questions.

The Jackson Hole, Wyoming tram carries skiers and other visitors from the town to the summit in 12 minutes. It rises 4,139 feet in elevation from the town to the summit. It stops at the top and bottom for 8 minutes for passengers to get on and off.

1. Assuming the tram travels at a steady speed, how far does it climb in 2, 3, 4, 6, and 8 minutes?

2. If the tram starts at 8:00 A.M., how many round trips can it make in 12 hours?

3. How many total feet would the tram ascend and descend in those 12 hours?

For exercises 4 and 5, answer the questions.

4. What tools did you consider using to answer exercises 1–3?

5. What tool did you use for each exercise?

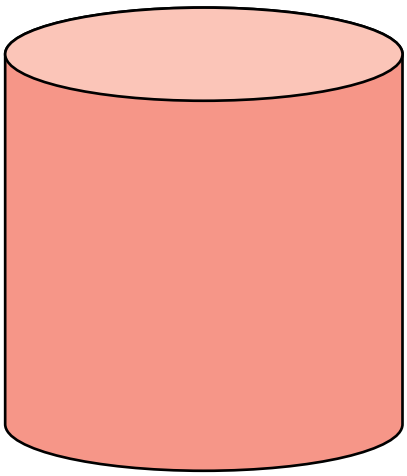
Reflect

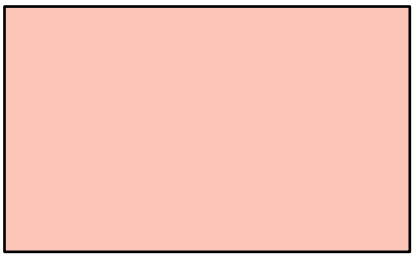
How do tools help us with making sense of and solving math problems?

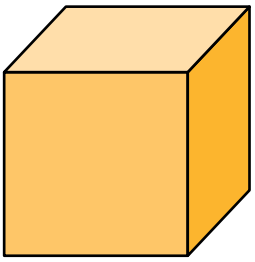
Math is Explaining and Sharing

Be Curious

Which doesn't belong?



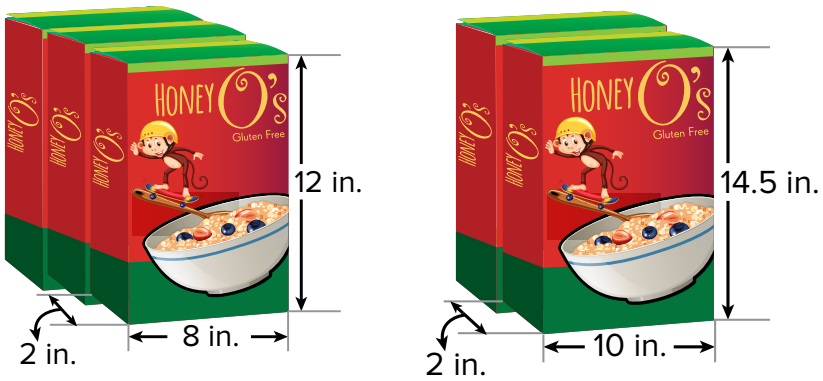




Cereal Boxes

Yuzuki is buying her favorite breakfast cereal. She can buy three large-sized boxes or two jumbo-sized boxes for the same price.

Which option do you recommend?



When we do math, we develop arguments to defend our thinking. We use conjectures, examples, and counterexamples in our arguments.

I can use equations, drawings, or words to develop an argument.

I recommend she buy the two jumbo boxes.

- Two jumbo boxes have a greater total volume.
  - Volume of the large box:
    $12 \times 8 \times 2 = 192$ in^3
    $192 \times 3 = 576$ in^3
  - Volume of the jumbo box:
    $14.5 \times 10 \times 2 = 290$ in^3
    $290 \times 2 = 580$ in^3
- There is less packaging with two boxes.
- Two boxes are easier to store than three boxes.

Math is... Justifying

How can you explain your thinking to others?

When we do math, we listen to the arguments of others and decide whether the arguments are convincing.

Others might recommend that Yuzuki buy the three large boxes.

- The cereal will stay fresher because each box will be open for less time.
- Even though the volume of two jumbo boxes is greater, that does not mean that the amount of cereal is greater.

Math is... Critiquing

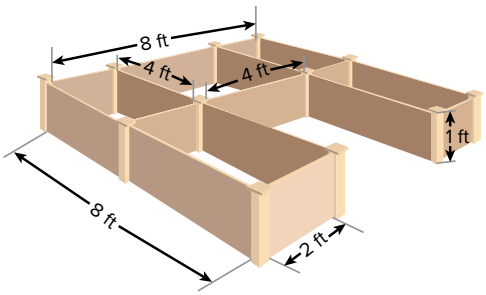
What connections do you see between your thinking and that of a classmate?

