

Student Workbook

	UNIT	Name
		1 Factors and Multiples



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Factors and Multiples

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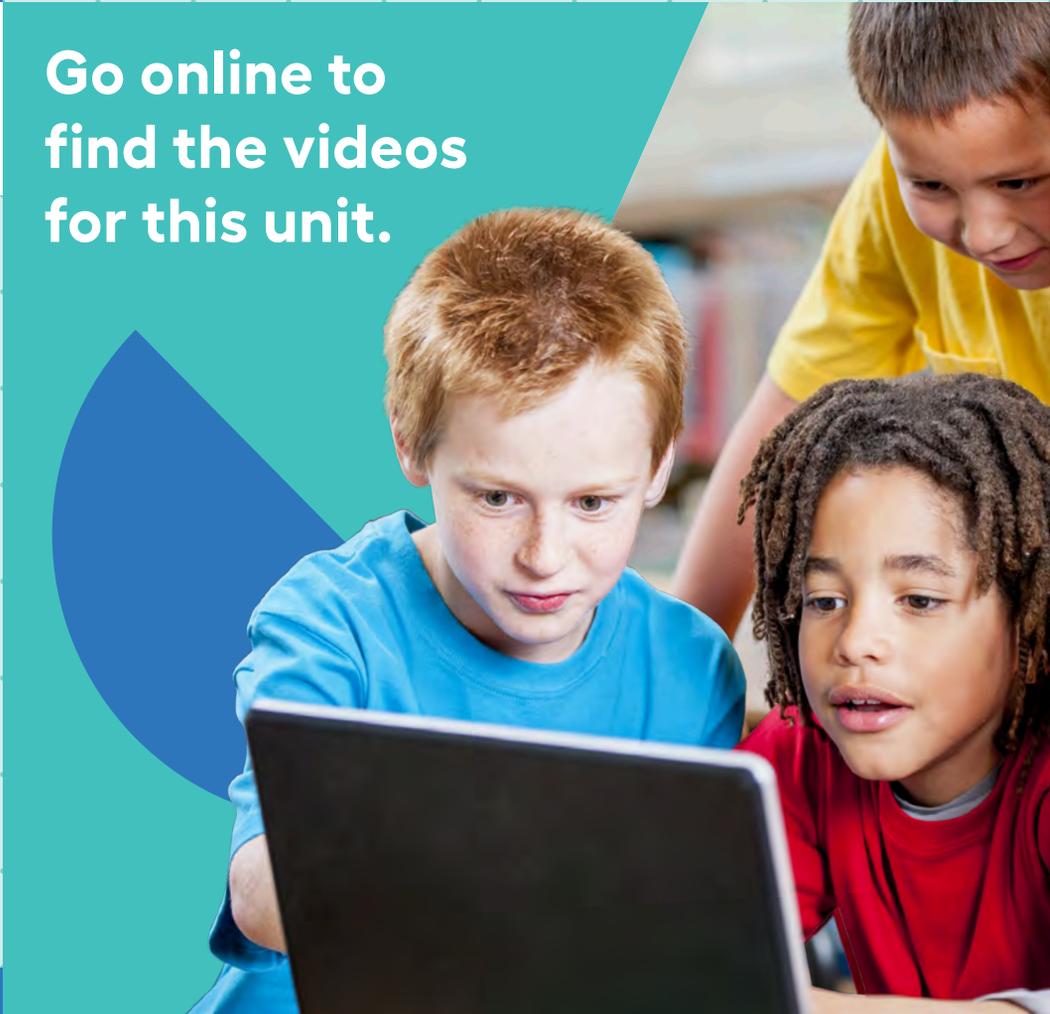
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for this unit.



VIDEOS

FAMILY SUPPORT

Unit 1 Family Support video



INSPIRE MATH

The Art of Piet Mondrian video



Section

A

Understand Factors and Multiples



I will determine if a number is prime or composite and relate the side lengths and area of a rectangle to factors and multiples.

Alignments

Building On
3.MD.C, 3.MD.C.7.a,
3.OA.C.7

Addressing
4.OA.B.4, 4.OA.C.5

Building Towards
4.OA.B.4

Mathematical Practice
MP6, MP7, MP8



Name

Date

Lesson 1

Multiples of a Number

Let's build some rectangles.

