Multiples and Factors

LESSON 8

Dear Family,

This week your child is learning about multiples and factors.

Your child will be using factor pairs, multiples, and composite numbers to solve problems like the one below.

> *Monica is pasting 18 stars in rows on the wall. She wants to put the same number of stars in each row. Find all the ways she can arrange the stars.*

- One way to paste the stars is 3 rows of 6. Another way is 6 rows of 3. 3 and 6 are a **factor pair** of 18 because $3 \times 6 = 18$.

- Other ways to paste the stars are:
  2 rows of 9 or 9 rows of 2
  1 row of 18 or 18 rows of 1

- 18 is a **composite number.** It has factor pairs besides 1 and 18. Factor pairs of 18 are 3 and 6, 2 and 9, 1 and 18.

- 18 is a **multiple** of 1, 2, 3, 6, 9, and 18.

- There are 6 ways Monica can arrange the stars.

Invite your child to share what he or she knows about multiples and factors by doing the following activity together.

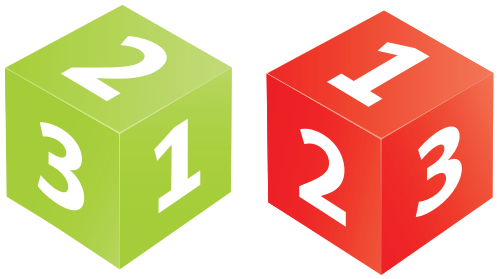
ACTIVITY FACTORS

Do this activity with your child to explore factors.

Materials 2 number cubes

- One player rolls both number cubes and uses the numbers on the cubes to make a two-digit number. Roll again if both numbers are the same.
- The other player reverses the order of the digits to make another two-digit number.

  Example:



Player 1: 21
Player 2: 12

- Each player finds all the factor pairs of his or her number.

  Example:

  Player 1: Factor pairs of 21 are 1 and 21, 3 and 7.
  Player 2: Factor pairs of 12 are 1 and 12, 2 and 6, 3 and 4.

- The player with the most factor pairs is the winner of the round.

  Example:

  Player 2 wins the round because the number 12 has 3 factor pairs. Player 1's number, 21, has only 2 factor pairs.

- Play 5 rounds.

Explore Multiples and Factors

In previous lessons, you multiplied and divided numbers. Now you can use multiplication and division to find factors and multiples and learn a way to classify a number by how many factors it has. Use what you know to try to solve the problem below.

A garden has several rows of pumpkin plants. Each row has 10 plants. How many pumpkin plants could be in the garden?

Learning Target

- Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.

SMP 1, 2, 3, 4, 5, 6, 7, 8

TRY IT

Math Toolkit

- counters
- number lines
- index cards
- sticky notes
- multiplication models

DISCUSS IT

Ask your partner: Do you agree with me? Why or why not?

Tell your partner: I disagree with this part because . . .

CONNECT IT

1 LOOK BACK

How can you describe how many pumpkin plants there could be?

2 LOOK AHEAD

You can extend your thinking about multiplication by looking at **factors of a number**, factor pairs, multiples, prime numbers, and composite numbers.

a. A **factor pair** is two numbers that are multiplied to give a product.

Since $1 \times 20 = 20$, a factor pair of 20 is _____ and _____.

b. Fill in the multiplication equations to show the other factor pairs of 20.

_____ × _____ = 20

Factor pair: _____ and _____

_____ × _____ = 20

Factor pair: _____ and _____

c. What are the six different factors of 20? _____

d. A **multiple** is the product of a given number and any other whole number. When you multiply numbers, the product is a multiple of each factor. So, 20 is a multiple of each of its six factors.

The number 20 is a multiple of _____, _____, _____, _____, _____, and _____.

e. A number with more than one factor pair is called a **composite number**. A **prime number** has only one factor pair: the number itself and 1. The number 1 is neither prime nor composite.

