

UNIT

10

Patterning and Algebra

Students in a grade 7 class were raising money for charity. Some students had a “bowl-a-thon.”

This table shows the money that one student raised for different bowling times.

Time (h)	Money Raised (\$)
1	8
2	16
3	24
4	32
5	40
6	48

- What patterns do you see in the table?
- Suppose you drew a graph of the data. What might the graph look like?

What You'll Learn

- Describe, extend, and explain patterns.
- Use patterns to make predictions.
- Show patterns as graphs.
- Write and evaluate algebraic expressions.
- Read and write equations.
- Solve equations.

Why It's Important

- Extending a pattern is a useful problem-solving strategy.
- Using algebra is an efficient way to describe a pattern.





Key Words

- ordered pairs
- algebraic expression
- evaluate
- equation
- solve an equation

Order of Operations

Recall this order of operations.

Brackets

Perform operations inside the brackets.

Divide and multiply

Do in order from left to right.

Add and subtract

Do in order from left to right.

Example

Simplify.

a) $6 + 3 \times 4$

b) $(5 + 3) \div 2$

c) $18 \div 3 \times 2$

Solution

$$\begin{array}{l} \text{a) } 6 + 3 \times 4 = 6 + 12 \\ \phantom{\text{a) } 6 + 3 \times 4} = 18 \end{array}$$

Multiply first.
Then add.

$$\begin{array}{l} \text{b) } (5 + 3) \div 2 = 8 \div 2 \\ \phantom{\text{b) } (5 + 3) \div 2} = 4 \end{array}$$

Add in brackets first.
Then divide.

$$\begin{array}{l} \text{c) } 18 \div 3 \times 2 = 6 \times 2 \\ \phantom{\text{c) } 18 \div 3 \times 2} = 12 \end{array}$$

Divide first.
Then multiply.

✓ Check

1. Simplify.

a) $5 \times 7 + 2$

b) $5 \times (7 + 2)$

c) $13 + 2 \times 8$

d) $13 + 2 - 8$

e) $13 + 8 \div 2$

f) $13 - 8 \div 2$

g) $12 \div 4 + 2$

h) $12 \div (4 + 2)$

i) $12 + 4 \div 2$

2. a) Simplify.

i) $3 + 4 \times 2 + 5$

ii) $3 \times 4 + 2 \times 5$

iii) $3 \times (4 + 2) \times 5$

iv) $3 \times (4 + 2) + 5$

v) $3 \times 4 \times 2 + 5$

vi) $3 + 4 + 2 \times 5$

b) All the expressions in part a have the same numbers and the same operations. Why are the answers different?

Graphing on a Coordinate Grid

$(3, 2)$ is an **ordered pair**. It tells the position of a point on a grid.

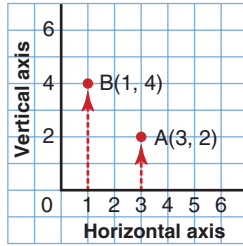
In an ordered pair, the first number is the horizontal distance from the origin, O .

The second number is the vertical distance from the origin.

We use a letter to label a point.

To plot point $A(3, 2)$, start at 3 on the horizontal axis, then move up 2.

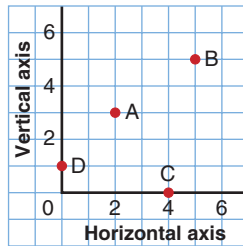
To plot point $B(1, 4)$, start at 1 on the horizontal axis, then move up 4.



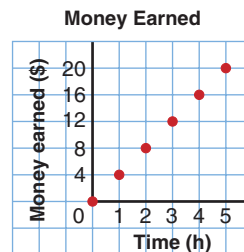
The numbers in an ordered pair are also called the **coordinates** of a point.

✓ Check

3. Write the ordered pair for each point on the grid.



4. On graph paper, draw a grid.
Plot and label these points:
 $A(2, 9)$, $B(5, 3)$, $C(8, 8)$, $D(0, 10)$
5. The graph shows the money earned for the time worked.
- How much money was earned in 4 h?
 - How long will it take to earn \$12.00?
 - What is the hourly rate of pay?



Focus Extend patterns and use them to make predictions.

Explore

Work with a partner.

➤ Suppose this pattern continues.



Describe the pattern.

What is the next figure in the pattern?

What is the 17th figure?

How can you find out without drawing 17 figures?

➤ Suppose this pattern continues.



Figure 1

Figure 2

Figure 3

Figure 4

Describe the pattern.

What is the next figure in the pattern?

How many dots will there be in the 15th figure?

How can you find out without drawing 15 figures?

Reflect & Share

How are the two patterns the same?

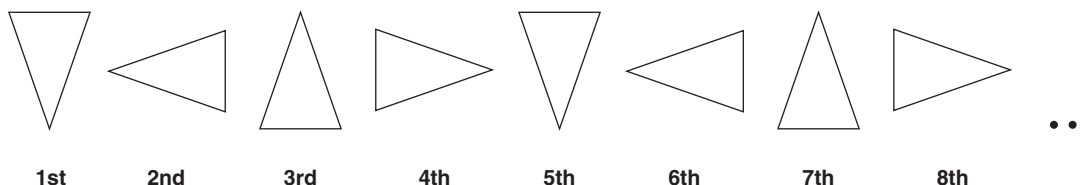
How are they different?

Compare your answers with those of another pair of classmates.

Did you use the same strategies to answer the questions? Explain.

Connect

Here is a pattern of triangles.



The pattern is made up of different positions of an isosceles triangle. To get the next term each time, rotate the triangle a $\frac{1}{4}$ turn clockwise about its centre.

The core of the pattern is 4 triangles.

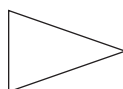
The 5th term is the same as the 1st term.

The 6th term is the same as the 2nd term, and so on.

To find any term in the pattern, we find which of the first 4 terms it matches.

Think of multiples of 4: 4, 8, 12, 16, 20, 24, 28, ...

All the 4th, 8th, 12th, 16th, 20th, 24th, 28th, ... terms have the triangle pointing to the right.



To find the 99th term, we find the closest multiple of 4.

100 is a multiple of 4, so the 100th term is the same as the 4th term.

The 99th term will be the same as the 3rd term:



The 99th term is the triangle pointing up.

We can use the same ideas to make predictions with number patterns.

Example

Each pattern continues.

- i) Describe each pattern.
 - ii) Write the next 3 terms.
 - iii) Find the 50th term.
- a) 4, 7, 10, 13, ... b) 1, 4, 9, 16, ...

Solution

- a) 4, 7, 10, 13, ...
- i) The pattern begins with 4.
To get the next term, add 3 each time.
 - ii) The next 3 terms are: $13 + 3 = 16$
 $16 + 3 = 19$
 $19 + 3 = 22$
- The next 3 terms are 16, 19, 22.

- iii) Since the terms increase by 3 each time, compare the pattern with multiples of 3.

Pattern: 4, 7, 10, 13, 16, 19, 22, ...

Multiples of 3: 3, 6, 9, 12, 15, 18, 21, ...

Each term in the pattern is 1 more than a multiple of 3.

So, the terms in the pattern are multiples of 3, plus 1.

The 1st term: $1 \times 3 + 1 = 4$

The 2nd term: $2 \times 3 + 1 = 7$

The 3rd term: $3 \times 3 + 1 = 10$

The 4th term: $4 \times 3 + 1 = 13$, and so on

• •
• •
• •

The 50th term: $50 \times 3 + 1 = 151$

The 50th term is 151.

- b) 1, 4, 9, 16, ...

