PEARSON

Math Makes Sense 5

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Table of Contents

UNIT 2

Whole Numbers

Multiplying and Dividing Whole Numbers

Measurement

Fractions and Decimals

Geometry

Statistics and Probability

Transformations

Welcome to

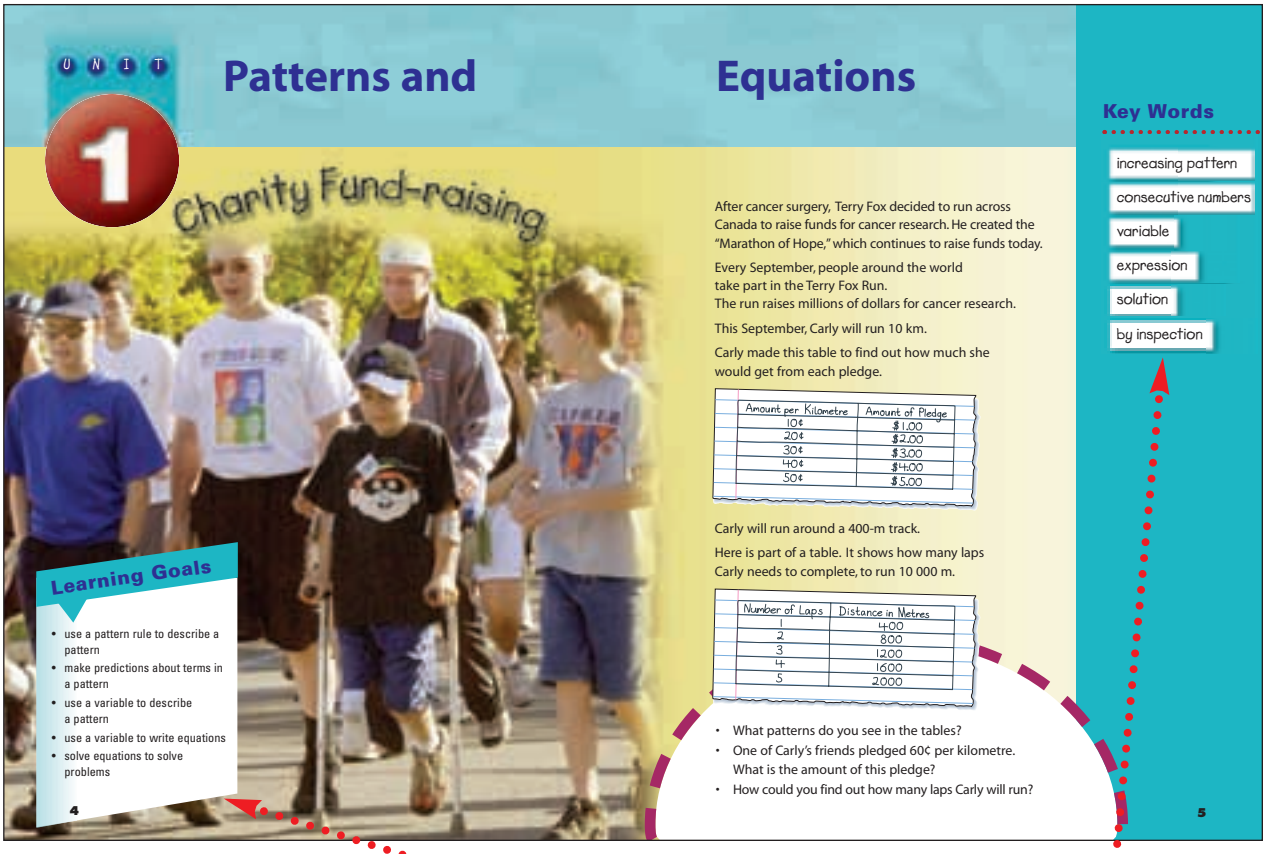
Pearson Math Makes Sense 5

Math helps you understand what you see and do every day.

You will use this book to learn about the math around you. Here's how.

In each Unit:

- A scene from the world around you reminds you of some of the math you already know.



Find out what you will learn in the **Learning Goals** and important **Key Words**.

In each Lesson:

You **Explore** an idea or problem, usually with a partner. You often use materials.

Then you **Show and Share** your results with other students.

LESSON 6

Multiplying 2-Digit Numbers

Explore

How many different ways can you find the product 14 × 23? Show your work for each strategy you use.

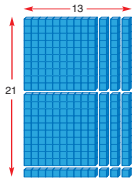
Show *and* Share

Share your strategies with another pair of students. If you used a strategy they did not use, explain your strategy to them.

Connect

Multiply 21 × 13
Here are three strategies students used to find the product.

➤ Rami modelled the problem with Base Ten blocks.
The array is a rectangle.
Its area is 21 × 13.

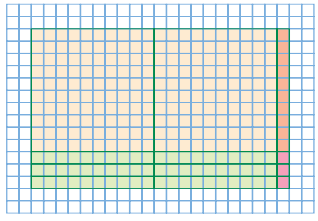


Rami sees there are:
- 2 hundreds or 200
- 7 tens or 70
- 3 ones or 3

200 + 70 + 3 = 273

➤ Keisha used grid paper.
She drew an array with 13 rows and 21 squares in each row.

20 × 10 = 200 | 1 × 10 = 10



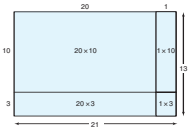
20 × 3 = 60 | 1 × 3 = 3

Keisha recorded her work like this:

21
× 13
200
10
60
+ 3
273

So, 21 × 13 = 273

➤ Samuel drew a diagram similar to Keisha's array.



I get partial products by multiplying each number in the first expanded form by each number in the second expanded form.

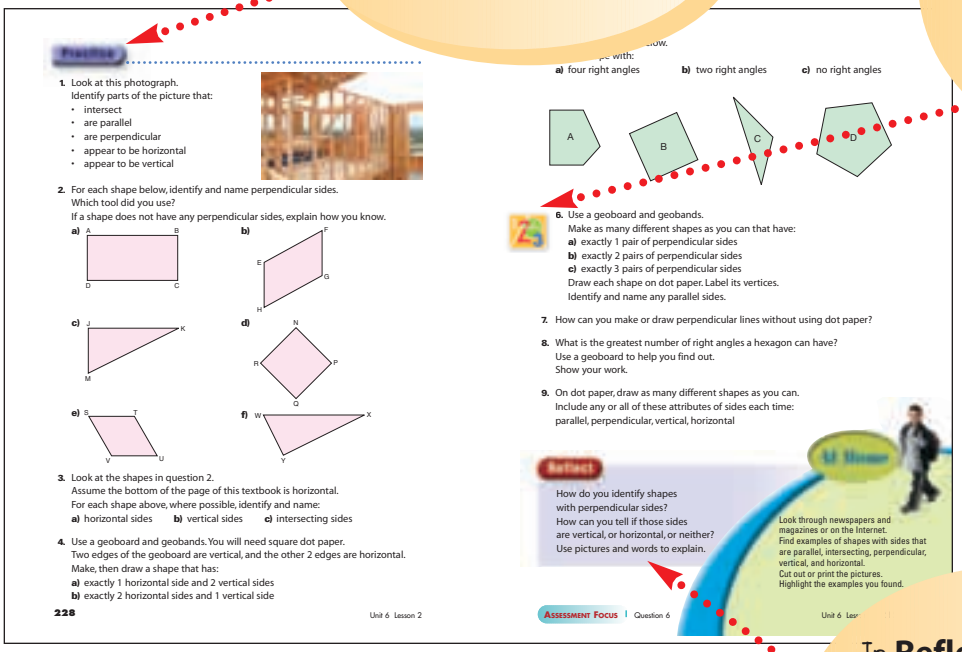
Samuel wrote each factor in expanded form.
Then he wrote 4 **partial products**.
Samuel wrote: 21 × 13 = (20 + 1) × (10 + 3)
= (20 × 10) + (20 × 3) + (1 × 10) + (1 × 3)
= 200 + 60 + 10 + 3
= 273
So, 21 × 13 = 273

92 LESSON FOCUS I Use different strategies to multiply two numbers.

Unit 3 Lesson 6 93

Connect summarizes the math. It often shows a solution, or multiple solutions, to a question.