There is only one way to put 11 pumpkins in equal rows.

Is 11 a *prime* or *composite* number? _____

3 REFLECT

How is 20 a multiple of 5? Explain using multiplication and skip-counting.

_____

_____

Prepare for Multiples and Factors

1 Think about what you know about multiplication. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.

Word	In My Own Words	Example
factor pair		
multiple		
prime number		
composite number		

2 Is 9 a prime or composite number? Explain.

3 Solve the problem. Show your work.

A park has several rows of trees. Each row has 5 trees. How many trees could be in the park?

Solution

4 Check your answer. Show your work.

Develop Multiples

Read and try to solve the problem below.

Leona has 5 cups of oats. She needs 2 cups of oats for one full batch of oatmeal muffins. Can she use all of her oats by making multiple full batches of muffins?

TRY IT

Math Toolkit

- counters
- cups
- number lines
- index cards
- sticky notes
- multiplication models

DISCUSS IT

Ask your partner: Can you explain that again?

Tell your partner: I knew . . . so I . . .

Explore different ways to understand multiples.

Leona has 5 cups of oats. She needs 2 cups of oats for one full batch of oatmeal muffins. Can she use all of her oats by making multiple full batches of muffins?

PICTURE IT

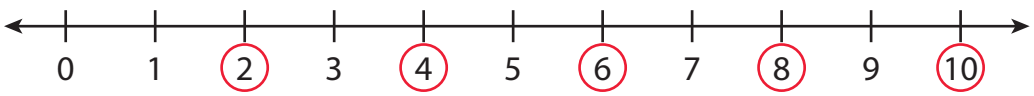
You can use a picture to help understand the problem.

The picture shows the oats Leona has, divided into 2-cup measuring cups.

MODEL IT

You can also use a number line to help understand the problem.

The number line shows multiples of 2 circled. To find the multiples of 2, you can start at 0 and skip-count by 2s. You can see that the **multiples of 2** are even numbers.



CONNECT IT

Now you will use the problem from the previous page to help you understand how to use multiples to solve a problem.

1. Why does the picture use measuring cups that hold 2 cups of oats?

2. How can you tell from the measuring-cup picture that Leona cannot use all 5 cups of oats in 2-cup batches?

3. What do the circled numbers on the number line represent?

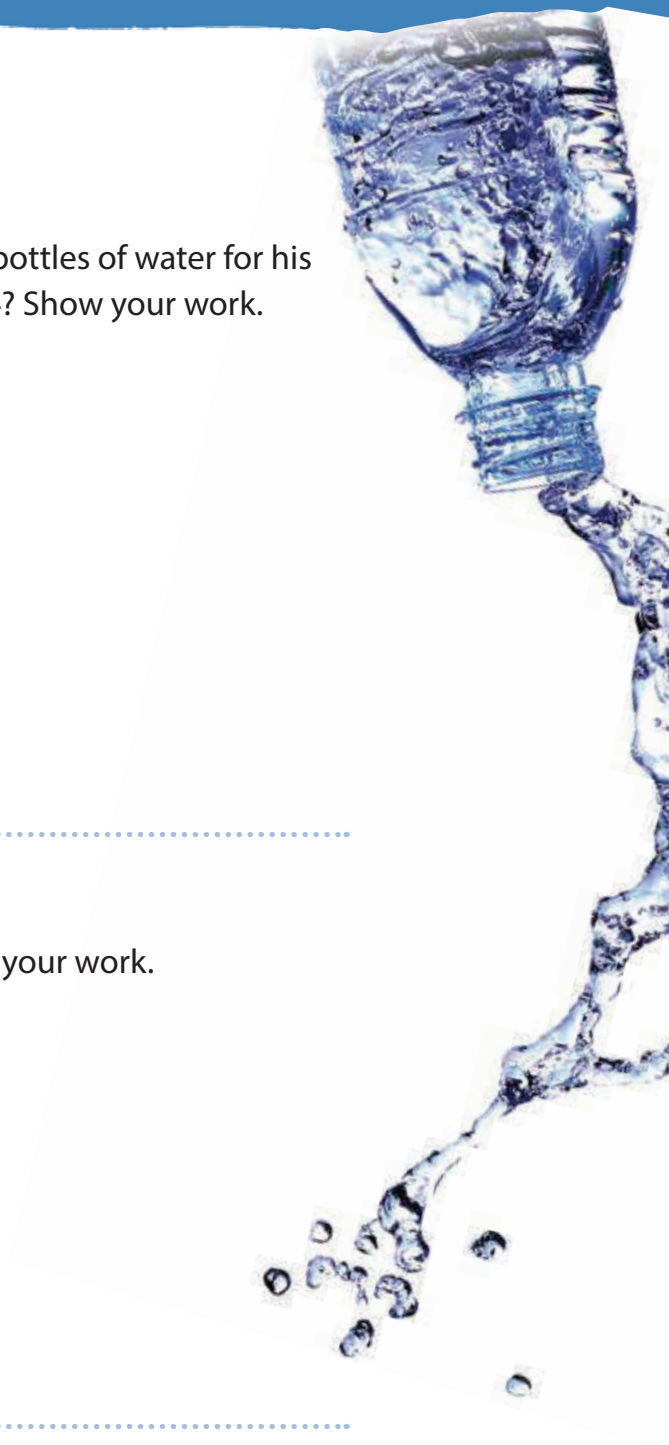
4. How can you tell from the number line that 5 is not a multiple of 2?