- i) The pattern begins with 1.

To get the 2nd term, add 3.

To get the 3rd term, add 5.

To get the 4th term, add 7.

To get each successive term, increase the number you add by 2 each time.

- ii) The next 3 terms are: $16 + 9 = 25$

$$25 + 11 = 36$$

$$36 + 13 = 49$$

The next 3 terms are 25, 36, 49.

- iii) To use the same method to get the 50th term, we would need to know the 49th term and what to add.

So, we look at the pattern a different way.

The pattern is: 1, 4, 9, 16, 25, 36, 49, ...

These are the perfect squares: $1^2, 2^2, 3^2, 4^2, 5^2, 6^2, 7^2, \dots$

So, the 50th term is: $50^2 = 2500$

The 50th term is 2500.

Recall that a perfect square is the product of a number and itself.

Practice

1. This pattern continues.



- Describe the pattern.
- Sketch the next 3 terms.
- Sketch the 29th term and the 49th term.

2. This pattern continues.



- Describe the pattern.
- Sketch the next 3 terms.
- Describe the 18th term and the 38th term.
Sketch them if you can.

3. For each pattern:

- Describe the pattern.
- Write the next 3 terms.
- Find the 40th term. Explain how you found it.

- a) 6, 9, 12, 15, ... b) 6, 10, 14, 18, ... c) 6, 11, 16, 21, ...

4. There is a pattern in the patterns in question 3.

Write the first 5 terms of the next pattern. Justify your answer.

5. For each pattern:

- Describe the pattern.
- Write the next 3 terms.
- Find the 20th term.

- a) 2, 4, 8, 16, ... b) 3, 6, 12, 24, ...

6. Look at the patterns below.

How are they the same? How are they different?

- Write the next 3 terms for each pattern.
- Write the 20th term in each pattern.

- a) 2, 5, 10, 17, 26, ... b) 0, 3, 8, 15, 24, ...



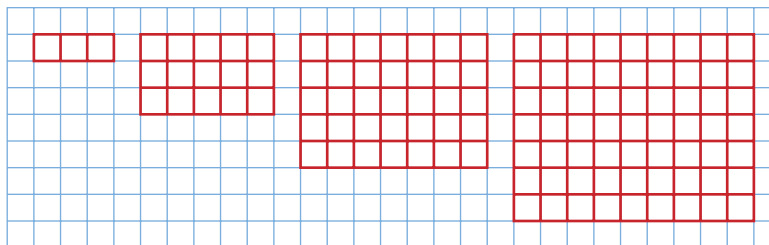
Mental Math

Estimate each product.
Order the products from
least to greatest.

- 24.8×3.2
- 35.23×2.89
- 13.21×5.78
- 5.5×15.5

What strategies did
you use?

7. This pattern continues.

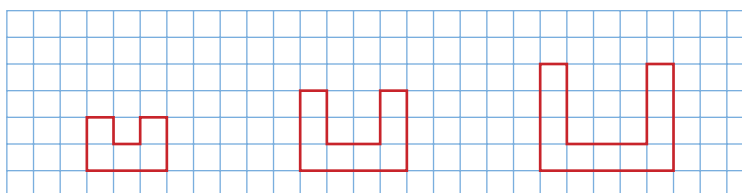


- a) Describe the pattern.
b) Sketch the next 3 terms.
c) Describe the 17th term and the 37th term.
Sketch them if you can.
8. **Assessment Focus** Create two different number patterns.
Each pattern must contain the numbers 12 and 32.
Describe each pattern in words.
Write the next 4 terms in each pattern.

Take It Further

9. a) Describe this pattern. The pattern continues.
b) How many squares would be in the 10th figure?
c) What are the perimeters of the 4th figure and 5th figure?
d) What is the perimeter of the 10th figure?
e) How many squares are there in the figure with perimeter 72?
f) Could you make one of the figures using exactly 27 small squares? Explain.

Use a geoboard and
geoband if they help.



10. Create two different number patterns that contain the numbers
16, 20, and 25. Write the first 5 terms in each pattern.

Reflect

Describe how you identify a number pattern.
Use two different examples from this lesson.

Explore

Work with a partner.

You will need grid paper.

One CD costs \$10.

- Copy and complete this table.
Find the cost for up to 10 CDs.
- Graph the data in the table.

Number of CDs	Cost (\$)
0	
2	
4	
6	
8	
10	

Reflect & Share

Describe the patterns in the table.

How are these patterns shown in the graph?

Connect

We can use a table and a graph to illustrate number patterns.

Recall this pattern from *Section 10.1, Example, page 369*.

Term 1: 4

Term 2: 7

Term 3: 10

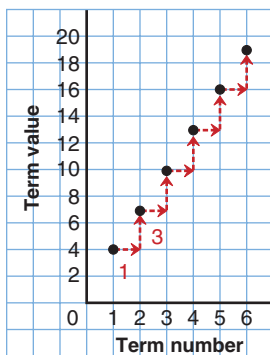
Term 4: 13

Term 5: 16

Term 6: 19

We write these terms in a table.

Term Number	Term Value
1	4
2	7
3	10
4	13
5	16
6	19



We plot these data on a graph.

The *Term number* is plotted on the horizontal axis.

The *Term value* is plotted on the vertical axis.

The graph is a set of points that lie on a straight line.

To get from one point to the next, move 1 unit right and 3 units up.

Moving 1 unit right is the same as adding 1 in the first column to get the next term number.

Moving 3 units up is the same as adding 3 in the second column to get the next term value.

We can use a table related to an Input/Output machine to make a pattern.

Example 1

- a) Complete the table for this pattern:
Multiply each number by 2, then add 3.
- b) Graph the pattern.
Explain how the graph shows the pattern.

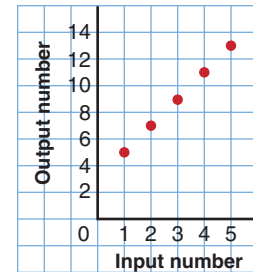
Input	Output
1	
2	
3	
4	
5	

Solution

Input	Output
1	5
2	7
3	9
4	11
5	13

- a) Multiply each Input number by 2, then add 3.
- $$1 \times 2 + 3 = 5$$
- $$2 \times 2 + 3 = 7$$
- $$3 \times 2 + 3 = 9$$
- $$4 \times 2 + 3 = 11$$
- $$5 \times 2 + 3 = 13$$

- b) The points lie on a straight line.
To get from one point to the next, move 1 unit right and 2 units up.
Moving 1 unit right is the same as adding 1 to an Input number to get the next Input number.
Moving 2 units up is the same as adding 2 to an Output number to get the next Output number.



Example 2

- a) Describe the patterns in this table.
- b) Use the patterns to extend the table
3 more rows.
- c) Graph the table in part b. Explain how the graph shows the patterns.

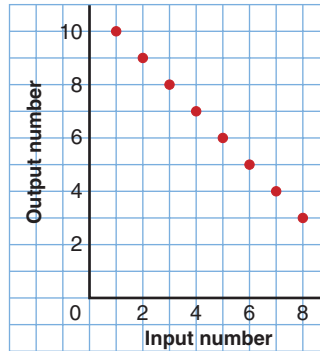
Input	Output
1	10
2	9
3	8
4	7
5	6

Solution

- a) The numbers in the Input column start at 1 and increase by 1 each time.
The numbers in the Output column start at 10 and decrease by 1 each time.
The sum of matching Input and Output numbers is 11.

- b) The next 3 Input numbers are 6, 7, 8.
The next 3 Output numbers are 5, 4, 3.