Practice questions help you to use and remember the math.



1. Look at this photograph.
Identify parts of the picture that:
- intersect
- are parallel
- are perpendicular
- appear to be horizontal
- appear to be vertical

2. For each shape below, identify and name perpendicular sides.
Which tool did you use?
If a shape does not have any perpendicular sides, explain how you know.

a) b) c) d) e) f)

3. Look at the shapes in question 2.
Assume the bottom of the page of this textbook is horizontal.
For each shape above, where possible, identify and name:
a) horizontal sides **b)** vertical sides **c)** intersecting sides

4. Use a geoboard and geobands. You will need square dot paper.
Two edges of the geoboard are vertical, and the other 2 edges are horizontal.
Make, then draw a shape that has:
a) exactly 1 horizontal side and 2 vertical sides
b) exactly 2 horizontal sides and 1 vertical side

228 Unit 6 Lesson 2

...with:
a) four right angles **b)** two right angles **c)** no right angles

A B C D

6. Use a geoboard and geobands.
Make as many different shapes as you can that have:
a) exactly 1 pair of perpendicular sides
b) exactly 2 pairs of perpendicular sides
c) exactly 3 pairs of perpendicular sides
Draw each shape on dot paper. Label its vertices.
Identify and name any parallel sides.

7. How can you make or draw perpendicular lines without using dot paper?

8. What is the greatest number of right angles a hexagon can have?
Use a geoboard to help you find out.
Show your work.

9. On dot paper, draw as many different shapes as you can.
Include any or all of these attributes of sides each time:
parallel, perpendicular, vertical, horizontal

Reflect
How do you identify shapes with perpendicular sides?
How can you tell if those sides are vertical, or horizontal, or neither?
Use pictures and words to explain.

Look through newspapers and magazines or on the Internet.
Find examples of shapes with sides that are parallel, intersecting, perpendicular, vertical, and horizontal.
Cut out or print the pictures.
Highlight the examples you found.

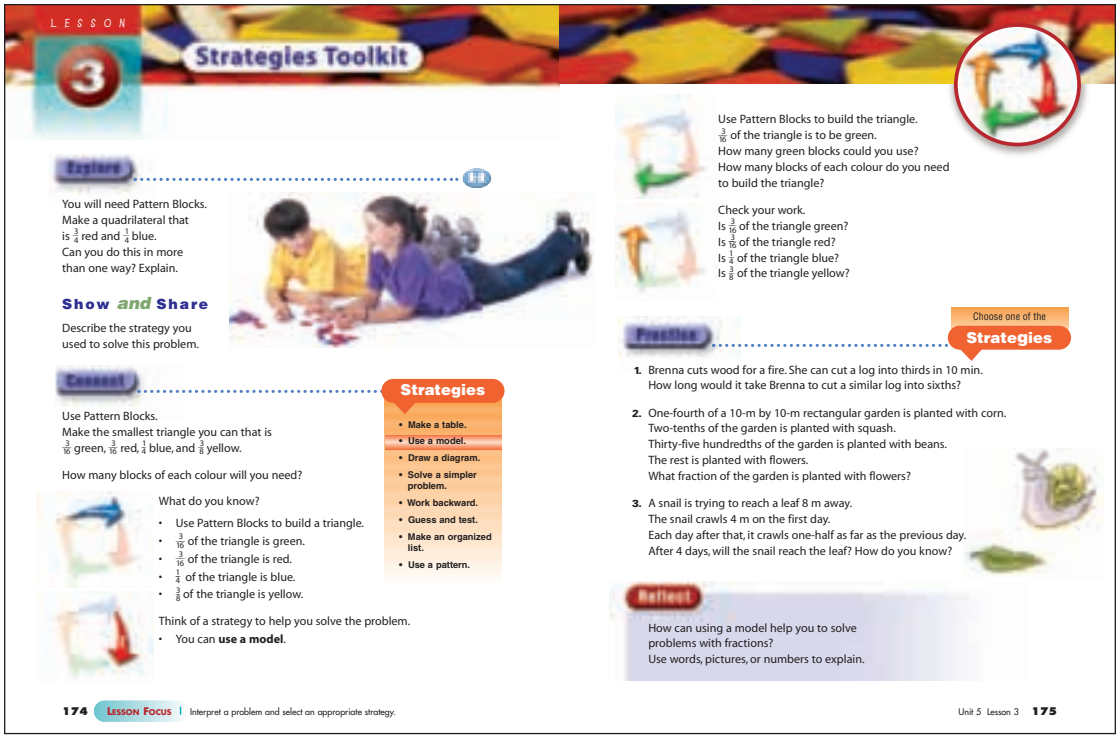
Assessment Focus | Question 6

Unit 6 Less...

reminds you to use pictures, words, or numbers in your answers.

In **Reflect**, think about the big ideas of the lesson and about your learning style.

- Learn about strategies to help you solve problems in each **Strategies Toolkit** lesson.



LESSON 3

Strategies Toolkit

Explore

You will need Pattern Blocks.
Make a quadrilateral that is $\frac{3}{4}$ red and $\frac{1}{4}$ blue.
Can you do this in more than one way? Explain.

Show *and* Share

Describe the strategy you used to solve this problem.

Connect

Use Pattern Blocks.
Make the smallest triangle you can that is $\frac{3}{16}$ green, $\frac{3}{16}$ red, $\frac{1}{4}$ blue, and $\frac{3}{8}$ yellow.

How many blocks of each colour will you need?

What do you know?
- Use Pattern Blocks to build a triangle.
- $\frac{3}{16}$ of the triangle is green.
- $\frac{3}{16}$ of the triangle is red.
- $\frac{1}{4}$ of the triangle is blue.
- $\frac{3}{8}$ of the triangle is yellow.

Think of a strategy to help you solve the problem.
- You can **use a model**.

Strategies
- Make a table.
- Use a model.
- Draw a diagram.
- Solve a simpler problem.
- Work backward.
- Guess and test.
- Make an organized list.
- Use a pattern.

Use Pattern Blocks to build the triangle.
$\frac{3}{16}$ of the triangle is to be green.
How many green blocks could you use?
How many blocks of each colour do you need to build the triangle?

Check your work.
Is $\frac{3}{16}$ of the triangle green?
Is $\frac{3}{16}$ of the triangle red?
Is $\frac{1}{4}$ of the triangle blue?
Is $\frac{3}{8}$ of the triangle yellow?

Practice

Choose one of the **Strategies**

1. Brenna cuts wood for a fire. She can cut a log into thirds in 10 min.
How long would it take Brenna to cut a similar log into sixths?

2. One-fourth of a 10-m by 10-m rectangular garden is planted with corn.
Two-tenths of the garden is planted with squash.
Thirty-five hundredths of the garden is planted with beans.
The rest is planted with flowers.
What fraction of the garden is planted with flowers?

3. A snail is trying to reach a leaf 8 m away.
The snail crawls 4 m on the first day.
Each day after that, it crawls one-half as far as the previous day.
After 4 days, will the snail reach the leaf? How do you know?

Reflect
How can using a model help you to solve problems with fractions?
Use words, pictures, or numbers to explain.

174 Lesson Focus | Interpret a problem and select an appropriate strategy.

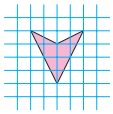
Unit 5 Lesson 3 175

- Check up on your learning in **Show What You Know** and **Cumulative Review**.

