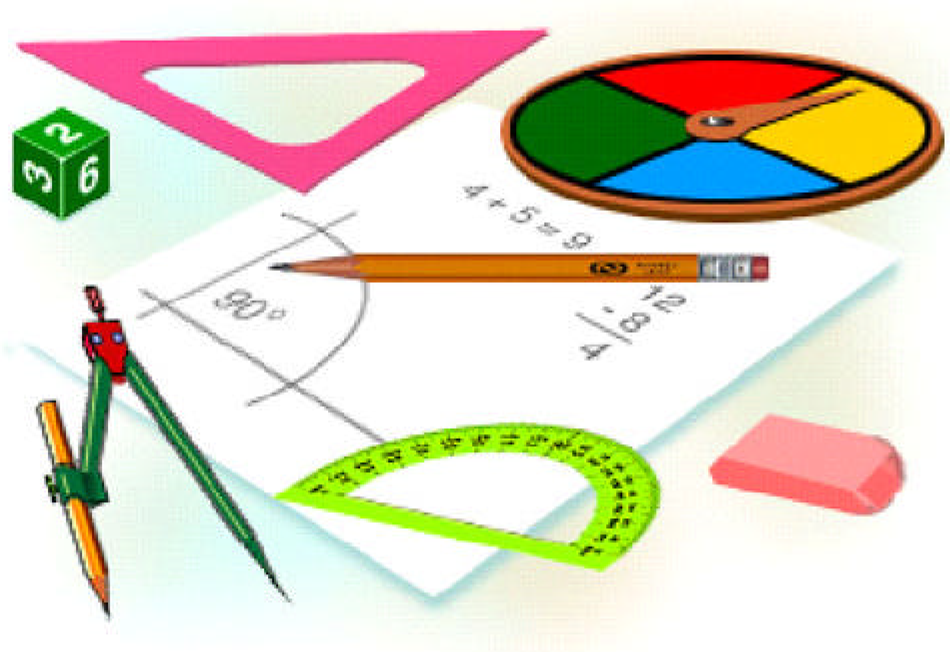
The Next Step

Mathematics Applications for Adults



Book 14018 – Equations: Equalities and Inequalities

OUTLINE

Mathematics - Book 14018

Equations: Equalities And Inequalities
Introduction To Equations: Equalities And Inequalities
rewrite English statements as math expressions.
solve equalities.
simplify an expression using correct order of operations.
Problem Solving With Equations and Equalities
solve multi-step problems requiring the performance of any combination of mathematical operations involving equalities, with or without a calculator.

THE NEXT STEP

Book 14018

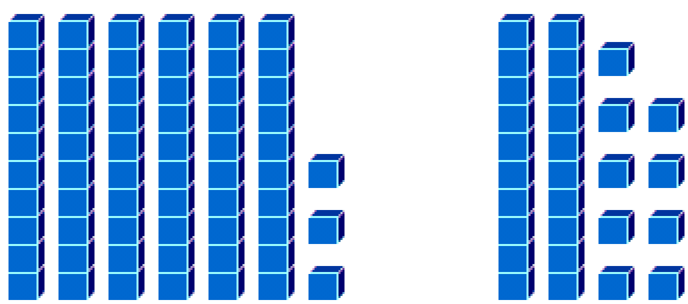
Equations: Equalities and Inequalities

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.

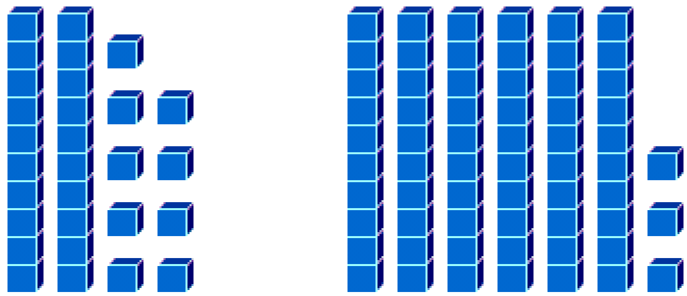
<	>
is less than	**is greater**
2 < 10	**10 > 2**

