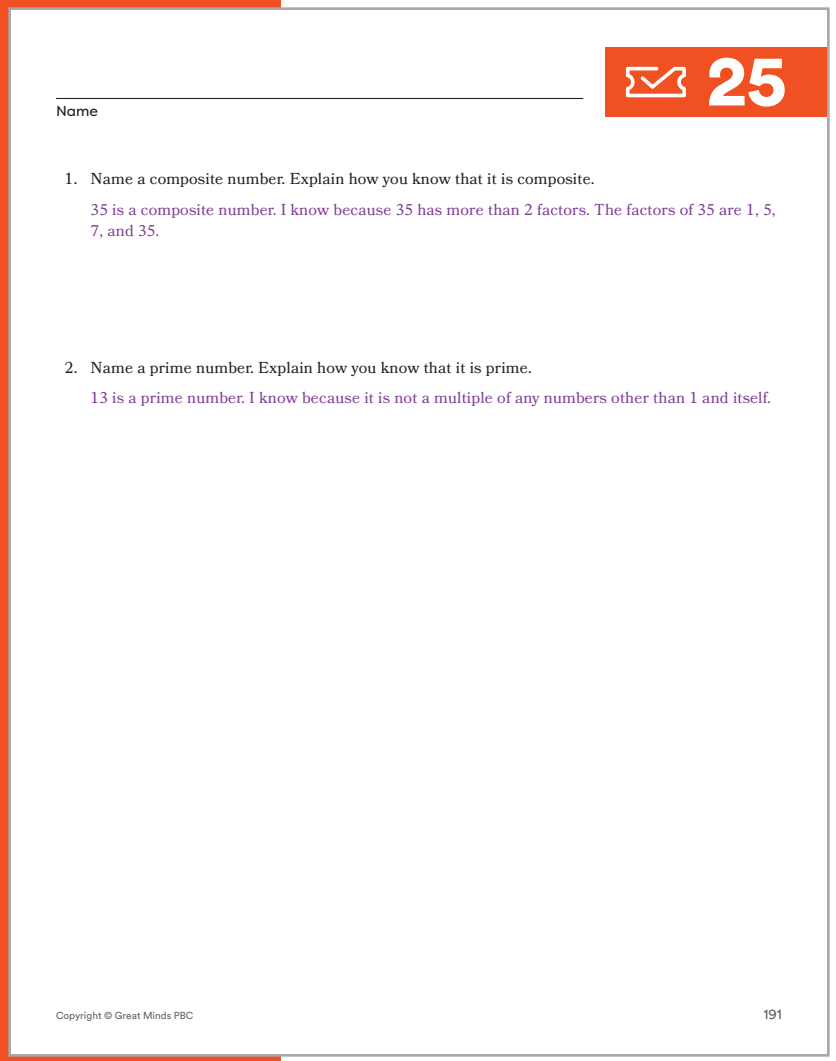
Routines to Support Multilingual Learners' Social Status in the Mathematics Classroom

Participant Handout

25

LEESON 25

Explore properties of prime and composite numbers up to 100 by using multiples.



Name

25

1. Name a composite number. Explain how you know that it is composite.

   35 is a composite number. I know because 35 has more than 2 factors. The factors of 35 are 1, 5, 7, and 35.

2. Name a prime number. Explain how you know that it is prime.

   13 is a prime number. I know because it is not a multiple of any numbers other than 1 and itself.

Lesson at a Glance

Students use the Sieve of Eratosthenes to identify all prime and composite numbers between 1 and 100. They use their findings to identify properties of prime and composite numbers.

There is no Problem Set for this lesson.

Key Question

- How can you use multiples to identify prime and composite numbers?

Achievement Descriptors

4.Mod2.AD3 **Identify** a multiple of a given whole number in the range 1–100. (4.OA.B.4)

4.Mod2.AD4 **Determine** whether a whole number up to 100 is prime or composite. (4.OA.B.4)

Agenda

Fluency 15 min

Launch 5 min

Learn 30 min

- The Sieve of Eratosthenes
- Use Factors to Identify Multiples
- Properties of Prime and Composite Numbers

Land 10 min

Materials

Teacher

- Hundreds Chart (in the teacher edition)
- Colored pencils (2)

Students

- Compare Numbers Sprint (in the student book)
- Colored pencils (2)

Lesson Preparation

- Consider tearing out the Sprint pages in advance of the lesson.
- Review the Math Past resource to support delivery of Launch.
- Gather one red and one blue colored pencil per student and teacher.

