Build It, Grow It: Factors and Multiples

Teacher		**Class**	Grade 4
Subject	Math	**Topic**	Factors and multiples
Date		**Room**	
Lesson length	60 minutes	**Country**	United States

Students find all factor pairs with rectangles and link them to multiples. They build, list pairs, and sort numbers as prime or composite.

Curriculum links

- 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.
- Determine all factor pairs for a whole number from 1 to 100, using concrete, pictorial, and numerical representations [1].

Learning objectives

- Students will find all factor pairs for whole numbers to 100 using rectangles.
- Students will connect factors and multiples and test multiples of one-digit numbers.
- Students will decide if numbers to 100 are prime, composite, or neither.

Success criteria

- I can list all factor pairs for numbers to 100 in order.
- I can show a number is a multiple of its factors.
- I can sort numbers as prime, composite, or 1 neither.

What students already know

Show 12 dots. Ask: What times facts make 12? Listen for 1x12, 2x6, 3x4.

Key words

factor	a number that goes into another with nothing left over [4]
multiple	what you get when you times a number by 1, 2, 3 and so on [11]
factor pair	two whole numbers that times together to make a given number [16]
prime	has just two dividers: 1 and itself [13]
composite	has more than two dividers, not just 1 and itself [13]

Materials

- square tiles or counters, grid paper, pencils
- Slides 1-11, whiteboard and markers
- Video clip 1 (0:00-5:00) on Slide 6
- Worksheet Task B copies, sticky notes

Before the lesson

- Count out bags of 36 square tiles or counters for each pair and stack grid paper
- Load Slides 1-11 and test Video clip 1 (0:00-5:00) on Slide 6 with sound

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- Print Worksheet Task B for each student and sticky notes for class sort

Lesson outline

0–8 min **Starter** 8 min · Whole class

Hook interest with rectangles and recall multiplication facts needed for factors.

YOU DO

1. Show Slide 1 and hold up 12 tiles. Say the hook and let pairs talk for 1 minute.
2. Show Slide 5 and take a vote: Which number looks most fun to find factors for?
3. Show Slide 2 objectives and link vote to finding factor pairs.
4. Do a 2-minute times-table chant for 2s, 3s, 4s to warm up.

STUDENTS DO

1. Turn and talk about rectangles they could make with 12 tiles.
2. Vote for 24, 49, 29 or 36 on Slide 5 and say why.
3. Join in times-table chant and recall facts that make 12.

Say: I have 12 tiles. How many different flat rectangles can you build with all 12? Talk to your partner and picture the rectangles. We will build them all today to find factor pairs.

Worked example: With 6 tiles you can make 1 x 6, a long row of 6, and 2 x 3, 2 rows of 3 [11]. Those are the factor pairs of 6.

Ask: What times facts make 12? (1 x 12, 2 x 6, 3 x 4 [12].) · What times facts do you already know that make 24? (1 x 24, 2 x 12, 3 x 8, 4 x 6.)

Check understanding: Each student shows one fact for 12 on mini whiteboard. If many miss 3 x 4, quickly build it with tiles before moving on.

Support: Let students handle 6 tiles first to find 1 x 6 and 2 x 3 before trying 12. **Stretch:** Ask: If 12 makes 3 rectangles, can you predict if 36 will make more or fewer?

Use: Slides 1-2, 5

8–20 min **Teaching** 12 min · Whole class

Model a systematic way to find every factor pair without missing any.

YOU DO

1. Show Slide 3 big idea and Slide 4 steps: start with 1, try 2, 3, 4 in order, stop when pairs meet.
2. Model with tiles under a camera for 24: 1 x 24, 2 x 12, 3 x 8, 4 x 6.
3. Play Video clip 1 on Slide 6 to show factor pairs building numbers and multiples counting up.
4. Think aloud why you stop after 4 x 6 because factors always appear in pairs [16].

STUDENTS DO

1. Watch modeling and call out whether 2, 3, 4, 5 divide 24 with no leftover.
2. Copy the ordered factor rainbow for 24 on whiteboards.
3. Watch video and listen for factor pairs building numbers.

Say: Factors build a number, multiples grow from it. To find all pairs, start with 1 times the number. Try 2, then 3, then 4 in order. Keep it if it goes in with nothing left over. Stop when pairs meet or cross.

