PRIME NUMBERS - PRIME DECOMPOSITION

Numbers that have only 2 factors are called prime numbers. The first prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, 23, etc

A number that is not a prime is called a composite number.

Any composite number can be expressed as a product of its prime factors.

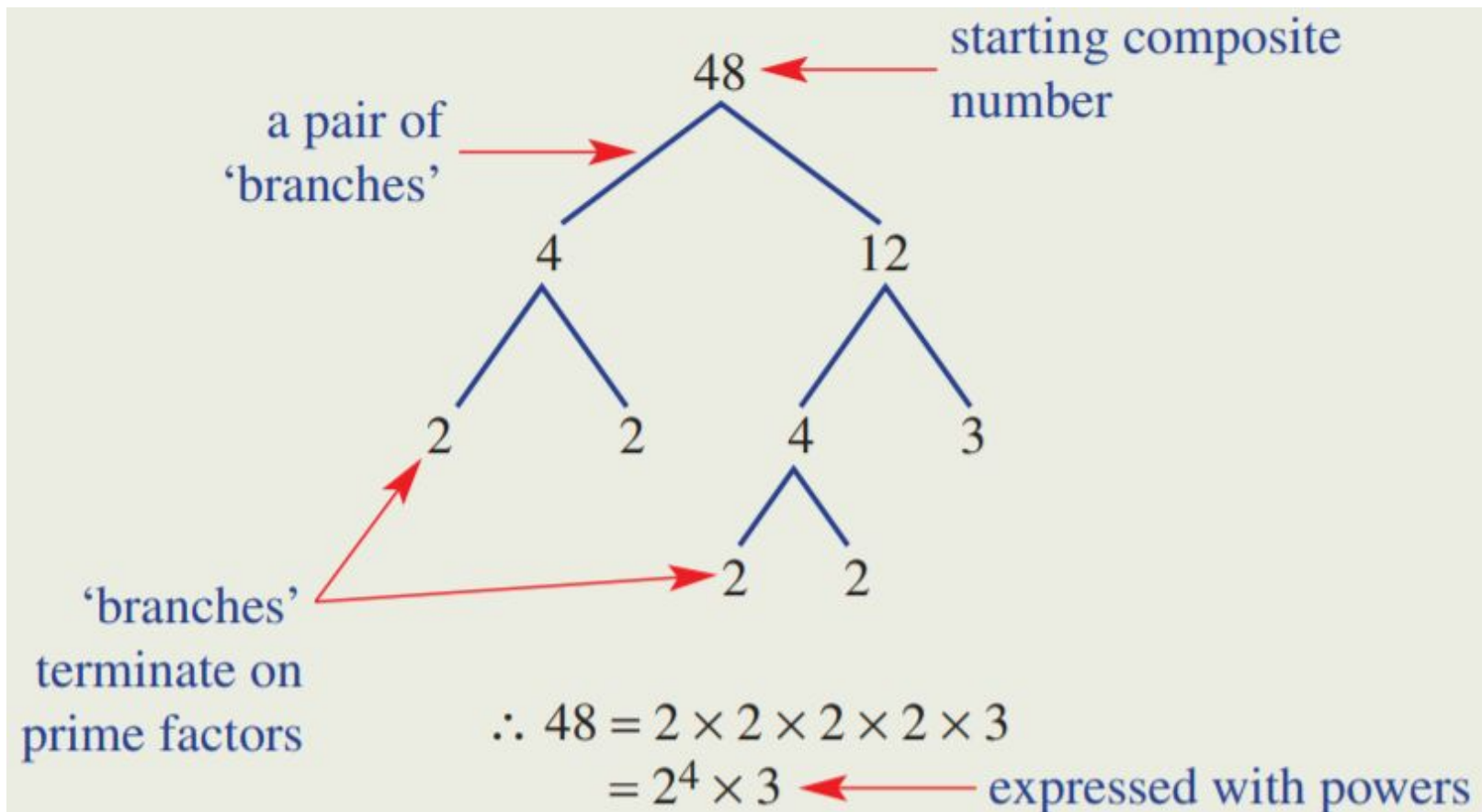Example: 8190 is not a prime. It can be decomposed as:

$8190 = 2 \times 3 \times 3 \times 5 \times 7 \times 13$ (also noted $2 \times 3^2 \times 5 \times 7 \times 13$)

To decompose a number into prime factors, use Shift FACT on the calculator.