Fluency

15

Sprint: Compare Numbers

Materials—S: Compare Numbers Sprint

Students compare two multi-digit whole numbers to build fluency with comparing numbers from module 1.

Have students read the instructions and complete the sample problems.

Write >, =, or < to compare the two numbers.

1.	2,375	>	1,735
2.	45,162	<	45,189

Direct students to Sprint A. Frame the task.

I do not expect you to finish. Do as many problems as you can, your personal best.

Take your mark. Get set. Think!

Time students for 1 minute on Sprint A.

Stop! Underline the last problem you did.

I'm going to read the answers. As I read the answers, call out "Yes!" if you got it correct. If you made a mistake, circle the answer.

Read the answers to Sprint A quickly and energetically.

Count the number you got correct and write the number at the top of the page. This is your personal goal for Sprint B.

Celebrate students' effort and success.

Provide about 2 minutes to allow students to complete more problems or to analyze and discuss patterns in Sprint A. If students are provided time to complete more problems on Sprint A, reread the answers but do not have them alter their personal goals.

Lead students in one fast-paced and one slow-paced counting activity, each with a stretch or physical movement.

Point to the number you got correct on Sprint A. Remember this is your personal goal for Sprint B.

Direct students to Sprint B.

Take your mark. Get set. Improve!

Time students for 1 minute on Sprint B.

Stop! Underline the last problem you did.

I'm going to read the answers. As I read the answers, call out "Yes!" if you got it correct. If you made a mistake, circle the answer.

Read the answers to Sprint B quickly and energetically.

Count the number you got correct and write the number at the top of the page.

Determine your improvement score and write the number at the top of the page.

Celebrate students' improvement.

Teacher Note

Consider asking the following questions to discuss the patterns in Sprint A:

- Which problems were easiest for you to compare? Why?
- Which place value did you use to compare in problems 1–4? In problems 5–8?

Teacher Note

Count forward by 70 from 0 to 700 for the fast-paced counting activity.

Count backward by 7 tens from 70 tens to 0 tens for the slow-paced counting activity.

Choral Response: Multiples

Students say the first five multiples of 3 and 6 and then answer questions by using the lists of multiples to develop fluency with multiples.

When I give the signal, say the first five multiples of 3. Ready?

Display each multiple one at a time as students count.

3, 6, 9, 12, 15

After asking each question, wait until most students raise their hands, and then signal for students to respond.

Multiples of 3: 3, 6, 9, 12, 15

Multiples of 6: 6, 12, 18, 24, 30

Raise your hand when you know the answer to each question. Wait for my signal to say the answer.

Is 9 a multiple of 3? Yes.

Is 10 a multiple of 3? No.

Is 15 a multiple of 3? Yes.

When I give the signal, say the first five multiples of 6. Ready?

Display each multiple one at a time as students count.

6, 12, 18, 24, 30

Is 9 a multiple of 6? No.

Is 12 a multiple of 6? Yes.

Is 24 a multiple of 6? Yes.

Is 3 a multiple of 3, 6, or both? 3

Is 6 a multiple of 3, 6, or both? Both

Teacher Note

Because zero multiplied by any number is zero, we could consider it to be the first multiple of every number. However, when we skip-count, we typically start with the unit we are counting by. We usually think of the unit itself as the first multiple instead of 0. For example, when counting by a unit of 3 the first multiple is 1×3, the second is 2×3, and so on. The zeroth multiple is 0×3.

Launch

5

Students predict how a sieve might relate to mathematics.

Display the picture of a sieve.

What do you know about the object?

We use it in the kitchen.

It filters or strains things.

Things that are larger than the holes get trapped inside and the rest fall through the holes.

Have you ever used this or something like it before? What have you used it for?

I used it to sift flour and powdered sugar while baking.

I used it to strain seeds and pulp from fruit juice.