WARM-UP Which Three Go Together



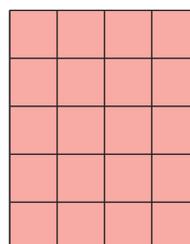
All Kinds of Area

Which 3 go together?

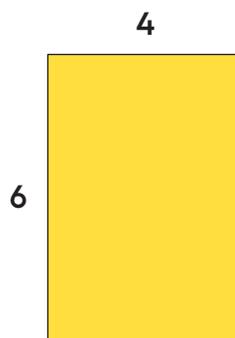
(A)



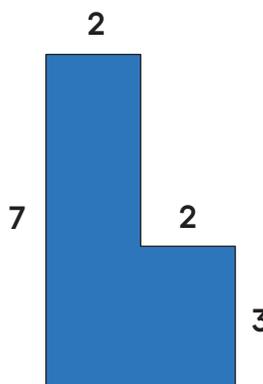
(B)



(C)



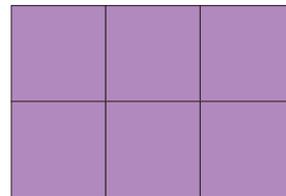
(D)



1

Build Rectangles and Find Area

- 1 Build 5 different rectangles with each of the given widths. Record the area of each rectangle in the table.



	area of rectangle				
2 tiles wide					
3 tiles wide					
4 tiles wide					

- 2 Discuss with a partner what you notice about the areas in each row of the table.

3 Predict the area of another rectangle that has each width.
Explain your reasoning.

- 2 tiles:

- 3 tiles:

- 4 tiles:

2

What Areas Can You Build?

1 Elena builds rectangles with a width of 3 units and an area of 30 square units or less.

- a. Build the rectangles Elena could make and draw the rectangles on grid paper. Label the area and the side lengths of each rectangle.
- b. What is the area of each rectangle you built?

- c. What do you notice about the areas?

2 Why is 28 square units not a possible area for a rectangle with a width of 3 units?

3 Elena decides that the area of the rectangle can be more than 30 square units. Find 2 other areas it could have. Explain or show your reasoning.

4 What is an area that is *not* possible for a rectangle with a width of 3 units? Explain or show your reasoning.

Name

Date

Lesson 2

Factor Pairs

Let's learn about factor pairs.



WARM-UP Number Talk



Multiplication

Find the value of each expression mentally.

(A) 2×7

(B) 4×7

(C) 3×7

(D) 7×7

1 How Many Rectangles?

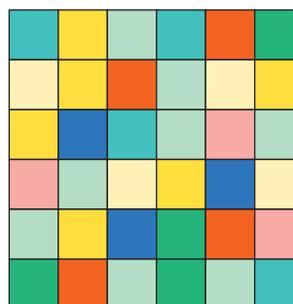
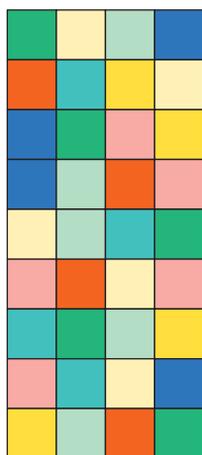
Your teacher will assign 2 numbers to your group. Each number represents the area of a rectangle.

- 1 On grid paper:
 - Draw all the possible rectangles that have the given area.
 - Label the area and side lengths of each rectangle.
 - Use only whole numbers for side lengths.
 - Use each pair of side lengths only once.

(For example, if you draw a rectangle with 4 units across and 6 units down, you don't need to also draw a rectangle with 6 units across and 4 units down because they have the same pair of side lengths.)

- 2 When you think you've drawn all the possible rectangles for both areas, cut out your rectangles and put them on a poster. Make 1 poster for each area you were assigned.

- 3 Display your poster for all to see.



2

How Many Rectangles?

As you visit each poster, discuss with your partner:

1 What do you notice? Use the following sentence frames when you share:

a. "I notice that some of the posters ..."

b. "I notice the posters for areas _____ and _____ are alike because ..."

2 How do you know that all possible rectangles were found for the given area?

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Lesson 3

Prime and Composite Numbers

Let's identify prime and composite numbers.