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.***

$$\mathbf{4} + \mathbf{8} = \mathbf{2} \times \mathbf{6}$$
$$\mathbf{3x} \div \mathbf{2} = \mathbf{17}$$

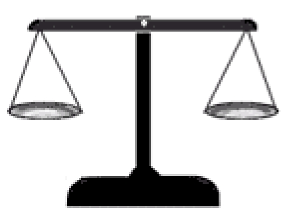
Any sentence using the symbol ≠, <, >, ≤, or ≥, is called an ***inequality***.

$$\mathbf{15} > \mathbf{7}$$

$$\mathbf{6} \neq \mathbf{3} + \mathbf{1}$$

$$\mathbf{x} + \mathbf{2} \leq \mathbf{12}$$

SYMBOLS	
$<$	is less than
$>$	is greater than
$\leq$	is less than or equal to
$\geq$	is greater than or equal to
$\sqrt{\ }$	positive square root
$\neq$	is not equal to
$+$	plus, add
-	minus, subtract
X	multiplied by, multiply
.	Multiplied by, multiply
$\div$	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***.

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. $7a$, $5x$, $3y$…).

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, $7x$, 7 and x are factors.

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:

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

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
$- \quad x + 5$	Negative *x* plus 5
$- \quad (x + 5)$	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

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

1. The product of 8 and a number is 24 **8n = 24**	2. A number minus 57 is -3
3. Twice the sum of a certain number and 97 is 214	4. A number increased by 20 is 111

5. eleven less than eleven times what number is 33	6. 5 more than 3 times a number is 23
7. eight times a number, less 3, is 77	8. 20 less than a number equals -15
9. 11 less than twice a number is 7	10. 5 less than what number equals 62
11. twelve times the sum of a number and 4, is 84	12. ten times what number added to 8 is 38
13. 10 less than the product of 9 and a number is 71	14. The sum of 12 and the product of 6 and a number is 42
15. The sum of 81 and a number is 112	16. four times what number equals 40
17. The sum of what number and seven times the same number is 96	18. One-fifth of a number is 45
19. 73 less than a number equals 19	20. The sum of 8 and the product of 2 and a number is 26

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.

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

Þ ***Perform all operations with parentheses (brackets) and exponents before carrying out the remaining operations in an equation. Parentheses or brackets may come in these forms: ( ), { }, or [ ].***

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.*

4

Distributive Property

The distributive property says this: ***Multiplication and addition can be linked together by "distributing" the multiplier over the addends in an equation.***

3 x (1 + 4) = (3 x 1) + (3 x 4)
3 x 5 = 3 + 12
15 = 15

Associative Property of Addition

The property which states that for all real numbers *a*, *b*, and *c*, their sum is always the same, regardless of their grouping:

$$(a + b) + c = a + (b + c)$$

Example:

$$(2 + 3) + 4 = 2 + (3 + 4)$$

Associative Property of Multiplication

The property which states that for all real numbers *a*, *b*, and *c*, their product is always the same, regardless of their grouping:

$$(a \cdot b) \cdot c = a \cdot (b \cdot c)$$

Example:

$$(5 \cdot 6) \cdot 7 = 5 \cdot (6 \cdot 7)$$

Simplify

To combine like terms

Example:

Simplify. $n^2 + 4n - 9n + 7 - 5$

$n^2 + 4n - 9n + 7 - 5$	*Collect like terms by using*
$n^2 + (4n - 9n) + (7 - 5)$	*the Associative Property.*
$n^2 + (^-5n) + 2$	*Combine like terms.*
$n^2 - 5n + 2$	

Solving Equations using Inverse Operations

Inverse operations are used in algebra to simplify an equation for solving.
One operation is involved with the unknown and the inverse operation is used to solve the equation.

Addition and subtraction are inverse operations.
Given an equation such as $7 + x = 10$, the unknown x and 7 are *added*. Use the inverse operation subtraction. To solve for n, subtract 7 from 10. The unknown value is therefore 3.

