

1 Identifying Prime and Composite Numbers

Prime Numbers

A prime number is a whole number (1 or greater) with exactly two whole-number factors, 1 and the number itself.

- A prime number can be written as the product of only two whole numbers, $1 \times$ the number itself.

For example, 11 is prime because $11 = 1 \times 11$ and no other pair of whole numbers will work to make the equation true.

- One way to figure out if a number is prime is to divide it by other whole numbers (other than 1 or the number itself).

- If there is no remainder, then the number is not prime.

- If you try every number and there is a remainder each time, then the number is prime.

For example:

12 is not prime because ...
 $12 \div 3 = 4$.

7 is prime because ...

$7 \div 2 = 3 \text{ R}1$.

$7 \div 3 = 2 \text{ R}1$.

$7 \div 4 = 1 \text{ R}3$.

$7 \div 5 = 1 \text{ R}2$.

$7 \div 6 = 1 \text{ R}1$.

- Another way to figure out if a number is prime is to make rectangles with an area equal to that number of square tiles. If only one rectangle is possible, the number is prime.

For example, 7 is prime because you can create only one rectangle with 7 tiles.



The rectangle's dimensions are the two whole-number factors of 7 ($7 = 1 \times 7$).

You may see two rectangles, a 1-by-7 one and a 7-by-1 one, but the rectangles are the same rectangle turned 90° .

Prime Numbers (continued)

- Here are all the prime numbers up to 100.

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

Prime numbers to 100

- You should notice the following:
- There isn't a clear pattern to the prime numbers.
 - All prime numbers are odd, except for 2.
 - Not all odd numbers are prime (e.g., 9, 15, 21, ...).

Composite Numbers

A composite number is any whole number other than 1 that is not a prime number. A composite number has more than two factors.

For example, 4, 6, 8, 9, and 10 are all composite numbers.

- A composite number can be written as the product of two whole numbers in addition to $1 \times$ the number itself.

For example, 20 is composite because $20 = 4 \times 5$ and 10×2 as well as 1×20 .

- One way to figure out if a number is composite is to divide it by another whole number (other than 1 or the number itself). If there is no remainder, the number is composite.

For example, 15 is composite because $15 \div 3 = 5$.

Composite Numbers (continued)

- Another way to figure out if a number is composite is to make rectangles with an area equal to that number of square tiles. If more than one rectangle is possible, the number is composite.

For example, 8 is composite because you can create more than one rectangle with 8 tiles.



The rectangles' dimensions are the whole-number factors of 8 (1×8 and 2×4).

- In the 100-chart that shows prime numbers, notice the following about composite numbers:
 - There isn't a clear pattern to the composite numbers.
 - All even numbers, except for 2, are composite.
 - Many composite numbers are odd (e.g., 9, 15, 21, ...).

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

Prime numbers to 100

Why 1 and 0 Are Special

- The number 1 is a special number because it is neither prime nor composite. We know that prime numbers have two factors, 1 and the number itself, and we know that composite numbers have more than two whole-number factors. The number 1 has only one whole-number factor, 1 (since $1 = 1 \times 1$), so it is neither prime nor composite.
- The number 0 is also special. Prime and composite numbers are defined as whole numbers 1 or greater, so 0 is not considered when deciding if a number is prime or composite.

Definitions

composite number: a whole number that has more than two whole-number factors; for example, 8 is composite because it can be written as 1×8 or 2×4

even number: a whole number that can be grouped into two equal groups; for example, 100 is even because $100 = 50 + 50$

factor: one of the numbers you multiply in a multiplication sentence; for example, in $2 \times 5 = 10$, 2 and 5 are factors

odd number: a whole number that cannot be grouped into two equal groups; for example, 101 is odd because $101 = 50 + 50 + 1$

prime number: a whole number with exactly two whole-number factors, 1 and the number itself; for example, 5 is prime because 5 can only be written as a product as 1×5

product: the result of multiplying; for example, in $3 \times 4 = 12$, 12 is the product

whole numbers: the counting numbers and 0; i.e., 0, 1, 2, 3, ...