

4 Prime Factorization

Find all the prime numbers to 50.

First, list the numbers from 1 to 50:

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

Cross out 1, since it is not a prime number.

Except for 2 itself, cross out all the remaining numbers that have 2 as a factor.

Except for 3 itself, cross out all the remaining numbers that have 3 as a factor.

Why do we not have to cross out numbers that have 4 as a factor?

Except for 5 itself, cross out all the remaining numbers that have 5 as a factor.

Why do we not have to cross out numbers that have 6 as a factor?

Except for 7 itself, cross out all the remaining numbers that have 7 as a factor.

Why can we stop after crossing out numbers that have 7 as a factor?

List the numbers to 50 that have not been crossed out. These are the prime numbers less than 50.

What do you notice about the ones digits of these prime numbers?

There are some pairs of prime numbers whose difference is two. These are called twin primes. 3 and 5 are twin primes. List all the twin primes less than 50.

A **prime number** is a number greater than 1. It has exactly two factors, 1 and the number itself.



A **composite number** has at least two factors that are not 1. The number 1 is neither prime nor composite.



1. The factors of 12 are 1, 2, 3, 4, 6 and 12.
Which factors of 12 are prime factors?

Prime factors are any factors of a number which are prime numbers.



2. Express 12 as a product of prime factors only.

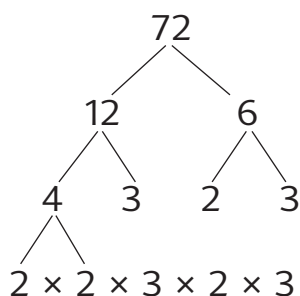
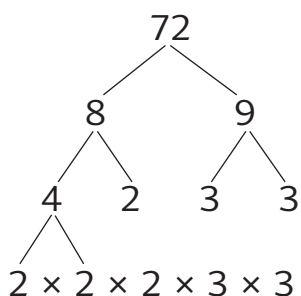
$$12 = \square \times \square \times \square$$

3. Find the prime factorization of 72.

Prime factorization is the process of factoring a composite number into its prime factors.



Method 1: Use a factor tree.



Method 2: Use continuous division, starting with the lowest prime number that is a factor.

$$\begin{array}{r|l}
 2 & 72 \\
 \hline
 2 & 36 \\
 \hline
 2 & 18 \\
 \hline
 3 & 9 \\
 \hline
 3 & 3 \\
 \hline
 & 1
 \end{array}$$

$$72 = 2 \times 2 \times 2 \times 3 \times 3$$

4. Find the prime factorization of the following numbers.

(a) 15

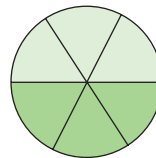
(b) 50

(c) 36

3 Addition and Subtraction of Unlike Fractions

Ann ate $\frac{1}{3}$ of a cake.

Her brother ate $\frac{1}{2}$ of the same cake.



What fraction of the cake did they eat altogether?

$$\frac{1}{3} + \frac{1}{2} = \frac{2}{6} + \frac{3}{6}$$

$$= \text{orange square}$$

The cake is divided into 6 equal parts.
Ann ate 2 parts and her brother ate 3 parts.



They ate orange square of the cake altogether.

$\frac{1}{3}$ and $\frac{1}{2}$ do not have the same denominator.

They are called **unlike fractions**.

$\frac{2}{6}$ and $\frac{3}{6}$ have the same denominator.

They are called **like fractions**.

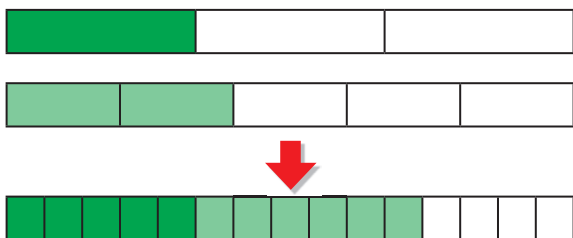
We can change unlike fractions to like fractions using equivalent fractions:

$$\frac{1}{3}, \frac{2}{6}, \dots$$

$$\frac{1}{2}, \frac{3}{6}, \dots$$



1. (a) Add $\frac{1}{3}$ and $\frac{2}{5}$.



$$\frac{1}{3} + \frac{2}{5} = \frac{\text{orange square}}{15} + \frac{\text{orange square}}{15}$$

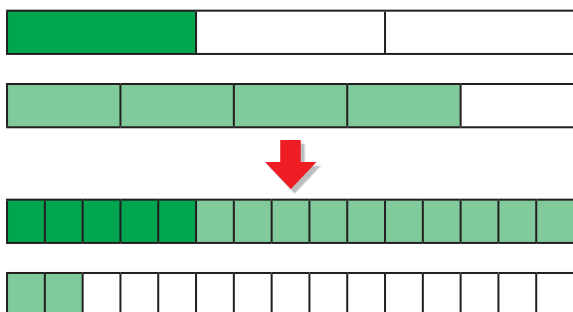
$$= \frac{\text{orange square}}{15}$$

15 is a common multiple of 3 and 5.

We can estimate the answer. $\frac{1}{3}$ and $\frac{2}{5}$ are both less than 1. The answer will be less than 1.



- (b) Add $\frac{1}{3}$ and $\frac{4}{5}$.



$$\frac{1}{3} + \frac{4}{5} = \frac{\text{orange square}}{15} + \frac{\text{orange square}}{15}$$

$$= \frac{\text{orange square}}{15}$$

$$= \text{orange square}$$

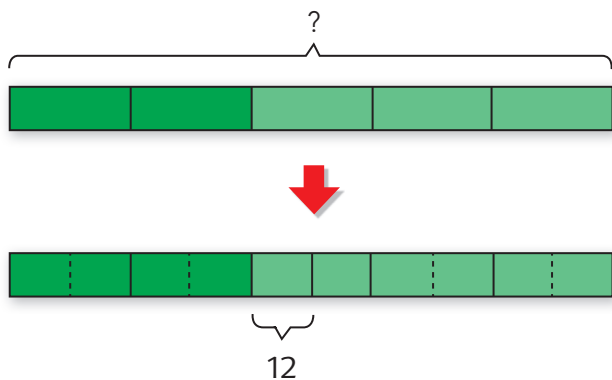
$\frac{1}{3}$ is less than $\frac{1}{2}$. $\frac{4}{5}$ is close to 1. We can estimate that the answer may be greater than 1 but less than $1\frac{1}{2}$.



4. Lindsey read $\frac{2}{5}$ of a book on Monday.

She read 12 pages on Tuesday.

If she still had $\frac{1}{2}$ of the book to read, how many pages were there in the book?



1 unit = 12

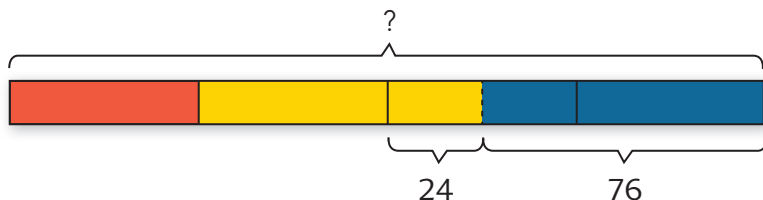
10 units =

5. Of the beads in a box, $\frac{1}{4}$ are red.

There are 24 more yellow beads than red beads.

The remaining 76 beads are blue.

How many beads are there altogether?



$\frac{1}{2}$ \longrightarrow $24 + 76 =$ beads

1 \longrightarrow beads