Multiplication and division are inverse operations.
Given an equation $7x = 21$. x and 7 are multiplied to create a value of 21. To solve for x, divide 21 by 7 for an answer of 3.

<u>Examples for addition, subtraction, division, and multiplication.</u>

Addition Problem	Solution
$x + 15 = 20$	$x = 20 - 15 = 5$
Subtraction Problem	Solution
$x - 15 = 20$	$x = 20 + 15 = 35$
Multiplication Problem	Solution
$3x = 21$	$x = 21 \div 3 = 7$

Division Problem	Solution
$x \div 12 = 3$	$y = 3 \times 12 = 36$

Solving Equations using Rules of Equality

The Rule of Equality
The same fundamental operation can be made on both sides of the equation, using the same number and the equation will remain equal to the original. (This does not apply to division by 0)

This rules means that what you do on one side of an equation, has to be done on the other side. For example, it means you can add 5 to both the left and right side of the equations.

Given: $x - 5 = 40$

1. Add 5 to both sides of the equation which gives you: $x - 5 + 5 = 40 + 5$
2. Simplify for $x - 5 + 5$ and $40 + 5$, to give you the equation $x = 45$

Practice Exercise

Solve each equation.

1. $x + 9 = 86$ 77
2. $38 = a - 57$ ______
3. $65 + y = 118$ ______
4. $x - 34 = 46$ ______
5. $x + 42 = 48$ ______
6. $33 + y = 34$ ______
7. $x - 39 = 51$ ______
8. $13 = a - 3$ ______
9. $x + 100 = 114$ ______
10. $x - 73 = 21$ ______
11. $83.1 + y = 141.4$ ______
12. $x + 47 = 51$ ______
13. $25 + y = 77$ ______
14. $x + 92 = 107$ ______
15. $x - 5 = 95$ ______
16. $31 = a - 36$ ______
17. $44 = a - 14$ ______
18. $38 + y = 138$ ______

Solve each equation.

1. $7b = 56$ 8

2. $n \div 21 = 5$ ______

3. $3237 = 39a$ ______

4. $\frac{b}{8} = 11$ ______

5. $2b = 8$ ______

6. $\frac{b}{4} = 5$ ______

7. $6b = 6$ ______

8. $\frac{b}{8} = 7$ ______

9. $n \div 35 = 6$ ______

10. $6818.4 = 94.7a$ ______

11. $2115 = 47a$ ______

12. $4b = 28$ ______

13. $720 = 12a$ ______

14. $\frac{b}{11} = 6.5$ ______

15. $-6130 = 61.3a$ ______

16. $204 = -34a$ ______

17. $6851.7 = 99.3a$ ______

18. $12b = 120$ ______

Solving Equations using Two or More Operations

Using your knowledge of applying the rule of equality and the inverse operations, you can solve more complicated equations that require more than one operation.

For example, $2x + 7 = 11$, cannot be completed in one step. You need to use division and subtraction.

The easy approach for this equation is to subtract 7 on each side which gives you $(2x + 7) - 7 = 11 - 7$, or $2x = 4$. You can then divide each side by 2 which gives you $(2x) \div 2 = 4 \div 2$ or $x = 2$!

Of course you can apply the division to $2x + 7 = 11$ first, which would be $(2x + 7) \div 2 = 11 \div 2$. The problem with that is you have to divide the entire $(2x + 7)$, which cannot be easily simplified. Using subtraction first makes solving the equation much easier.

Terms on Both Sides of an Equation

Terms that contain an unknown can appear on both sides of an equation. Usually, we move all terms containing an unknown to the left side of the equation. To move a term containing an unknown from the right side of the equation to the left side, change its sign and place it next to the unknown on the left side.

Rule 1: If the term is preceded by a positive sign, remove the term from the right side and subtract it from the left side.

Rule 2: If the term is preceded by a negative sign, remove the term from the right side and add it to the left side.