Let's Explore More

a. What other arguments can you make for buying the three large boxes? for buying the two jumbo boxes?

Community Garden

A neighborhood group is building a community garden.



How much soil will the group need to fill the garden beds?

When we do math, we look to be precise in our arguments and use appropriate vocabulary.

- The problem asks for the amount of soil needed to fill the garden beds, so I can use volume in my argument.
- Volume is measured in cubic units, so I will use cubic units in my solution and in my justification.
- The problem requires that I consider the dimensions of different parts of the garden.

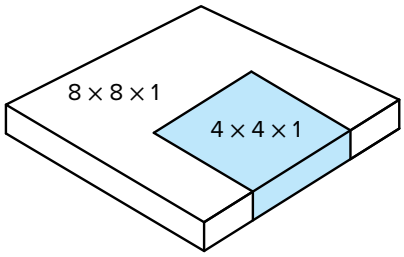
Math is... Using Vocabulary

What mathematical terms can you use to make your argument clear?

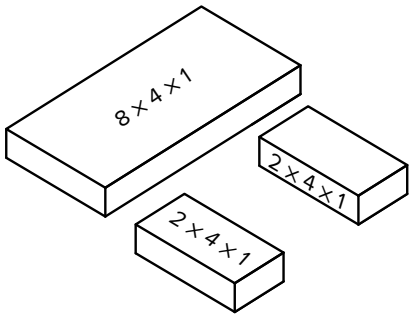
When we do math, we check our calculations to make sure they are accurate.

I can determine volume in different ways to make sure my solution is accurate.

- I can determine the volume of the rectangular prism and then subtract. $64\ ft^3 - 16\ ft^3 = 48\ ft^3$



- I can decompose into rectangular prisms and add the volumes of each prism. $32\ ft^3 + 2(8\ ft^3) = 48\ ft^3$



Math is... Precision

How can you determine accuracy in this problem?

Let's Explore More

a. What is another way to determine the volume of the garden beds?

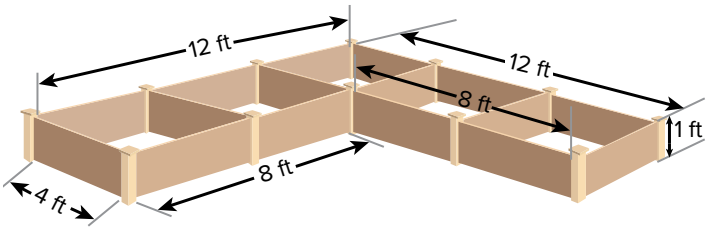
Summarize: **Math is Explaining and Sharing**

When we do math,

- we communicate our reasoning to our classmates.
- we make conjectures about mathematical generalizations.
- we listen to the arguments of our classmates and ask probing questions to clarify their thinking.
- we decide whether the arguments of our classmates make sense.
- we communicate precisely.
- we label units accurately.
- we check that our calculations are accurate.

Apply: **Another Option for the Community Garden**

Another design, shown here, is also being considered for the community garden.



Question Which garden bed design would you recommend and why?

Answer the question in the space below.

Name _____ Date _____ Period _____

Practice

For exercises 1 and 2, answer the questions.

1. Why is it important to defend your solutions and explain your thinking?

2. What helps you decide whether your classmates' arguments are convincing?

For exercises 3 and 4, answer the questions.

3. How precise do you need to be when comparing the two different garden beds in the Apply problem on page 28?

4. Which measure—area or volume—did you use to answer the Apply problem on page 28? Explain why.

Reflect

What helps you construct an argument to defend your thinking about a problem and its solution?

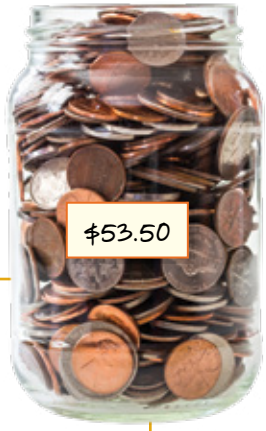
Math is Finding Patterns

Be Curious

What do you notice?
What do you wonder?

Guess How Many

Akela's change jar is full of pennies, nickels, dimes, and quarters. The value of the coins is $53.50.



How many of each coin could be in the jar?

When we do math, we look for patterns and relationships

The value of each coin is a pattern.
I can multiply the number of each coin by its value.

- Each penny has a value of $0.01.
  100 pennies has a value of $1.00.
- Each nickel has a value of $0.05.
  100 nickels has a value of $5.00.
- Each dime has a value of $0.10.
  100 dimes has a value of $10.
- Each quarter has a value of $0.25.
  100 quarters has a value of $25.