Unit 8 Show What You Know

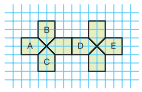
LESSON 1 3 4

1. Copy the shape on grid paper.
   a) Translate the shape in any direction you like. Draw its translation image.
   b) Draw a line of reflection. Draw the reflection image.
   c) Choose a point of rotation and a fraction of a turn. Rotate the shape and draw its rotation image.
   d) Describe the position and orientation of each image in parts a, b, and c. How does each description help you identify the transformation?



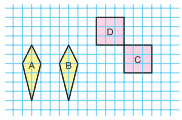
2. Draw a shape on grid paper.
   a) Translate the shape any way you like. Draw its translation image. Record the translation. Include each direction and the number of squares moved.
   b) Reflect the shape. Draw its reflection image. Label the line of reflection. Find how far the shape and its image are from this line.
   c) Rotate the shape. Draw its rotation image. Describe the rotation. Include the direction of the turn, the fraction of the turn, and the point of rotation.

3. Describe a transformation that would move shape A to each image.
   a) Image B b) Image C
   c) Image D d) Image E



LESSON 1

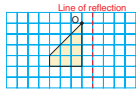
4. Describe the translation that moves:
   a) Shape B to Image A
   b) Shape D to Image C



1 3 4

5. In question 4, which other transformation would move each shape to its image?

6. Copy this shape on grid paper. Predict the position of the image after each transformation below. Draw each image to check your prediction.
   a) a reflection in the line of reflection
   b) a translation 3 squares right and 4 squares up
   c) a $\frac{1}{4}$ turn counterclockwise about O



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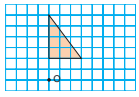
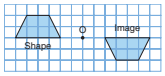
7. Copy this triangle and point O on grid paper. Draw the image after a $\frac{1}{4}$ turn clockwise about O.



1 3 4 5

8. Describe the transformation that moves the shape to its image.



UNIT 8 Learning Goals

- translate, reflect, and rotate a shape
- draw and describe images after transformations
- identify a transformation

- The **Unit Problem** returns to the opening scene. It presents a problem to solve or a project to do using the math of the unit.

Unit Problem Languages We Speak

This table shows how many people spoke the Aboriginal languages and the top 10 non-official languages in 1971 and in 2001. In 30 years, there have been many changes in Canada.

Home Language	Number of People, 1971	Number of People, 2001
Aboriginal languages	122 205	181 350
Arabic		209 240
Cantonese		345 730
Chinese	77 890	392 950
German	213 350	220 685
Greek	86 825	
Hungarian	50 670	
Dutch	36 170	
Italian	425 230	371 200
Polish	70 960	163 745
Portuguese	74 760	187 475
Punjabi		280 535
Spanish		258 845
Tagalog		185 420
Ukrainian	144 755	
Yiddish	26 330	

1. Which languages were in the table in 1971 but not in 2001?
2. Which languages have grown in use from 1971 to 2001?
3. Which languages have declined in use from 1971 to 2001?
4. Tell whether each statement is true or false. Give reasons for your answers.
   a) In 1971, about twice as many people spoke Ukrainian as Chinese.
   b) In 2001, about 2000 more people spoke Tagalog than Polish.
   c) In 2001, about 60 000 more people spoke Aboriginal languages than in 1971.
   d) In 2001, fewer than 350 000 people spoke Italian.
   e) In 2001, more than 479 000 people spoke German or Spanish.
5. Write two other true statements based on the data in the table.
6. a) In 2001, about how many people spoke Polish or Portuguese?
   b) About how many more people spoke Polish in 2001 than in 1971?
   c) About how many more people spoke Portuguese in 2001 than in 1971?
7. Write a problem that someone could solve using the table. Solve your problem and explain your solution.

Check List

Your work should show
- your thinking in words, pictures, or numbers
- the strategies you used to estimate
- how you know your answers are reasonable
- a clear solution to your problem

Reflect on Your Learning

You have learned different ways to estimate. Which way do you find easiest? Why? Use examples to show the different types of questions for which you estimate.

Explore some interesting math when you do the **Investigations**.

Investigation

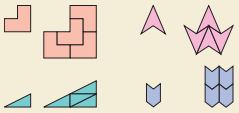
Rep-Tiles

You will need Pattern Blocks.

Part 1

A **rep-tile** is a polygon that can be copied and arranged to form a larger polygon with the same shape.

These are rep-tiles: These are not rep-tiles:



➤ Which Pattern Blocks are rep-tiles?
How did you find out?

Part 2

Choose a block that is a rep-tile.
Do not use orange or green blocks.
Build an increasing pattern.
Record the pattern.
➤ Choose one Pattern Block that is a rep-tile.
This is Frame 1.
➤ Now take several of the same type of block.
Arrange the blocks to form a polygon with the same shape.
This is Frame 2.

➤ Continue to arrange blocks to make larger polygons with the same shape.
The next largest polygon is Frame 3.
➤ Suppose the side length of the green Pattern Block is 1 unit.
Find the perimeter of each polygon.
➤ Suppose the area of the green Pattern Block is 1 square unit.
Find the area of each polygon.
Copy and complete the table.

Frame	Number of Blocks	Perimeter	Area
1	1		
2			

Part 3

➤ What patterns can you find in the table?
➤ How many blocks would you need to build Frame 7?
How do you know?
➤ Predict the area and the perimeter of the polygon in Frame 9.
How did you make your prediction?

Display Your Work

Record your work.
Describe the patterns you found.

Take It Further

Draw a large polygon you think is a rep-tile.
Trace several copies.
Cut them out.
Try to arrange the copies to make a larger polygon with the same shape.
If your polygon is a rep-tile, explain why it works.
If it is not, describe how you could change it to make it work.

Use **Technology.** Follow the instructions for using a calculator or computer to do math.
Look for  and  .

TECHNOLOGY

Using *Census at School* to Find Second-Hand Data

How do you and your classmates compare to other students across Canada?
You can find out on a Web site called *Census at School*.
It provides data about students from age 8 to 18.

You can use questions from *Census at School* to collect first-hand data about your own classmates.
Then, you can check the Web site for second-hand data about students from other parts of the country.
You can even find out how students in other parts of the world answered the same questions.

Your teacher can register your class so you can complete a questionnaire online. The data from your class are then included with those already on the database.

Here are some of the questions you can answer.

- Do you have allergies?
- Which pets do you have?
- What is your favourite physical activity?
- How do you usually travel to school?

You will see **Games** pages.

Sum Fun

Games

You will need 2 number cubes each labelled 1 to 6.

➤ Take turns to roll the number cubes.
➤ Find the sum of the 2 numbers rolled.
If the sum is even, you score a point.
If the sum is odd, your partner scores a point.
➤ Record the results in a table.
➤ The first player to score 20 points wins.
➤ Who do you think will have more points after 36 turns?
Explain.

Jean	Jack
Odd Sum	Even Sum
|||| ||	|||| |||

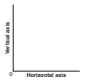
➤ List the outcomes of the game.
➤ Which is more likely: an even sum or an odd sum?
Or, are these sums equally likely?
How do you know?

Illustrated Glossary

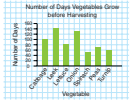
a.m.: A time between midnight and just before noon.

Area: The amount of surface a shape or region covers. We measure area in square units, such as square centimetres or square metres.

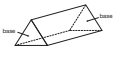
Axis (plural: axes): A number line along the edge of a graph. We label each axis of a graph to tell what data it displays. The horizontal axis goes across the page. The vertical axis goes up the page.



Bar graph: Displays data by using bars of equal width on a grid. The bars may be vertical or horizontal.



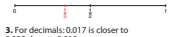
Base: The face that names an object. For example, in this triangular prism, the bases are triangles.