5. How many cups of oats would Leona use in 3 batches of muffins?

6. Explain how you can find out whether a number, such as 5, is a multiple of 2.

7 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for using multiples to solve a problem? Explain.



APPLY IT

Use what you just learned to solve these problems.

8 There are 4 bottles of water in a pack. Patrick needs 20 bottles of water for his soccer team. Can he buy exactly 20 bottles in packs of 4? Show your work.

Solution

9 What are the first five multiples of the number 3? Show your work.

Solution

10 How can you tell if 24 is a multiple of a given number?

Practice Multiples

Study the Example showing how to use multiples to solve a word problem. Then solve problems 1–6.

EXAMPLE

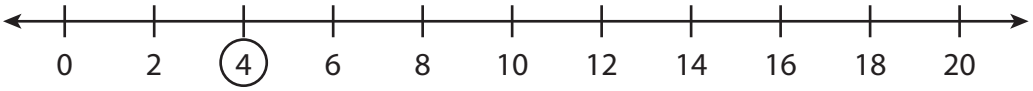
Markers come in boxes of 5. Paul needs 40 markers for students in the art club. Can Paul buy exactly 40 markers in boxes of 5? How many boxes does he need to buy?

Find multiples of 5.

$5 \times 1 = \mathbf{5}$	$5 \times 4 = \mathbf{20}$	$5 \times 7 = \mathbf{35}$
$5 \times 2 = \mathbf{10}$	$5 \times 5 = \mathbf{25}$	$5 \times 8 = \mathbf{40}$
$5 \times 3 = \mathbf{15}$	$5 \times 6 = \mathbf{30}$	$5 \times 9 = \mathbf{45}$

40 is a multiple of 5.
Paul can buy exactly 40 markers in boxes of 5.
Paul needs to buy 8 boxes.

1 Skip-count by 4s to find multiples of 4. Circle the multiples on the number line.



2 Complete the multiplication facts to find more multiples of 4.

$4 \times 6 =$ _____

$4 \times$ _____ $=$ _____

$4 \times$ _____ $=$ _____

$4 \times$ _____ $=$ _____

$4 \times$ _____ $=$ _____

$4 \times$ _____ $=$ _____

3 Look at problems 1 and 2. Are these the only multiples of 4? Use words and numbers to explain.

Vocabulary

multiple the product of a given number and any other whole number.