Math is... Looking for Patterns

What patterns do you see?

When we do math, we use patterns and relationships we notice to solve problems.

The jar could have:

- 150 pennies = $1.50
- 145 nickels = $7.25
- 150 dimes = $15.00
- 119 quarters = $29.75

Because the value of the coins ends in 0, the number of pennies can only be a multiple of 5.

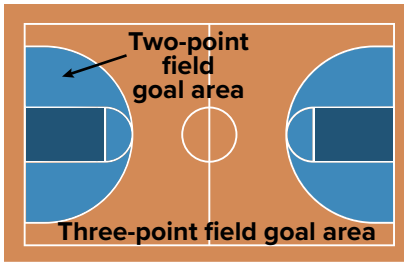
Math is... Using Patterns

What patterns could you use to solve the problem?

Let's Explore More

a. How can you use patterns to come up with other combinations of coins?

High Scorer



Two basketball players make 10 shots in a row after scoring some points. Player A had scored 18 points before making 10 two-pointers in a row. Player B had 6 points before scoring 10 three-pointers in a row.

How many points did each player have after their 10 shots in a row?

When we do math, we look for repeated calculations and use them to make generalizations.

- Each number in Player A's points is 2 greater than the number before it. The rule is to add 2.
- Each number in Player B's points is 3 greater than the number before it. The rule is to add 3.
- To get the 10th number for Player A, I add 2 to the score ten times. I can use the expression $(10 \times 2) + 18$. Player A's score is 38.
- To get the 10^{th} number for Player B, I add 3 to the score ten times. I can use the expression $(10 \times 3) + 6$. Player B's score is 36.

Math is... Generalizing

How can arriving at a generalization help to solve the problem?

When we do math, we evaluate the reasonableness of solutions as we work through a problem and make any adjustments necessary.

I can check my patterns by creating a table and filling in each number of the patterns.

Player A	18	20	22	24	26	28	30	32	34	36	38
Player B	6	9	12	15	18	21	24	27	30	33	36

Let's Explore More

a. What pattern do you notice in the scores for each player?

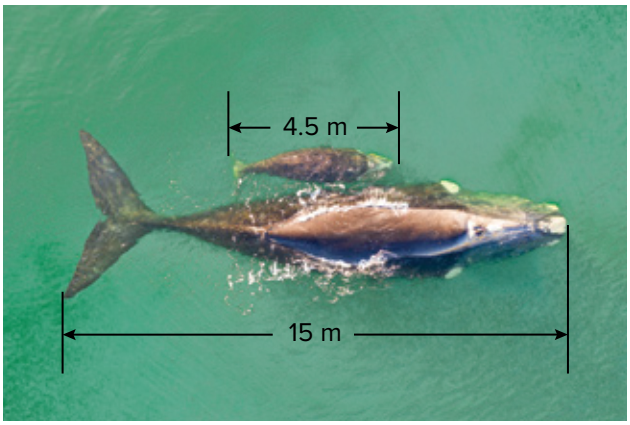
Summarize: **Math is Finding Patterns**

When we do math,

- we look for patterns and relationships.
- we use patterns and relationships to solve problems.
- we notice repeated calculations and use them to make generalizations.
- we evaluate the reasonableness of our solutions as we work through a problem and make adjustments as needed.

Apply: **Baby Growth**

Sei whales, a kind of baleen whale, measure 4.5 meters long at birth and grow about 2.5 centimeters each day. An adult sei whale averages 15 meters in length.



Question At what age would the sei whale reach 15 meters in length?

Answer the question in the space below.

Name _____ Date _____ Period _____

Practice

For exercises 1–3, use the patterns to answer the questions.

1. What is the rule for each pattern?

Pattern A	3	6	9	12	15					

Pattern B	3	6	12	24	48					

2. Use the rules to determine the 10th number in each pattern.

3. How can you show that your rules fit the patterns?

For exercise 4, answer the question.

4. What patterns do you notice in your everyday life? Think about non-mathematical patterns.

Reflect

What other patterns and relationships do you know about in math? How do you use those patterns and relationships to solve problems?

Be Curious

What do you notice?
What do you wonder?

Math is About Doing

What is math?

Math is solving problems.

When we do math, we solve problems.

- We make sense of problems.
- We think about what we know and don't know about the problem.
- We look for patterns and relationships among quantities.
- We visualize the problem and choose a useful representation.
- We select and use tools that are appropriate.
- We develop a solution plan.
- We are aware of our progress in solving the problem and shift strategies when needed.

Math is... Mindset

What is your problem-solving process?

When we do math, sometimes we get stuck.

