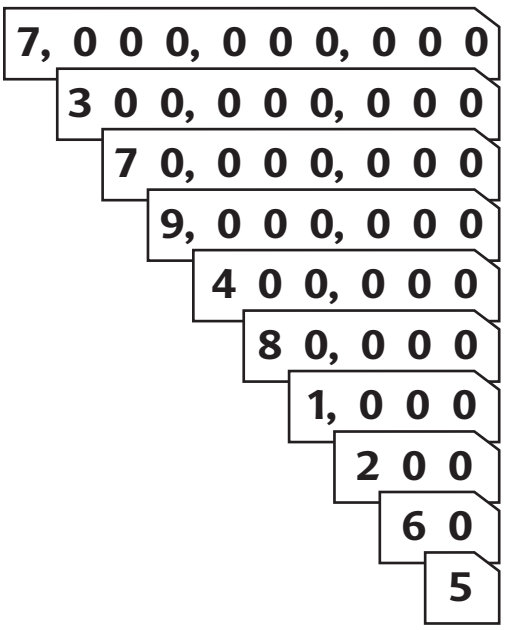
Unit 1 : Whole Numbers

Friendly Notes

Large Numbers

The number 7,379,481,265 can be represented as shown below.



Standard form: 7,379,481,265

Expanded form: 7,000,000,000 + 300,000,000 + 70,000,000 + 9,000,000 + 400,000 + 80,000 + 1,000 + 200 + 60 + 5

The number 7,379,481,265 written in words is seven billion, three hundred seventy-nine million, four hundred eighty-one thousand, two hundred sixty-five.

7,379,481,265
Starting from the right, each group of 3 digits forms a **period**. Commas separate the periods.

Billions			Millions			Thousands			Ones		
Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones
		7	3	7	9	4	8	1	2	6	5

The place value of 3 in 7,379,481,265 is hundred millions.

The digit 4 is in the hundred thousands place.

The value of the digit 9 is 9,000,000.

1 billion less than 7,379,481,265 is 6,379,481,265.

Which number is smaller, 8,425,678,900 or 8,455,678,837?

8,4**2**5,678,900

8,4**5**5,678,837

20 million is less than 50 million.

8,425,678,900 is smaller.

Approximation and Estimation

To round a number to a certain place value, we look at the digit in the next lower place value. If it is less than 5, we round down. If it is 5 or greater, we round up.

1. Round 1,345,826,917 to the nearest hundred million.

   What digit is in the hundred millions place?

   1,345,826,917

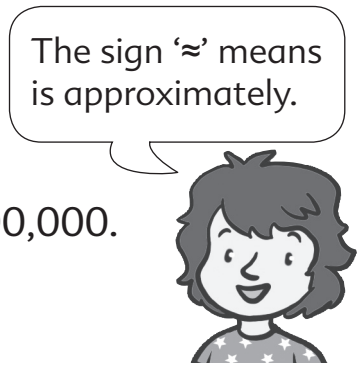
   What digit is in the next lower place value?

   1,345,826,917

   Do we round up or down?

   1,345,826,917 ≈ 1,300,000,000

   1,345,826,917 is approximately 1,300,000,000.



2. Round 426,839,105 to the nearest ten million.

   What digit is in the ten millions place?

   426,839,105

   What digit is in the next lower place value?

   426,839,105

   Do we round up or down?

   426,839,105 ≈ 430,000,000

   426,839,105 is approximately 430,000,000.

3. Round each number to the nearest ten million.
Then estimate the value of each of the following.

(a) 386,591,200 + 123,456,789

(b) 827,356,409 − 453,608,721

(a) 386,591,200 + 123,456,789
≈ 390,000,000 + 120,000,000
= 510,000,000

(b) 827,356,409 − 453,608,721
≈ 830,000,000 − 450,000,000
= 380,000,000

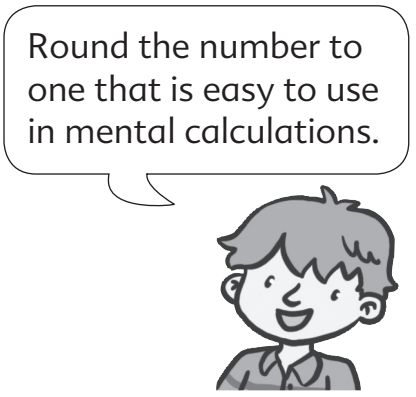
4. Estimate the value of each of the following.