4 Amare orders 72 mugs. Mugs are packed 8 to a box. How many boxes of mugs does Amare order?

Tell whether each equation or statement could be used to solve the problem.

	Yes	No
$72 = 8 \times b$	Ⓐ	Ⓑ
$72 \div 8 = b$	Ⓒ	Ⓓ
List multiples of 8: 8, 16, 24, 32, 40, . . .	Ⓔ	Ⓕ
$b = 72 + 8$	Ⓖ	Ⓗ

5 A box of cupcakes has 6 cupcakes. Abby wants to buy only full boxes of cupcakes. Find two possible numbers of cupcakes Abby can buy. Show your work.

Abby can buy _____ cupcakes or _____ cupcakes.

6 Strawberries come in 1-pound, 2-pound, and 5-pound boxes. Stacy wants to buy exactly 10 pounds of strawberries. What are two ways that Stacy can buy exactly 10 pounds of strawberries? Tell which sizes of boxes she can buy and how many of each size box. Show your work.

Solution _____

_____

Develop Factors and Factor Pairs

Read and try to solve the problem below.

Alfred is arranging 40 model cars into rows. He wants to put the same number of cars in each row. Find all the ways he can arrange the cars.

TRY IT

Math Toolkit

- counters
- unit tiles
- grid paper
- sticky notes

DISCUSS IT

Ask your partner: How did you get started?

Tell your partner: I started by . . .

Explore different ways to understand factors and factor pairs.

Alfred is arranging 40 model cars into rows. He wants to put the same number of cars in each row. Find all the ways he can arrange the cars.

MODEL IT

You can use arrays to help understand the problem.

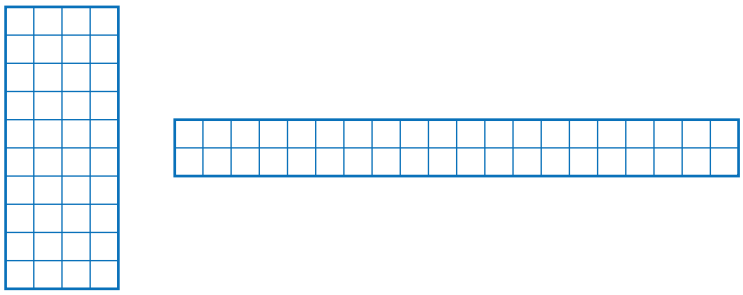
One way Alfred can arrange his cars is in 5 rows of 8.

5 and 8 are a factor pair of 40. This means Alfred could also arrange the cars in 8 rows of 5.

MODEL IT

You can also use area models to help understand the problem.

Two more ways Alfred can arrange the cars are 10 rows of 4 and 2 rows of 20.



10 and 4 are a factor pair of 40. This means Alfred could also arrange the cars in 4 rows of 10.

2 and 20 are another factor pair of 40. So Alfred could also arrange the cars in 20 rows of 2.

CONNECT IT

Now you will use the problem from the previous page to help you understand how to find factors and factor pairs.

1. List all of the factor pairs of 40.

2. Each number in a factor pair is a factor. How many factors does 40 have?

3. Why might it be helpful to always start with the number 1 and work up when finding factors of a number?

4. Explain how to use arrays or area models to find factor pairs.

5 REFLECT

Look back at your **Try It**, strategies by classmates, and **Model Its**. Which models or strategies do you like best for finding all of the factors of a number? Explain.

APPLY IT

Use what you just learned to solve these problems.

6 Brad has 18 blocks. He wants to make an array with the same number of blocks in each row. What are all the different ways Brad can arrange the blocks? Show your work.

Solution

7 What are the factors of the number 27? Show your work.

Solution

8 Heidi arranges 12 photos on pages in her photo album. She puts the same number of photos on each page. Which list shows all of the possible numbers of photos that Heidi can put on each page?