FACTOR TREE

A factor tree can be used to show the prime factors of a composite number.

starting composite number

a pair of 'branches'

48

4   12

2   2   4   3

'branches' terminate on prime factors

2   2

$\therefore 48 = 2 \times 2 \times 2 \times 2 \times 3$
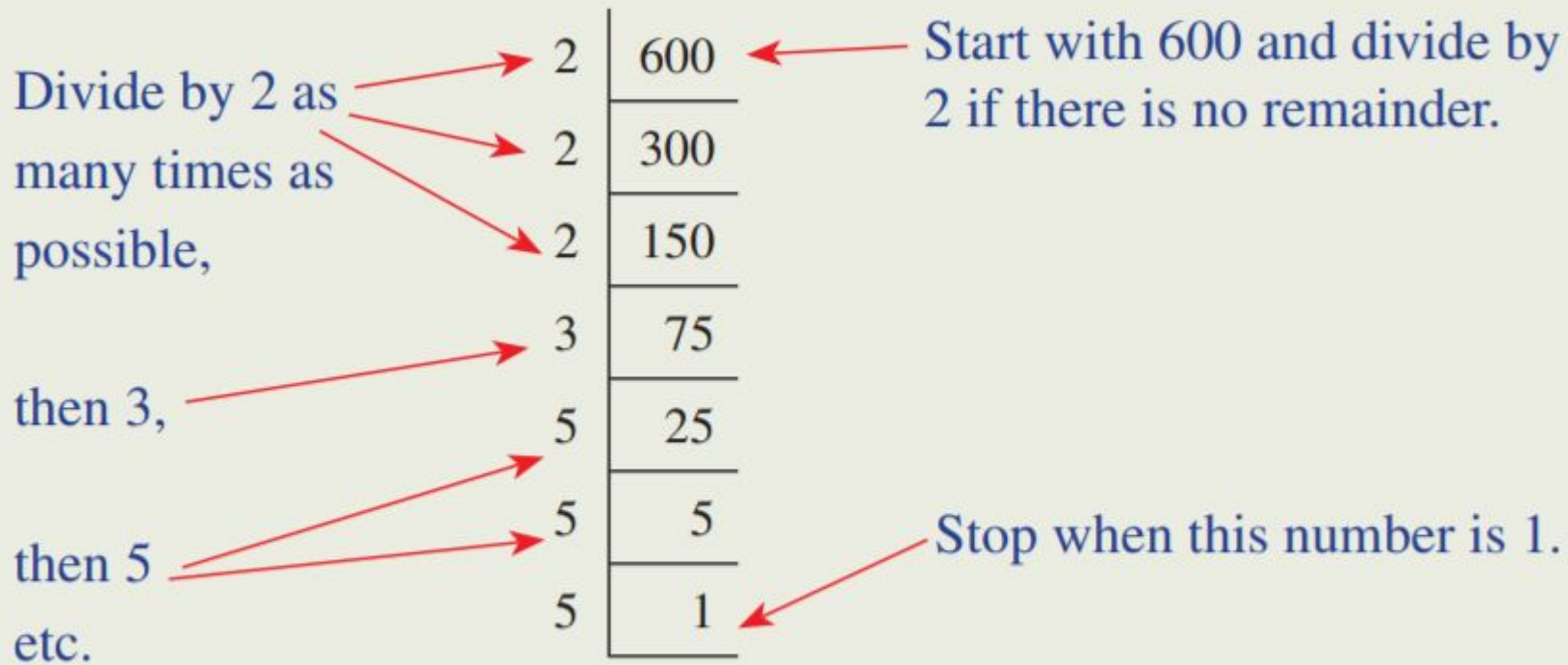$= 2^4 \times 3$ ← expressed with powers

FACTOR TREE (CONT.)

- Each branch of the factor tree eventually terminates in a prime factor.

- It does not matter with which pair of factors you start a factor tree. <u>The final set of prime factors will always be the same</u>.

- It is conventional to write the prime factors of a composite number in ascending order.

  Example: $360 = 2^3 \times 3^2 \times 5$

(rather than $5 \times 2^3 \times 3^2$ or $3^2 \times 5 \times 2^3$ or any other order)

FACTOR TREE (CONT.)

Here is another way to decompose a number, using division by prime numbers.

Divide by 2 as many times as possible,

2	600	← Start with 600 and divide by 2 if there is no remainder.
2	300	
2	150	

then 3,

3	75

then 5 etc.

5	25
5	5	Stop when this number is 1.
5	1	

$$600 = 2 \times 2 \times 2 \times 3 \times 5 \times 5$$
$$600 = 2^3 \times 3 \times 5^2$$