Composite Numbers Example

Factor 84 and verify why it is composite

WORKED EXAMPLE

A composite number is a whole number greater than 1 with more than two positive factors. Factoring into primes gives a reliable way to list and count every divisor.

Problem

Show that 84 is composite and find its prime factorization.

KEY FACT	VALUE
Number	84
Prime factorization	2^2 x 3 x 7
Positive factor count	(2 + 1)(1 + 1)(1 + 1) = 12

Step-by-step solution

1. Find a factor pair

84 is even, so divide by 2. The pair 2 and 42 is a nontrivial factor pair, which is enough to show 84 is composite.

84 = 2 x 42

2. Continue factoring into primes

Factor 42 as 2 x 21, then factor 21 as 3 x 7. All factors are now prime.

84 = 2 x 2 x 3 x 7 = 2^2 x 3 x 7

3. List the positive factors

Combine the prime powers in every possible way to obtain all positive divisors.

1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84

4. Count the choices

For 2^2 there are three exponent choices; for 3 and 7 there are two each. Their product is the number of divisors.

(2 + 1)(1 + 1)(1 + 1) = 12

ANSWER

84 is composite. Its prime factorization is 2^2 x 3 x 7, and it has 12 positive factors.

Check

Multiplying the primes back gives 2 x 2 x 3 x 7 = 84. Also, 2 x 42 = 84 is a direct factor-pair check.