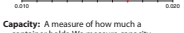
Benchmark: Used for estimating by writing a number to its closest benchmark; for example,

1. For whole numbers: 47 532 is closer to the benchmark 47 500 than to the benchmark 47 600.

2. For fractions: $\frac{1}{4}$ is closer to $\frac{1}{2}$ than to 0 or to 1.



3. For decimals: 0.017 is closer to 0.020 than to 0.010.



Capacity: A measure of how much a container holds. We measure capacity in litres (L) or millilitres (mL).

Carroll diagram: A diagram used to sort numbers or attributes.

Centimetre: A unit used to measure length.
We write one centimetre as 1 cm.
1 cm = 0.01 m
1 cm = 10 mm
100 cm = 1 m

Certain event: An event that always happens.

Clockwise: The hands on a clock turn in a clockwise direction.

The **Glossary** is an illustrated dictionary of important math words.

Investigation

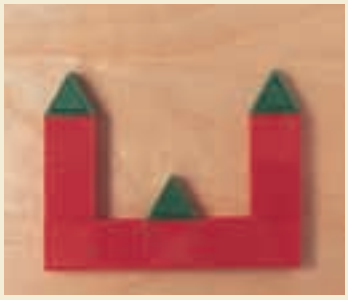
Building Patterns

You will need Pattern Blocks.
Be sure you have squares and triangles.

Part 1

Look at this pattern.

Frame 1



Frame 2

Frame 3

How many squares are in each frame?
How many triangles are in each frame?

Each block has a side length of 1 unit.
What is the perimeter of each frame?

Record the frame number, number of squares, number of triangles, and perimeter in a table.

Part 2

➤ Build Frame 4.
How many squares and triangles did you use?
What is the perimeter?
Record the data in your table.

➤ How many squares and triangles will you need to build Frame 5?
How did you find out?
Build Frame 5 to check your prediction.

➤ Predict the number of squares and triangles needed to build Frame 10.
How did you make your prediction?

➤ Write each pattern rule:
- the numbers of squares in the frames
- the numbers of triangles in the frames
- the perimeters of the frames

Display Your Work

Record your work.
Describe the patterns you discovered.

Take It Further

Choose three different Pattern Blocks.
Build your own pattern.
Sketch the first 4 frames.
What number patterns can you find?

UNIT 1

Patterns and Charity Fund-raising

Learning Goals

- use a pattern rule to describe a pattern
- make predictions about terms in a pattern
- use a variable to describe a pattern
- use a variable to write equations
- solve equations to solve problems

Equations

Key Words

- increasing pattern
- consecutive numbers
- variable
- expression
- solution
- by inspection

After cancer surgery, Terry Fox decided to run across Canada to raise funds for cancer research. He created the "Marathon of Hope," which continues to raise funds today.

Every September, people around the world take part in the Terry Fox Run.
The run raises millions of dollars for cancer research.

This September, Carly will run 10 km.

Carly made this table to find out how much she would get from each pledge.

Amount per Kilometre	Amount of Pledge
10¢	$1.00
20¢	$2.00
30¢	$3.00
40¢	$4.00
50¢	$5.00

Carly will run around a 400-m track.

Here is part of a table. It shows how many laps Carly needs to complete, to run 10 000 m.

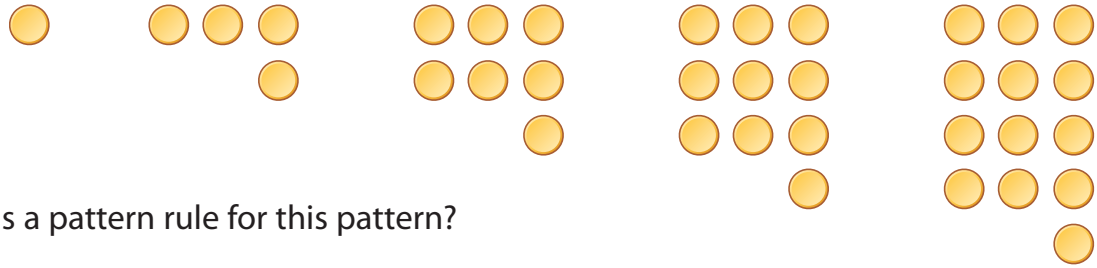
Number of Laps	Distance in Metres
1	400
2	800
3	1200
4	1600
5	2000

- What patterns do you see in the tables?
- One of Carly's friends pledged 60¢ per kilometre. What is the amount of this pledge?
- How could you find out how many laps Carly will run?

LESSON 1

Number Patterns and Pattern Rules

How would you describe this pattern?
What type of pattern is it?



What is a pattern rule for this pattern?

Explore

➤ For each number pattern below:
Identify a pattern rule.
Write the next 5 terms.
What did you do to one term to get the next term?

- 3, 4, 6, 9, 13, . . .
- 3, 4, 6, 7, 9, . . .
- 1, 4, 3, 6, 5, 8, . . .
- 1, 2, 5, 10, 17, 26, . . .

➤ Choose one pattern above.
Use counters to show the pattern and to check that the next 2 terms were correct.

➤ Make up a similar pattern.
Trade patterns with another pair of classmates.
Write a rule for your classmates' pattern.

Show *and* Share

Share your patterns with other classmates.
How do you know each pattern rule is correct?
For any pattern, did you find more than one rule? Explain.

Lesson Focus | Analyse a number pattern and state the pattern rule.

Connect

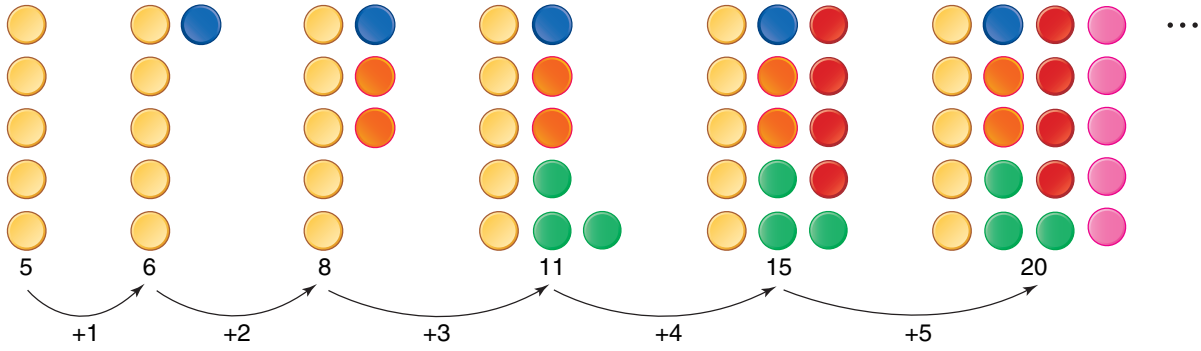
➤ Here is a number pattern.

5 +1 6 +2 8 +3 11 +4 15 ...

A pattern rule is:

Start at 5. Add 1.
Increase the number you add by 1 each time.
To get the next 5 terms, continue to increase the number you add by 1 each time.
5, 6, 8, 11, 15, 20, 26, 33, 41, 50, . . .

We can use counters to show the pattern.



➤ Here is another number pattern.

10 −4 6 +5 11 −4 7 +5 12 ...

A pattern rule is:

Start at 10. Alternately subtract 4, then add 5.
To get the next 5 terms, continue to subtract 4, then add 5.
10, 6, 11, 7, 12, 8, 13, 9, 14, 10, . . .

When we alternately subtract, then add, there are two patterns in one.

Practice

1. Write the first 5 terms of each pattern.
a) Start at 3. Add 2 each time.
b) Start at 1. Add 2. Increase the number you add by 1 each time.

2. For each pattern in question 1:
a) Use counters to show the first 5 terms.
b) Predict the next 2 terms.
c) Use counters to check your predictions.

3. Write the next 4 terms in each pattern.
Write each pattern rule.
What did you do to each term to get the next term?
a) 1, 2, 4, 5, 7, 8, . . .
b) 2, 4, 3, 5, 4, 6, 5, . . .
c) 98, 85, 87, 74, 76, . . .
d) 1, 10, 7, 70, 67, 670, . . .