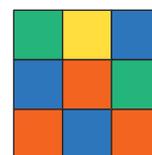
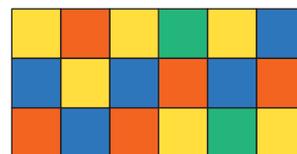


ACTIVITY Card Sort

1 Area

Your teacher will give you a set of cards that show rectangles.

- 1 Sort the cards into 4 categories in a way that makes sense to you. Be ready to explain the meaning of your categories.
- 2 Group the cards into rectangles that have the same area. Be ready to explain your reasoning.
- 3 For each group of cards that have the same area, think of at least one more rectangle. Record its length and width. Be prepared to explain your reasoning.



2

Prime or Composite?

The table shows different areas. How many rectangles with whole-number side lengths can be made for each area?

Complete the table.

Rectangles with the same pair of side lengths should be counted only once. For example, if you count a rectangle with 4 units across and 6 units down, you don't need to also count a rectangle with 6 units across and 4 units down.

area (square units)	how many rectangles?	prime or composite?
2		
10		
48		
11		
21		
23		
60		
32		
42		
31		
56		

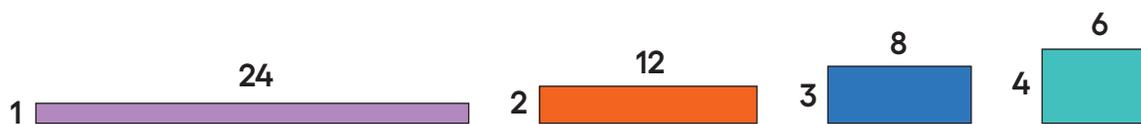
A

Summary

We used our understanding of the area of rectangles to learn about factors, multiples, factor pairs, prime numbers, and composite numbers.

If we know the side length of a rectangle, we could find the areas that the rectangle could have. For instance, a rectangle with a side length of 3 could have an area of 3, 6, 9, 12, 15, or other numbers that result from multiplying 3 by a whole number. We call these numbers **multiples** of 3.

If we know the area of a rectangle, we can find the side lengths that it could have. For example, a rectangle with an area of 24 square units could have side lengths of 1 and 24, 2 and 12, 3 and 8, or 4 and 6. We call these pairs of side lengths the **factor pairs** of 24.



We also learned that a number that has only one factor pair—1 and the number itself—is called a **prime number**. For instance, 5 is prime because its only factor pair is 1 and 5.

A number that has two or more factor pairs is a **composite number**. For instance, 15 is composite because its factor pairs are 1 and 15, and 3 and 5.

Name

Date

Lesson 4

Multiplication Practice

Let's practice multiplication.



WARM-UP Number Talk



Factors Over Ten

Find the value of each expression mentally.

(A) 10×6

(B) 3×6

(C) 13×6

(D) 12×4

1

Sort the Multiplication Facts

Take turns sorting the multiplication expressions into one of these groups:

- know it right away
- can find it quickly
- don't know it yet

Multiplication expressions I'm going to practice:

A _____

B _____

C _____

D _____

E _____

Name

Date

SECTION

A

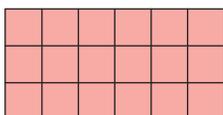
Practice Problems

1

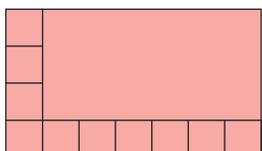
Pre-unit

Find the area of each rectangle. Explain your reasoning.

a.



b.



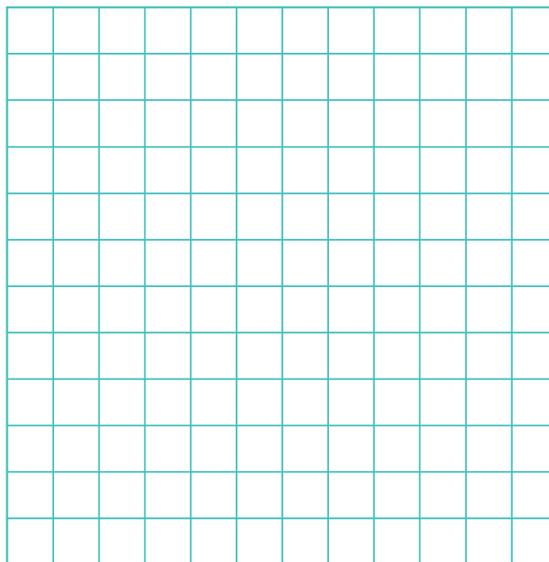
2

Pre-unit

On the grid, draw a rectangle whose area is represented by each expression.

a. 3×5

b. 4×8



3

from Unit 1, Lesson 1

Tyler wants to build a rectangle with an area of 20 square units using square tiles.

