

# Algebraic expressions and equations

## EXPRESSION

An **expression** is a number, a variable, or a combination of numbers and variables using operation symbols.

### Expressions:

$$3+5$$

$$n-1$$

$$6 \cdot 7$$

$$\frac{x}{y}$$

### Words:

3 plus 5

n minus one

6 times 7

x divided by y

### English Phrase:

the sum of three and five

the difference of n and one

the product of six and seven

the quotient of x and y

# Algebraic expressions and equations

## EQUATION

An **equation** is two expressions connected by an *equal sign*.

### Equations:

$$3+5 = 8$$

$$n-1 = 14$$

$$6 \cdot 7 = 42$$

$$x = 53$$

$$y+9 = 2y-3$$

### English Sentence:

The sum of three and five *is equal* to eight.

n minus one *equals* fourteen.

The product of six and seven *is equal* to forty-two.

x *is equal* to fifty-three.

y plus nine *is equal* to two y minus three.

# Translating words to math

$x+y$  sum of  $x$  and  $y$   
 $x$  plus  $y$   
 $y$  more than  $x$   
 $x$  increased by  $y$

$x \cdot y$  product of  $x$  and  $y$   
 $x$  times  $y$   
 $x$  of  $y$

$x-y$  difference of  $x$  and  $y$   
 $x$  minus  $y$   
 $y$  less than  $x$   
 $x$  decreased by  $y$   
 $y$  is subtracted from  $x$

$x \div y$  quotient of  $x$  and  $y$   
 $x$  divided by  $y$   
 $x$  over  $y$   
 $y$  into  $x$   
per

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Exercise 1: translate the following statements into expressions

(1) The product of  $x$  and 3 more than  $x$

(2) The product of  $a$  and twice the difference of  $x$  and 3

(3) The sum of four times  $x$  and 12

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Exercise 1: translate the following statements into expressions

(1) The product of  $x$  and  $3$  more than  $x$

$$x \times x+3$$

answer:  $x(x+3)$

(2) The product of  $a$  and twice the difference of  $x$  and  $3$

(3) The sum of four times  $x$  and  $12$

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read it and split  
it mentally into  
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$$? + 12$$

← read this one now, and also split it mentally into operations

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$$x \times x+3$$

answer:  $x(x+3)$

(2) The product of  $a$  and  $2$  times the difference of  $x$  and  $3$

$$a \times 2(x - 3)$$

answer:  $2a(x-3)$

(3) The sum of  $4$  times  $x$  and  $12$

$$4x + 12$$

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$$4x + 12$$

answer:  $4x + 12$

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# Translating words to math

Exercise 1: translate the following statements into expressions

(4) The product of  $x$  plus 3 and  $a$  minus 2

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(5) The quotient of the sum of  $x$  and 4 and twice  $y$

(6) Two-thirds of the sum of  $a$  and  $b$

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Exercise 1: translate the following statements into expressions

(4) The product of  $x + 3$  and  $a - 2$

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Exercise 1: translate the following statements into expressions

(4) The product of  $x$  plus 3 and  $a$  minus 2

$$(x + 3) \times (a - 2) \text{ parentheses!!!!!!!!}$$

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answer:  $(x+3)(a-2)$

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Two readings:

The quotient of the sum of  $x$  and 4 and twice  $y$   
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The quotient of the sum of  $x$  and 4 and twice  $y$   
and

The quotient of the sum of  $x$  and 4 and twice  $y$

meaningless!

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which 'and' to choose?

Two readings:

~~The quotient of the sum of  $x$  and 4 and twice  $y$  — not this one!~~

The quotient of the sum of  $x$  and 4 and twice  $y$

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$$\frac{x+4}{2y}$$

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$$\frac{2}{3} \times (a + b)$$

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$$\frac{2}{3} \times$$

$$(a + b)$$

$$\text{answer: } \frac{2}{3}(a+b)$$

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Exercise 2: translate the following statements into equations

- (1) 6 less than  $x$  is 6 more than  $x$  ← same strategy as in Exercise 1, with an added equality symbol: “is” is translated as “=”
- (2) The square of the result when 10 is subtracted from twice a number is equal to 124
- (3) The sum of two unknown consecutive odd integers is 113. The smaller integer is denoted by letter  $a$ .

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Exercise 2: translate the following statements into equations

(1) 6 less than  $x$  is 6 more than  $x$   
 $(x - 6) = (x + 6)$

← same strategy as in Exercise 1,  
with an added equality symbol:  
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← same strategy as in Exercise 1,  
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“is” is translated as “=”

It is important that you put  $x-6$ , not  $6-x$ !

