

Writing Pattern Rules

Goal Use rules to extend patterns and write pattern rules.

1. Steve learned that a year on Venus is about seven Earth months long.

a) Complete the table for Venus.

Venus	
Number of years on Venus	Number of months on Earth
1	7
2	
3	
4	

b) Write a pattern rule to calculate the number of Earth months in any number of years on Venus.

c) Use your pattern rule to calculate the approximate number of Earth months in 12 years on Venus.

2. Bev saves \$12 each month from her paper route.

a) Write a pattern of numbers that shows the amount Bev saves in 1 to 4 months.

b) Write a pattern rule to calculate the amount she saves in any number of months.

c) Use your pattern rule to calculate the amount Bev saves in 10 months.

d) Bev wants to buy a new hockey jersey for \$100. For how many months does she need to save?

At-Home Help

A **pattern** is a group of numbers, shapes, or objects that follow a rule while repeating or changing.

To extend a pattern you can use a table or a pattern rule that relates the term number to the pattern rule.

A **term number** is the number that tells the position of an item in a pattern.

For example, the pattern 2, 4, 6, 8, 10, ... can be shown in a table like this:

Term number	Number in pattern
1	2
2	4
3	6
4	8
5	10

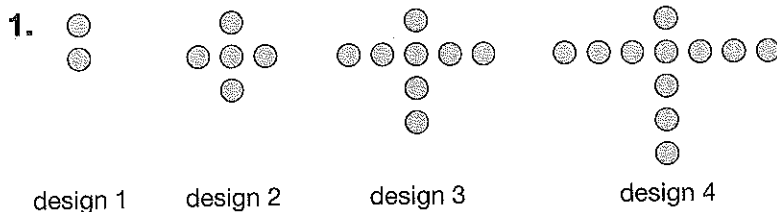
A pattern rule to get any number in the pattern is multiply 2 by the term number.

$$\begin{aligned} 10\text{th term} &= 2 \times 10 \\ &= 20 \end{aligned}$$

Relationship Rules for Patterns

Goal

Write relationship pattern rules based on the term number.



- a) Complete the table to show the number of dots in designs 1 to 4.

Design number	Number of dots

- b) Write the first term and the common difference.

- c) How many dots are in design 8?

2. Determine the 11th term in each pattern. Use a pattern rule. Show your work.

a) 1, 5, 9, 13, ... c) 2.2, 4.4, 6.6, 8.8, ...

b) 21, 26, 31, 36, ... d) \$1.25, \$1.75, \$2.25, \$2.75, ...

At-Home Help

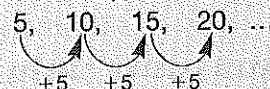
A **recursive pattern rule** is a pattern rule that tells you the start number of a pattern and how the pattern continues.

For example, a recursive rule for the pattern 5, 8, 11, 14, ... is start with 5 and add 3.

A **common difference** is the difference between any two consecutive terms in a pattern. Not all patterns have a common difference.

For example, the pattern

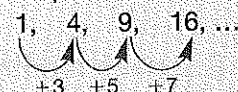
$$5, 10, 15, 20, \dots$$



has a common difference of 5.

The pattern

$$1, 4, 9, 16, \dots$$



has no common difference.

An **explicit pattern rule** is a pattern rule that tells you how to get any term in the pattern without listing all the terms before it.

For example, an explicit pattern rule for 5, 8, 11, 14, ... uses the first term (5) and the common difference (3).

To calculate the 20th term,

$$\begin{aligned}
 \text{20th term} &= \text{first term} + [(\text{term number} - 1) \times (\text{common difference})] \\
 &= 5 + (19 \times 3) \\
 &= 5 + 57 \\
 &= 62
 \end{aligned}$$

Variables in Expressions

Goal Use variables in an expression.

1. Arpita is baking cookies for a school bake sale. One batch of cookies uses 75 g of chocolate chips.

a) Calculate the number of grams of chocolate chips in the first four batches of cookies.

b) Write an explicit pattern rule for the number of grams of chocolate chips in the 10th batch.

c) Write your pattern rule using a variable for the batch number. Use the variable b .

d) Calculate the number of grams of chocolate chips in the first four batches using your answer in part c). Show your work.

e) How many grams of chocolate chips does Arpita need to make 11 batches of cookies?

At-Home Help

A **variable** is a letter or symbol that is used to show a quantity. This quantity can have different values.

For example, t is a variable that could be used to represent the amount of time you surf the Internet each day.

Variables are usually used when writing explicit pattern rules to make the rules easier to write.