- a. Can Tyler build a rectangle with a width of 4 units? Explain or show your reasoning.

- b. Can Tyler build a rectangle with a width of 6 units? Explain or show your reasoning.

4

from Unit 1, Lesson 2

List the possible whole-number side lengths of rectangles with an area of 32 square units. Explain or show how you know your list is complete.

5

from Unit 1, Lesson 3

List the factor pairs of each number. Is each number prime or composite?
Explain or show your reasoning.

a. 37

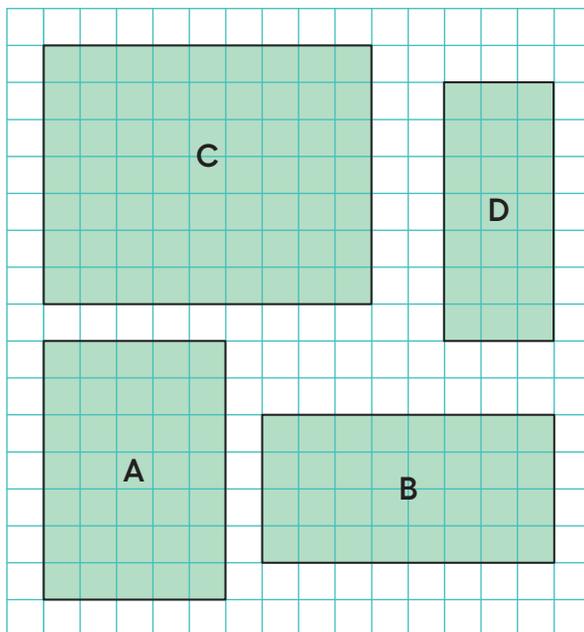
b. 27

c. 77

6

from Unit 1, Lesson 4

- a. Use multiplication facts to calculate the area of each rectangle.



- b. How did you use multiplication facts to calculate the areas?

7

Exploration

- a. You want to arrange all of the students in your class in equal rows.
- i. How many rows can you have? How many students would be in each row?

- ii. What if you add the teacher to the arrangement? How would your rows change?

- b. Find some objects at home (such as silverware, stuffed animals, cards from a game) and decide how many equal rows you can arrange them in and how many objects are in each row.

8

Exploration

What is the largest prime number you can find? Explain or show why it is a prime number.

Notes

Section

B

Find Factor Pairs and Multiples



I will use the relationship between multiplication and division to find factor pairs and multiples.

Alignments

Building On
3.OA.B.5, 3.OA.C.7

Addressing
4.OA.A.3, 4.OA.B,
4.OA.B.4

Building Towards
4.OA.B.4

Mathematical Practice
MP1, MP2, MP3, MP4,
MP6



Name	Date
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Lesson 5

More Multiples

Let's solve problems that involve factors and multiples.

WARM-UP Estimation Exploration

Banquet Seating

About how many chairs are in this room?



Record an estimate that is:

too low	about right	too high

1

Choose the Right Tables

Students are preparing for a party. The school has tables where 6 people can sit and tables where 8 people can sit.

The students can only choose one type of table and they want to avoid having empty seats.



- 1 Jada's class has 18 students. Which table would you choose for Jada's class? Explain or show your reasoning.

1 Choose the Right Tables

2 Noah's class has 30 students. Which table would you choose for Noah's class? Explain or show your reasoning.

3 Which table would you choose for Noah's and Jada's classes together? Can you find more than one option? Explain or show your reasoning.

4 If you also want places for Noah's teacher and Jada's teacher to sit, which table would you choose? Explain or show your reasoning.

2

Party Hats and Noisemakers

Lin and Diego are planning school parties.

- Each package of party hats has 10 party hats.
- Each package of noisemakers has 8 noisemakers.



1 Lin needs 50 party hats for his school party.

- a. How many packages of party hats should Lin buy? Explain or show your reasoning.

- b. Can Lin buy exactly 50 noisemakers? How many packages of noisemakers should Lin buy? Explain or show your reasoning.