EXAMPLE 1 Solve for x in $3x = 2x + 7$

Step 1 Write down the equation $3x = 2x + 7$. Subtract $2x$ from $3x$.

$$3x = 2x + 7$$
$$3x - 2x = 7$$

Step 2 Combine the x's.

$$\boldsymbol{x = 7}$$

Answer: $\boldsymbol{x = 7}$

EXAMPLE 2 Solve for y in $2y - 6 = -3y + 24$

Step 1 Write down the equation $2y - 6 = -3y + 24$. Add $3y$ to $2y - 6$.

$$2y - 6 = -3y + 24$$
$$2y + 3y - 6 = 24$$

Step 2 Combine the *y*'s.

$$5y - 6 = 24$$

Step 3 Add 6 to 24.

$$5y = 24 + 6$$
$$5y = 30$$

Step 4 Divide 30 by 5.

$$y = 30 \div 5$$
$$\boldsymbol{y = 6}$$

Answer: $\boldsymbol{y = 6}$

Practice Exercise

Solve each problem.

1. $21 + o = 47$ $o = 26$ **2.** $69 - s = 14$ _____

3. $j - 5 = 51$ _____ **4.** $r \times 10 = 30$ _____

5. $r + 18 = 37$ _____ **6.** $r + 5 \times 25 \times 4 = 508$ _____

7. $6 \div 3 + g \times = 137$ _____ **8.** $o \div 4 + 20 = -23$ _____

9. $6 + t = 19$ _____ 10. $3 \times 17 \times (p - 13) = 0$ _____

11. $-12 \times g = 84$ _____ 12. $p \times 18 = 270$ _____

13. $y + 6 = 14$ _____ 14. $o + 14 = 24$ _____

15. $18 + y \times 9 = 117$ _____ 16. $(8 + 4) \times f = 168$ _____

17. $-18 \div y \times 15 = 45$ _____ 18. $a \times 17 \times 18 = 1224$ _____

19. $21 \times i = 210$ _____ 20. $p \times 11 + 4 = 268$ _____

Solve each equation.

1. $0.2x = 2$	2. $-6 = 5x - 2x$
3. $2a + 4a + 8 = 44$	4. $\frac{b}{6} = 12$
5. $x - \frac{1}{6}x = 20$	6. $1x = 5$
7. $0.08x = 0.48$	8. $8m + 19 - 3m = 54$
9. $12 = 6x - 4x$	10. $121 = 5x + 6x$

11. $x - \frac{1}{9}x = 16$	12. $0.4x = -3.6$
13. $0.6x = 7.2$	14. $2y + 3 = y - 7$
15. $12x = 108$	16. $3x - 2x + 4 = 7$
17. $0.6x = 6.6$	18. $0.3x = 0.3$

Solve each equation.

1. $\frac{108}{x} = 9$	2. $8x - 17 = 7$
3. $4y + 6 = y + 18$	4. $\frac{b}{4} + 7.8 = 17.8$
5. $\frac{b}{4} + 6 = 17$	6. $2x - 5.3 = 8.7$
7. $15x + 17 - 5x = 3x + 101$	8. $2x + 56 = 66$
9. $\frac{b}{5} - 8 = 2$	10. $22 - \frac{1}{3}b = 13$

11. $3z - z - 5 = z + 8$	**12.** $9x + 8.4 = 80.4$
13. $2x - 51 + 5x = 19$	**14.** $10n = 48 - 2n$
15. $39 + \frac{6}{9}b = 87$	**16.** $7x - 24 = 11$
17. $4x - 66 + 7x = 11$	**18.** $\frac{18}{x} = 2$
19. $37 + \frac{1}{6}b = 48$	**20.** $-8x + 55.4 = -32.6$
21. $\frac{b}{6} + 9.9 = 19.9$	**22.** $7x = -27 - 2x$
23. $\frac{b}{12} - 8 = 3$	**24.** $5a = -3a + 24$

Solving an Equation With Parentheses

Parentheses or *brackets* are commonly used in algebraic equations. Parentheses are used to identify terms that are to be multiplied by another term, usually a number.

