Multiplication and Division of Whole Numbers

Multiplication of whole numbers

Multiplication is the repeated addition of the same number.
The numbers that are multiplied are called **factors**. The answer is called the **product**.
The times sign **"x"** is one symbol that is used to mean multiplication.
The basic fact of multiplying one-digit numbers should be memorized.
Multiplication of larger numbers requires the repeated use of the basic multiplication facts.

A number multiplying by one digit

1. Multiply 4×7
2. Write the 8 in the ones' column and carry the 2 to the tens' column
3. The 3 in the 37 is 3 tens.
4. Multiply 4×3 tens and carry the digit.
5. Write 14.

	2
37	**37**
x 4	**x 4**
8	**148**

A number multiplying by larger numbers

47 **x 23** **141**	**47** **x 23** **141** **94**	**47** **x 23** **141** ——— **(3 * 47)** **940** **1081** **(20 * 47)**
Multiply the ones digit The last digit is written in the ones' column	Multiply the tens' digit The last digit is written in in the tens' column	Add **(141 + 94)**

Properties of Multiplication

The multiplication property of zero $a \times 0 = 0$ or $0 \times a = 0$

The multiplication property of one $a \times 1 = a$ or $1 \times a = a$

The commutative property of multiplication $a \times b = b \times a$

The associative property of multiplication $(a \times b) \times c = a \times (b \times c)$

Exponents

$4 * 4 * 4 * 4 * 4 = 4^5$

exponent

base

An exponent indicates how many times a base is multiplied by itself.
This example is read as "Four raised to the fifth power."

Division of whole numbers

Division may be represented by the symbol "÷"

Ex. $24 \div 4 = 6$

Notice that the quotient multiplied by the divisor equals the dividend.

6	x	4 =	24
quotient		divisor	dividend

Ex.

$$6\overline{)25}\quad 4,\ \underline{24},\ 1$$

In this example the divisor does not divide equally into the dividend and there is a remainder of 1.

Properties of Division

If $a \neq 0$, $0/a = 0$	Zero divided by any number other than zero is zero.
If $a \neq 0$, $a/a = 1$	Any number other than zero divided by itself is one.
$a / 1 = a$	A number divided by one is the number.
$a / 0$ is undefined	Division by zero is undefined.

Factors and prime factorization

Natural number factors of a number divide that number evenly (there is no remainder).

1,2,3, and 6 are natural number factors of 6 because they divide into 6 evenly.

$$1\overline{)6}\quad 6$$

$$2\overline{)6}\quad 3$$

$$3\overline{)6}\quad 2$$

$$6\overline{)6}\quad 1$$

Notice that both the divisor and the quotient are factors of the dividend.

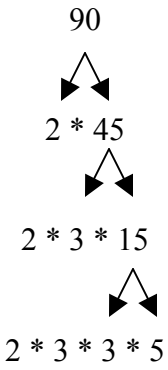
To find the factors of a number, try dividing the number by 1, 2, 3, 4, 5, … Those numbers that divide into the number evenly are its factors. Continue this process until the factors start to repeat.

A **prime number** is a natural number greater than one that has exactly two natural number factors, 1 and the number itself. 7 is prime because its only factors are 1 and 7. If a number is not prime, it is a **composite** number. 6 is a composite number since it has factors of 2 and 3.

The prime numbers less than 50 are:

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47.

The **prime factorization** of a number is the expression of the number as a product of its prime factors. To find the prime factors of 90, begin with the smallest prime number as a trial divisor and continue with prime numbers as trial divisors until the final quotient is prime.



The prime factorization of 90 is 2 * 3 * 3 * 5