Number Cue Cards

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Square Number

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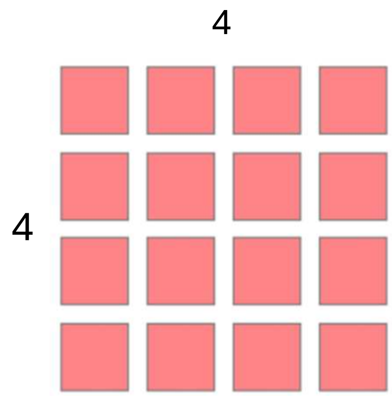
Square or Not?

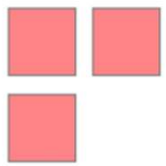
Finding square numbers with counters is about arranging all your counters into an array with the same number of rows and columns. If you can, the number is square. If you can't, it's not square.

How to decide if a number is square or not using counters:

- **Pick a target number (N)**. For your target number, choose the correct number of counters. No counters? Sketch them instead.
- **Build equal rows and columns.** Arrange your N counters into an array.
- **Square or not square?** If you can make an array with the same number of rows and columns (e.g., n x n), the number is square. If you can't, it's not square.
- **State your final answer clearly**. N is a square number because I can make an array using N counters that is exactly n x n. N is not a square number because I can't make an array that is exactly n x n.



16 is a square number because I can make an array that is exactly 4 x 4 using 16 counters.



3 is not a square number because I can't make an array that has the same number of rows and columns using 3 counters.

How to Identify a Square Number on a Multiplication Grid

To **identify a square number**, we can use a multiplication grid.

How to find a square number on a multiplication grid:

- **Find the same row and column**. Look down the left-hand side for a number, then look across the top for the same number. The place where that row and column meet is n x n, which is a square number. No grid? Draw your own instead.
- **Scan the main diagonal.** Alternatively, start at 1 x 1 in the top-left and move diagonally down-right: 2 x 2, 3 x 3, 4 x 4, and so on. Every intersection you touch on is a square number.
- **Name the square clearly.** Say it as “n squared” and write it as n^2. For example, at the 5-row and 5-column intersection, read “five squared” and note 5^2 = 5 x 5 = 25.
- **Build the diagonal list**. Write the diagonal values to make a quick reference strip. Keep it beside the grid for rapid spotting in lessons, tests and exams.

	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

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1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144

Square Root

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How to Identify the Square Root of a Number

A square root of a number is a value that can be multiplied by itself to give the original number. It is written with the symbol √.

How to find a square root of a number on a multiplication grid:

- **Locate the Diagonal.** Find the diagonal line where the row and column numbers are the same (1×1, 2×2, 3×3…).
- **Spot the Square Number.** Numbers on this diagonal are perfect squares (e.g., 9, 16, 25, 36).
- **Read the Row/Column.** The number at the row/column tells you the square root. Example: 36 is at 6×6 → $\sqrt{36} = 6$.
- **Check Off-Diagonal Numbers.** If the number is not on the diagonal (like 20 at 4×5), it's not a perfect square. Its square root will not be a whole number.

	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

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Factor

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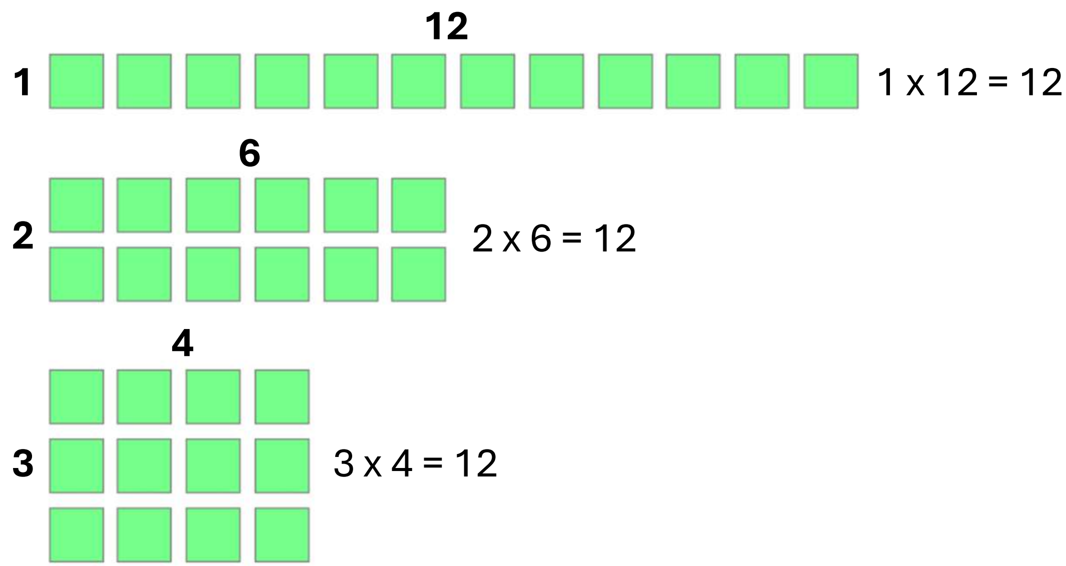
How to Find the Factors of a Number Using Counters

Finding factors with counters is about arranging all your counters into full, even arrays (no gaps, no leftovers). Each valid array gives you a factor pair.