Ⓐ 2, 3, 4, 6

Ⓑ 1, 3, 4, 12

Ⓒ 1, 2, 3, 4, 6, 12

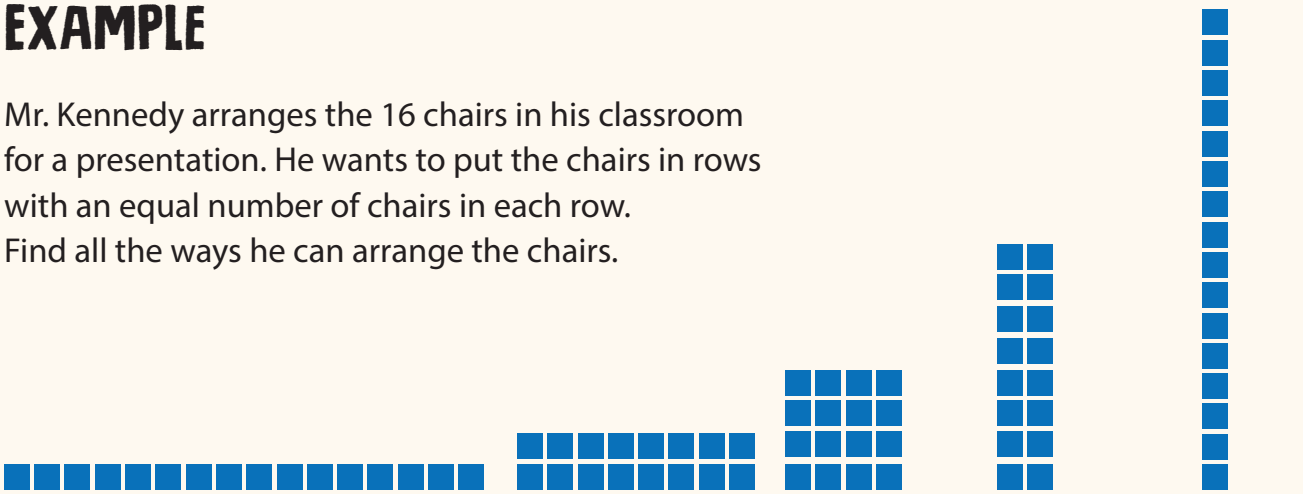
Ⓓ 1, 2, 3, 4, 6, 8, 12

Practice Factors and Factor Pairs

Study the Example about factors and factor pairs.
Then solve problems 1–6.

EXAMPLE

Mr. Kennedy arranges the 16 chairs in his classroom for a presentation. He wants to put the chairs in rows with an equal number of chairs in each row.
Find all the ways he can arrange the chairs.



1 row of 16 chairs	2 rows of 8 chairs	4 rows of 4 chairs	8 rows of 2 chairs	16 rows of 1 chair
$1 \times 16 = 16$	$2 \times 8 = 16$	$4 \times 4 = 16$	$8 \times 2 = 16$	$16 \times 1 = 16$

Factors of 16: 1, 2, 4, 8, 16
Factor pairs: 1 and 16, 2 and 8, 4 and 4
Mr. Kennedy can arrange the chairs in 5 ways.

Vocabulary

factor pair two numbers that are multiplied together to give a product.

$2 \times 4 = 8$, so 2 and 4 are a factor pair of 8.

1 Complete the list to show the factors of 50.

1, ..., 5, ..., 25, ...

2 Write the factor pairs of 50.

1 and ....., ... and ....., ... and .....

3 The 20 students in Amanda's class each carved a wooden plate to display on the wall. They want each row to have the same number of plates. Find all the ways to display the plates. Show your work.

Solution .....

.....