- c) The graph is a set of points that lie on a straight line.



Input	Output
1	10
2	9
3	8
4	7
5	6
6	5
7	4
8	3

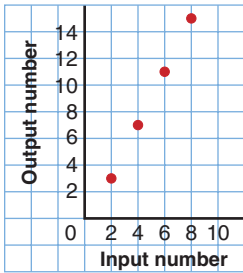
The line goes down to the right.
As the Input numbers increase from 1 to 8,
the Output numbers decrease from 10 to 3.

Practice

Input	Output
1	
2	
3	
4	
5	

- Copy and complete this table for each pattern.
 - Multiply each Input number by 3.
 - Add 2 to each Input number.
 - Multiply each Input number by 3, then add 2.
 - Add 2 to each Input number, then multiply by 3.
- Copy and complete this table for each pattern.
 - Divide each Input number by 10.
 - Subtract 3 from each Input number.
 - Divide each Input number by 10, then subtract 3.

Input	Output
100	
80	
60	
40	
20	



3. Look at this graph.
- Make an Input/Output table for the graph.
 - What patterns do you see in the table?
 - Extend the table 3 more rows. Explain how you did this.

4. The students at a school sell pins at a school fair to raise money for charity.

The students charge \$1.50 per pin.

- Copy and complete this table.
- Graph the data in the table in part a.
- Suppose you know how many pins were sold. How can you find how much money was collected:

Number of Pins	Money Collected
10	
20	
30	
40	
50	
60	

- by using the table?
- by using the graph?

5. For each table:
- Describe the pattern in the Output column.
 - How can you find an Output number when you know an Input number?
 - Write the next 3 rows in each table.

a)

Input	Output
2	6
4	8
6	10
8	12
10	14

b)

Input	Output
2	6
4	12
6	18
8	24
10	30

c)

Input	Output
2	6
4	10
6	14
8	18
10	22

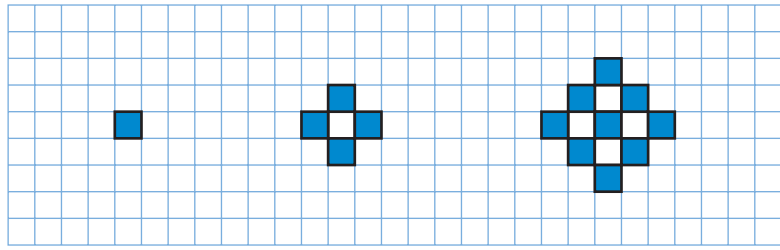
6. **Assessment Focus** Mr. Francis is planning a school picnic.

- Mr. Francis estimates he needs 2 sandwiches for each student, plus 3 extras. Make a table for the number of sandwiches needed for 5, 10, 15, 20, 25, 30 students.
- Mr. Francis estimates he needs 1 drink for each student, plus 5 extras. Make a table for the number of drinks needed for up to 30 students.
- Draw graphs for the tables in parts a and b. Explain how each graph shows the patterns in the tables.



Take It Further

7. a) Copy this pattern on grid paper.
Extend the pattern to show the next 2 figures.



- b) Copy and complete this table for the first 5 figures.

Figure Number	Number of Blue Squares

- c) Draw a graph to show the data in the table.
d) How is this graph different from other graphs you have drawn?
e) How could you use the graph or the table to find the number of blue squares in the 9th figure?

Calculator Skills

Three numbers have a product of 24.5. One number is 0.25. What might the other two numbers be?

Reflect

Explain how a pattern in words can be represented by a table and a graph.

Use an example in your explanation.



Math Link

History

The word "algebra" comes from the Arabic world "al-jabr." This word appeared in the title of one of the earliest algebra texts, written around the year 825 by al-Khwarizmi. He lived in what is now Uzbekistan.

Explore



Work with a partner.

Tehya won some money in a competition.

She has two choices as to how she gets paid.

Choice 1: \$20 per week for one year

Choice 2: \$400 cash now plus \$12 per week for one year

Which method would pay Tehya more money? Explain.

For what reason might Tehya choose the method that pays less?

Reflect & Share

Work with another pair of classmates.

For each choice, write a rule you can use to calculate the total money

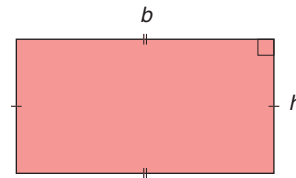
Tehya has received at any time during the year.

Connect

Recall how we used variables in the formulas for the area and perimeter of a rectangle.

Area: $A = bh$

Perimeter: $P = 2(b + h)$



In these formulas, b represents the length of the base and h represents the height.

We can also use a variable to represent a number in an expression.

For example, we know there are 100 cm in 1 m.

There are 2×100 cm in 2 m.

There are 3×100 cm in 3 m.

To write an expression for the number of centimetres in any number of metres, we say there are $n \times 100$ cm in n metres.

n is a variable.

n represents any number we choose.

We can choose any letter as a variable.
 The letters n and x are frequently used.
 The expression $n \times 100$ is written $100n$.
 $100n$ is an **algebraic expression**.

Variables are written in italics so they are not confused with units of measurement.

Here are some other algebraic expressions, and their meanings.
 In each case, n represents the number.

- Three more than a number: $3 + n$ or $n + 3$
- Seven times a number: $7n$
- 8 less than a number: $n - 8$
- Twenty divided by a number: $\frac{20}{n}$

Example 1

A car travels at an average speed of 50 km/h.
 How far will the car travel in: a) 3 h? b) t hours?

Solution

$t \times 50$ is equal to $50 \times t$,
 which is written $50t$.

- In 1 h, the car travels 50 km.
- a) In 3 h, the car travels: $3 \times 50 \text{ km} = 150 \text{ km}$
 b) In t hours, the car travels: $t \times 50 \text{ km} = 50t$ kilometres

Example 2

Write an algebraic expression for each statement.

- a) the amount of money earned at \$5/h
- b) the perimeter of a square
- c) eight more than three times a number
- d) double a number and subtract 5

Solution

We often choose a letter to remind us what the variable represents.

t for time
 s for side length
 n for number

- For each statement, choose a variable to represent the number.
- a) Let t hours represent the time worked.
 Then, the amount earned is $5 \times t$, or $5t$ dollars.
- b) Let s centimetres represent the side length of the square.
 Then, the perimeter in centimetres is $4 \times s$, or $4s$ centimetres.
- c) Let n represent the number.
 Three times the number: $3n$
 Then add 8: $3n + 8$
- d) Let x represent the number.
 Double the number means 2 times the number: $2x$
 Then subtract 5: $2x - 5$

Practice

If you use x as a variable, write it so it is not confused with a multiplication sign, \times .



Remember that the fraction bar indicates division.

- Write an algebraic expression for each statement.
 - six more than a number
 - a number multiplied by eight
 - a number decreased by six
 - a number divided by four
- A person earns \$4/h baby-sitting. Find the money earned for each time.
 - 5 h
 - 8 h
 - t hours
- Find the area of a rectangle for each length and width.
 - length: 8 cm; width: 6 cm
 - length: 10 cm; width: 5 cm
 - length: l centimetres; width: w centimetres
- A person walks at an average speed of 5 km/h. Find the distance walked in each time.
 - 2 h
 - 5 h
 - t hours
- Write each algebraic expression in words. Use the words “a number” in place of the variable.
 - $n + 8$
 - $6a$
 - $\frac{p}{5}$
 - $k - 11$
 - $27 - n$
 - x^2
- Write an algebraic expression for each statement.
 - Double a number and add three.
 - Subtract five from a number, then multiply by two.
 - Subtract one-half of a number from 17.
 - Divide a number by seven, then add six.
 - A number is subtracted from twenty-eight.
 - Twenty-eight is subtracted from a number.
- Write each expression in words.
 - $(40 - 3)r$
 - $40 - 3r$
 - How are the expressions and statements in part a similar? Different?