4. Find each missing term. Describe the pattern.
a) 3, 23, 13, 33, □, 43, 33, . . .
b) 99, 98, 198, 197, □, 296, 396, . . .
c) 2, 22, 12, 132, 122, 1342, □, . . .

5. What is the 7th term of this pattern?
Start at 200. Subtract 8 each time.
How could you find the 7th term without writing the first 6 terms?

6. What is the 10th term of this pattern?
Start at 13. Alternately subtract 4, then add 5.

7. The first 2 terms of a pattern are 6, 12, . . .
How many different patterns can you write with these 2 terms?
For each pattern, list the first 6 terms and write the pattern rule.
Show your work.

Reflect

How do you find the pattern rule for a number pattern?
Use an example to explain.

LESSON 2

Using Patterns to Solve Problems

What are the missing numbers?
How do you know?

Explore

Sam charges $6 for each hour he baby-sits.

- How much does Sam earn when he works 2 hours? 3 hours? 4 hours? 5 hours? Show your results in a table.

Time Worked (hours)	Money Earned ($)
1	6

- What patterns do you see in the table? How is each term different from the term before? Use the patterns to predict how much Sam will earn working 21 hours.
- Will Sam earn exactly $40? $45? $50? How do you know?
- Sam saves all the money he earns. He needs $250 to buy a mountain bike. How many hours does Sam need to work?
- Make up your own problem you can solve using this table. Trade problems with another pair of classmates. Solve your classmates' problem.

Show *and* Share

Share your answers with your classmates.
Did you solve the problems the same way? Explain.

Connect

One puzzle book costs $17.

➤ How much does it cost to buy 2 books? 3 books? 4 books?

Make a table.
When you add 1 to the number of books, you add $17 to the cost.

Number of Books	Cost ($)
1	17
2	34
3	51
4	68

These numbers are multiples of 17.

Two books cost $34.
Three books cost $51.
Four books cost $68.

➤ Use a pattern to predict the cost of 20 books.

One pattern rule for the cost is:

Start at 17. Add 17 each time.

Another pattern rule for the cost is:

The number of books multiplied by 17

To predict the cost of 20 books, multiply: $20 \times 17 = 340$
Twenty books cost $340.

➤ Suppose you have $200.
Can you buy puzzle books and have no money left over?

Extend the pattern to see if 200 is a term.
Use a calculator.

Continue to add 17:
17, 34, 51, 68, 85, 102, 119, 136, 153, 170, 187, 204, . . .

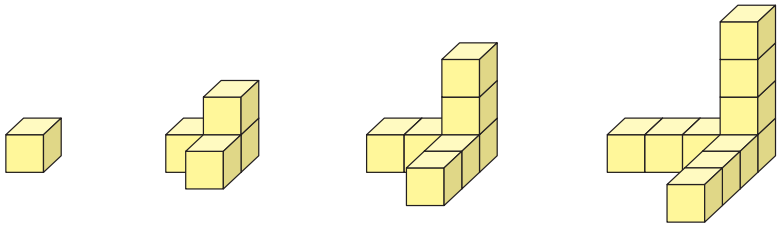
Two consecutive terms are 187 and 204.

So, 200 is not a term in the pattern.
If you try to spend $200, you will have money left over.

When one number follows another number, the numbers are **consecutive**.

Practice

1. Here is a pattern of linking cubes.



Object 1 Object 2 Object 3 Object 4

The pattern continues. Use linking cubes.

Object	Number of Cubes
1	1

a) Make the next two objects.

b) Copy and complete this table for the first 6 objects.

c) How does the pattern grow?
Write a pattern rule for the number of cubes.

d) How many cubes will there be in the 10th object?
How do you know?

e) Will any object have 50 cubes? 51 cubes? How do you know?

2. The pattern in this table continues.

Number of CDs	Cost ($)
1	16
2	32
3	48
4	64
5	

a) Which of these numbers is the next term in the *Cost* column?
77, 78, 79, 80, 81
How do you know?

b) Write a pattern rule for the cost in dollars.

c) Write the next 5 terms in the *Cost* column.

d) How is each term in the *Cost* column different from the term before?
How is each term different from the following term?

Math Link

Nature

In a beehive, bees make honeycomb to store their honey. The cells in the honeycomb form a pattern.

3. Hilary delivers newspapers. Each week she collects $25.

a) How much money has Hilary collected at the end of 1 week? 2 weeks?

b) Make a table to show the amounts for the first 8 weeks.

c) How is each amount different from the amount before?

d) How much will Hilary collect in total in 3 weeks?

e) Will Hilary ever collect a total of $240? $250? $260?
How do you know?

f) Write a problem you could solve using the table in part b.
Solve your problem.

4. The sunflower is the only single flower that grows as high as 300 cm.
Suppose it grows 30 cm each week.
In which week could a sunflower reach a height of 300 cm? Explain.

5. Dave read 40 pages on Monday, 37 pages on Tuesday, and 34 pages on Wednesday.
This pattern of pages read continued until Dave finished his book.

a) Which of the numbers below is the number of pages Dave read on Thursday? How do you know?
29, 30, 31, 32, 33

b) What was the total number of pages Dave read the first 7 days?

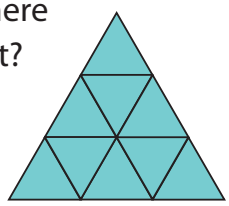
c) Dave finished his book on the day he read 1 page.
How many pages are in the book?

Show your work.

6. Look at this shape.

a) How many triangles are there with a side length of 1 unit? 2 units? 3 units?

b) How many triangles are in this shape?



Reflect

How can using patterns help you solve problems? Use an example from this lesson to explain.

At Home

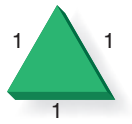
What number patterns do you see at home?
Look through magazines, newspapers, and around your community.
Write about the patterns you see.
How is each term different from the term before?

LESSON 3

Using a Variable to Describe a Pattern

Explore

You will need green Pattern Blocks and triangular dot paper.
The side length of the block is shown.



➤ Make an increasing pattern with the blocks.
Draw each figure in the pattern on dot paper.

➤ What is the perimeter of each figure?

➤ Copy and complete this table for the first 3 figures.

Figure Number	Perimeter (units)
1	

➤ Continue the pattern.
Make the next 3 figures.
Draw these figures on dot paper.
Extend the table for these 3 figures.

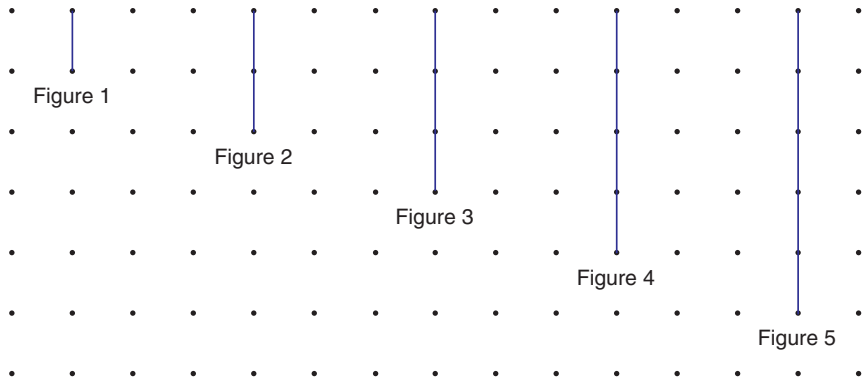
➤ What patterns do you see in the table?
How is each perimeter different from the perimeter before?
How is the perimeter related to the figure number?

Show *and* Share

Compare your table with that of another pair of students.
Suppose you know the figure number.
What would you do to get the perimeter of the figure?
What is the perimeter of the 100th figure? The 200th figure?

Connect

➤ Here is a pattern of line segments drawn on dot paper.