4 Tell whether each statement about the factors of 18 is *True* or *False*.

	True	False
All the factors of 18 are 2, 3, 6, 9, and 18.	Ⓐ	Ⓑ
1 and 18 are a factor pair.	Ⓒ	Ⓓ
180 is a factor because $10 \times 18 = 180$.	Ⓔ	Ⓕ
One array showing the factor pair of 3 and 6 would have 3 rows of 6 objects.	Ⓖ	Ⓗ

5 Carlos arranges his building blocks into 2 rows of 12 blocks. Liz arranges her blocks into 6 rows of 4 blocks. If they each use the same number of blocks, what two other ways can they arrange their blocks? Show your work.

Solution

6 Jonah has 100 flowers to arrange in vases. He wants to put the same number of flowers in each vase. List the factor pairs of 100. Then complete the table to show the different ways to arrange the flowers.

Factor pairs of 100:

Number of vases									
Number of flowers in each vase									

Develop Prime and Composite Numbers

Read and try to solve the problem below.

Janae has 36 pennies. Nate has 23 pennies. Are these numbers prime or composite?

TRY IT

Math Toolkit

- pennies
- counters
- unit tiles
- grid paper

DISCUSS IT

Ask your partner: Why did you choose that strategy?

Tell your partner: The strategy I used to find the answer was . . .

Explore different ways to understand prime and composite numbers.

Janae has 36 pennies. Nate has 23 pennies. Are these numbers prime or composite?

PICTURE IT

You can use pictures to help understand the problem.

Janae

36 pennies can be divided into 3 equal stacks of 12.

Nate

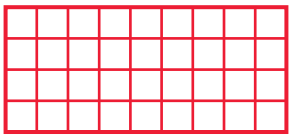
23 pennies cannot be divided into equal stacks.

MODEL IT

You can also use area models to help understand the problem.

With composite numbers, you can make area models that have more than one equal-sized row.

Janae



With prime numbers, you can only make one area model that has one equal-sized row.

Nate

CONNECT IT

Now you will use the problem from the previous page to help you understand how to identify prime and composite numbers.

1 What factor pair is shown by Janae's stacks of pennies?

2 Is 36 a prime or composite number?

How do you know?

3 Is 23 a prime or composite number?

How do you know?

4 Explain how you can use models to decide if a number is prime or composite.

5 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for deciding if a number is *prime* or *composite*? Explain.

APPLY IT

Use what you just learned to solve these problems.

6 Mrs. Reynaldo picks up 17 playground balls after recess. She wants to put the same number of balls into each ball bin. What different ways can she put the balls into bins? Show your work.

Solution

7 Is 17 a *prime number* or a *composite number*? Show your work.

Solution

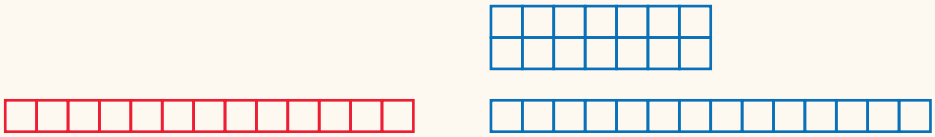
8 Tell whether 18 and 19 are *prime* or *composite*. Explain how knowing the factors of the numbers help you decide whether they are prime or composite.

Practice Prime and Composite Numbers

Study the Example showing how to identify prime and composite numbers. Then solve problems 1–6.

EXAMPLE

Ms. Morris teaches a morning class with 13 students and an afternoon class with 14 students. Which class has a prime number of students?



13 has one factor pair: **1** and **13**.
13 is a prime number.

14 has more than one factor pair: **2** and **7**, **1** and **14**.
14 is a composite number.

The morning class has a prime number of students.

1 Is the number 2 prime or composite? Explain.

2 Kevin runs 23 laps around the track. Is the number 23 prime or composite? Explain.

3 Mae has more than 3 bracelets. She has an even number of bracelets. Is the number of bracelets that Mae has a prime number or a composite number? Explain.

Vocabulary

prime number a whole number greater than 1 whose only factors are 1 and itself.