Number Strategies

The regular price of a pair of running shoes is \$74.99. What is the sale price in each case?

- 50% off
- 25% off
- 30% off
- 70% off

8. a) Write an algebraic expression for each statement.
- three more than a number
 - a number added to three
 - three less than a number
 - a number subtracted from three
- b) How are the expressions in part a alike?
How are they different? Explain.
9. Write each expression in words.
- a) $6h + 5$ b) $\frac{(n-3)}{4}$ c) $\frac{t}{4} + 12$
d) $3(x-3)$ e) $32 - \frac{w}{5}$ f) $\frac{w}{5} - 32$

10. Assessment Focus

- a) Use the cards below to make an algebraic expression for each statement. Write the expression.



- nine times a number subtract 4
 - the sum of four times a number and nine
 - a number plus five
 - nine more than one-quarter of a number
- b) Create two more expressions using the cards.
Write each expression in words.
Show your work.
11. A pizza with cheese and tomato toppings costs \$8.00. There is a cost of \$1 for each extra topping.
Write an algebraic expression for the cost of a pizza with e extra toppings.



Reflect

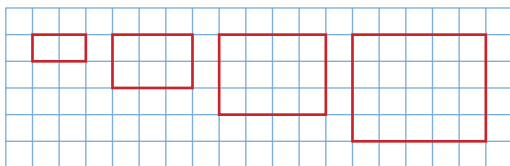
Why do we write algebraic expressions? How are they useful?

Mid-Unit Review

LESSON

- 10.1 1.** For each pattern:
- Describe the pattern.
 - Write the next 3 terms.
 - Find the 10th term.
- 5, 8, 11, 14, ...
 - 14, 25, 36, 47, ...
 - 1, 8, 27, 64, ...
 - 1, 3, 7, 15, 31, ...

- 2. a)** Describe this pattern.



The pattern continues.

- Write the dimensions of the next 2 rectangles.
 - Write the areas of the first 5 rectangles.
 - What are the dimensions and area of the 19th rectangle?
 - Which rectangle has area 110 square units?
- 10.2 3. a)** Complete the table in the next column for this pattern: Multiply each term by 4, then subtract 1.
- b)** Graph the pattern. Explain how the graph shows the pattern.

Input	Output
1	
2	
3	
4	
5	
6	

- 4. a)** Describe the pattern in the Output column.
- b)** How can you find an output number when you know an input number?

Input	Output
1	8
2	11
3	14
4	17
5	20
6	23

- c)** Write the next 3 rows in the table.
- d)** Graph the table. Explain how the graph shows the pattern.

- 10.3 5.** Write an algebraic expression for each statement.
- eleven more than a number
 - four less than a number
 - a number divided by three
 - a number multiplied by nine
 - the sum of five times a number, and 2
 - seventeen more than two times a number

- 6.** Write each expression in words. Use the words “a number” in place of each variable.

a) $n + 3$ **b)** $21 - h$ **c)** $9n$ **d)** $\frac{a}{4}$

Focus Substitute a number for a variable in an algebraic expression.

Explore



Work with a partner.

Ms. Prasad plans to hold a party for a group of her friends.

The cost of renting a room is \$25.

The cost of food is \$3 per person.

Which algebraic expression gives the total cost, in dollars, of the party for n people?

$$3 + 25n \qquad 28n \qquad 28 + n \qquad 25 + 3n$$

Check your answer by finding the cost for 10 people.

Reflect & Share

Compare your answer with that of another pair of classmates.

How did you decide which expression was correct?

How does the expression change in each of the following cases?

- The cost of food doubles.
- The rent of the room doubles.

Connect

When we replace a variable with a number, we **substitute** a number for the variable.

When we replace a variable with a number in an algebraic expression, we **evaluate** the expression. That is, we find the value of the expression for a particular value of the variable.

Recall the work you did in *Unit 6 Measuring Perimeter and Area*. You substituted numbers for variables in the formulas for area and perimeter.

We use the same method to evaluate algebraic expressions.

Example

Write each algebraic expression in words.

Then evaluate for the value of the variable given.

a) $5k + 2$ for $k = 3$

b) $\frac{(x-3)}{5}$ for $x = 13$

Solution

$5k$ means $5 \times k$.

- a) $5k + 2$ means 5 times a number, then add 2.

Replace k with 3 in the expression $5k + 2$.

Use the order of operations.

$$\begin{aligned} 5k + 2 &= 5 \times 3 + 2 && \text{Multiply first.} \\ &= 15 + 2 && \text{Add.} \\ &= 17 \end{aligned}$$

- b) $\frac{(x-3)}{5}$ means subtract 3 from a number, then divide by 5.

Replace x with 13.

$$\begin{aligned} \frac{(x-3)}{5} &= \frac{(13-3)}{5} && \text{Do the operation in brackets first.} \\ &= \frac{10}{5} && \text{Divide.} \\ &= 2 \end{aligned}$$

Recall that a variable is a symbol that can represent a set of numbers. If we substitute consecutive numbers in an algebraic expression, we get a pattern.

Use the algebraic expression $3n + 2$.

Substitute $n = 1, 2, 3, 4,$ and 5 .

$$\begin{aligned} \text{When } n = 1, 3n + 2 &= 3(1) + 2 \\ &= 3 + 2 \\ &= 5 \end{aligned}$$

$$\begin{aligned} \text{When } n = 2, 3n + 2 &= 3(2) + 2 \\ &= 6 + 2 \\ &= 8 \end{aligned}$$

$$\begin{aligned} \text{When } n = 3, 3n + 2 &= 3(3) + 2 \\ &= 9 + 2 \\ &= 11 \end{aligned}$$

$$\begin{aligned} \text{When } n = 4, 3n + 2 &= 3(4) + 2 \\ &= 12 + 2 \\ &= 14 \end{aligned}$$

$$\begin{aligned} \text{When } n = 5, 3n + 2 &= 3(5) + 2 \\ &= 15 + 2 \\ &= 17 \end{aligned}$$

Use the values of n as the Input.

Use the values of $3n + 2$ as the Output.

Then, write the patterns in a table.

To get each Output number, multiply the Input number by 3, then add 2.

Input n	Output $3n + 2$
1	5
2	8
3	11
4	14
5	17

Practice

Mental Math

Find each sum.

