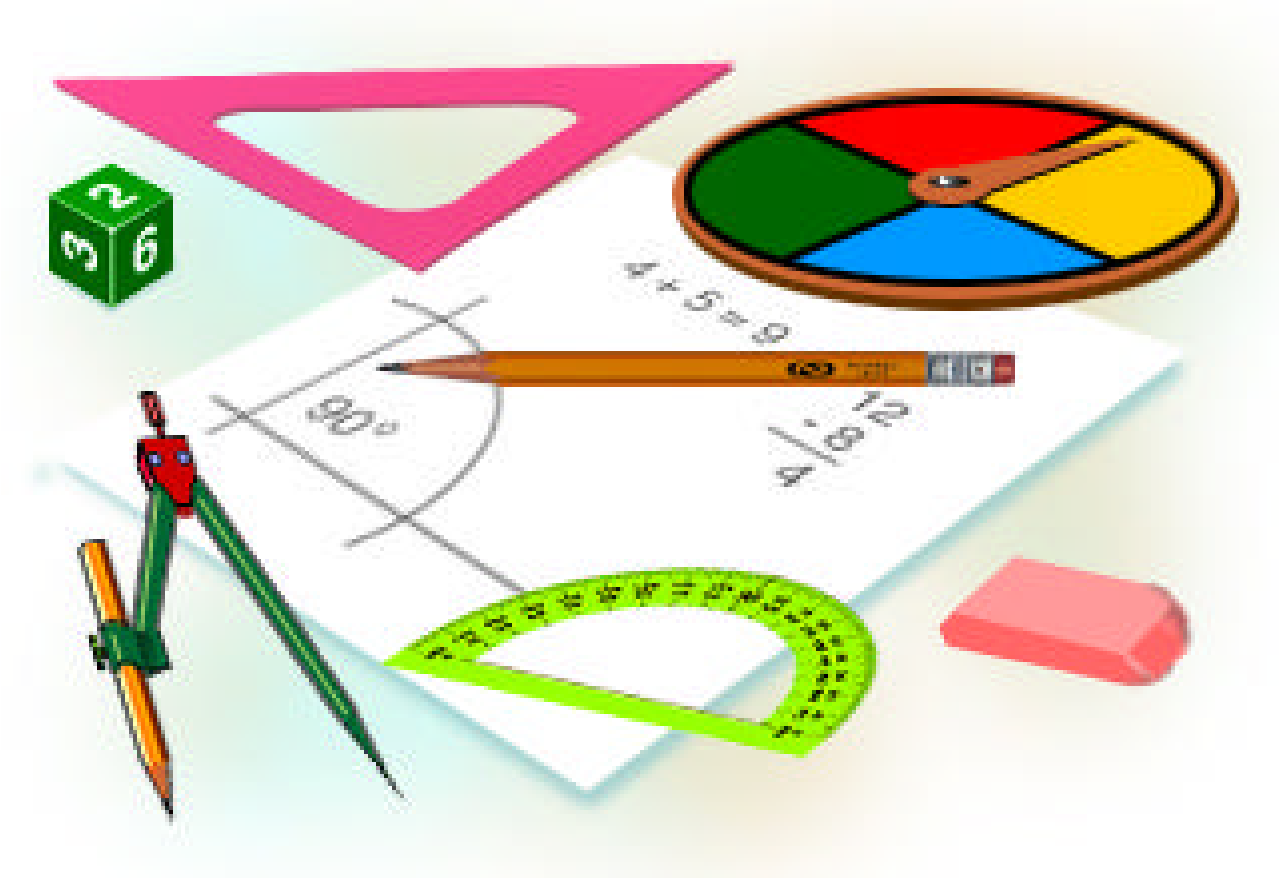
The Next Step

Mathematics Applications for Adults



Book 14017 – Equations: Equalities And Inequalities

OUTLINE

Mathematics - Book 14017

Equations: Equalities And Inequalities
Introduction To Equations: Equalities And Inequalities
rewrite English statements as math expressions.
simplify an expression using correct order of operations.

THE NEXT STEP

Book 14017

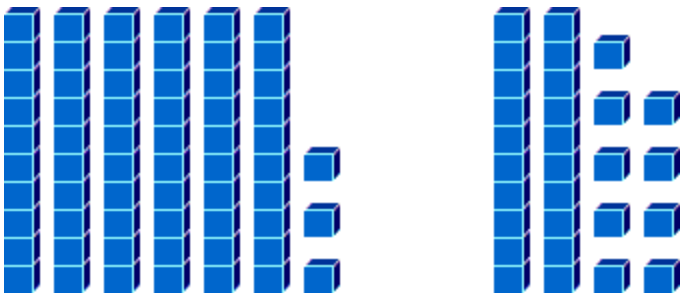
Equations and Inequalities

Introduction to Equations: Equalities and Inequalities

Ordering numbers means listing numbers from least to greatest, or from greatest to least. Two symbols are used in ordering.