The first step in solving an equation is to remove the parentheses by multiplication. Then, combine separated unknowns and solve for the unknown.

Follow these four steps to solve an algebraic equation:

Step 1 Remove parentheses by multiplication.
Step 2 Combine separated unknowns.
Step 3 Do addition or subtraction first.
Step 4 Do multiplication or division last.

To remove parentheses, multiply each term inside the parentheses by the number outside the parentheses. If the parentheses are preceded by a negative sign or number, remove the parentheses by changing the sign of each term within the parentheses.

For example, $+4(x + 3)$ becomes $4 \bullet x + 4 \bullet 3 = 4x + 12$, and $-(3z + 2)$ becomes $-3z - 2$.

EXAMPLE 1 Solve for x in $4(x + 3) = 20$

Step 1 Write down the equation. Remove parentheses by multiplication.

$$4(x + 3) = 20$$
$$4x + 12 = 20$$

Step 2 Subtract 12 from 20.

$$4x = 20 - 12$$
$$4x = 8$$

Step 3 Divide 8 by 4.

$$x = 8 \div 4$$
$$\mathbf{x = 2}$$

Answer: $\boldsymbol{x = 2}$

EXAMPLE 2 Solve for z in $4z - (3z + 2) = 5$

Step 1 Write down the equation. Remove parentheses by multiplication.

$$4z - (3z + 2) = 5$$
$$4z - 3z - 2 = 5$$

Step 2 Combine the z's.

$$z - 2 = 5$$

Step 3 Add 2 to 5.

$$z = 5 + 2$$
$$\mathbf{z = 7}$$

Answer: $\mathbf{z = 7}$

Parentheses may appear on both sides of an equation. Remove both sets of parentheses as your first step in solving for the unknown.

EXAMPLE Solve for x in $3(x - 6) = 2(x + 3)$

Step 1 Write down the equation. Remove both sets of parentheses by multiplication.

$$3(x - 6) = 2(x + 3)$$
$$3x - 18 = 2x + 6$$

Step 2 Subtract $2x$ from $3x - 18$.

$$3x - 2x - 18 = 6$$
$$x - 18 = 6$$

Step 3 Add 18 to 6.

$$x = 6 + 18$$
$$\boldsymbol{x = 24}$$

Answer: $\boldsymbol{x = 24}$

Practice Exercise

Solve each of the following equations.

1. $2(a + 3) = 16$
2. $4(b - 2) = 8$
3. $2m - 3(m + 3) = -13$
4. $-3y + 2(2y - 1) = -6$
5. $5(z - 1) = 4(z + 4)$
6. $7(a - 2) = 6(a + 1)$
7. $3(y + 1) = 9 - (y + 2)$
8. $4(z - 2) = -2(z - 5)$

Problem Solving with Equations, Equalities and Inequalities

Equations may be used to solve word problems. To solve a word problem, read the whole problem carefully and then follow these three steps:

> **Step 1** Represent the unknown with a letter.
> **Step 2** Write an equation that represents the problem.
> **Step 3** Solve the equation for the unknown.

EXAMPLE 1 Seven times a number is equal to 147. What is the number?

Step 1 Let x equal the unknown number.
Step 2 Write an equation for the problem.

$$7x = 147$$

Step 3 Solve the equation. Divide each side by 7.

$$\frac{7x}{7} = \frac{147}{7}$$

$$\mathbf{x = 21}$$

Answer: $x = 21$
The unknown number is 21.

EXAMPLE 2 **Six times a number plus 7 is equal to 55. What is the number?**

Step 1 Let x equal the unknown number.
Step 2 Write an equation for the problem.

$$6x + 7 = 55$$

Step 3 Solve the equation.
a) Subtract 7 from 55.
b) Divide 48 by 6.

$$6x = 55 - 7$$
$$6x = 48$$
$$x = 48 \div 6$$
$$\boldsymbol{x = 8}$$

Answer: The number is 8.

