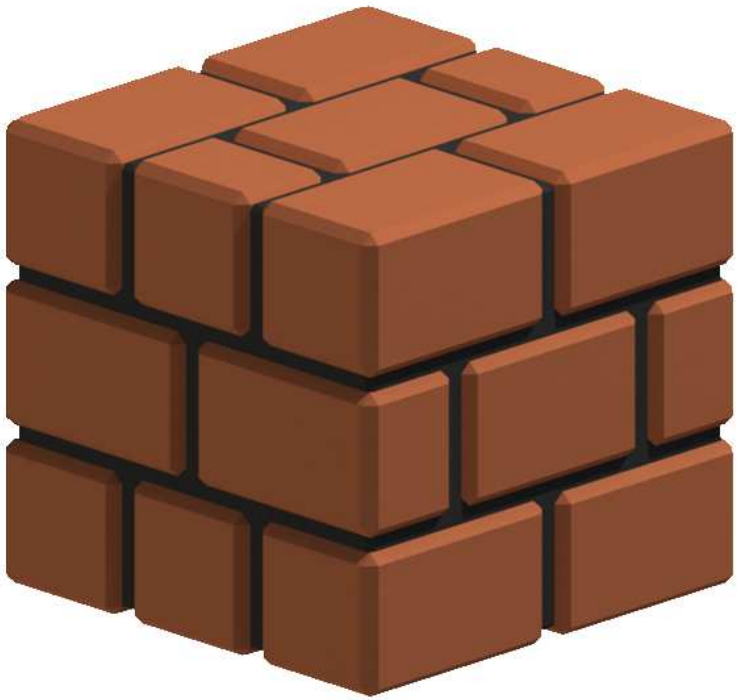
How to Do Word Problems



Building the Foundation

The notion that **Mathematics is a language**, is held by many mathematicians and is being expressed on frequent occasions.

Mathematics is the language of science. It is unique among languages in its ability to provide precise expression for every thought or concept that can be formulated in its terms.

When working with word problems, It is essentials and highly recommended to read the problem more than once, pick up the keywords, and translate those keywords into equivalent mathematical symbols.

Keywords:

The challenge in doing word problems is taking the English words and translating them into mathematics. Once this task is obtained, the actual math involved is often fairly simple and straightforward, but figuring out the actual translation can seem nearly impossible if we face difficulties identifying keywords.

In this chapter, we focus on keywords that translate into mathematical symbols and operations such as addition, subtraction, multiplication, division, power, and root.

Operation: Addition

Verbal Expression	Mathematical Translation
A plus B	$A + B$
Sum of A and B	$A + B$
Total of A and B	$A + B$
A increased by B	$A + B$
A more than B	$B + A$
A is added to B	$B + A$

Operation: Subtraction

Verbal Expression	Mathematical Translation
A minus B	$A - B$
A less B	$A - B$
Difference of A and B	$A - B$
A decreased by B	$A - B$
A fewer than B	$B - A$
A subtracted from B	$B - A$

Operation: Multiplication

Verbal Expression	Mathematical Translation
A times B	$A \cdot B$
Product of A and B	$A \cdot B$
Twice A	$2A$
Double A	$2A$
A of (with fractions, decimals, and percents) B	$A \cdot B$
Triple A	$3A$

Operation: Division

Verbal Expression	Mathematical Translation
A divided by B	$\frac{A}{B}$
Quotient of A and B	$\frac{A}{B}$
Ratio of A to B	$\frac{A}{B}$
A over B	$\frac{A}{B}$
P% of A	$\frac{P}{100} \cdot A$

Operation: Exponent & Root

Verbal Expression	Mathematical Translation
A squared	A^2
A cubed	A^3
A raised to power of n	A^n
Square root of A	$\sqrt{A}$
Cube root of A	$\sqrt[3]{A}$

Mathematical Expression

It is a collection of numbers, letters (variables), and mathematical operations.

Mathematical expressions do not not contain any equal sign, and we often simplify or evaluate mathematical expressions.

Example:

$$2x-5, x^2+5x, \frac{x}{\sqrt{x}-10}, (x+y)^2-2xy, \sqrt{b^2-4ac}, x^2y^3$$

Example:

Translate into a mathematical expression: The sum of some number and -10.

Solution:

We first start by using the **Let** statement to represent the unknown which in this case is a number. So let x be the number. Now we should identify the keyword **sum**. Now looking at the translation table for addition, the phrase can be translated to

$$x + (-10) = x - 10$$

Example:

Translate into a mathematical expression: Some number less -8.

Solution:

So let x be some number. Now we should identify the keyword **less**.

Less leads to subtraction operation.

Now looking at the translation table for subtraction, the phrase can be translated to

$$x - (-8) = x + 8$$

Example:

Translate into a mathematical expression: 5 more than twice some number.

Solution:

We begin with let x be some number. Now we should identify the keywords **twice** and **more than**.

Twice leads to multiplication operation while **More than** leads to multiplication operation.

Now looking at the translation tables for multiplication and addition operations, the phrase can be translated to

$$2x + 5$$

Example:

Translate into a mathematical expression: The difference of -12 and half of some number.

Solution:

We begin with let x be some number. Now we should identify the keywords **difference** and **half of**.

Difference leads to subtraction operation while **half of** leads to multiplication operation.

Now looking at the translation tables for subtraction and multiplication operations, the phrase can be translated to

$$-12 - \frac{1}{2}x$$

Example:

Translate into a mathematical expression: The quotient of 100 and square root of some number.

Solution:

We begin with let x be some number. Now we should identify the keywords **quotient** and **square root**.

quotient leads to division operation while **square root** leads to root operation.

Now looking at the translation tables for division and root operations, the phrase can be translated to

$$\frac{100}{\sqrt{x}}$$

Example:

Translate into a mathematical expression: Square of some number subtracted from twice the number.

Solution:

We begin with let x be some number. Now we should identify the keywords **square**, **subtracted from** and **twice**.

square leads to exponent operation, and **subtracted from** leads to subtraction operation while **twice** leads to multiplication operation.

Now looking at the translation tables for exponent, subtraction and multiplication operations, the phrase can be translated to

$$2x - x^2$$

Example:

Translate into a mathematical expression: Four times the sum of two numbers reduced by their product.

Solution:

We begin with let x and y be these two numbers. Now we should identify the keywords **times**, **sum**, **reduced by**, and **product**.

times leads to multiplication, **sum** leads to addition, **reduced by** leads to subtraction, and **product** leads to multiplication operations.

The phrase can be translated to

$$4(x+y)-x\cdot y$$

Example:

Translate into a mathematical expression: The difference of two numbers squared increased by twice their product.

Solution:

We begin with let x and y be these two numbers. Now we should identify the keywords **difference**, **squared**, **increased by**, **twice** and **product**.

difference leads to subtraction, **squared** leads to exponent, **increased by** leads to addition, **twice**, and **product** both lead to multiplication operations.

The phrase can be translated to

$$(x-y)^2+2\cdot x\cdot y=(x-y)^2+2xy$$