- $(-2) + (+10)$
- $(-6) + (-9)$
- $(+8) + (-7)$
- $(+11) + (+7)$

1. Evaluate each expression by replacing x with 4.
 - a) $x + 5$
 - b) $3x$
 - c) $2x - 1$
 - d) $\frac{x}{2}$
 - e) $3x + 1$
 - f) $20 - 2x$

2. Evaluate each expression by replacing z with 7.
 - a) $z + 12$
 - b) $10 - z$
 - c) $\frac{(z+5)}{2}$
 - d) $3(z - 1)$
 - e) $35 - 2z$
 - f) $3 + \frac{z}{7}$

3. Write each algebraic expression in words. Then, evaluate the expression for $n = 3$.
 - a) $n - 1$
 - b) $5n + 2$
 - c) $\frac{n}{3} + 5$
 - d) $n + 1$
 - e) $2(n + 9)$
 - f) $\frac{(n+7)}{2}$

4. Copy and complete each table. Explain how to get an Output number when you know the Input number.

<p>a)</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <thead> <tr> <th style="padding: 5px;">Input x</th> <th style="padding: 5px;">Output $2x$</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">1</td><td></td></tr> <tr><td style="text-align: center;">2</td><td></td></tr> <tr><td style="text-align: center;">3</td><td></td></tr> <tr><td style="text-align: center;">4</td><td></td></tr> <tr><td style="text-align: center;">5</td><td></td></tr> </tbody> </table>	Input x	Output $2x$	1		2		3		4		5		<p>b)</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <thead> <tr> <th style="padding: 5px;">Input m</th> <th style="padding: 5px;">Output $10 - m$</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">1</td><td></td></tr> <tr><td style="text-align: center;">2</td><td></td></tr> <tr><td style="text-align: center;">3</td><td></td></tr> <tr><td style="text-align: center;">4</td><td></td></tr> <tr><td style="text-align: center;">5</td><td></td></tr> </tbody> </table>	Input m	Output $10 - m$	1		2		3		4		5		<p>c)</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <thead> <tr> <th style="padding: 5px;">Input p</th> <th style="padding: 5px;">Output $3p + 4$</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">1</td><td></td></tr> <tr><td style="text-align: center;">2</td><td></td></tr> <tr><td style="text-align: center;">3</td><td></td></tr> <tr><td style="text-align: center;">4</td><td></td></tr> <tr><td style="text-align: center;">5</td><td></td></tr> </tbody> </table>	Input p	Output $3p + 4$	1		2		3		4		5	
Input x	Output $2x$																																					
1																																						
2																																						
3																																						
4																																						
5																																						
Input m	Output $10 - m$																																					
1																																						
2																																						
3																																						
4																																						
5																																						
Input p	Output $3p + 4$																																					
1																																						
2																																						
3																																						
4																																						
5																																						



5. Jason works at a local fish and chips restaurant. He earns \$7/h during the week, and \$9/h on the weekend.
 - a) Jason works 8 h during the week and 12 h on the weekend. Write an expression for his earnings.
 - b) Jason works x hours during the week, and 5 h on the weekend. Write an algebraic expression for his earnings.
 - c) Jason needs \$115 to buy sports equipment. He worked 5 h on the weekend. How many hours does Jason need to work during the week to have the money he needs?



- 6. Assessment Focus** Kouroche is organising an overnight camping trip. The cost of renting a cabin is \$20. The cost of food is \$9 per person.
- How much will the trip cost if 5 people go? 10 people go?
 - Write an algebraic expression for the cost of the trip if p people go.
 - Suppose the cost of food doubles.
Write an expression for the total cost of the trip for p people.
 - Suppose the cost of the cabin doubles.
Write an expression for the total cost of the trip for p people.
 - Explain why using the variable p is helpful.
- 7.** A value of n is substituted in each expression to get the number in the box. Find each value of n .
- $5n$ 30 **b)** $3n - 1$ 11
 - $4n + 7$ 15 **d)** $5n - 4$ 11
 - $4 + 6n$ 40 **f)** $\frac{n}{8} + 1$ 5

Take It Further

- 8.** Each table shows patterns. Write an algebraic expression to describe how each Output relates to the Input.

a)

Input x	Output
1	3
2	6
3	9
4	12

b)

Input x	Output
1	1
2	4
3	7
4	10

c)

Input x	Output
5	2
10	7
15	12
20	17

- 9.** Find a value for p and a value for q so that $p - 3q$ has a value of 1. How many different ways can you do this? Explain.

Reflect

Explain why it is important to use the order of operations when evaluating an algebraic expression. Use an example to explain.

Explore

Work with a partner.

- Write an algebraic expression for these statements:
Think of a number.
Multiply it by 3.
Add 4.
- The answer is 13. What is the original number?

Reflect & Share

Compare your answer with that of another pair of classmates.

If you found different values for the original number, who is correct?

Can both of you be correct?

How can you check?

Connect



When we write an algebraic expression as being equal to a number, we have an **equation**.

For example, we have an algebraic expression $3x + 2$.

When we write $3x + 2 = 11$, we have an equation.

An equation is a statement that two expressions are equal.

Here is another example.

Zena bought 3 CDs.

All 3 CDs had the same price.

The total cost was \$36.

What was the cost of 1 CD?

We can write an equation for this situation.

Let p dollars represent the cost of 1 CD.

Then $3p = 36$ is an equation that represents this situation.

Example 1

Mark thinks of a number.
He multiplies the number by 2, then adds 15.
The answer is 35. Write an equation for the problem.

Solution

Let n represent the number Mark thinks of.
Multiply the number by 2: $2n$
Then add 15: $2n + 15$
The equation is: $2n + 15 = 35$

Example 2

Write an equation for each sentence.

- Three more than a number is 15.
- Five less than a number is 7.
- A number subtracted from 5 is 1.
- A number divided by 3 is 10.

Solution

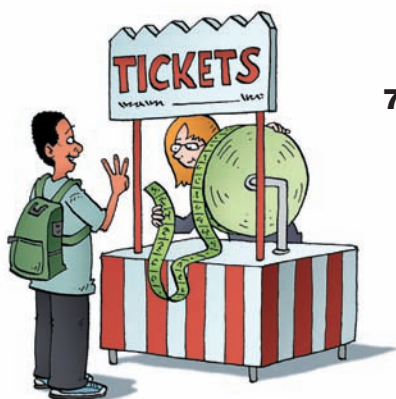
- Three more than a number is 15.
Let x represent the number.
Three more than x : $x + 3$
The equation is: $x + 3 = 15$
- Five less than a number is 7.
Let x represent the number.
Five less than x : $x - 5$
The equation is: $x - 5 = 7$
- A number subtracted from 5 is 1.
Let x represent the number.
 x subtracted from 5: $5 - x$
The equation is: $5 - x = 1$
- A number divided by 3 is 10.
Let x represent the number.
 x divided by 3: $\frac{x}{3}$
The equation is: $\frac{x}{3} = 10$

Practice

Mental Math

Find each difference.

- $(-7) - (-3)$
- $(-6) - (+5)$
- $(+2) - (-5)$
- $(+5) - (+9)$



1. Write an equation for each sentence.
 - a) Eight more than a number is 12.
 - b) Three times a number is 12.
 - c) Eight less than a number is 12.
2. Write a sentence for each equation.
 - a) $12 + n = 19$
 - b) $3n = 18$
 - c) $12 - n = 5$
 - d) $\frac{n}{2} = 6$
3. Write an equation for each sentence.
 - a) Five added to two times a number is 35.
 - b) Eight plus one-half a number is 24.
 - c) Six subtracted from three times a number is 11.
4. Write each equation in words.
 - a) $5x - 7 = 37$
 - b) $\frac{x}{3} + 4 = 9$
 - c) $17 - 2x = 3$
5. Match each equation with the correct sentence.
 - a) $n + 4 = 8$ A. Four less than a number is 8.
 - b) $4n = 8$ B. Four more than four times a number equals 8.
 - c) $4n - 4 = 8$ C. The sum of four and a number is 8.
 - d) $n - 4 = 8$ D. Four less than four times a number equals 8.
 - e) $4 + 4n = 8$ E. The product of four and a number is 8.
6. Alona thinks of a number. She divides the number by 4, then adds 10. The answer is 14. Write an equation for the problem.
7. **Assessment Focus** Write an equation for each sentence.
 - a) Bhavin's age 7 years from now will be 20.
 - b) Five times the number of students is 295.
 - c) The perimeter of a rectangle with length 15 cm and width w centimetres is 38 cm.
 - d) The cost of 2 tickets at x dollars each and 5 tickets at \$4 each is \$44.