The table shows each figure number and the number of dots on the figure.

Figure Number	Number of Dots
1	$2 = 1 + 1$
2	$3 = 2 + 1$
3	$4 = 3 + 1$
4	$5 = 4 + 1$
5	$6 = 5 + 1$

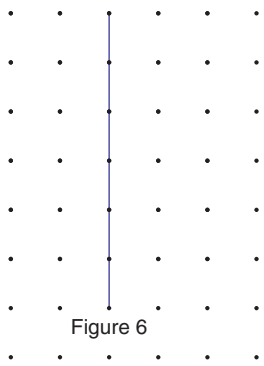
The number of dots is 1 more than the figure number.

We can write each number of dots as this sum: Figure number + 1

We can use a letter, such as *f*, to represent any figure number.
f is called a **variable**.
Then, the number of dots on Figure *f* is $f + 1$.
$f + 1$ is an **expression** that represents the pattern in the numbers of dots.

A variable is shown in italics.

We can check that this expression is correct.
For the number of dots on the 6th figure, replace *f* with 6.
Then, $f + 1 = 6 + 1$
$= 7$
The 6th figure has 7 dots.
We continue the pattern above to verify this.



➤ We can use a variable to write a pattern rule.
Look at this pattern: 7, 8, 9, 10, 11, . . .
Each term is 1 more than the preceding term.
Look for a way to relate the value of a term to its position in the pattern.

Term Position	Term Value
1	$7 = 1 + 6$
2	$8 = 2 + 6$
3	$9 = 3 + 6$
4	$10 = 4 + 6$
5	$11 = 5 + 6$

Let n represent any term position.
Then, the term value is $n + 6$.
So, an expression for the pattern rule is $n + 6$.

We can check that the expression $n + 6$ is correct.
For the 5th term, replace n with 5.
$n + 6 = 5 + 6$
$= 11$
This matches the value of the 5th term in the table above.
So, the expression is correct.

Practice

1. For the pattern below:
a) Copy and complete the table.
b) Write an expression to represent the pattern in the numbers of dots.

Figure Number	Number of Dots

Figure 1 Figure 2 Figure 3 Figure 4 Figure 5

2. For the pattern below:
a) Copy and complete the table.
b) Write an expression to represent the pattern in the numbers of squares.

Figure Number	Number of Squares

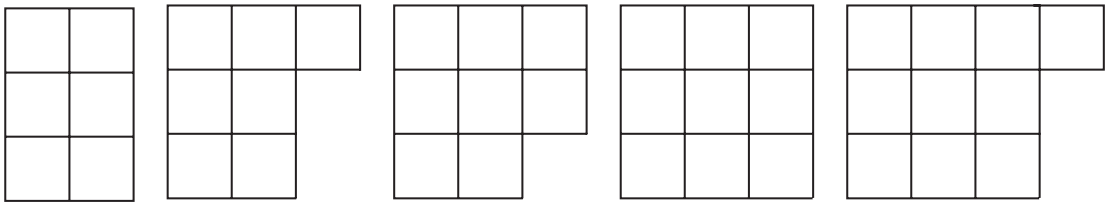


Figure 1 Figure 2 Figure 3 Figure 4 Figure 5

3. For each table, write an expression for the number of dots in any figure.
Check that each expression is correct.

a)

Figure Number	Number of Dots
1	5
2	6
3	7
4	8
5	9
6	10

b)

Figure Number	Number of Dots
1	6
2	7
3	8
4	9
5	10
6	11

c)

Figure Number	Number of Dots
1	0
2	1
3	2
4	3
5	4
6	5

4. Use a variable to write a pattern rule for each number pattern.
a) 2, 3, 4, 5, 6, 7, . . . **b)** 10, 11, 12, 13, 14, 15, . . . **c)** 8, 9, 10, 11, 12, 13, . . .

5. Find the 100th term in each pattern in question 4.
Explain how you did this.

6. Write an expression for each number pattern.
Write the next 5 terms in each pattern.
Explain how you know the expressions and terms are correct.
a) 15, 16, 17, 18, 19, . . . **b)** 16, 17, 18, 19, 20, . . .
Show your work.

7. Here are some decreasing patterns.
Match each pattern with an expression below.
How can you check that you are correct?
a) 99, 98, 97, 96, 95, . . . **b)** 34, 33, 32, 31, 30, . . . **c)** 50, 49, 48, 47, 46, . . .
A. $51 - t$ **B.** $35 - t$ **C.** $100 - t$

8. Use a variable to write a pattern rule for each number pattern.
a) 10, 9, 8, 7, 6, 5, . . . **b)** 40, 39, 38, 37, 36, 35, . . . **c)** 1000, 999, 998, 997, 996, . . .
How is each pattern different from the patterns in question 4?

Reflect

How can using a variable help you represent a pattern?
Use words, numbers, or pictures to explain.

Tic-Tac-Toe Challenge

You will need 1-cm grid paper.
Think about the game Tic-Tac-Toe.
On a 3 by 3 grid, people take turns to write X or O.
The winner is the person who gets 3 in a row, column, or diagonal.

O		X
	O	X
		X

Try Tic-Tac-Toe on a 4 by 4 grid.
Take turns to write X or O in a grid square until one person gets 3 in a row.

Play the game several times.
Try to find a strategy so the person who plays first always wins.
Where does that person write her first X or O?

Variation: Play Tic-Tac-Toe on a 4 by 4 grid so the first person to get 4 in a row *loses*.

LESSON 4

Strategies Toolkit

Explore

Two students stretch a piece of modelling clay until it breaks into 2 pieces. This is Round 1.
The students then stretch each new piece until it breaks into 2 pieces. This is Round 2.
This process continues.
How many pieces of clay will there be after Round 8?

Show *and* Share

Describe the strategy you used to solve the problem.

Connect

Suppose a cow produces her first female calf when she is 2 years of age.
After that, she produces a female calf each year.
Suppose each cow produces her first female calf when she is 2 years of age and no cows die.
How many cows will there be after 5 years?

What do you know?

- Each cow produces a female calf at age 2.
- Every year after that, she produces 1 female calf.
- No cows die.

Think of a strategy to help you solve the problem.

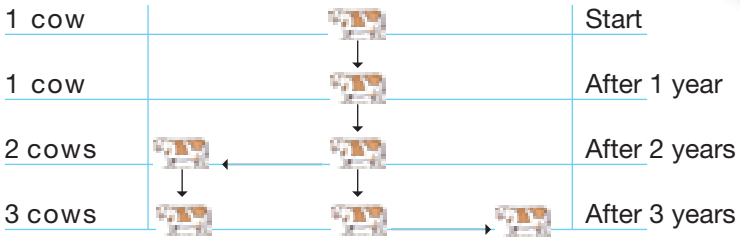
- You can **draw a diagram**.
- Find out how many cows there are after 1 year, then after 2 years, and so on.

Strategies

- **Make a table.**
- **Use a model.**
- **Draw a diagram.**
- **Solve a simpler problem.**
- **Work backward.**
- **Guess and test.**
- **Make an organized list.**
- **Use a pattern.**

Lesson Focus | Interpret a problem and select an appropriate strategy.

Copy and continue the diagram.



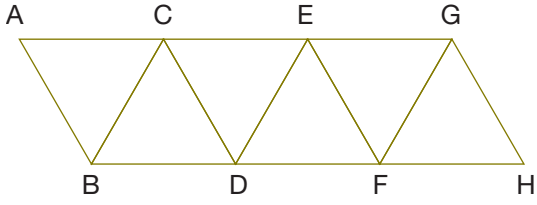
After 1 year, there is 1 cow.
After 2 years, there are 2 cows.
After 3 years, there are 3 cows.
How many cows are there after 5 years?

Check your work.
What pattern do you see in the numbers of cows?