(2) The square of the result when 10 is subtracted from twice a number is equal to 124

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Let's work on this one next,  
In this one "is equal to" will be replaced  
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$$(\quad)^2 = 124$$

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$$(2n - 10)^2 = 124$$

Let's work on this one next,  
In this one "is equal to" will be replaced  
with "=" symbol

I used  $n$  for the "number", but I could also use  $x$ , or  $t$ , or ...

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3 and 5 are two consecutive odd integers; so are 9 and 11, etc.

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If  $a$  denotes the smaller integer among them (think of 3), then the second one must be  $a+2$  (then we will get  $3+2=5$ )!

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$$a + a + 2$$

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$$a + a + 2 =$$

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$$a + a + 2 = 113$$



## Everyday math applications

**Word Problem:** The length of a rectangular pool is 5 meters less than twice the width. If the pool's perimeter is 62 meters, what is the width?

In order to solve this problem, we will need to set up an equation and solve it. We do prefer to work with only one variable when we expect only one equation.

Let's build an equation for this problem!

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Let's draw a rectangle:



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Let's draw a rectangle:  
What do we know about its length?



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Let's draw a rectangle:  
What do we know about its length?  
the length of a rectangular pool is 5 meters less than twice the width



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Let's draw a rectangle:

What do we know about its length?

the length of a rectangular pool is 5 meters less than twice the width

Let's translate it, assuming that  $w$  is used for the width!

length =  $2w - 5$ .



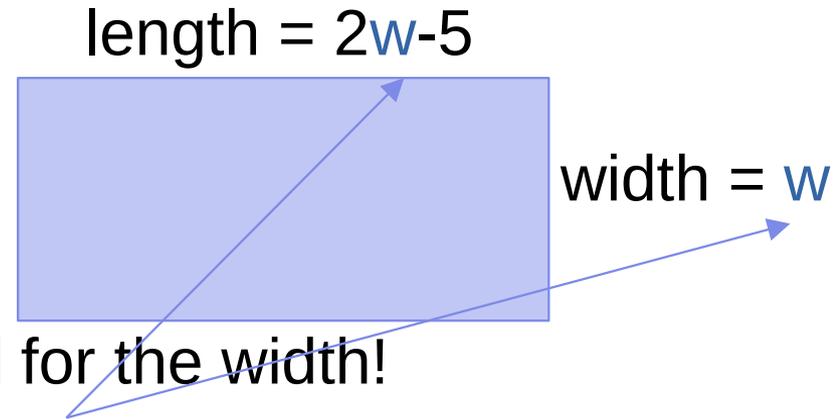
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Let's draw a rectangle:

What do we know about its length?  
the length of a rectangular pool is 5 meters less than twice the width

Let's translate it, assuming that  $w$  is used for the width!  
length =  $2w - 5$ . Let's update our picture:



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**Word Problem:** The length of a rectangular pool is 5 meters less than twice the width. If the pool's perimeter is 62 meters, what is the width?

Let's draw a rectangle:

Next, the perimeter  $P$  of a rectangle is

$$P = 2 \times \text{width} + 2 \times \text{length}$$

$$\text{length} = 2w - 5$$



$$\text{width} = w$$

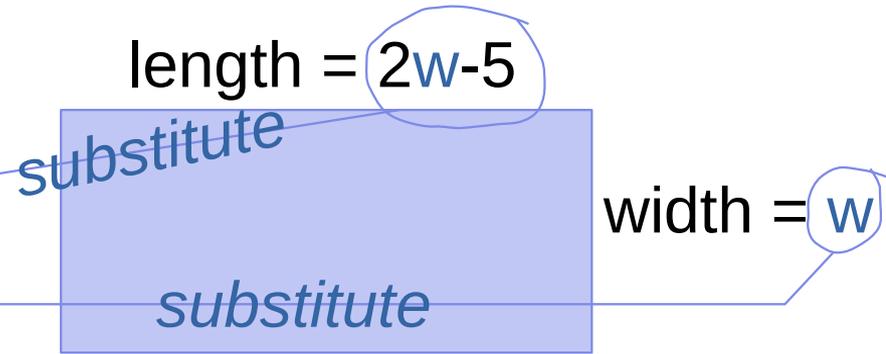
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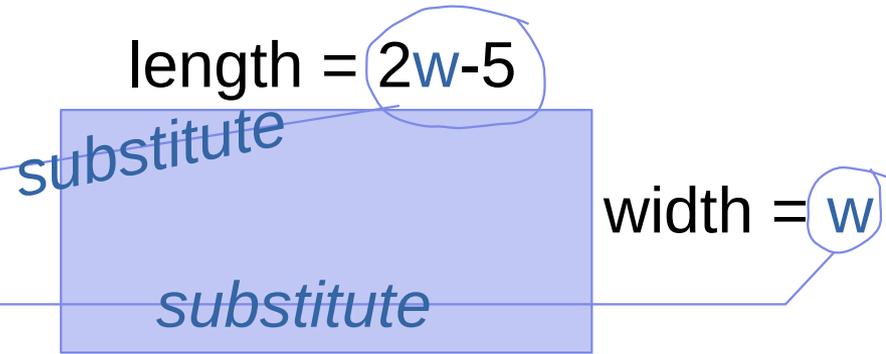
# Everyday math applications