Which equation was the most difficult to write? Explain.

Reflect

Describe the difference between an equation and an expression.
Give an example of each.

Explore



Work with a partner.

On the way home from school, 3 students get off the bus at the first stop. Seven get off at the next stop. Five get off at the next stop. Ten get off at the next stop. There are now 2 students left on the bus. How many students were on the bus when it left the school? How many different ways can you solve the problem?

Reflect & Share

Discuss your strategies for finding the answer with another pair of classmates.

Did you use an equation? Did you use reasoning?

Did you draw a picture? Explain.

Connect

Recall the equation about the cost of 1 CD, from *Section 10.5 Reading and Writing Equations*, page 387.

The equation is $3p = 36$, where p is the cost of 1 CD.

When we use the equation to find the value of p , we **solve the equation**.

Here are 2 ways to solve this equation.

Method 1: By Systematic Trial

$$3p = 36$$

We choose a value for p and substitute.

$$\text{When } p = 10, 3p = 30$$

30 is too small, so choose a greater value of p .

$$\text{When } p = 20, 3p = 60$$

60 is too large, so choose a lesser value of p .

$$\text{When } p = 15, 3p = 45$$

45 is too large, so choose a lesser value of p .

When $p = 12$, $3p = 36$

This is correct.

The cost of 1 CD is \$12.

Method 2: By Inspection

$$3p = 36$$

We find a number which, when multiplied by 3, has product 36.

We know that $3 \times 12 = 36$; so, $p = 12$.

The cost of 1 CD is \$12.

We say that the value $p = 12$ makes the equation $3p = 36$ true.

A value $p = 10$ would not make the equation true because 3×10 does not equal 36.

The value $p = 12$ is the only solution to the equation.

That is, there is only one value of p that makes the equation true.

Example 1

Solve by inspection.

a) $x + 7 = 10$

b) $\frac{24}{n} = 6$

c) $40 - y = 30$

d) $9z + 2 = 38$

Solution

a) $x + 7 = 10$

Which number added to 7 gives 10?

We know that $3 + 7 = 10$; so, $x = 3$.

b) $\frac{24}{n} = 6$

This means $24 \div n = 6$.

Which number divided into 24 gives 6?

We know that $24 \div 4 = 6$; so, $n = 4$.

c) $40 - y = 30$

Which number subtracted from 40 gives 30?

We know that $40 - 10 = 30$; so, $y = 10$.

d) $9z + 2 = 38$

9 times which number, plus 2, gives 38?

We know $36 + 2 = 38$

So, 9 times which number is 36?

We know that $9 \times 4 = 36$; so, $z = 4$.

Example 2

Solve by systematic trial.

a) $2a - 28 = 136$

b) $\frac{y}{4} = 220$

Solution

a) $2a - 28 = 136$

When the numbers are large, use a calculator.

Try $a = 50$; then, $2 \times 50 - 28 = 72$

72 is too small, so choose a greater value of a .

Try $a = 100$; then, $2 \times 100 - 28 = 172$

172 is too big, so choose a lesser value of a .

Try $a = 75$; then, $2 \times 75 - 28 = 122$

122 is too small, so choose a greater value of a .

Try $a = 80$; then, $2 \times 80 - 28 = 132$

132 is too small, but it is close to the value we want.

Try $a = 82$; then, $2 \times 82 - 28 = 136$

This is correct.

$a = 82$ is the solution.

b) $\frac{y}{4} = 220$

Use a calculator. We know the number is much greater than 220, because the number is divided by 4 to get 220.

Try $y = 1000$; then, $\frac{1000}{4} = 250$ This is too big.

Try $y = 900$; then, $\frac{900}{4} = 225$ This is closer, but still too big.

Try $y = 850$; then, $\frac{850}{4} = 212.5$ This is too small.

Try $y = 880$; then, $\frac{880}{4} = 220$ This is correct.

$y = 880$ is the solution.

We can write, then solve, an equation to solve a problem.

Example 3

Kiera shared 420 hockey cards equally among her friends.

Each friend had 105 cards.

a) Write an equation that describes this situation.

b) Solve the equation to find how many friends shared the cards.

Solution

- a) Let h represent the number of friends who shared the cards.
Then, each friend had $\frac{420}{h}$ cards.
Also, each friend had 105 cards.
So, the equation is: $\frac{420}{h} = 105$
- b) Solve $\frac{420}{h} = 105$ by inspection.
Think: $420 \div h = 105$
Which number divides into 420 to give the quotient 105?
We know $400 \div 4 = 100$; so, try $h = 4$.
 $420 \div 4 = 105$
So, the solution is $h = 4$.
Four friends shared the cards.

Practice

1. Solve each equation.

a) $x + 3 = 12$

b) $y + 9 = 9$

c) $10 + 2z = 20$

d) $17 + 3c = 26$

2. Solve each equation.

a) $x - 4 = 3$

b) $10 - n = 10$

c) $2z - 7 = 1$

d) $13 - 4k = 5$

3. Shenker has 45 CDs.

He gives 10 CDs to his brother.

a) Write an equation you can solve to find how many CDs Shenker has left.

b) Solve the equation.

4. Solve by inspection.

a) $x + 4 = 15$

b) $2k - 13 = 3$

c) $3y = 24$

d) $\frac{z}{9} = 2$

5. Solve by systematic trial.

a) $n + 5 = 33$

b) $8z = 88$

c) $43 - 3y = 16$

d) $\frac{x}{7} = 4$



Mental Math

Estimate.

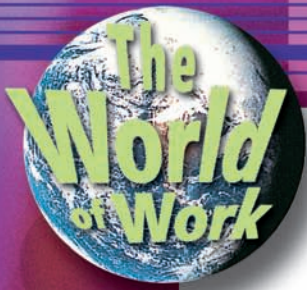
- $\frac{1}{4}$ of 22
- $\frac{2}{5}$ of 36
- $\frac{2}{3}$ of 91
- $\frac{3}{8}$ of 79



6. The perimeter of a square is 156 cm.
- Write an equation you can solve to find the side length of the square.
 - Solve the equation.
7. The side length of a regular hexagon is 9 cm.
- Write an equation you can solve to find the perimeter of the hexagon.
 - Solve the equation.
8. Use questions 6 and 7 as a guide.
- Write your own problem about side length and perimeter of a figure.
 - Write an equation you can use to solve the problem.
 - Solve the equation.
9. Eli has 130 comic books.
He gives 10 to his sister, then shares the rest equally among his friends.
Each friend has 24 comic books.
- Write an equation you can solve to find how many friends were given comics.
 - Solve the equation.
10. Find the value of n that makes each equation true.
- | | |
|---------------------------|------------------------|
| a) $3n = 27$ | b) $2n + 3 = 27$ |
| c) $2n - 3 = 27$ | d) $\frac{n}{3} = 27$ |
| e) $\frac{n}{2} + 3 = 27$ | f) $\frac{3n}{2} = 27$ |
11. **Assessment Focus** Write a problem that can be described by each equation. Solve each equation.
Which equation was the most difficult to solve? Explain.
- | | |
|------------------------|------------------|
| a) $2x - 1 = 5$ | b) $4y = 24$ |
| c) $\frac{z}{38} = 57$ | d) $5x + 5 = 30$ |
| e) $\frac{25}{y} = 5$ | f) $52 - 4 = 4x$ |

Reflect

How does knowing your number facts help you solve an equation by inspection? Give examples in your explanation.