EXAMPLE 3 **Three times the quantity a number minus 4 is equal to two times the sum of the number plus 3. What is the number?**

Step 1 Let x equal the unknown number.
$3(x – 4)$ is three times the quantity x minus 4
$2(x + 3)$ is two times the sum of x plus 3
Step 2 Write an equation for the problem.

$$3(x – 4) = 2(x + 3)$$

Step 3 Solve the equation.
a) Remove parentheses.

b) Subtract $2x$ from $3x - 12$.
c) Add 12 to 6.

$$3x - 12 = 2x + 6$$
$$3x - 2x - 12 = 6$$
$$x - 12 = 6$$
$$x = 6 + 12$$
$$\boldsymbol{x = 18}$$

Answer: The number is 18.

Sam & Silo by *Dumas*

Examples 4, 5 and 6 show how to set up a word or story problem in algebra. Study these carefully.

EXAMPLE 4 **Bill saves 1/2 of his monthly paycheck. If his monthly savings is $92, how much does he earn each month?**

Step 1 **Let x = monthly income because this is the unknown quantity that you must find.**
$92 = monthly savings
1/2 = fraction saved

Step 2 **Write an equation for the problem.**
Fraction saved times income = savings

$$1/2x = \$92$$

Step 3 **Solve the equation. Multiply each side by 8.**

$$(8)1/2x = \$92(8)$$
$$x = \$736$$

Answer: $x = \$736$
Bill earns $736 each month

EXAMPLE 5 **Jack and Steve do yard work. Because Jack provides the truck, gas, and yard equipment, he receives twice the money that Steve does. If they collect $540, how much does each receive?**

Step 1 **Let x = Steve's share**

$2x$ = Jack's share (We know that Jack receives twice Steve's share.)

Step 2 **Write an equation for the problem.**

Jack's share plus Steve's share = \$540

$$2x + x = 540$$

Step 3 **Solve the equation.**

a) Combine the x's.

b) Divide 540 by 3.

$$3x = 540$$

$$x = 540 \text{ ¸ } 3$$

$$x = \$180$$

$$2x = \mathbf{2(180)} = \$360$$

Answer: x = \$180 Steve's share

$2x$ = \$360 Jack's share

EXAMPLE 6 **Mary, Anne, and Sally share living expenses. Anne pays \$25 less rent than Mary. Sally pays twice as much rent as Anne. If the total rent is \$365, how much rent does each pay?**

Step 1 ***Hint:*** **Since you know nothing about how much Mary pays for rent, let Mary's rent equal x.**

Let x = Mary's rent

$x - 25$ = Anne's rent

$2(x – 25)$ = Sally's rent

Step 2 **Write an equation for the problem.**
Mary's + Anne's + Sally's = total rent.

$$x + (x - 25) + 2(x - 25) = 365$$

Step 3 **Solve the equation.**
a) Remove parentheses.
b) Combine the *x*'s and the numbers.
c) Add 75 to 365.
d) Divide 440 by 4.

$$x + x - 25 + 2x - 50 = 365$$
$$4x - 75 = 365$$
$$4x = 365 + 75$$
$$4x = 440$$
$$x = 440 \div 4$$
$$x = 110$$

Answer: x = \$110, Mary's rent
$x - 25$ = \$85, Anne's rent
$2(x - 25)$ = \$170, Sally's rent

Practice Exercise

Solve for the number.

1. If 8 is added to a certain number, the sum is 19. What is the number?

2. If a large number is divided by 12, the answer is 121. What is the large number?

3. Joan pays 1/12 of her total monthly income in property taxes. If she paid $45 last month in taxes, what was her monthly income?

4. When a certain number is decreased by 12, the result is 9. Find the number.

5. Jim pays 2/7 of his monthly earnings for the rent of his truck. If his truck rental averages $220 a month, what is his average monthly income?

6. Eight times a number plus 9 is equal to 73. What is the number?

7. Two-thirds of a number plus one-sixth of the same number is equal to 25. What is the number?

8. Susan and Terry run a day-care center. Since they use Susan's

house, it was agreed that her share is to be twice Terry's share. If they earn $225, how much is each person's share?