Worked example: For 24: 1 x 24 fits, 2 x 12 fits, 3 x 8 fits, 4 x 6 fits, 5 does not fit. Next would be 6 x 4 which we already have, so stop [12]. Factors in order are 1, 2, 3, 4, 6, 8, 12, 24.

Ask: Why do we stop after 4 x 6 for 24? (The next would be 6 x 4, which we already have; pairs meet in the middle [12].) · What are all the factors of 12 in order? (1, 2, 3, 4, 6, 12 from 1 x 12, 2 x 6, 3 x 4 [12].)

Check understanding: All show factors of 12 on whiteboards. If order is mixed or pairs missing, remodel trying 2, 3, 4 in order.

Support: Give a multiplication chart and have students circle 1 x 24, 2 x 12, 3 x 8, 4 x 6 to see pairs before writing. **Stretch:** Ask what would happen with 25: which pair repeats and why?

Use: Slides 3-4, 6, Video clip 1 (0:00–5:00)

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20–40 min **Main activity** 20 min · Pairs

Find all factor pairs for numbers to 36 by building every rectangle.

YOU DO

1. Show Slide 9 task: build every rectangle with counters, write each as a pair, decide prime or composite.
2. Hand out tiles, grid paper and pencils. Demo recording for 18: build, draw, write 1 x 18.
3. Circulate, prompt testing in order: Did you try 2? 3? 4? What is the partner number?
4. Stop class at 15 minutes for two pairs to show rainbows for 18 and 24.

STUDENTS DO

1. Build rectangles with 12 tiles, record 1 x 12, 2 x 6, 3 x 4, draw on grid paper [12].
2. Repeat with 18, 24 and 30 to find all factor pairs using tiles and pictures [1].
3. Draw rectangles and write matching factor pairs underneath from smallest to largest.

Say: Work with your partner. Build every flat rectangle you can with all the tiles. Draw it on grid paper. Write each one as a pair, like 3 x 8. Then list the factors smallest to largest.

Worked example: For 18: 1 x 18 fits, 2 x 9 fits, 3 x 6 fits, 4 does not fit, 5 does not fit, 6 would repeat 6 x 3. So factor pairs are 1 x 18, 2 x 9, 3 x 6 and factors are 1, 2, 3, 6, 9, 18.

Ask: How do you know you have found every pair for 18? (We tried 1, 2, 3, 4 in order and stopped when pairs met; 6 x 3 repeats 3 x 6.) · What are the factor pairs for 30? (1 x 30, 2 x 15, 3 x 10, 5 x 6.)

Check understanding: Pairs hold up factor lists for 24: 1, 2, 3, 4, 6, 8, 12, 24. Scan for missing 6 or 8 and send pairs back to build the missing rectangle.

Support: Start with 6 tiles and 8 tiles only, where students can find 1 x 6, 2 x 3 and 1 x 8, 2 x 4 using the tiles [11]. **Stretch:** Try 36 tiles and check if any rectangle is a square, then explain why it has an odd number of factors.

Use: Slide 9

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40–52 min **Teaching** 12 min · Whole class

Connect factor pairs to multiples and to prime or composite sorting.

YOU DO

1. Show Slide 7 key words and Slide 10 cards: factors fit in, multiples grow out.
2. Model with 7 x 5 = 35: 7 and 5 are factors of 35, 35 is a multiple of 7 and 5 [18].
3. Model Worksheet Task B first two rows together: list pairs, then circle multiples.
4. Model prime check: list factors, stamp prime if only 1 and itself, composite if more [13].

STUDENTS DO

1. Discuss with partner: If 7 x 5 = 35, are 7 and 5 factors or multiples? Is 35 a factor or multiple?
2. Write one sentence on sticky note, such as 12 is a multiple of 3 because 3 is a factor of 12, and post for sort.
3. Start Worksheet Task B: practice factor pairs and multiples step by step with partner.

Say: If A times B equals C, then A and B are factors of C, and C is a multiple of A and B [18]. A number is a multiple of another number exactly when the other is a factor of it [4]. Prime has only 1 and itself. Composite has more factors.