Clothes Buyer

When you buy a pair of jeans, do you ever wonder who bought the jeans for the store to sell to you? The clothes buyer balances all kinds of purchasing variables (purchase price, quantity discounts, foreign exchange, shipping, and taxes) as well as selling variables (profit margin, the effect of price on sales, regional variations) to make the best purchase decision. If he buys too much stock, or at the wrong price, the company could end up selling the clothes at a loss. If the buyer buys too little, he misses out on sales, and customers go elsewhere. The buyer may use a spreadsheet. He can try different “what if” scenarios by changing either the variables or the formulas in the spreadsheet.

A buyer knows that the sales of an item (thousands of units per month) peak a few months after arrival and then slow down over time. However, sales of seasonal or trendy items peak almost

immediately, remain steady for a couple of months, and then drop off quickly. What might graphs that show these two sales trends look like?



Choosing a Strategy

Strategies

- Make a table.
- Use a model.
- Draw a diagram.
- Solve a simpler problem.
- Work backward.
- Guess and check.
- Make an organized list.
- Use a pattern.
- Draw a graph.
- Use logical reasoning.

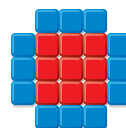
1. There are 2 schools. Each school has 3 buildings. Each building has 4 floors. Each floor has 5 classrooms. Each classroom has 6 rows of desks. Each row has 7 desks.
How many desks are there in the two schools?
2. a) Write the next three terms in this pattern: 1, 4, 3, 6, 5, 8, 7, ...
b) What is the pattern rule?
c) Write the 21st and the 50th terms. Explain how you did this.
3. Here is a pattern of tiles.



Term 1



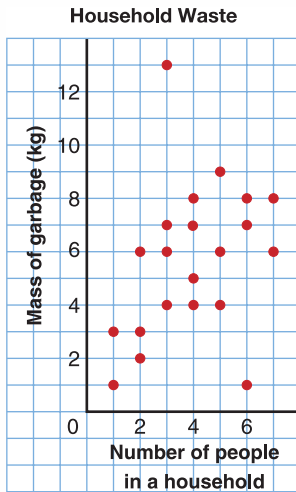
Term 2



Term 3

- a) Make a table to show the numbers of red and blue tiles in each term.
This pattern continues.
 - b) How many red tiles will there be in the 20th term?
 - c) How many blue tiles will there be in the 100th term?
 - d) What will be the total number of tiles in the 30th term?
 - e) How many red tiles will be in the term that has 48 blue tiles?
How do you know?
4. A can that contains 5 red balls and 3 green balls has a mass of 43 g.
When the can contains 3 red balls and 5 green balls, the mass is 37 g.
When the can contains 1 red ball and 1 green ball, the mass is 19 g.
What is the mass of the can and each ball?
 5. Marisha and Irfan have money to spend at the carnival.
If Marisha gives Irfan \$5, each person will have the same amount of money. If, instead, Irfan gives Marisha \$5, Marisha will have twice as much as Irfan.
How much money does each person have?



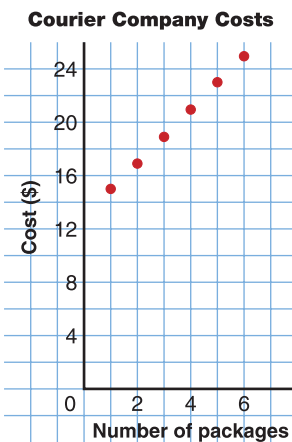


6. The graph shows the garbage put out by 21 households in one week.
- How does the mass of garbage relate to the number of people in the household?
 - Give three possible reasons why one household has 13 kg of garbage.
 - Give three possible reasons why one household has 1 kg of garbage.

7. For a school trip, the charge for using the school bus is \$50. The cost of food is \$10 per student.
- Copy and complete this table for up to 10 students.

Number of students	1	2	3	4	5
Total cost of trip (\$)					

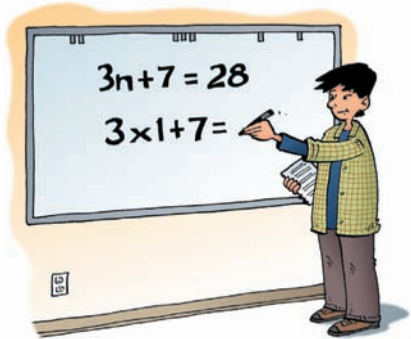
- What is the total cost for each number of students?
 - 12
 - 15
 - 20
- Each person pays a fair share. What is the cost per person when each number of students goes on the trip?
 - 5
 - 10
 - 15



8. The graph shows the price charged by a local courier company to collect and deliver packages.
- What is the cost to have 6 packages collected and delivered?
 - Extend the pattern in the graph. What is the cost to have 8 packages collected and delivered?
 - Why does it cost \$15 to collect and deliver one package, but only \$17 to collect and deliver 2 packages?
9. I am a 3-digit number.
My hundreds digit is the square of my ones digit.
My tens digit is the product of my hundreds digit and my ones digit.
- What number, or numbers, could I be?
 - What do you notice about your answer(s)?

What Do I Need to Know?

- ✓ A variable is a letter or symbol that represents a number, or a set of numbers.
A variable can be used to write an expression:
“3 more than a number” is $3 + n$.
A variable can be used to write an equation:
“4 more than a number equals 11” is $4 + n = 11$.
- ✓ We can solve equations by:
 - inspection
 - systematic trial



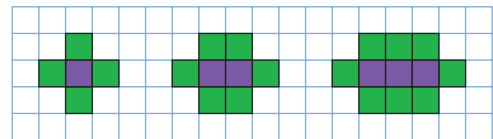
For extra practice, go to page 447.

What Should I Be Able to Do?

LESSON

- 10.1** 1. For each pattern:
- i) Describe the pattern.
 - ii) Write the next 3 terms.
 - iii) Find the 20th term.
- Explain how you did this.
- a) 5, 12, 19, 26, ...
 - b) 3, 9, 27, 81, ...
 - c) 96, 93, 90, 87, ...
 - d) 10, 21, 32, 43, ...
 - e) 9, 13, 17, 21, ...
2. Your favourite aunt gives you 1¢ on April 1, 2¢ on April 2, 4¢ on April 3. She continues doubling the daily amount until April 12.
- a) How much will you get on April 12?
 - b) What is the total amount you will receive?

3. a) Describe this pattern:
2, 5, 11, 23, 47, ...
- b) Write the next 3 terms.
 - c) Write a similar pattern.
Use a different start number.
4. This pattern continues.



- a) Describe the pattern.
- b) Sketch the next 3 figures.
- c) Describe the 12th figure and the 22nd figure.
Sketch them if you can.

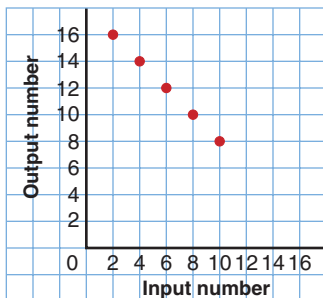
10.2

5. Copy and complete this table for each pattern.

Input	Output
4	
6	
8	
10	
12	

- Add 3 to each Input number.
- Multiply each Input number by 2.
- Subtract 3 from each Input number.
- Divide each Input number by 2.
- Divide each Input number by 2, then add 3.
- Multiply each Input number by 2, then subtract 3.

6. Look at this graph.



- Make an Input/Output table for the graph.
- What patterns do you see in the table?
- Extend the table 3 more rows. Explain how you did this.
- What happens if you try to extend the table further?

- Describe the patterns in this table.
- Use the patterns to extend the table 3 more rows.