Practice

Choose one of the **Strategies**

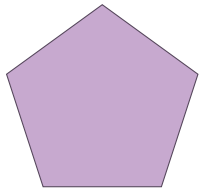
1. A mouse crawls through this maze.
The mouse always moves forward.



a) How many different paths could the mouse take from A to B?
From A to C? From A to D?
What pattern do you see?

b) Predict the number of different paths the mouse could take from A to H.

2. Here is a regular pentagon. Copy the pentagon.
Join each vertex to all other vertices.
How many different triangles are there?



Reflect

How does drawing a diagram help to solve a problem?
Use words, pictures, and numbers to explain.

LESSON 5

Using a Variable to Write an Equation

Which statements below are equations?
How do you know?

$3 + 7 = 10$ $3 + 7 + 10$ $12 = 14 - 2$ $12 - 2 + 14$ $5 - 1 = 2 + 2$

How would you say each equation without using these words:
"plus", "add", "minus", or "take away"?

Explore

You will need index cards and scissors.

➤ Create 4 game cards, each one similar to one of the cards below.
Use one of $+$, $-$, $\times$, or $\div$ in each equation.

Eight is three more than a number.	$8 = \square + 3$
Two less than a number is nine.	$\triangledown - 2 = 9$
Four times a number is twenty.	$4 \times \lozenge = 20$
Five is thirty divided by a number.	$5 = 30 \div *$

➤ Cut the cards in half, then shuffle them.
Trade your cards with those of another pair of classmates.
Match each sentence to its equation.

Show *and* Share

What strategies did you use to write the equations?
How did you decide which symbol to use?
What strategies did you use to match the cards?
For each sentence, how could you write the equation a different way?

Connect

We may be able to write an equation to help us solve a problem.
We use a letter variable to represent what we do not know.

➤ Jean-Luc opened a package of 20 pencils.
He gave out some pencils.
There were 6 pencils left.
How many pencils did Jean-Luc give out?

We use a variable to represent the number of pencils given out.
Let p represent the number of pencils given out.
Here are 3 equations we can write.

- We know that:
  Total number of pencils = number given out + number left
  One equation is: $20 = p + 6$
- We know that:
  Number left = total number of pencils − number given out
  A second equation is: $6 = 20 - p$
- We know that:
  Number given out = total number of pencils − number left
  A third equation is: $p = 20 - 6$

➤ Marie had 36 e-mails in her inbox.
This was twice as many e-mails as she had last week.
How many e-mails did Marie have last week?

Let e represent the number of e-mails Marie had last week.
Here are 2 equations we can write.

- We know that:
  2 × number of e-mails last week = number of e-mails this week
  One equation is: $2 \times e = 36$
  Or, $2e = 36$

We write $2 \times e$ as $2e$: that is, we do not write the multiply sign.

- We know that:
  Number of e-mails last week = number of e-mails this week ÷ 2
  A second equation is: $e = 36 \div 2$

Practice

1. Which equation below represents this problem? Explain your choice.
Together, Melissa and Pierre have 15 rare hockey cards.
Melissa has 9 cards.
How many cards does Pierre have?

a) $c = 15 + 9$ **b)** $15 = c + 9$ **c)** $9 = 15 + c$ **d)** $c - 15 = 9$

Write an equation for each of questions 2 to 4.

2. Mary-George has 4 buckets of clams
for the Long House feast.
Each bucket contains the same number of clams.
Altogether, Mary-George has 120 clams.
How many clams are in each bucket?

3. Lesley read 114 pages of an exciting novel.
The novel is 204 pages.
How many more pages does Lesley have to read?

4. The water cooler held 66 cups of water.
Each minute, 3 cups of water were taken.
How many minutes did it take for the water cooler to empty?

Write 2 equations for each of questions 5 and 6.

5. Three towers were built. Each tower had the same number of toy blocks.
Altogether, there were 144 blocks.
How many blocks were in each tower?

6. Jaipreet picked 30 boxes of blueberries in the bush.
After she sold some boxes, she had 13 boxes left.
How many boxes did Jaipreet sell?

7. Write a word problem for which you can write an equation.
Write as many equations as you can for your problem.
Explain how you know each equation represents the problem.

Reflect

Look at the questions above.
Explain how you decided whether to use $+$, $-$, $\times$, or $\div$ in an equation.

LESSON 6

Solving Equations Involving Addition and Subtraction

How many counters are in the bag?
How do you know?

Explore

➤ Solve this problem:
Rui has $35.
After he spent some money, Rui had $19 left.
How much money did Rui spend?

➤ How many different ways can you solve the problem?
Describe each strategy you used.

Show *and* Share

Share your strategies and solution with another pair of classmates.
If you wrote an equation, did you write the same equation?
If not, is one equation incorrect? Explain.
If you did not write an equation, work together now
to write and solve an equation to solve the problem.

Connect

Wendy washed 72 windows in an apartment building.
She had 98 windows to wash altogether.
How many more windows has Wendy to wash?

Write an equation to solve this problem.
Let w represent the number of windows Wendy has still to wash.
We know that:
Total number of windows = windows already washed + windows still to be washed
One equation is:

$$98 = 72 + w$$

Here are two ways to solve this equation.

- Guess and test

  $98 = 72 + w$
  Guess a number for w, then test to see if you are correct.

  Guess: $w = 10$
  Test: $72 + 10 = 82$ This is too low.

  Guess: $w = 20$
  Test: $72 + 20 = 92$ This is too low, but closer to the number we want.

  Guess: $w = 25$
  Test: $72 + 25 = 97$ This is very close.

  Guess: $w = 26$
  Test: $72 + 26 = 98$
  So, $w = 26$

$w = 26$ is the **solution** to the equation.

- **By inspection**

  $98 = 72 + w$
  Which number do we add to 72 to get 98?

  We subtract to find out.
  The number we add is: $98 - 72 = 26$
  So, $w = 26$

By *inspection* means I look at, or *inspect*, the equation to try to figure out the number that w represents.

Wendy has 26 more windows to wash.

Practice

1. Solve each equation.
Which strategy will you use?
a) $20 = c + 1$ **b)** $c + 2 = 20$ **c)** $3 + c = 20$ **d)** $20 = 4 + c$

2. Solve each equation.
Which strategy will you use?
a) $10 = n - 1$ **b)** $n - 2 = 10$ **c)** $10 - n = 3$ **d)** $4 = 10 - n$

For each of questions 3 to 7, write an equation.
Solve the equation to solve the problem.

3. Scott and Jamie have a collection of autographed pictures.
Altogether, they have 36 pictures.
Scott has 13 pictures.
How many pictures does Jamie have?

4. The girls' field hockey team has 32 jerseys.
Some of these jerseys are new. Nineteen jerseys are from last year.
How many jerseys are new?

5. Mandeep buys a case of 24 cans of juice.
In one week, Mandeep drinks 11 cans.
How many cans are left?

6. Sholeh wants to add 40 files to a folder in her laptop computer.
There is only enough room for 13 files. Sholeh cannot delete any files.
How many files will not fit?

7. A ribbon is 45 cm long. Adam cuts off a piece.
The ribbon that is left is 12 cm long.
How long was the piece Adam cut off?

8. For each equation, write a story problem that could be solved by using the equation.
a) $30 = a + 5$ **b)** $b - 4 = 25$ **c)** $40 - c = 16$ **d)** $35 = d - 11$

9. a) Write as many different equations as you can for this problem:
Sandra and Kirk have 72 linking cubes.
Kirk has 28 cubes.
How many cubes does Sandra have?
b) Solve each equation you wrote in part a.
c) Solve the problem in part a.
Show your work.

Reflect

Which method for solving an equation do you find easiest?
Explain your choice.

LESSON 7

Solving Equations Involving Multiplication and Division

Explore

➤ Solve this problem:

For a school fund-raiser, Yettis is packing boxes
for children in Guyana, South America.
Yettis has 48 notebooks.
She puts 6 notebooks in each box.
How many boxes will have notebooks?