5 is a prime number; its factors are 5 and 1.

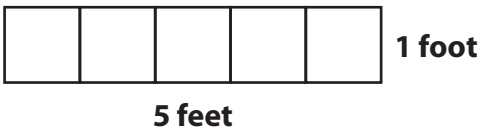
composite number a number that has more than one pair of factors.

8 is a composite number; it has the factors 1, 2, 4, and 8.

4 Tell whether each statement is *True* or *False*.

	True	False
The number 9 is prime.	Ⓐ	Ⓑ
2 is the only even prime number.	Ⓒ	Ⓓ
All the odd numbers between 1 and 10 are prime.	Ⓔ	Ⓕ
Some composite numbers have only two factors.	Ⓖ	Ⓗ

5 The area of a garden is 5 square feet. The dimensions of the garden are 1 foot and 5 feet. 1 and 5 are factors of the number 5.



a. Is the number 5 a prime number? .....

b. Suppose another rectangular garden has an area of 11 square feet. What could be the dimensions of the garden?

6 Jordan and Mitchell plan a graduation party with 45 guests. They want to seat an equal number of guests at each table. They want each table to have more than one guest. Answer the questions below.

a. List the different ways the guests and tables can be arranged. Tell how many tables are needed for each group of guests.

b. Jordan and Mitchell forgot to include themselves in the seating. They still want to have an equal number of guests at each table. List the ways the guests and tables can be arranged now.

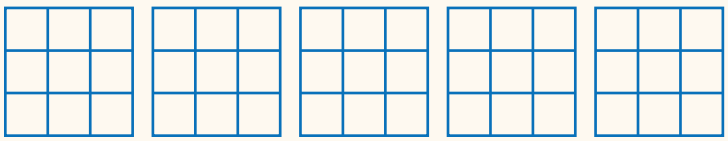
Refine Multiples and Factors

Complete the Example below. Then solve problems 1–9.

EXAMPLE

School pictures have 9 pictures on a sheet. Hallie needs 45 pictures for her family and classmates. Can she get exactly 45 pictures in sheets of 9? If so, how many sheets does she need?

Look at how you could show your work using a picture.



Solution .....

.....

Any number that has 0 or 5 in the ones place is a multiple of 5!

PAIR/SHARE

How else could you solve this problem without using models?

APPLY IT

1 There are 12 levels in Liang's new video game. Suppose he plays the same number of levels each day. What are all the possibilities for the number of days Liang could play the game without repeating a level? Show your work.

I notice that 2 is a factor of every even number!

Solution .....

PAIR/SHARE

Why do you need to find the factors of 12 to solve this problem?

2 A basketball team scores 37 points in one quarter.
Is the number 37 prime or composite? Show your work.

Starting with 1 is a good way to find factors!

PAIR/SHARE
Why do you need to find the factors of 37 to solve this problem?

Solution

3 Grant walks 2 miles every day. Which could NOT be the number of miles that Grant has walked after some number of days?

Ⓐ 2

Ⓑ 3

Ⓒ 10

Ⓓ 18

What do you know about multiples of 2?

Noelle chose Ⓑ as the correct answer. How did she get that answer?

PAIR/SHARE
Discuss why answer Ⓐ is incorrect.

4 Simon arranges his 36 toy cars into equal-sized piles. Which list shows all of the possible numbers of cars that could be in each pile?

Ⓐ 2, 3, 4, 6

Ⓑ 1, 2, 3, 4, 6

Ⓒ 2, 3, 4, 6, 9, 12, 18

Ⓓ 1, 2, 3, 4, 6, 9, 12, 18, 36

5 Reggie eats 31 raisins. Which correctly describes 31 as a prime number or a composite number and tells the number of factor pairs 31 has?