Input	Output
5	1
15	3
25	5
35	7
45	9
55	11

- 10.3 8. Write an algebraic expression for each statement.
- twenty more than a number
 - one less than a number
 - a number increased by ten
 - a number multiplied by thirteen

9. Write each algebraic expression in words.

- $n + 4$
- $25 - h$
- $\frac{a}{5}$
- $5 - 2n$

- 10.4 10. Evaluate each expression for $x = 3$.

- $x + 8$
- $9x$
- $2x - 1$
- $\frac{x}{2}$
- $10x + 4$
- $9 - 3x$

11. A value of n is substituted in each expression to get the number in the box. Find each value of n .

- $5n$ 40
- $6n - 1$ 11
- $2n + 8$ 16
- $3n - 4$ 14

- 12.** One pair of running shoes costs \$70.
- What is the cost of 3 pairs? 7 pairs?
 - What is the cost of r pairs of running shoes?
 - Write an algebraic expression for the number of pairs of shoes you could buy for d dollars.

10.5 13. Write each equation in words.

- $x + 3 = 17$
- $3y = 24$
- $\frac{x}{4} = 5$
- $3y - 4 = 20$
- $7 + 4x = 35$

14. Write a problem that can be represented by each equation.

- $x + 5 = 21$
- $5n - 2 = 28$

15. Write an equation for each sentence.

- Six times the number of people in the room is 258.
- The area of a rectangle with length 6 cm and width w centimetres is 36 cm^2 .
- One-half of a number is 6.

16. Write a problem that can be represented by each equation.

- $x + 2 = 23$
- $4 - x = 12$
- $5x = 35$
- $\frac{x}{9} = 5$

17. Write an equation to find the length of one side of an equilateral triangle with perimeter 24 cm.

10.6 18. Solve each equation.

- $12 = 3n$
- $21 - n = 18$
- $\frac{27}{n} = 9$
- $\frac{n}{9} = 27$
- $n - 21 = 30$
- $3n + 2 = 11$

19. Solve each equation.

- $17 - 3n = 2$
- $17 + 3n = 47$
- $3n - 17 = 4$
- $\frac{n}{17} = 25$

20. At Queen Mary School, 98 students walk to school. There are 250 students in the school.

- Write an equation you can solve to find how many students do not walk to school.
- Solve the equation.

21. At Sir Robert Borden School, twice as many students take the bus as walk to school. Seventy-four students walk to school.

- Write an equation you can solve to find how many students take the bus.
- Solve the equation.

Practice Test

Input	Output
1	
2	
3	
4	
5	

- Copy and complete the table for this pattern:
Multiply each number by 5, then subtract 3.
 - Graph the pattern.
Explain how the graph shows the pattern.
 - Extend the table 3 more rows.
Plot the point for each row on the graph.
 - How can you find the Output number when the Input number is 47?
 - How can you find the Input number when the Output number is 47?
 - Can the Input number be 100? Explain.
 - Can the Output number be 100? Explain.
- Angelina wins money in a competition.
She is given the choice as to how she is paid.
Choice 1: Get \$1 the 1st day, \$2 the 2nd day, \$4 the 3rd day, \$8 the 4th day, and so on.
This pattern continues for 3 weeks.
Choice 2: Get \$1 000 000 today.
 - With which method of payment will Angelina get more money?
 - How did you use patterns to solve this problem?
 - After how many days will the money Angelina gets from Choice 1 be approximately \$1 000 000?
- Here are 5 algebraic expressions: $2 + 3n$, $2n + 3$, $3n - 2$, $\frac{2n}{2}$, $\frac{3n}{2}$
Are there any values of n that will produce the same number when substituted in two or more of the expressions?
Investigate to find out. Show your work.
- Solve each equation by systematic trial or by inspection.
 - $3x + 90 = 147$
 - $\frac{84}{h} = 12$
 - $\frac{26}{y} + 3 = 16$
 - $147 - 3x = 90$Explain your choice of method in each case. Show your work.

Two students raised money for charity in a bike-a-thon. The route was from Timmins to Kapuskasing, a distance of 165 km.

Part 1

Ingrid cycled at an average speed of 15 km/h.

How far does Ingrid travel in 1 h? 2 h? 3 h? 4 h? 5 h?

Record the results in a table.

Time (h)					
Distance (km)					

Graph the data in the table.

Graph *Time* horizontally and *Distance* vertically.

Write an algebraic expression for the distance Ingrid travels in t hours.

Use the expression to find how far Ingrid travels in 7 h.

How could you check your answer?

Write an equation to represent Ingrid travelling 135 km in t hours.

Solve the equation.

What have you found out?

Part 2

Liam cycled at an average speed of 20 km/h.

Repeat *Part 1* for Liam.

Part 3

How are the graphs for Ingrid and Liam alike?

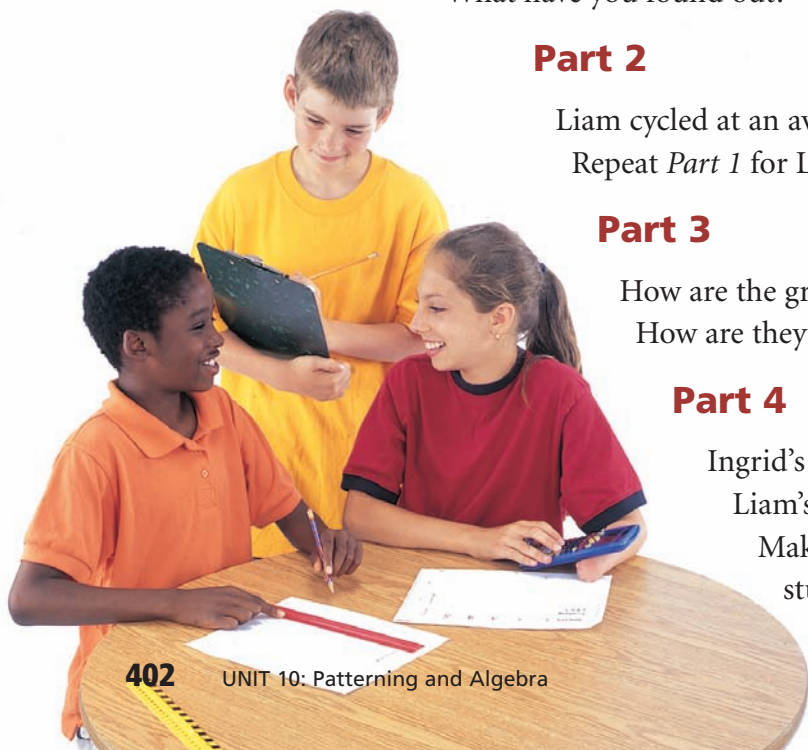
How are they different?

Part 4

Ingrid's sponsors paid her \$25 per kilometre.

Liam's sponsors paid him \$20 per kilometre.

Make a table to show how much money each student raised for every 10 km cycled.



Distance (km)	Money Raised by Ingrid (\$)	Money Raised by Liam (\$)
10		
20		
30		

How much money did Ingrid raise if she cycled d kilometres?
 How much money did Liam raise if he cycled d kilometres?

Liam and Ingrid raised equal amounts of money.
 How far might each person have cycled? Explain.

Check List

Your work should show:

- ✓ all tables and graphs, clearly labelled
- ✓ the equations you wrote and how you solved them
- ✓ how you know your answers are correct
- ✓ explanations of what you found out



Reflect on the Unit

How are number patterns related to algebra?
 How are algebraic expressions related to equations?
 Give examples in your explanation.