(a) 11,021,040 × 5

(b) 84,976,314 ÷ 3

(a) 11,021,040 × 5
≈ 11,000,000 × 5
= 55,000,000

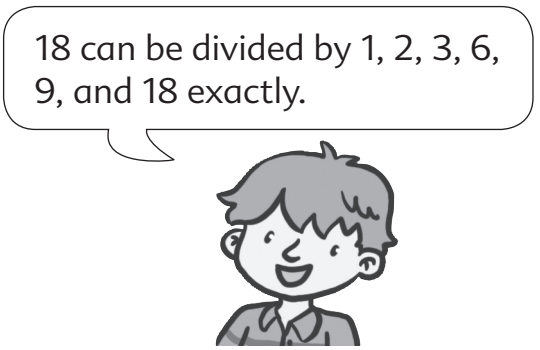
(b) 84,976,314 ÷ 3
≈ 90,000,000 ÷ 3
= 30,000,000



Factors and Multiples

Factors of a certain number divide the number exactly. A whole number can be expressed as a product of factors.

1. Find the factors of 18.



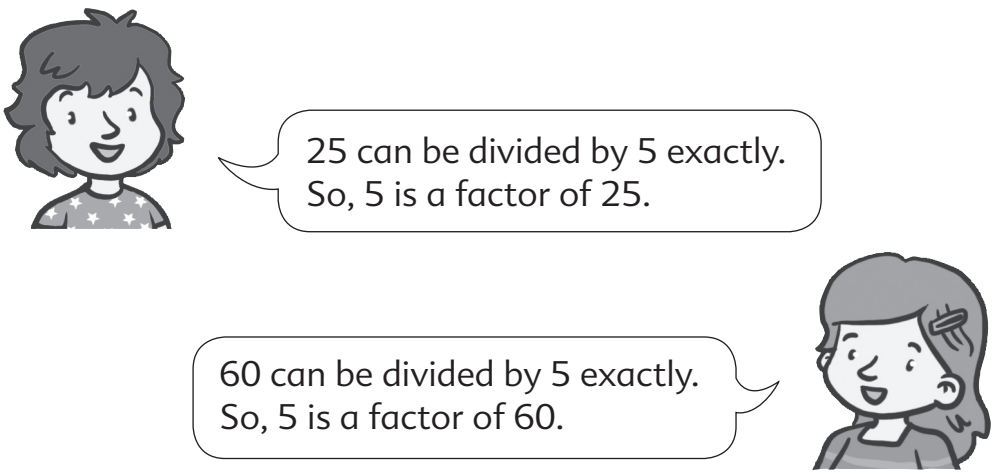
$18 = 1 \times 18$

$18 = 2 \times 9$

$18 = 3 \times 6$

The factors of 18 are 1, 2, 3, 6, 9, and 18.

2. Is 5 a common factor of 25 and 60?



As 5 is a factor of both 25 and 60, it is a **common factor** of 25 and 60.

Multiples of a number can be obtained by multiplying the number by whole numbers.

3. List the first four multiples of 6.

$1 \times 6 = 6$

$2 \times 6 = 12$

$3 \times 6 = 18$

$4 \times 6 = 24$

The first four multiples of 6 are 6, 12, 18, and 24.

4. Is 98 a common multiple of 2 and 7?

$$\begin{array}{r} 49 \\ 2\overline{)98} \\ 8 \\ \hline 18 \\ 18 \\ \hline 0 \end{array} \qquad \begin{array}{r} 14 \\ 7\overline{)98} \\ 7 \\ \hline 28 \\ 28 \\ \hline 0 \end{array}$$

Since 98 can be divided by both 2 and 7, 98 is a common multiple of 2 and 7.

Prime Factorization

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

A **composite number** is a whole number greater than 1 which has at least two factors that are not 1.

The numbers 0 and 1 are neither prime nor composite.

1. Identify
   (a) the prime numbers, and
   (b) the composite numbers, in the following.

   3, 4, 7, 21, 31, 47

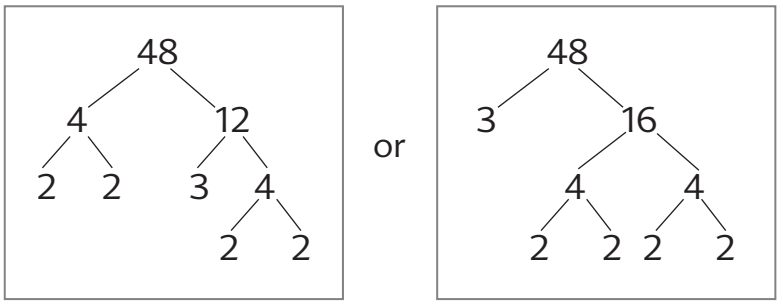
   (a) The prime numbers are 3, 7, 31, and 47.
   (b) The composite numbers are 4 and 21.