For example, an explicit pattern rule for the pattern 50, 100, 150, 200, ... is $50 \times n$. The variable n is the term number.

Term (n)	Value ($50 \times n$)
1	$50 \times 1 = 50$
2	$50 \times 2 = 100$
3	$50 \times 3 = 150$

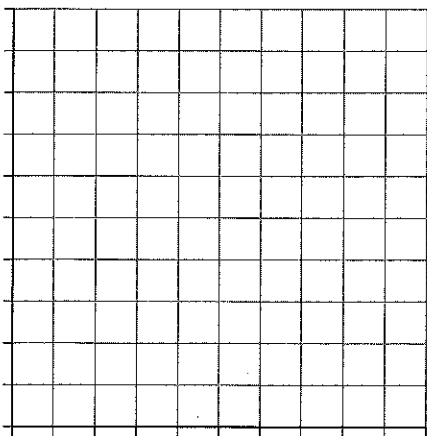
Representing Patterns on a Graph

Goal Represent patterns in tables and on graphs.

1. George buys baseballs in packages of 6.
 - a) Complete the table to show the total number of baseballs in 0 to 6 packages.

Number of packages	Number of baseballs

- b) Graph the number of baseballs compared to the number of packages.



- c) Write a pattern rule to calculate the number of baseballs in any number of packages. Use the variable n in your rule.
 - d) Determine the number of baseballs in 15 packages.

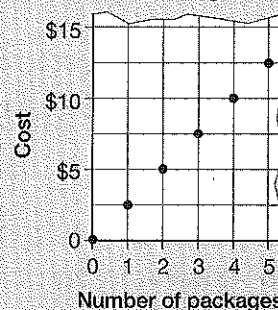
At-Home Help

Patterns can be represented in tables or graphs.

For example: It costs \$2.50 to buy a package of juice boxes. To determine the cost of 20 packages, you can extend a table or graph, or use a pattern rule.

Number of packages	Cost
0	0
1	\$2.50
2	\$5.00
3	\$7.50
4	\$10.00
5	\$12.50

Cost Compared to Number of Packages



A pattern rule to calculate the cost for any number of packages is $\$2.50 \times n$.

$$\begin{aligned} \text{Cost of 20 packages} &= \$2.50 \times 20 \\ &= \$50.00 \end{aligned}$$

Equal Expressions

Goal

Write equal expressions and determine the value of a missing term in an equation.

1. Which expressions are equal? Use an equals sign. If they are not equal, change one expression to make them equal.

a) $2 + 3$ $5 + 0$

b) $1 + 7$ $2 + 5$

c) $8 + 6$ $2 + 9$

d) $3 + 8$ $6 + 5$

2. Replace each so the expressions are equal.

a) $5 +$ $= 7 + 6$

$=$ _____

b) $9 - 4 =$ $+ 3$

$=$ _____

c) $\times 3 = 2 + 7$

$=$ _____

d) $12 \div$ $= 4 \times 3$

$=$ _____

3. Isabelle has five swim practices and three soccer practices this month. Judy has the same number of practices this month. Judy has two swim practices.

a) Write an expression for the number of practices Isabelle has.

b) Write an expression for the number of practices Judy has.

c) Write an equation with your expressions.

d) How many soccer practices does Judy have? Explain what you did.

At-Home Help

An **expression** is a mathematical statement made with numbers or variables and operations.

For example: $5 + 3 - 7$ is an expression with numbers only.

$6 \times t$ is an expression with a variable.

An **equation** is a mathematical statement that has an expression on each side of the equal sign. Both expressions must be equal in an equation.

Variables in Equations

Goal Solve equations including symbols representing variables.

1. A gym has twice as many soccer balls as basketballs. Altogether there are 36 balls.

a) Explain what is represented by the equation $S + B = 36$.

b) Explain what is represented by the equation $S = B + B$.

c) How many basketballs are there? How many soccer balls are there?

2. In a granola recipe, there is three times as much oats as coconut. The total mass of oats and coconut is 600 g.

a) Explain what is represented by the equation $O + C = 600$.

b) Explain what is represented by the equation $O = C + C + C$.

c) How many grams of each ingredient are there?

At-Home Help

An equation can sometimes have more than one variable.

For example, $A + O = 9$ and $A = O + O$ are equations with the variables A and O .

To solve for A and O , use the expression $O + O$ for A in the first equation.

$$O + O + O = 9$$

Since three 3s are 9, O must be 3. Use 3 for O in the second equation to get $A = 3 + 3$. Since $3 + 3 = 6$, A must be 6.