Worked example: 3 x 4 = 12, so 3 and 4 are factors of 12 and 12 is a multiple of 3 and 4 [18]. For prime: 17 has only 1 and 17, so it is prime [13]. For multiples: 56 is a multiple of 7 because 7 x 8 = 56. Multiples of 4 go 4, 8, 12, 16, 20, 24 and so on [13].

Ask: Is 27 a multiple of 3? How do you know? (Yes, because 3 x 9 = 27 and 3 is a factor of 27.) · Is 17 prime or composite? What is the evidence? (Prime, it has only 1 and 17 [13].)

Check understanding: Quick thumbs up or down: Is 48 a multiple of 6? Is 29 prime? If split, re-list factor pairs on board.

Support: Provide sentence frames: ___ is a factor of ___ because ___ x ___ = ___, and ___ is a multiple of ___ because of the same fact [18]. **Stretch:** Ask if 5 is both a factor and a multiple of 5, and have students defend with a times fact and a divide fact.

Use: Slides 7, 10, Worksheet Task B

52–60 min **Plenary** 8 min · On their own

Check all three goals: pairs, multiples, and prime or composite.

YOU DO

1. Show Slide 11 quiz and read each prompt aloud.
2. Give 5 minutes silent work: list pairs for 18, test 56, sort 17.
3. Take answers, show correct pairs and facts, link back to I can statements on Slide 2.
4. Collect papers as exit ticket and preview next lesson on common multiples.

STUDENTS DO

1. Answer Slide 11 quiz on paper on their own.
2. Compare with partner and correct any missed pair or fact.
3. Rate themselves on I can list pairs, spot multiples, sort prime or composite.

Say: Show what you can do on your own. List every pair. Give the times fact to prove a multiple. Give the full factor list to prove prime or composite. Then check yourself against our goals.

Ask: List all factor pairs for 18. (1 x 18, 2 x 9, 3 x 6.) · Is 56 a multiple of 7? (Yes, 7 x 8 = 56.) · Is 17 prime or composite? Why? (Prime, only 1 and 17 [13].)

Check understanding: Collect exit tickets. If more than a third miss pairs or call 1 prime, reteach with tiles in small group tomorrow.

Support: Allow multiplication chart for checking 18 and 56, but require writing the pair or fact. **Stretch:** Add: True or false, 35 is a multiple of 5? Explain with 5 x 7 = 35.

Use: Slide 11

Common mistakes

Mistake	How to spot it	How to fix it
Listing multiples when asked for factors, like 12, 24, 36 for factors of 12	Answers are bigger than the target number	Remind factors fit in and are the target or smaller, multiples grow out [12]; cross out any number over the target.
Missing 1 and the number itself or missing the square pair like 6 x 6	List starts at 2 or has even count for a square number	Always start with 1 times the number [4] and test in order until pairs meet; 6 x 6 counts once [16].
Calling 1 prime	Student says 1 has two factors or stamps 1 as prime	List factors of 1: only 1. It is neither prime nor composite because it has only one factor [13].

Support

- Start with 6 tiles and 8 tiles only to find 1 x 6, 2 x 3 and 1 x 8, 2 x 4 using tiles [11].
- Give multiplication chart and factor rainbow arcs to see pairs before writing lists.
- Use sentence frames for factor-multiple links and limit prime hunt to 1-15 with tiles first.

Stretch

- Try 36 tiles and check if any rectangle is a square, then explain why it has an odd number of factors.
- Predict arches for 48 or 60 from 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 [16] and defend if 5 is both a factor and multiple of 5.
- Test if 51 is prime or composite by trying factor pairs and divisibility by 3.

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For the LSE or teaching assistant

Sit with target pairs in main activity. Prompt trying 2, 3, 4 in order, help draw rectangles and write pairs. In plenary, scribe pairs if needed and check 1 is marked neither.

Check for understanding

Question	Answer
List all factor pairs for 18.	1 x 18, 2 x 9, 3 x 6
Is 56 a multiple of 7? Give the fact.	Yes, 7 x 8 = 56
Is 17 prime or composite? Why?	Prime, only factors are 1 and 17 [13]

Homework

Find all factor pairs for 36, list factors in order, and tell if 36 is prime or composite.

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