I used it to drain pasta after cooking.

One name for the object is a sieve. We will be using a mathematical sieve today.

Invite students to turn and talk about what they think a mathematical sieve might do or how it might be used.

Display the picture of Eratosthenes.

The mathematical sieve we will use today is a process created by Eratosthenes. He was a Greek mathematician born more than 2,200 years ago. Eratosthenes also studied many other topics. He invented the study of geography and correctly estimated the distance around the earth.

Math Past

The Math Past resource includes more information about sieves and Eratosthenes. The resource also provides more information about how the Sieve of Eratosthenes works to identify prime and composite numbers.

Language Support

Displaying a picture of a sieve and activating students' prior knowledge of similar tools may help students better understand how a sieve works. Such support may also help students understand, as they follow the process of the Sieve of Eratosthenes, what happens to the numbers in the hundreds chart.

Transition to the next segment by framing the work.

Today, we will find out what types of numbers the Sieve of Eratosthenes can help us identify.

Learn 30

The Sieve of Eratosthenes

Materials—T: Hundreds Chart, colored pencils; S: Colored pencils

Students use the Sieve of Eratosthenes algorithm to eliminate multiples on the hundreds chart.

Direct students to the hundreds chart in their books and display Hundreds Chart.

The Sieve of Eratosthenes uses multiples to identify a certain type of number. We will use a hundreds chart and what we know about multiples to show the process that Eratosthenes used. Then we will see what type of number was identified.

Let's start at the beginning of the chart and cross off the multiples of each number as we go.

1	2	3	~~4~~	5	~~6~~	7	~~8~~	~~9~~	~~10~~
11	~~12~~	13	~~14~~	~~15~~	~~16~~	17	~~18~~	19	~~20~~
~~21~~	~~22~~	23	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~	29	~~30~~
31	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	37	~~38~~	~~39~~	~~40~~
41	~~42~~	43	~~44~~	~~45~~	~~46~~	47	~~48~~	~~49~~	~~50~~
~~51~~	~~52~~	53	~~54~~	~~55~~	~~56~~	~~57~~	~~58~~	59	~~60~~
61	~~62~~	~~63~~	~~64~~	~~65~~	~~66~~	67	~~68~~	~~69~~	~~70~~
71	~~72~~	73	~~74~~	~~75~~	~~76~~	~~77~~	~~78~~	79	~~80~~
~~81~~	~~82~~	83	~~84~~	~~85~~	~~86~~	~~87~~	~~88~~	89	~~90~~
~~91~~	~~92~~	~~93~~	~~94~~	~~95~~	~~96~~	97	~~98~~	~~99~~	~~100~~

Point to 1 on the hundreds chart.

What will happen if we cross off all multiples of 1?

If we cross off the multiples of 1, then we will cross off every number.

We will identify 1 as a special type of number.

Direct students to shade in 1 with their red colored pencil.

Circle 2 on the hundreds chart and direct students to do the same.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Let's start with 2 and cross off the rest of the multiples of 2. What number will we cross off first?

4

Give students 1 minute to cross off 4 and the rest of the multiples of 2 on their charts. Do the same on the hundreds chart.

What strategy did you use to identify and cross off the multiples of 2?

I skip-counted by twos.

I crossed off all the even numbers since I know they are all multiples of 2.

After a few rows, I realized the multiples of 2 are in columns, so I crossed off all the columns of even numbers.

What is the next number on the hundreds chart after 2 that is not crossed off?

3

Circle 3 on the hundreds chart and direct students to do the same.

Let's cross off the multiples of 3. What is the next multiple of 3?

6, but it's already crossed off.

Why is 6 already crossed off?

6 is a multiple of 2.

UDL: Representation

Consider activating prior knowledge by inviting students to think about the hundreds charts they used in lessons 23 and 24 to identify multiples. Invite them to picture in their heads what the hundreds charts looked like with the multiples of 2 circled before they begin crossing off the multiples of 2. Use a similar strategy for the other factors as the lesson progresses.