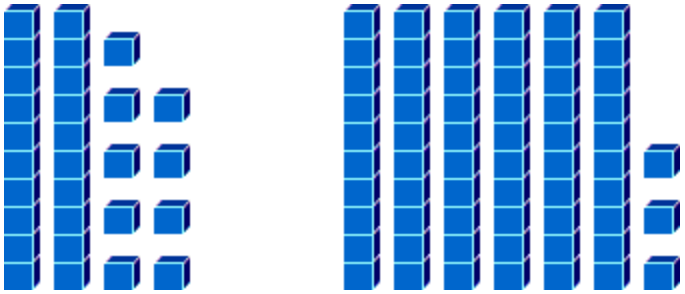
<	>
is less than	**is greater**
2 < 10	**10 > 2**

Greater Than >



63 is **greater than** 29.
63 > 29

Less Than <



29 is **less than** 63.
29 < 63

Sometimes numbers in a set can be "***greater than or equal to***" members of another set. Likewise, members of a set are sometimes "***less than or equal to***" members of another set. A bar is added to ***less than*** and ***greater than*** symbols to show that they are also equal.

≤	≥
is less than or equal to	**is greater than or equal to**

Algebraic or number sentences use the symbols =, ≠, <, >, ≤, or ≥ to show the relationship between two quantities.

Any sentence using the symbol = is called an ***equality*** or ***equation.***

4 + 8 = 2 x 6
3x ÷ 2 = 17

Any sentence using the symbol ≠, <, >, ≤, or ≥, is called an ***inequality***.

$$15 > 7$$

$$6 \neq 3 + 1$$

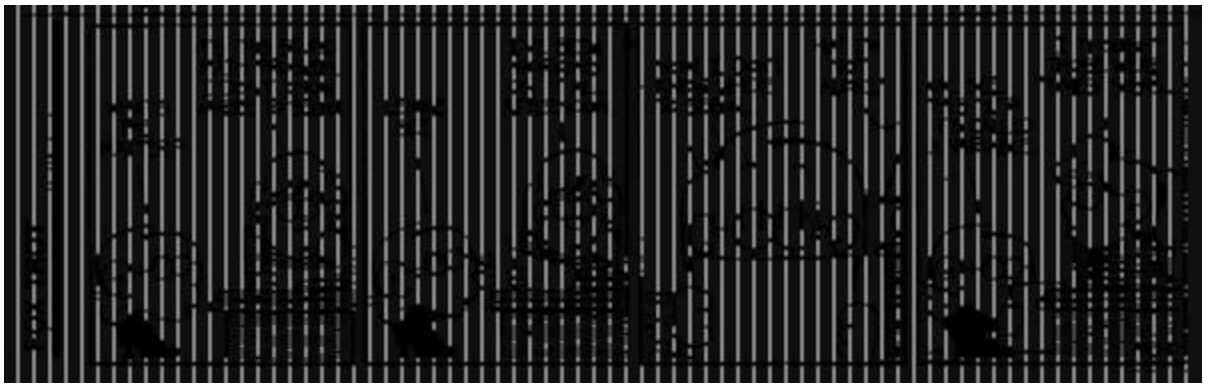
$$x + 2 \leq 12$$

SYMBOLS	
<	is less than
>	is greater than
≤	is less than or equal to
≥	is greater than or equal to
$\sqrt{\ }$	positive square root
≠	is not equal to
+	plus, add
-	minus, subtract
X	multiplied by, multiply
.	Multiplied by, multiply
÷	divided by, divide
=	equal to

Algebra is a division of mathematics designed to help solve certain types of problems quicker and easier. Algebra operates on the idea that an equation represents a scale such as the one shown above. Instead of keeping the scale balanced with weights, we use numbers, or constants.

These numbers are called constants because they constantly have the same value. For example the number 47 always represents 47 units or 47 multiplied by an unknown number. It never represents another value.

In algebra, we often use letters to represent numbers. A letter that stands for a number is called a ***variable*** or ***unknown***.



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A variable can be used to represent numbers in addition, subtraction, multiplication, or division problems. The symbols used in algebra are "+" for addition and "-" for subtraction. Multiplication is indicated by placing a number next to a variable; no multiplication sign is used. Division is indicated by placing a number or variable over the other.

An equation is made up of ***terms***. Each term is a number standing alone or an unknown multiplied by a ***coefficient*** (i.e. 7*a,* 5*x*, 3*y…*).

For example, $3y + 5y = 32$ would be considered a three term equation. $12y - 11y - 9 = 17$ would be considered a four term equation.

Factors are numbers that are multiplied together. For instance, the factors of 12 are 3 and 4, 2 and 6, and 1 and 12. In the algebraic term, 7*x*, 7 and *x* are factors.

Sometimes the order in which you add, subtract, multiply, and divide is very important. For example, how would you solve the following problem?

2 x 3 + 6

Would you group

(2 x 3) + 6 or **2 x (3 + 6) ?**

Which comes first, addition or multiplication? Does it matter?

Yes. Mathematicians have written two simple steps:

1. ***All multiplication and division operations are carried out first, from left to right, in the order they occur.***

2. ***Then all addition and subtraction operations are carried out, from left to right, in the order they occur.***

For example:

8 ¸ 2 + 2 x 3 – 1 = 4 + 6 – 1 = 9

4 6 10

step 1 step 2

Perform all operations with parentheses (brackets) and exponents before carrying out the remaining operations in an equation.