**Word Problem:** The length of a rectangular pool is 5 meters less than twice the width. If the pool's perimeter is 62 meters, what is the width?

Let's draw a rectangle:

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$$\begin{aligned} P &= 2 \times \text{width} + 2 \times \text{length} = \\ &= 2 \times w + 2 \times (2w - 5) = \end{aligned}$$



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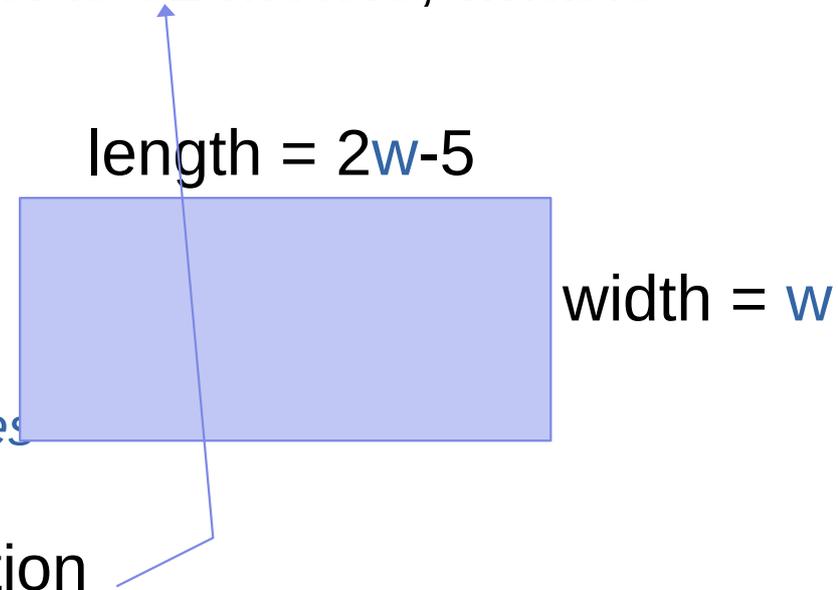
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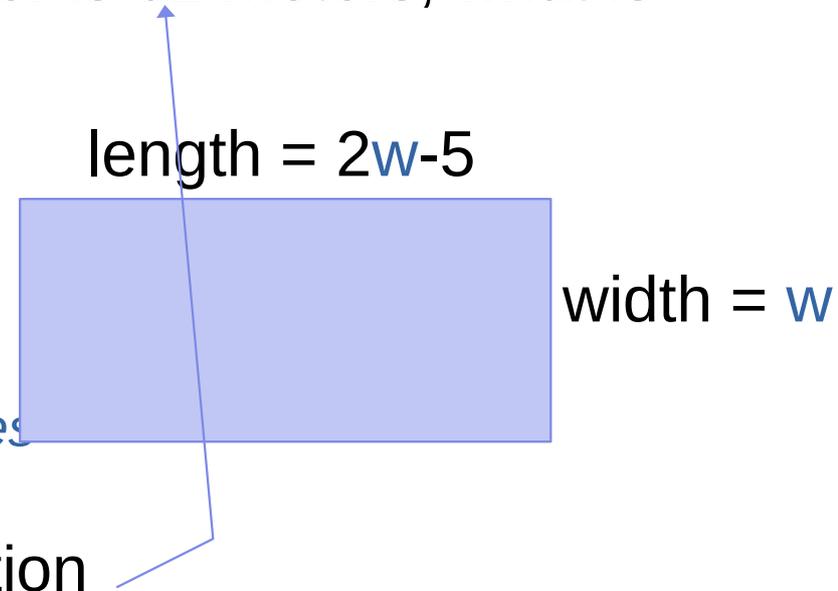
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$$6w - 10 = 62 - \text{our equation is ready!}$$