➤ How many different equations can you write to solve the problem?
List each equation.

Show *and* Share

Share your equations and solution with another pair of classmates.
What types of equations did you write?
What strategies did you use to solve your equations?

Connect

Clive watched the first snow of the season fall outside his window.
Each hour, 3 cm of snow fell.
The total snowfall was 15 cm.
For how many hours did it snow?

Write an equation to solve this problem.
Let t represent the number of hours it snowed.
Here are 3 equations we can write and solve.

➤ Using multiplication
We know that:
Total snowfall = snow that falls in 1 h × number of hours it snowed
One equation is:

$15 = 3 \times t$

Or, $15 = 3t$

$3t$ is a short way to write $3 \times t$.

To solve this equation, think:
Which number do we multiply 3 by to get 15?
We know that: $3 \times 5 = 15$
So, $t = 5$

➤ Using division

- We know that:
  Number of hours it snowed = total snowfall ÷ snow that falls in 1 h
  One equation is:
  $t = 15 \div 3$
  So, $t = 5$
- We also know that:
  Snow that falls in 1 h = total snowfall ÷ number of hours it snowed
  Another equation is:
  $3 = 15 \div t$
  To solve this equation, think:
  Which number do we divide 15 by to get 3?
  We know that: $15 \div 5 = 3$
  So, $t = 5$

The snow fell for 5 h.

Practice

1. Solve each equation.

a) $2 \times m = 4$ **b)** $2 \times m = 6$ **c)** $2 \times m = 8$ **d)** $2 \times m = 10$
e) $3 \times m = 18$ **f)** $3 \times m = 21$ **g)** $3 \times m = 24$ **h)** $3 \times m = 27$

2. Solve each equation.

a) $20 = 5c$ **b)** $2c = 30$ **c)** $4c = 44$ **d)** $50 = 5c$
e) $6c = 42$ **f)** $56 = 7c$ **g)** $8c = 64$ **h)** $54 = 9c$

3. Solve each equation.

a) $n = 16 \div 2$ **b)** $30 \div n = 10$ **c)** $8 = 48 \div n$ **d)** $5 = n \div 6$
e) $25 \div n = 5$ **f)** $6 = 42 \div n$ **g)** $n = 72 \div 8$ **h)** $n \div 4 = 8$

4. Solve each equation.

a) $63 \div r = 7$ **b)** $21 = 7s$ **c)** $t \div 5 = 7$ **d)** $36 = 4u$
e) $49 \div 7 = v$ **f)** $5w = 45$ **g)** $8 = 40 \div z$ **h)** $8n = 80$

For each of questions 5 to 9, write an equation.
Solve the equation to solve the problem.

5. For a traditional burning ceremony, Cam had 22 bundles of cedar logs.
Each bundle contained 3 logs.
How many logs did Cam have altogether?

6. Holly made a comic book with 8 pages.
She had several copies of the book printed.
Holly paid for 96 pages altogether.
How many comic books did she print?

7. Starkley used his computer to write and record a drum track.
Each bar of the song had 4 beats.
The printout showed 31 bars of music.
How many beats did Starkley record?

8. Kimberly left Edmonton for a long car trip.
She travelled 400 km in 5 h.
About how far did Kimberly travel in 1 h?

9. Teagan picked cranberries for one week.
Each day, he picked 30 baskets of cranberries.
How many baskets did Teagan pick in 7 days?

10. For each equation, write a story problem that could be solved by using the equation.
a) $45 = 5n$ **b)** $77 \div 7 = r$ **c)** $6 = 24 \div s$ **d)** $t \div 7 = 8$

11. **a)** Write an equation.
b) Write a story problem that could be solved by solving the equation.
c) Solve the equation and the problem.
d) What other equations could you write to solve the story problem?
Show your work.

Reflect

When you have a problem that can be solved by dividing, why can you write at least two equations for the problem?
Use an example to explain.

Match It!

Your teacher will give you copies of Equation Cards and Problem Cards.
You will need scissors.
The goal of the game is to match each Equation Card to a Problem Card, and explain why the match was made.

- Cut out the cards.
  Shuffle the cards.
  Place all the cards face up in an array.

- Take turns to pick two matching cards.
  Explain how you know the match is correct.
  If the match is not correct, the player returns the cards to the array, and awaits his next turn.

- One point is awarded for the correct match.
  One point is awarded for a clear explanation.
  A bonus point is awarded for solving the equation and the problem.

- Play until all the cards have been matched, or until a player has 10 points.

Unit 1 Show What You Know

LESSON

1

1. Write the first 6 terms of each pattern.

a) Start at 100. Subtract 6 each time.

b) Start at 10. Alternately, add 5 then subtract 2.

2. For each pattern below:

- Use counters to show the first 3 terms.
- Predict the 6th and 7th terms.
- Use counters to check your predictions.
- Describe the pattern.
  How is each term different from the term before?
- Write a pattern rule.

a) 2, 4, 6, 8, 10, . . . **b)** 2, 4, 7, 11, 16, . . . **c)** 2, 4, 5, 7, 8, . . .

2

3. For each pattern below, choose the number that is the next term in the pattern. Explain your choice.

a) 5, 8, 12, 15, 19, . . .
Which number is the next term: 20, 21, 22, 23, or 24?

b) 50, 48, 47, 45, 44, . . .
Which number is the next term: 43, 42, 41, 40, or 39?

c) 10, 12, 16, 22, 30, . . .
Which number is the next term: 34, 36, 38, 40, or 42?

4. A magazine costs $4.00.

a) What is the cost of 2 magazines? 3 magazines? 4 magazines? 5 magazines? 6 magazines?
Show your answers in a table.

b) How much would 98 magazines cost?

c) How many magazines can you buy with $100?

d) Suppose you have $50.00.
Can you buy magazines and have no money left over?
How do you know?

3

5. Use a variable to write a pattern rule for each number pattern. Find the 50th term in each pattern.

a) 4, 5, 6, 7, 8, . . .

b) 12, 13, 14, 15, 16, . . .

LESSON

3

6. For each hour Riley does chores, her mother increases her earnings by $1 per hour.
This table shows Riley's earnings per hour for the first 3 hours.

Hours Worked	Money Earned per Hour
1	$3
2	$4
3	$5

a) Copy the table.
Extend the table 3 more rows.
b) Use a variable to write an expression for the money earned per hour.
c) Suppose this pattern continues.
How much would Riley earn for the 10th hour she works?

For each of questions 7 to 9, write an equation for the problem, then use the equation to solve the problem.

5
6
7

7. Adala runs 5 km each day.
How far does Adala run in 17 days?

8. Joe is collecting cans of food for the food bank.
On Monday, he had 27 cans.
On Tuesday, he had 53 cans.
How many more cans did Joe have on Tuesday than on Monday?

9. Suri has 75 stickers.
She shares the stickers among her friends.
Each friend has 15 stickers.
How many friends received stickers?

10. For each equation, write a story problem that could be solved by using the equation.
a) $36 = 4n$ **b)** $4 + n = 36$
c) $36 = n - 4$ **d)** $n \div 4 = 36$

UNIT 1 Learning Goals

- ☑ use a pattern rule to describe a pattern
- ☑ make predictions about terms in a pattern
- ☑ use a variable to describe a pattern
- ☑ use a variable to write equations
- ☑ solve equations to solve problems

Unit Problem

Charity Fund-raising

Plan an event to raise money for charity.

Include:

- a description of the event
- how much you estimate the costs will be
- how much money you expect to raise
- tables to show any patterns in the money you expect to raise
- a poster to promote your fund-raising event

Check List

Your work should show

- ☑ a detailed plan of the event
- ☑ how you calculate the amount you expect to raise
- ☑ any tables and patterns you used
- ☑ correct math language

Reflect on Your Learning

Write about some of the different equations in the unit, and how you used them to solve problems.