8 ¸ (2 + 2) x 3 – 1 =

8 ¸ 4 x 3 – 1 =

2 x 3 – 1 =

6 – 1 = 5

To remember the order of operations, simply remember BEDMAS: Brackets, Exponents, Division, Multiplication, Addition, Subtraction.

Example:

$10 \div (2 + 8) \times 2^3 - 4$ *Add inside parentheses.*

$10 \div 10 \times 2^3 - 4$ *Clear exponent.*

$10 \div 10 \times 8 - 4$ *Multiply and divide.*

$8 - 4$ *Subtract.*

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An ***algebraic expression*** consists of two or more numbers or variables combined by one or more of the operations---addition, subtraction, multiplication, or division.

The following are examples of algebraic expressions:

Operation	Algebraic Expression	Word Expression
Addition	$x + 2$	x plus 2
Subtraction	$y - 3$	y minus 3
	$3 - y$	3 minus y
Multiplication	$4z$	4 times z
Division	$n/8$	n divided by 8
	$8/n$	8 divided by n

Many algebraic expressions contain more than one of the operations of addition, subtraction, multiplication, or division. Placing a number or variable outside of an

expression in parentheses (brackets) means that the whole expression is to be multiplied by the term on the outside.

For example, look at the difference in meaning between $3y + 7$ and $3(y + 7)$. If the number 2 were substituted for y in each expression, the following solutions would result:

$$3y + 7 = 3 \bullet 2 + 7 = 6 + 7 = \mathbf{13}$$

but

$$3(y + 7) = 3(2 + 7) = 3(9) = \mathbf{27}$$

Algebraic Expression	**Word Expression**
$3y - 7$	3 times y minus 7
$3(y - 7)$	3 times the quantity y minus 7
$-\ x + 5$	Negative x plus 5
$-\ (x + 5)$	Negative times the quantity x plus 5
$3x^2 + 2$	3 x-squared plus 2
$3(x^2 + 2)$	3 times the quantity x-squared plus 2

Practice Exercise

Translating Verbal Statements into Equations

Express each of the following problems algebraically.
(Hint: Use n as the unknown number and create an equation from the problem)

1. One-seventh of a number is 42 **n/7 = 42**
2. A number increased by 14 is 54
3. A number minus 95 is -67
4. Twice the sum of a certain number and 8 is 30
5. The sum of what number and five times the same number is 36
6. The product of 8 and a number is 32
7. one less than five times what number is 9
8. 71 less than a number equals 19
9. The sum of 100 and a number is 170
10. The sum of 49 and a number is 66
11. six times what number added to 7 is 25

12. 14 less than twice a number is -8
13. four times a number, less 9, is 11
14. 15 less than the product of 8 and a number is 33
15. 5 more than 3 times a number is 26
16. 52 less than what number equals 17
17. five times the sum of a number and 5, is 85
18. The sum of 10 and the product of 6 and a number is 34
19. six times what number equals 66
20. A number increased by 37 is 38

Solving an algebraic equation means finding the value of the unknown or variable that makes the equation a true statement. The ***solution*** is the value of the unknown that solves the equation.

To check if a possible value for the unknown is the solution of an equation, follow these two steps:

Step 1 Substitute the value for the unknown into the original equation.

Step 2 Simplify (do the arithmetic) and compare each side of the equation.

Example 1 Is $y = 5$ the solution for $3y - 9 = 6$?

Step 1 Substitute 5 for y. $3(5) - 9 = 6$?

Step 2 Simplify and compare. $15 - 9 = 6$?
$6 = 6$?

Since **$6 = 6$, $y = 5$ is a solution** of the equation.

Example 2 Is $x = 23$ the solution for $x - 7 = 14$?

Step 1 Substitute 23 for x. $(23) - 7 = 14$?

Step 2 Simplify and compare. $16 = 14$?

Since 16 is not equal to 14, ***x* = 23 is not a solution** of the equation.

Check if the possible value for the unknown (variable) is the solution to each equation. Circle "Yes" if the value is the solution, and circle "No" if it is not.

$x + 3 = 9$	Try $x = 4$	Yes No
$y - 12 = 37$	Try $y = 49$	Yes No
$3z = 39$	Try $z = 13$	Yes No
$a/15 = 3$	Try $a = 54$	Yes No
$\frac{3}{4}\ m = 3$	Try $m = 4$	Yes No

Answer Key

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2. n + 14 = 54 **3.** n – 95 = -67
4. 2(n + 8) = 30 **5.** n + 5n = 36
6. 8n = 32 **7.** 5n - 1 = 9 **8.** n – 71 = 19
9. 100 + n = 170 **10.** 49 + n = 66
11. 6n + 7 = 25 **12.** 2n – 14 = -8
13. 4n – 9 = 11 **14.** 8n – 15 = 33
15. 3n + 5 = 26 **16.** n – 52 = 17
17. 5(n + 5) = 85 **18.** 10 + 6n = 34
19. 6n =66 **20.** n + 37 = 38

Page 13 No, Yes, Yes, No, Yes