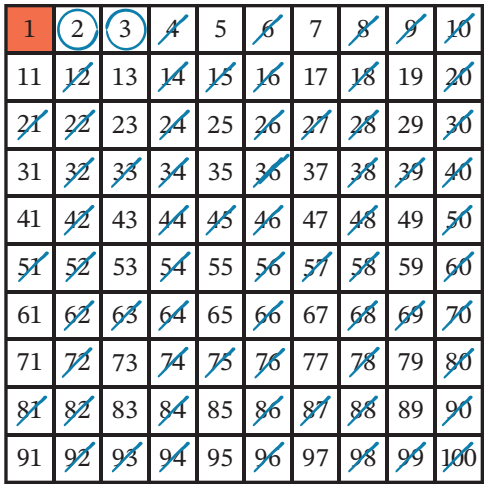
Give students 1 minute to cross off the multiples of 3 that are not already crossed off. Do the same on the hundreds chart.

To continue to eliminate multiples, let's use the next number that has not been crossed off yet and cross off its multiples. What is the next number that has not been crossed off?

5

Invite students to circle 5 and cross off the remaining multiples of 5. Do the same on the hundreds chart.

Give students 3 minutes to repeat the process, continuing with the multiples of 6. Once most students have at least circled 13 and identified its multiples, transition to the next segment.



Use Factors to Identify Multiples

Materials—T: Hundreds Chart

Students use factors to recognize that a multiple of one factor is also a multiple of the other factor.

Display the hundreds chart with multiples of 2 through 13 crossed off.

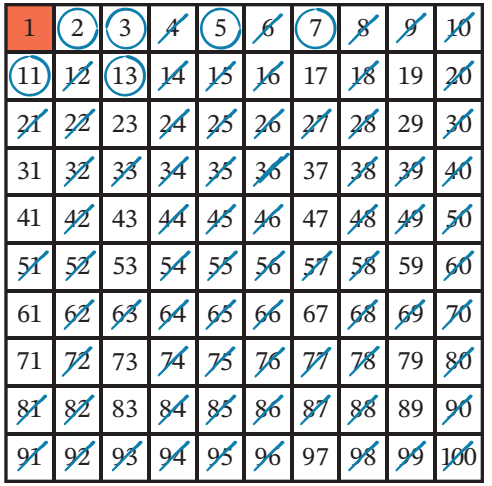
What did you notice about the multiples of 11 and 13?

All the multiples were already crossed out.

Invite students to turn and talk about why they think all the multiples of 11 and 13 were crossed out earlier.

Let's think more about the multiples of 11. How can we use multiplication to find the second multiple of 11?

$2 \times 11 = 22$



Differentiation: Support

For students who are not ready to efficiently multiply or divide to find multiples of two-digit numbers, consider supporting them in using the arrow way to find the next multiple. For example, to find multiples of 13, ask students to add 10 and then 3 more.

So 22 is a multiple of 11 and what number?

2

How can we use multiplication to find the next multiple of 11?

$3 \times 11 = 33$

33 is also a multiple of what number?

3

What is the greatest multiple of 11 on the chart?

99

What is 99 also a multiple of? How do you know?

99 is also a multiple of 9 because $9 \times 11 = 99$.

Why have all the multiples of 11 already been crossed off?

They have been crossed off because they are all multiples of smaller numbers. The multiples of 11 on the chart are multiples of 2, 3, and all the numbers to 9. Those were already crossed off.

Do you think all the multiples of 13 have already been crossed off? Why?

The largest multiple of 13 on the chart is 91. $7 \times 13 = 91$. All the multiples of the smaller factors less than 9 have already been crossed off.

Invite students to turn and talk about whether they think there will be any more multiples left on the chart to cross off.

Give students 2 minutes to continue circling the next number and crossing off any multiples until all numbers are either circled or crossed off.

What did you notice as you completed the chart?

There were no more multiples to cross off. Everything was crossed off already.

We circled every number that was left.

There were no more possible multiples on the chart because the numbers were too big.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

UDL: Engagement

Consider facilitating personal coping skills and strategies if students are overwhelmed by the size of the hundreds chart or the two-digit numbers. Remind students that when they need support, they are learning. Discuss strategies for persevering and dealing with frustration, such as the following:

- Use self-talk with statements such as, "I can do this."
- Pause to take deep breaths and calm down before working again.
- Choose a different approach to finding multiples.
- Ask a partner or the teacher a clarifying question.