How to determine the factors of a number using counters:

- **Pick a target number (N)**. For your target number, choose the correct number of counters. No counters? Sketch them instead.
- **Start with 1-row.** Make 1 row with all N counters. Since 1 and N will always be the factors of N, this will always work. State the factor pairs.
- **Systematically test row sizes.** Increase rows one by one. Try 2 rows, then 3, then 4, etc… If the counters split into equal rows with no leftovers, you've found a factor. If not, that row size is not a factor and you can move on. Write the factor pairs for every valid array.
- **Stop half-way.** You only need to test row sizes up to the square root of N. Beyond that, you'll just repeat the same pairs reversed.
- **State your final answer clearly**. Write all the factor pairs neatly.

Example: What are the factors of 12?



Factors of 12: 1 and 12, 2 and 6, 3 and 4

Prime Number

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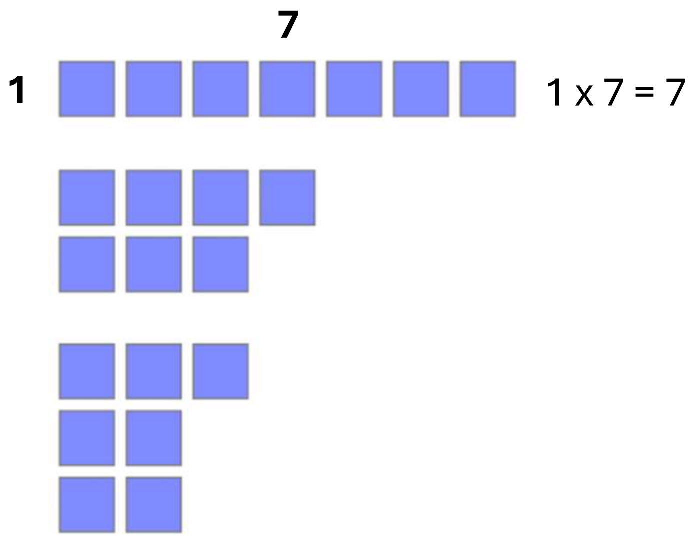
Prime or Not?

Finding prime numbers with counters is about arranging all your counters into arrays. If there is gaps or leftover counters, the number is prime.

How to determine if a number is prime or not using counters:

- **Pick a target number (N)**. For your target number, choose the correct number of counters. No counters? Sketch them instead.
- **Start with 1-row.** Make 1 row with all N counters. Since 1 and N will always be the factors of N, this will always work. State the factor pairs.
- **Systematically test row sizes.** Increase rows one by one. Try 2 rows, then 3, then 4, etc… If the counters split into equal rows with no leftovers, you've found a factor and the number is not prime. If not, that row size is not a factor and you can move on.
- **State your final answer clearly**. Write all the factor pairs neatly.

Example: Is 7 a prime number?



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Answer: 7 is a prime number because the only array I can make with 7 counters is 1 x 7 and 7 x 1

How to Identify a Prime Numbers on a 100-Square

Prime numbers have exactly two factors: 1 and themselves. The number 1 is not prime. Use your 100-square grid and follow this sieve-style process to reveal all primes up to 100.

- **Start with 1.** 1 doesn't have two factors so cross it out.
- **Move onto 2.** 2 is the only even prime number. Highlight 2 and cross out its multiples (e.g., 4, 6, 8, ..., 100.) REASON: All even numbers >2 are multiples of 2, they cannot be prime.
- **Move onto 3.** Circle 3 and cross out multiples of 3 (e.g., 6, 9, 12, 15...,99). REASON: 3 is a prime number, whereas multiples of 3 will always have more than two factors: 1, 3 and the number itself.
- **Skip crossed numbers (e.g., 4).**
- **Repeat for 5.** Circle 5. Cross out 10, 15, 20, ..., 100. REASON: 5 is a prime number, whereas multiples of 5 will always have more than two factors: 1, 5 and the number itself.
- **Repeat for 7:** Circle 7. Cross out 14, 21, 28, ..., 98.
- **Stop after checking 10.** You only need to sieve with primes up to 10. REASON: Any composite ≤100 has a prime factor ≤10.
- **Circle all remaining un-crossed numbers.**
- **Result.** These are the primes on your 100 square.

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

Acknowledgements

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