

## Section 1

# Direct Translation

Mathematics has a language all its own. In order to be able to solve many types of word problems, we need to be able to translate the English Language into Math Language.

Direct Translation is the process of translating English words and phrases into numbers, mathematical symbols, expressions, and equations.

Translating words into math is the foundation to understanding and successfully solving word problems. In this section, you will learn your new Math Language. Learning this language will make solving word problems easier than you would have ever imagined.

### · **Basic Operation Words: *Sum, Difference, Product, Quotient***

Basic Operation Words tell you what operation to perform. An operation refers to a mathematical calculation such as adding, multiplying, or using exponents.

Basic Operation Words are always accompanied by the word “**and**”. The operation word tells you what operation to perform and which symbol to use; the word “**and**” tells you where to put the symbol.

<b>Basic Operation Words</b>	<b>What They Mean</b>	<b>Symbol Used In Place Of “And”</b>
The sum of	To add	+
The difference of/between	To subtract	–
The product of	To multiply	• or ( )
The quotient of	To divide	÷

For example, in a word problem using the phrase: **the sum of 7 and 4**, the word “sum” tells you that you are using addition. The word “and” tells you where to put the symbol of addition, the plus sign (+). In this case, the phrase “**the sum of 7 and 4**” in English would translate to “**7 + 4**” in Math Language.

### TRANSLATION EXAMPLES

**English:** The difference between  $x$  and 5

**Math:**  $x - 5$

**English:** The quotient of 16 and  $r$

**Math:**  $16 \div r$

### · Reverse Operation Words: *More Than, Added To, Less Than, Subtracted From*

Reverse Operation Words also tell you what operation to perform and which symbol to use. But Reverse Operation Words *reverse* the order of the numbers, variables, or expressions.

Reverse Operation Words	What They Mean	Symbol Used With Reversed Order Of Numbers, Variables, Or Expressions
More than	To add	+
Added to	To add	+
Less than	To subtract	-
Subtracted from	To subtract	-

For example, in a word problem using the phrase: **6 less than 8**, the phrase “**less than**” tells you that you are using subtraction so you will use a minus sign. But also, because “**less than**” is a Reverse Word phrase, you need to change the order of the numbers. So in this case, the English phrase “**6 less than 8**” would translate to “**8 - 6**” in Math Language.

### TRANSLATION EXAMPLES

**English:**  $y$  added to 10  
**Math:**  $10 + y$

**English:** 6 subtracted from  $x$   
**Math:**  $x - 6$

### · Miscellaneous Operation Words: *Increased By, Decreased By, Twice, Squared*

These operation words are not accompanied by the word “and”. The Miscellaneous Operation Words will tell you what operation to perform, which symbol to use, and how a specific English word translates into Math Language. When using Miscellaneous Operation Words, the order of the numbers, variables, or expressions remain the same.

Miscellaneous Operation Words	What They Mean	How To Translate -- Represents Number, Variable, Or Expression
Increased by	To add	+
Decreased by	To subtract	-
Twice	Two times the number	$2 \cdot$
Squared	To use an exponent of 2	2
Cubed	To use an exponent of 3	3

### TRANSLATION EXAMPLES

**English:** 14 decreased by  $y$   
**Math:**  $14 - y$

**English:** Twice  $m$   
**Math:**  $2 \cdot m$

**English:**  $w$  squared  
**Math:**  $w^2$

· **Translation Words: *Is, The Result Is, A Number***

These words are the missing links that will help you fully translate English sentences into Math Language. Translation Words do not give you a specific operation to perform, but they must be translated in order for you to change your word problem into a math equation you can solve.

Miscellaneous Translation Words	What They Mean	How To Translate
Is	Is equal to	=
The result is	Is equal to	=
A number	An unknown (variable)	$x$ or $n$ or any letter

**TRANSLATION EXAMPLES**

**English:** Four times five is twenty  
**Math:**  $4 \cdot 5 = 20$

**English:** Seven decreased by a number  
**Math:**  $7 - n$

· **Important Multiplication Translation Rules**

Sometimes in a word problem you will see a phrase that tells you to multiply an amount times a number, such as “**three times a number**”. This means you would multiply three times a single item. In this case, it would be 3 times the variable  $x$ , or in Math, “ **$3x$** ”.

However, when you see a phrase that tells you to multiply an amount times an *operation*, such as “**three times the sum of y and 5**”, this means you would be multiplying three times the *result of the operation*.

In this case, you would first have to translate the operation words into Math Language, and then put that resulting expression in parentheses to be multiplied by 3, such as “**3(y + 5)**”.

This pattern would hold true no matter what type of operation it would be. The examples below illustrate this important concept.