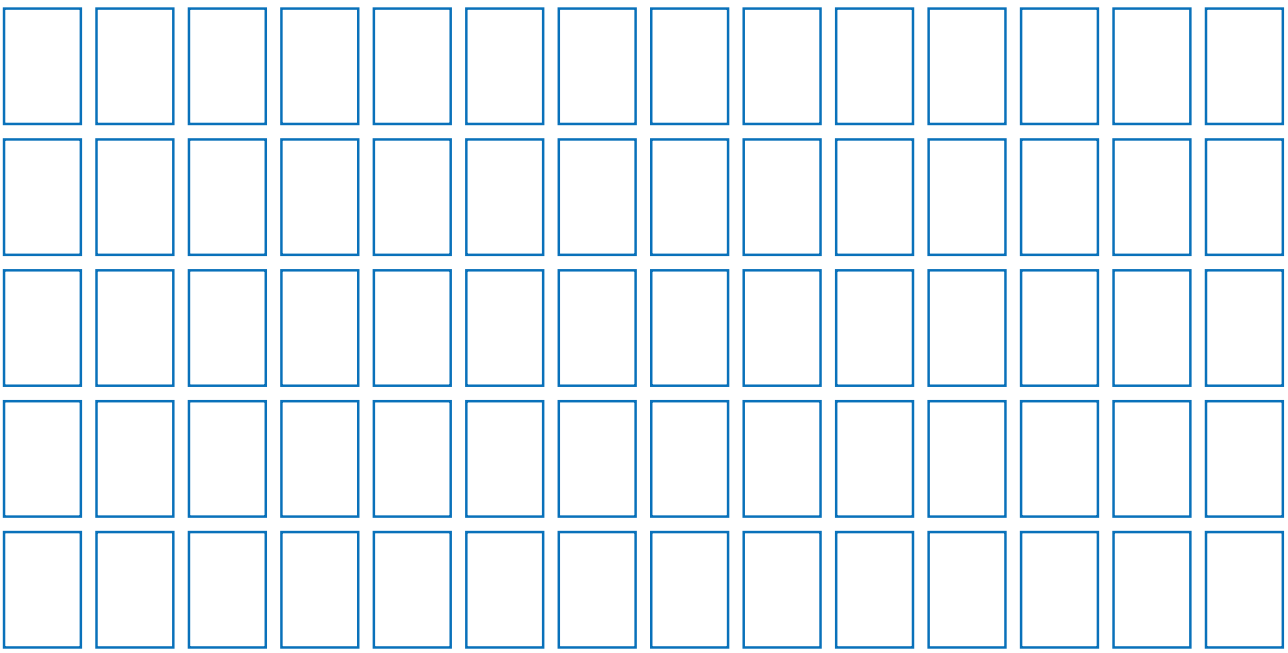
Ⓐ 31 is a prime number because it has 0 factor pairs.

Ⓑ 31 is a prime number because it has 1 factor pair.

Ⓒ 31 is a composite number because it has 1 factor pair.

Ⓓ 31 is a composite number because it has 2 factor pairs.

6 Sara is playing a memory card game with 24 cards. She wants to arrange the cards in equal rows. Shade in 24 boxes below to show one way that Sara could arrange the cards.



7 Tell whether each sentence is *True* or *False*.

	True	False
The number 96 is a multiple of 8. That means all of the factors of 8 are also factors of 96.	Ⓐ	Ⓑ
The number 1 is prime.	Ⓒ	Ⓓ
The number 1 is composite.	Ⓔ	Ⓕ
The number 2 is prime.	Ⓖ	Ⓗ
The number 9 has four factors.	Ⓘ	Ⓙ

8 Draw and label models to show all the factors of 15. Then tell if 15 is a prime or composite number. Show your work.

15 is a _____ number.

9 MATH JOURNAL

Write a multiple of 4. Explain how you know it is a multiple. List all the factor pairs of the number. Explain whether the number is prime or composite.

SELF CHECK Go back to the Unit 2 Opener and see what you can check off.