Some strategies to try are:

- Think of questions to ask a classmate or the teacher.
- Visualize the problem by drawing pictures of it.
- Think of problems you have seen like this before.
- Determine what you don't understand about the problem.

Math is... Mindset

How can you stay productive when you get stuck?

Let's Explore More

a. What part of problem solving is easy for you? What part is challenging?

Math is Done with Others

How do we do math as a community?

When we do math, we often work together.

When we work together, we collaborate and support each other.

- We listen attentively to classmates.
- We share our thinking.
- We are respectful of others' ideas.
- We critique the ideas of others, not our classmates.
- We take turns when sharing ideas.

Math is... Mindset

How do you work productively with your classmates?

When we do math, we sometimes work on our own.

- We stay focused on our work.
- We seek help when we are stuck.
- We respect our classmates' boundaries and work habits.
- We avoid interrupting our classmates unnecessarily.

Math is... Mindset

How do you work productively on your own?

Let's Explore More

a. What skills and knowledge do you bring to a group that helps the group be successful?

Summarize: **Math is Ours**

We are a community of math thinkers and doers. Sharing our math strengths with others helps us grow. Learning about the math strengths of others can help us grow, too.

When we do math as a community,

- we often work together.
- we sometimes work on our own.
- we show respect and consideration for our classmates and our community.
- we show respect for ourselves and our math ideas.

Apply: **Community Agreements**

Communities often have agreements that all members of the community must agree to in order to be a part of the community.

Question What ideas do you recommend that the whole class agrees to so that math class is a community of learners?

Answer the question in the space below.

Name _____ Date _____ Period _____

Practice

For exercises 1–3, answer the questions.

1. How do we make sure everyone agrees to the classroom norms for math class?

2. Who is responsible for making sure everyone follows the classroom norms?

3. How often should we update the classroom norms during the school year?

For exercises 4 and 5, answer the questions.

4. What are ways we want to celebrate when we do work well with one another?

5. How will you contribute to our math class community?

Reflect

What are my responsibilities to make sure we can all learn math productively?

Name _____ Date _____ Period _____

Unit Review

For exercises 1–4, answer the questions.

1. What does it mean to defend your thinking?

2. Why is a plan to solve a problem important?

3. How can we decide which tool to use to solve a problem?

4. What are some examples of patterns in the math you did last year?

Review

What should be our classroom norms for doing math?

Write up to 5 norms.

1.

2.

3.

4.

5.

Reflect

Choose one of the norms you wrote and tell why it is important.

Name _____ Date _____ Period _____

Mathematical Modeling

Gauging Our Human Footprint

The school principal is concerned that too much uneaten food from lunch is being thrown in the trash. The principal has asked you and your classmates to investigate his concern.

Choose one of the projects to complete.

Project One

The school cafeteria team tracked the amount of food made each day for 4 weeks. Over the same period, the custodial staff tracked the amount of the food discarded in the trash. The table shows the information.

	Week 1	Week 2	Week 3	Week 4
Amount of Food Made (lbs)	23	26	22	25
Amount of Food Discarded (lbs)	9	14	12	15

Your team will prepare a report for the principal that addresses the concern raised about amount of food waste. Your report will speak to the amount of food waste compared to the amount of food made each week and over the four weeks. Be sure to include an opinion on whether there is "too much food waste."

Project Two

Your team has been tasked with coming up with possible solutions to reduce the amount of food thrown in the trash.

Your recommendations will include a target amount of food waste based on the amount of food made and ideas for how to get to that target amount of food waste.

Name _____ Date _____ Period _____

Fluency Practice

Fluency Strategy

Multiply a whole number by a power of 10.

The number of zeros tells how many zeros to annex.

$43 \times 1{,}000{,}000 = 43{,}000{,}000$

Multiply a whole number by a power of 10 written with a base and an exponent.

The exponent tells how many zeros to annex.

$16 \times 10^5 = 1{,}600{,}000$

Multiply a decimal by a power of 10 written with a base and an exponent.

The exponent tells how many places to the right to move the decimal point.

$2.47 \times 10^3 = 2{,}470$

Fluency Check

Solve each equation.

1. $24 \times 10{,}000 =$ _____

2. $5.6 \times 100{,}000 =$ _____

3. $0.73 \times 1{,}000 =$ _____

4. $81 \times 1{,}000{,}000 =$ _____

5. $2.9 \times 100 =$ _____

6. $4.5 \times 10^6 =$ _____

7. $78 \times 10^5 =$ _____

8. $0.39 \times 10^3 =$ _____

9. $6.1 \times 10^2 =$ _____

10. $0.77 \times 10^4 =$ _____

Fluency Talk

How would you explain to a classmate how to multiply a number by a power of 10?