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

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

2. Express 48 as a product of prime factors only.

   Method 1: Use a factor tree.



$48 = 2 \times 2 \times 2 \times 2 \times 3$
$= 2^4 \times 3$

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

2	48
2	24
2	12
2	6
3	3
	1

$48 = 2 \times 2 \times 2 \times 2 \times 3$
$= 2^4 \times 3$

In 2^4, 2 is the base and 4 is the exponent.
The **exponent** tells us how many times the base is used as a factor.

3. Write each of the following using exponents.

(a) $5 \times 5 \times 5 \times 5 \times 5 \times 5$

(b) $3 \times 3 \times 3 \times 3 \times 7 \times 7 \times 7$

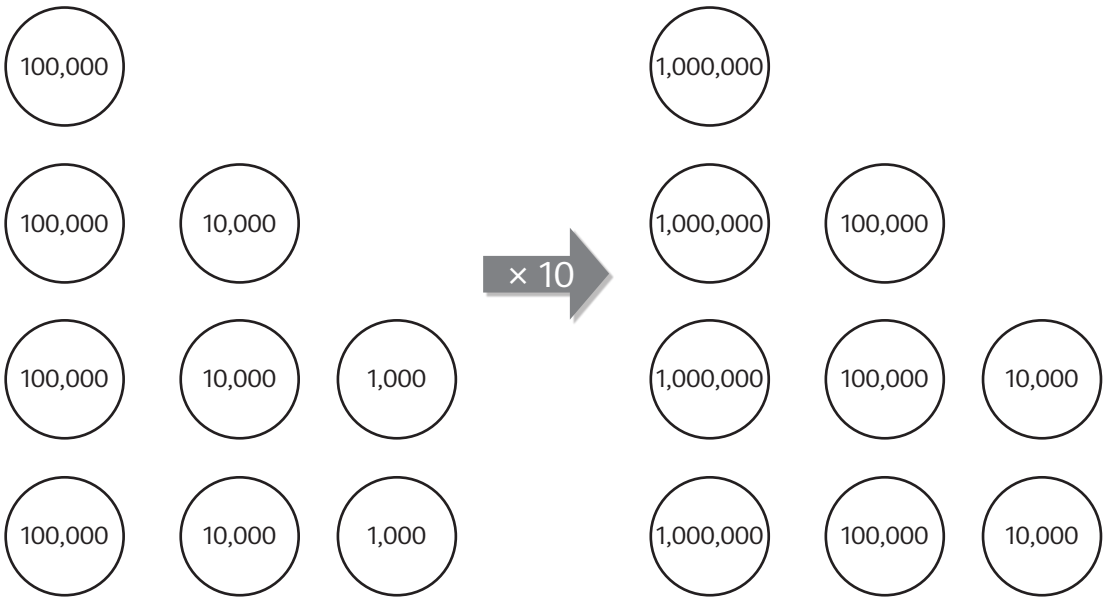
(a) $5 \times 5 \times 5 \times 5 \times 5 \times 5 = 5^6$

(b) $3 \times 3 \times 3 \times 3 \times 7 \times 7 \times 7 = 3^4 \times 7^3$

Multiplying by Tens, Hundreds, or Thousands

When multiplying a whole number by 10, the number is increased 10 times.

1. Multiply 432,000 by 10.



$432{,}000 \times \mathbf{10} = 4{,}320{,}00\mathbf{0}$

$432{,}000 \times 10^{\mathbf{1}} = 4{,}320{,}00\mathbf{0}$

2. Multiply 432,000 by 20.

$$\begin{aligned} 432{,}000 \times 2\mathbf{0} &= 432{,}000 \times 2 \times 1\mathbf{0} \\ &= 864{,}000 \times 1\mathbf{0} \\ &= 8{,}640{,}00\mathbf{0} \end{aligned}$$

Multiply 432,000 by 2 first.
$432{,}000 \times 2 = 864{,}000$

When multiplying a whole number by 100, the number is increased 100 times.

3. Multiply 150,000 by 100.

$150{,}000 \times 1\mathbf{00} = 15{,}000{,}0\mathbf{00}$

$150{,}000 \times 10^2 = 15{,}000{,}0\mathbf{00}$

4. Multiply 150,000 by 300.

$$\begin{aligned} 150{,}000 \times 3\mathbf{00} &= 150{,}000 \times 3 \times 1\mathbf{00} \\ &= 450{,}000 \times 1\mathbf{00} \\ &= 45{,}000{,}0\mathbf{00} \end{aligned}$$

When multiplying a whole number by 1,000, the number is increased 1,000 times.

