

Factor Detective Lab

Build arrays and justify every classification

GRADE 5 • 5.NS.2.a

5.NS.2.a "Given a whole number up to 100, create a concrete or pictorial representation to demonstrate whether the number is prime or composite, and justify reasoning."

NAME _____

DATE _____

For each task, build with counters or create a dot array in the box. Label rows and columns, record factor pairs, classify and justify. Use the writing lines for reasoning; show actual arrays, not just equations.

Build understanding

Use up to 100 counters. An array has equal rows with no gaps. A number greater than 1 is prime if its only factors are 1 and itself; it is composite if another equal-row arrangement works. One long row alone never proves a number is prime. Test possible row counts until the next row count squared exceeds the number; later pairs only reverse earlier ones.

Try it together

Build 10 counters in two equal rows. What does the array prove?

Two rows of five use all 10 counters. The factors 2 and 5 differ from 1 and 10. 10 is composite. The 2-by-5 array is sufficient evidence.

Two rows of five unit cells

1. Investigate 12

Investigate 12. Create an array model and decide prime or composite. For a prime claim, record the row counts you tested and why the search is complete.

2. Investigate 13

Investigate 13. Create an array model and decide prime or composite. For a prime claim, record the row counts you tested and why the search is complete.

--

3. Investigate 21

Investigate 21. Create an array model and decide prime or composite. For a prime claim, record the row counts you tested and why the search is complete.

--

4. Investigate 29

Investigate 29. Create an array model and decide prime or composite. For a prime claim, record the row counts you tested and why the search is complete.

5. A square arrangement

A club has 49 counters. Is 49 prime or composite? Create an array that proves your decision. Record all factor pairs, including a square array if one is possible.

6. Ninety-six counters

A teacher has 96 counters. Arrange all of them in 6 equal rows. Draw a labeled model, find the columns and use it to justify a prime or composite classification.

7. Check the exceptions

Show 1 counter and then 0 counters in two labeled parts of the box. Explain why neither 1 nor 0 is prime or composite. Use the requirement that prime and composite numbers are greater than 1.

Teacher notes

Check actual counters or complete dot arrays, with row tests for prime claims. One nontrivial array proves a composite unless all pairs are requested. A factor list alone is insufficient; rotations repeat the same pair.

Task 1

Composite: 1×12 , 2×6 , 3×4 . Require a nontrivial array.

Task 2

Prime: only 1×13 . Show a 1-by-13 array. Tests of 2 and 3 rows leave leftovers; $4 \times 4 > 13$ ends the search.

Task 3

Composite: 1×21 and 3×7 . Require a 3-by-7 array.

Task 4

Prime: only 1×29 . Show 1-by-29 and leftover tests for 2, 3, 4 and 5 rows; $6 \times 6 > 29$ ends the search.

Task 5

Composite: 1×49 and 7×7 .

Require a 7-by-7 array showing the nontrivial factors.

Task 6

Composite: $96 / 6 = 16$ columns.

Check the labeled 6-by-16 array uses all 96 counters.

Task 7

1 has only one positive factor, so it is not prime; 0 and 1 are not greater than 1, so neither is prime or composite. Show one counter for 1 and an empty region labeled 0.