### TRANSLATION EXAMPLES

**English:** Five times the difference of a number and three  
**Math:**  $5(x - 3)$

**English:** Six times a number  
**Math:**  $6n$

### · Putting It All Together

With the information you now have, it is time to put everything together. By being able to translate English word sentences into Math Language, the “dreaded word problems” will become normal math equations.

#### ***HELPFUL HINTS***

- Do not look at the problem as one long sentence. Look for keywords and break down the sentence into separate phrases.
- The first thing to look for is a word or phrase that indicates where the equal sign will be.
- Whatever words are in front of the phrase that means “is equal to” will translate into the math expression that goes before the equal sign.
- Whatever is after that phrase will translate into the expression that goes after the equal sign.

## Word Problem Workbook – Direct Translation Table

Key Words	What They Mean	How To Translate
The sum of	To add	+
The difference of/between	To subtract	–
The product of	To multiply	• or ( )
The quotient of	To divide	÷
More than	To add	+
Added to	To add	+
Less than	To subtract	–
Subtracted from	To subtract	–
Increased by	To add	+
Decreased by	To subtract	–
Twice	Two times the number	$2 \cdot$
Squared	To use an exponent of 2	$^2$

Is	Is equal to	=
The result is	Is equal to	=
A number	An unknown (variable)	$x$ or $n$ or any letter
Cubed	To use an exponent of 3	3



**EXAMPLES****EXAMPLE 1:** Six subtracted from a number is  $-5$ .**SOLUTION**

English –Bold Type	Math Translation
Six subtracted from a number <b>is</b> $-5$ .	Six subtracted from a number $= -5$
Six subtracted from <b>a number</b> is $-5$ .	Six subtracted from $x = -5$ .
Six <b>subtracted from</b> a number is $-5$ .	$x - 6 = -5$

**EXAMPLE 2 :**

If 7 is added to 3 times a number, the result is the difference of the number squared and 8.

**SOLUTION**

English –Bold Type	Math Translation
If 7 is added to 3 times a number, <b>the result is</b> the difference of the number squared and 8.	If 7 is added to 3 times a number, $=$ the difference of the number squared and 8.
If 7 is added to <b>3 times a number</b> , the result is the difference of <b>the number squared</b> and 8.	7 is added to $3x =$ the difference of $x^2$ and 8.
If 7 <b>is added to</b> 3 times a number, the result is <b>the difference of</b> the number squared <b>and</b> 8.	$3x + 7 = x^2 - 8$

**EXAMPLE 3:**Twice the sum of a number and 6 is equal to one more than  $-10$  times the number.**SOLUTION**

English –Bold Type	Math Translation
Twice the sum of a number and 6 <b>is equal to</b> one more than $-10$ times the number.	Twice the sum of a number and 6 $=$ one more than $-10$ times the number
Twice the sum of <b>a number</b> and 6 is equal to one more than $-10$ times <b>the number</b> .	Twice the sum of $x$ and 6 $=$ one more than $-10$ times $x$
<b>Twice</b> the sum of a number and 6 is equal to one more than $-10$ <b>times</b> the number.	$2(\text{the sum of } x \text{ and } 6) =$ one more than $-10x$
Twice <b>the sum of</b> a number <b>and</b> 6 is equal to one <b>more than</b> $-10$ times the number.	$2(x + 6) = -10x + 1$





## Direct Translation: Exercise Set

**Translate the following statements:**

1. The sum of 12 and a number is 10.
2. The difference between a number and 6 is  $-4$ .
3. Twice a number decreased by 2 is 11.
4. Three times a number increased by 7 is  $-1$ .
5. Six less than a number cubed is 15.
6. A number squared added to 8 is  $-5$ .
7. Five times the sum of 6 and a number is 24.
8. Twice the sum of a number and 10 is  $-20$ .
9. If 3 is subtracted from 4 times a number, the result is the sum of 5 times the number and 10.
10. If a number is added to 6, the result is the difference between twice the number and 5.
11. Four times the sum of a number and 10 is  $-92$ .
12. Six times the difference of 7 and a number is 12.
13. If a number is subtracted from 94, the result is 19 more than the product of 5 and the number.
14. If 3 is added to twice a number, the result is the difference of 4 times the number and 5.
15. Eight subtracted from 9 times a number is equal to the sum of 6 and the number squared.
16. The sum of 12 and a number is equal to the number cubed added to 5.
17. Eleven times the difference of a number and 42 is equal to the sum of the number cubed and 10.
18. The product of 6 and a number added to 3 is equal to the number squared increased by 8.

19. If 7 is subtracted from a number squared, the result is twice the sum of 5 times the number and
20. Six times the difference of twice a number and one is equal to the number cubed less than 16.