5. Multiply 240,000 by 1,000.

$240{,}000 \times 1{,}\mathbf{000} = 240{,}000{,}\mathbf{000}$

$240{,}000 \times 10^3 = 240{,}000{,}\mathbf{000}$

6. Multiply 240,000 by 4,000.

$$\begin{aligned} 240{,}000 \times 4{,}\mathbf{000} &= 240{,}000 \times 4 \times 1{,}\mathbf{000} \\ &= 960{,}000 \times 1{,}\mathbf{000} \\ &= 960{,}000{,}\mathbf{000} \end{aligned}$$

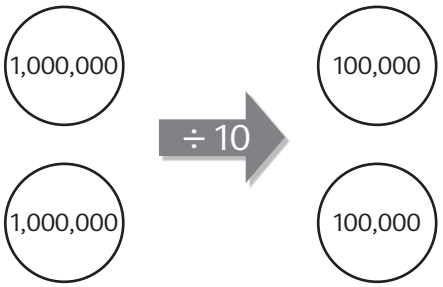
7. Estimate the value of $108{,}000 \times 2{,}015$.

$$\begin{aligned} 108{,}000 \times 2{,}015 &\approx 110{,}000 \times 2{,}\mathbf{000} \\ &= 220{,}000{,}\mathbf{000} \end{aligned}$$

Dividing by Tens, Hundreds, or Thousands

When dividing a whole number by 10, the number is reduced 10 times.

1. Divide 2,000,000 by 10.

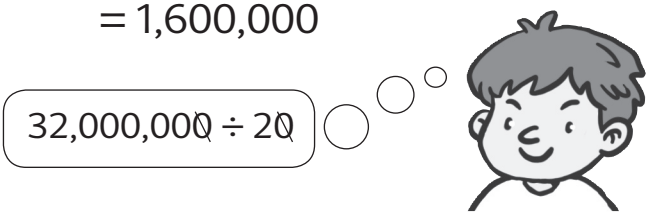


$2{,}000{,}00\mathbf{0} \div 1\mathbf{0} = 200{,}000$

$2{,}000{,}00\mathbf{0} \div 10^{1} = 200{,}000$

2. Divide 32,000,000 by 20.

$32{,}000{,}00\mathbf{0} \div 2\mathbf{0} = 32{,}000{,}00\mathbf{0} \div 1\mathbf{0} \div 2$
$= 3{,}200{,}000 \div 2$
$= 1{,}600{,}000$



When dividing a whole number by 100, the number is reduced 100 times.

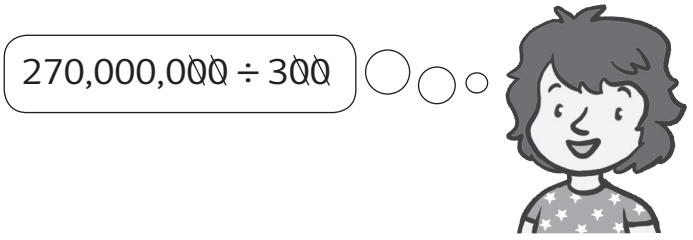
3. Divide 600,000,000 by 100.

$600{,}000{,}0\mathbf{00} \div 1\mathbf{00} = 6{,}000{,}000$

$600{,}000{,}0\mathbf{00} \div 10^{2} = 6{,}000{,}000$

4. Divide 270,000,000 by 300.

$270{,}000{,}0\mathbf{00} \div 3\mathbf{00} = 270{,}000{,}0\mathbf{00} \div 1\mathbf{00} \div 3$
$= 2{,}700{,}000 \div 3$
$= 900{,}000$



When dividing a whole number by 1,000, the number is reduced 1,000 times.

5. Divide 800,000,000 by 1,000.

$800{,}000{,}\mathbf{000} \div 1{,}\mathbf{000} = 800{,}000$

$800{,}000{,}\mathbf{000} \div 10^3 = 800{,}000$

6. Divide 750,000,000 by 5,000.

$750{,}000{,}\mathbf{000} \div 5{,}\mathbf{000} = 750{,}000{,}\mathbf{000} \div 1{,}\mathbf{000} \div 5$
$= 750{,}000 \div 5$
$= 150{,}000$

7. Estimate the value of 5,318,300,200 ÷ 6,955.

$5{,}318{,}300{,}200 \div 6955 \approx 5{,}600{,}000{,}\mathbf{000} \div 7{,}\mathbf{000}$
$= 800{,}000$