What number did you get to and notice there were no more multiples of that number on the chart?

I got to 53. The next multiple of 53 is 106, and 106 is not on the chart.

Invite students to turn and talk about how they know when all the multiples of a number have been crossed off.

Properties of Prime and Composite Numbers

Materials—T: Hundreds Chart, colored pencils; S: Colored pencils

Students identify the numbers on the chart as either prime or composite and analyze their properties.

A sieve separates larger objects from smaller objects, like seeds from fruit juice. Let's think about how the Sieve of Eratosthenes separated the numbers.

Invite students to think–pair–share about what is similar about all the numbers that are circled on the chart.

The circled numbers are prime numbers because their only factors are 1 and the number.

The circled numbers are prime numbers. They are not multiples of any other number.

The circled numbers are all prime numbers. What type of number are all the crossed-off numbers? How do you know?

The crossed-off numbers are composite numbers because they have more than two factors.

The composite numbers were crossed off because they are multiples of other numbers. That's how we know they have more than two factors.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Invite students to use their blue colored pencil to shade in the boxes containing the composite numbers.

Why is 1 not circled or shaded? What makes 1 special?

1 is not prime or composite. It only has one factor.

Present the following statements one at a time. Use the Always Sometimes Never routine to engage students in constructing meaning and discussing their ideas.

- An even number is a composite number.
- An odd number is a prime number.
- A multiple of a prime number is also a prime number.
- A prime number is only a multiple of two numbers, 1 and itself.

Give students 1 minute of silent think time to evaluate whether the statement is always, sometimes, or never true.

Have students discuss their thinking with a partner. Circulate and listen as they talk. Identify one or two students to share their thinking.

Then facilitate a class discussion. Invite students to share their thinking with the whole group. Encourage them to provide examples and nonexamples to support their claim. Conclude by coming to the following consensus:

- All even numbers except 2 are composite. 2 is a prime number.
- Some odd numbers are prime, but not all odd numbers are prime. For example, 15 is an odd number, but it is composite because it has more than two factors.
- If a number is a multiple of a number other than 1 or itself, that means it has more than two factors, so the number is composite. For example, 2 is a prime number, but all multiples of 2 are composite numbers because they also have 2 as a factor.
- A prime number only has two factors, 1 and itself. We know that a number is a multiple of its factors. That means a prime number is also a multiple of only two numbers.

Language Support

Consider supporting the Always Sometimes Never routine with sentence frames for student reference.

_____ is always true because _____.

_____ is sometimes true because _____.

_____ is never true because _____.

For example, _____.

Promoting the Standards for Mathematical Practice

When students discuss and defend whether a statement about prime and composite numbers is always, sometimes, or never true, they are constructing viable arguments and critiquing the reasoning of others (MP3).

Ask the following questions to promote MP3:

- Is it true that all even numbers are composite numbers? How do you know?
- What questions can you ask your partner to make sure you understand their argument that a prime number is only a multiple of 1 and itself?

Land 10

Debrief 5 min

Objective: Explore properties of prime and composite numbers up to 100 by using multiples.

Use the following prompts to guide a discussion about using multiples to identify prime and composite numbers.

What is one composite number you identified today? How do you know it is composite?

85 is a composite number because it is a multiple of 5. If it's a multiple of 5, then 5 is a factor of 85, so 85 has more than two factors.

What is one prime number you identified today? How do you know it is prime?

53 is a prime number because it is not a multiple of any numbers other than 1 and itself.

How can we find the prime numbers between 1 and 200?

We could add on to the hundreds chart, up to 200. We could continue the process of the Sieve of Eratosthenes by crossing off the multiples of each number. The numbers that are not crossed off are prime.

How can you use multiples to identify prime and composite numbers?

If a number is only a multiple of 1 and itself, it is a prime number.

If a number is a multiple of any number other than 1 or itself, it is a composite number.

Exit Ticket 5 min

Provide up to 5 minutes for students to complete the Exit Ticket. It is possible to gather formative data even if some students do not complete every problem.

25

Name _____ Date _____

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100