2 Diego needs 72 party hats for his school party.

a. How many packages of party hats should Diego buy? Explain or show your reasoning.

b. How many packages of noisemakers should Diego buy? Explain or show your reasoning.

3 Is it possible to buy exactly the same number of party hats and noisemakers? If so, what would that number be? If not, explain your reasoning.

Name

Date

Lesson 6

The Locker Problem

Let's figure out what's happening in a game about lockers.

ACTIVITY

1 Questionable Lockers

The picture shows lockers in a school hallway.

The 20 students in Tyler's fourth-grade class play a game in a hallway that has 20 lockers in a row. The lockers are numbered from 1 to 20.



- The 1st student starts with the 1st locker, and while going down the hallway, opens all the lockers.
- The 2nd student starts with the 2nd locker, and while going down the hallway, shuts every other locker.
- The 3rd student stops at every 3rd locker and opens the locker if it is closed or shuts the locker if it is open.
- The 4th student stops at every 4th locker and opens the locker if it is closed or shuts the locker if it is open.
- This process continues through the 20th student, so that all 20 students in the class touch the lockers.

Create a representation to show what you understand about this problem.
Consider:

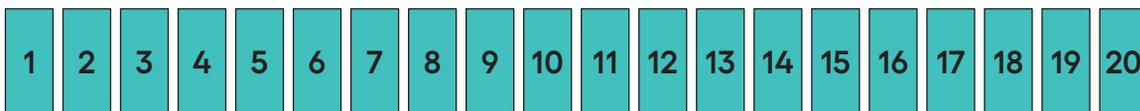
- How does your representation show lockers?
- How does your representation keep track of students who touch lockers?
- How does your representation show which lockers are open or closed?

2

An Open-and-Shut Case

Tyler's class plays the same locker game again.

Your goal this time is to find out which lockers are touched as each of the 20 students takes their turns.



- 1 Which locker numbers does the 3rd student touch?

- 2 Which locker numbers does the 5th student touch?

- 3 How many students touch locker 17? Explain or show how you know.

4 Which lockers are touched by only 2 students? Explain or show how you know.

5 Which lockers are touched by only 3 students? Explain or show how you know.

6 Which lockers are touched the most? Explain or show how you know.

If you have time: Which lockers are still open at the end of the game? Explain or show how you know.



Name

Date

Lesson 7

Find Factors and Multiples

Let's find factors and multiples of whole numbers from 1 to 100.



WARM-UP Number Talk



Division

Find the value of each expression mentally.

A $12 \div 3$

B $30 \div 3$

C $60 \div 3$

D $72 \div 3$

1

Factor and Multiple Statements

- 1 For each number, complete a statement using the word “factor” and a statement using the word “multiple.”

number	factor	multiple
10	_____ is a factor of _____ because ...	_____ is a multiple of _____ because ...
7	_____ is a factor of _____ because ...	_____ is a multiple of _____ because ...
50	_____ is a factor of _____ because ...	_____ is a multiple of _____ because ...
16	_____ is a factor of _____ because ...	_____ is a multiple of _____ because ...

1 Factor and Multiple Statements

number	factor	multiple
35	_____ is a factor of _____ because ...	_____ is a multiple of _____ because ...
20	_____ is a factor of _____ because ...	_____ is a multiple of _____ because ...
19	_____ is a factor of _____ because ...	_____ is a multiple of _____ because ...
6	_____ is a factor of _____ because ...	_____ is a multiple of _____ because ...

- 2** As you compare statements with your partner, discuss one thing you notice and one thing you wonder.

We used what we learned about factors, multiples, and prime and composite numbers between 1 and 100 to play games and solve problems.

We learned that numbers can share factors and multiples. Example:

- The number 2 is a factor of 6 and also a factor of 8.
- The number 24 is a multiple 6 and also a multiple of 8.

Knowing about factors and multiples helped us answer questions such as:

- “Can we put 24 chairs in 6 equal rows? What about 7 equal rows or 8 equal rows?”
- “If there are 20 lockers in a row (numbered 1 to 20) and a student touches every fourth locker, how many lockers would they touch? Which locker numbers would they touch?”

Name

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Lesson 8

Mondrian's Art

Let's make art with rectangles.