9. Five times a number minus 7 is equal to three times the same number plus 19. What is the number?

10. Lucy earns $400 a month in salary and she receives a commission of $18 for each appliance she sells. If last month Lucy earned a total of $886, how many appliances did she sell?

11. Three times the sum of a number plus 1 is equal to two times the sum of the number plus 4. What is the number?

12. Maria, Amy, and Sarah share food expenses. Amy pays $10 a month less than Maria. Sarah pays twice as much as Amy. If the monthly food bill is $310, how much does each pay?

13. Five times the quantity x minus 1 is equal to three times the quantity x plus 9. What is x?

14. Frank, Sam, and Lou went to lunch. Sam's meal cost $.45 less than Frank's. Lou's meal cost twice as much as Sam's. If the bill came to $9.25, how much does each one owe?

15. Two-thirds times the quantity y minus 3 is equal to one-third y. What is y?

Answer Key

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2. n – 57 = -3 **3.** 2(n + 97) = 214
4. n + 20 = 111 **5.** 11n – 11 = 33
6. 3n + 5 = 23 **7.** 8n – 3 = 77
8. n – 20 = -15 **9.** 2n – 11 = 7
10. n – 5 = 62 **11.** 12(n + 4) = 84
12. 10n + 8 = 38 **13.** 9n – 10 = 71
14. 12 + 6n = 42 **15.** 81 + n = 112
16. 4n = 40 **17.** n + 7n = 96 **18.** n/5 = 45
19. n – 73 = 19 **20.** 8 + 2n = 26

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2. 95 **3.** 53 **4.** 80 **5.** 6 **6.** 1 **7.** 90
8. 16 **9.** 14 **10.** 94 **11.** 58.3 **12.** 4
13. 52 **14.** 15 **15.** 100 **16.** 67 **17.** 58
18. 100

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2. 105 **3.** 83 **4.** 88 **5.** 4 **6.** 20
7. 1 **8.** 56 **9.** 210 **10.** 72 **11.** 45
12. 7 **13.** 60 **14.** 71.5 **15.** –100
16. –6 **17.** 69 **18.** 10

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2. 55 **3.** 56 **4.** 3 **5.** 19 **6.** 8 **7.** 15
8. –172 **9.** 13 **10.** 13 **11.** –7 **12.** 15
13. 8 **14.** 10 **15.** 11 **16.** 14 **17.** –6
18. 4 **19.** 10 **20.** 24

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1. x = 10 **2.** x = -2 **3.** a = 6 **4.** b = 72

5. x = 24 **6.** x = 5 **7.** x = 6 **8.** m = 7
9. x = 6 **10.** x = 11 **11.** x = 18
12. x = -.9 **13.** x = 12 **14.** y = -10
15. x = 9 **16.** x = 3 **17.** x = 11
18. x = 1

Page 22 **2.** x = 3 **3.** y = 4 **4.** b = 40 **5.** b = 44
6. x = 7 **7.** x = 12 **8.** x = 5 **9.** b = 50
10. b = 27 **11.** z = 13 **12.** x = 8
13. x = 10 **14.** n = 4 **15.** b = 72
16. x = 5 **17.** x = 7 **18.** x = 9
19. b = 66 **20.** x = 11 **21.** b = 60
22. x = -3 **23.** b = 132 **24.** a = 3

Page 26 **1.** a = 5 **2.** b = 4 **3.** m = 4 **4.** y = -4
5. z = 21 **6.** a = 20 **7.** y = 1 **8.** z = 3

Page 34 **1.** 11 **2.** 1452 **3.** $540 **4.** 21
5. $770 **6.** 8 **7.** 30
8. Terry gets $75; Susan gets $150 **9.** 13
10. 27 appliances **11.** 5
12. Maria pays $85; Amy pays $75; Sarah pays $150 **13.** x = 5 **14.** Frank owes $2.65; Sam owes $2.20; Lou owes $4.40 **15.** y = 9