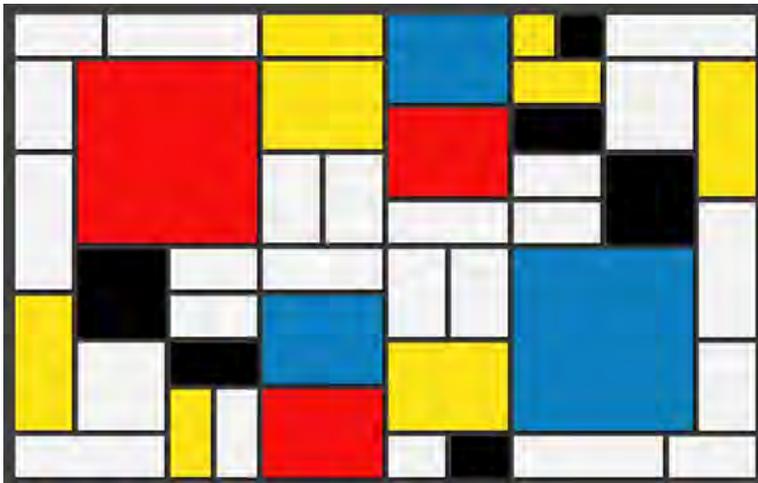
WARM-UP Notice and Wonder



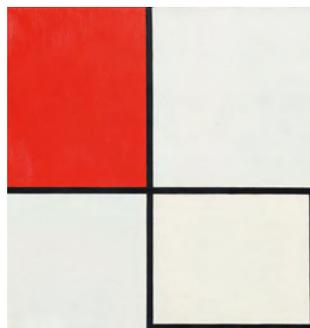
Piet Mondrian's Art

What do you notice? What do you wonder?

A



B



1

My Rectangle Art

- 1 Use grid paper to create a plan for your own artwork that uses at least 12 rectangles.
 - a. The areas of the rectangles should represent at least three of the following:
 - ___ all the factors of a number
 - ___ at least 6 multiples of a number
 - ___ prime numbers
 - ___ composite numbers
 - b. Explain or show your reasoning.
- 2 Turn your grid paper over and trace your design with a black marker or crayon. Color the design to emphasize the choices you made and give your artwork a title.

2

Analyze the Rectangles

Trade artwork with your partner.

Describe which of the following you see in the area of the rectangles in your partner's artwork:

- It shows all the factors of a number.
- It shows at least 6 multiples of a number.
- It shows prime numbers.
- It shows composite numbers.

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SECTION

B

Practice Problems

1

from Unit 1, Lesson 5

Pens are sold in packages of 5 and also in packages of 6.

- a. Jada wants to buy 60 pens for her class. Which packages of pens and how many should Jada buy if she doesn't want any extras? Explain or show your reasoning.

- b. Han wants to buy 55 pens for his class. Which packages of pens and how many should Han buy? Explain or show your reasoning.

2

from Unit 1, Lesson 6

a. Find the factor pairs of 36.

b. How many factors does 36 have?

c. List the factors of 15.

3

from Unit 1, Lesson 7

Select **all** numbers that are multiples of 8.

(A) 16

(B) 28

(C) 40

(D) 54

(E) 66

(F) 72

(G) 84

(H) 96

4

Exploration

a. List the multiples of 2 from 1 to 30.

b. List the multiples of 3 from 1 to 30.

c. What do you notice about the numbers in the two lists?

5

Exploration

Which number(s) from 1 to 100 have the most factors? Explain or show how you know.

GLOSSARY

composite number

A whole number with more than one factor pair.

factor pair of a whole number

Two whole numbers that multiply to result in that number. Example: 5 and 4 are a factor pair of 20.

multiple of a number

The result of multiplying that number by a whole number. Example: 18 is a multiple of 3, because it is a result of multiplying 3 by 6.

prime number

A whole number that is greater than 1 and has exactly one factor pair: the number itself and 1.

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Notes

Notes

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Notes



You are the reason we created Imagine IM.

You're a mathematician. You think about problems, share ideas, learn from mistakes, and get curious about what others are thinking.

Every lesson in Imagine IM is full of opportunities for you to engage in all of these activities!

This is your community, where you can explore, listen to others' reasoning, and connect the mathematics you learn to things you care about.

Lesson by lesson, you'll build confidence—both through familiar routines and by trying out different strategies to solve problems.

Start **exploring** now!



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