MATHEMATICS ALGEBRA

YEAR 5

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EDITOR'S NOTE

Editor's Note

My name is Steve and I set out on a mission to truly empower kids in their educational endeavours. Having been through all the rigorous tests myself and in the education industry for over a decade I have come to understand the fundamental factors required for students to excel in their education.

I know you will find this book valuable and if you would like to speak to my team and I reach out to us here:

https://scholarlytraining.com/

Regards, Steve

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Unit 12
Algebra

ALGEBRA

Algebra is the part of mathematics that helps represent problems or situations in the form of mathematical expressions. In algebra, we use numbers like 2, -7, 0.068, etc., which have a definite or fixed value. In algebra we use variables like x, y and z along with numbers.

Algebra helps solve the mathematical equations and allows to derive unknown quantities, like the bank interest, proportions, percentages. We can use the variables in the algebra to represent the unknown quantities that are coupled in such a way as to rewrite the equations.

The algebraic formulas are used in our daily lives to find the distance and volume of containers and figure out the sales prices as and when needed. Algebra is constructive in stating a mathematical equation and relationship by using letters or other symbols representing the entities. The unknown quantities in the equation can be solved through algebra.

12.1 Writing Equations for Word Problems

- First, you want to identify the unknown, which is your variable. What are you trying to solve for? Identify the variable: Use the statement, Let x=_____. You can replace the x with whatever variable you are using.
- Look for keywords that will help you write the equation. Highlight the key words and write an equation to match the problem.

- The following key words will help you write equations for Algebra word problems:

Addition	Subtraction	Multiplication	Division
altogether increase more plus sum total combine	difference decrease less fewer reduce minus	per times product double (2x) triple (3x) quadruple (4x)	quotient divided by divided into per share split

EXAMPLE

1. Linda was selling tickets for the school play. She sold 10 more adult tickets than children tickets and she sold twice as many senior tickets as children tickets. Let x represent the number of children's tickets sold.

a. Write an expression to represent the number of adult tickets sold.

Solution:

Since she sold 10 more adult tickets than children tickets, the expression is

x+10 number of adult tickets sold

b. Write an expression to represent the number of senior tickets sold.

Solution:

Since she sold twice (2x) as many senior tickets as children's tickets, the expression is:

2x number of adult tickets sold

c. If adult tickets cost S5, children's tickets cost S2, and senior tickets cost S3. Linda made S700. Write an equation to represent the total ticket sales.

Solution:

$$5\,(x + 10) + 2x + 3\,(2x) = 700$$

where:

5 = S5; (x+10) = # of adult tickets;
2 =S2; x=# of children'stickets
3 = S3; 2x=# of senior tickets; 700 = total amount

d. How many children's tickets were sold for the play? How many adult tickets were sold? How many senior tickets were sold?

Solution:

Solve for x then substitute into the original expressions:

$$5\,(x + 10\,) + 2x + 3\,(2x) + 100$$
$$5x + 50 + 2x + 6x = 700$$
$$13x + 50 = 700$$
$$\frac{3x}{13} \times \frac{650}{13}$$
$$x = 50$$

Thus,

x = 50	50 children's ticket
x + 10 = adults tickets	60 adult tickets
2x = senior tickets	2(50) = 100 senior tickets

A few notes about this problem:

- In this problem, the variable was defined for you. Let x represent the number of children's tickets sold tells what x stands for in this problem. If this had not been done for you, you might have written it like this:

  Let x=the number of children'stickets sold

- For the first expression, we know that 10 more adult tickets were sold. Since more means add, our expression was (x+10). Since the direction asked for an expression, we don't need an equal sign. An equation is written with an equal sign and an expression is without an equal sign. At this point, we don't know the total number of tickets.

- For the second expression, you knew that the key words, twice as many meant two times as many. So our expression was 2x.

- We know that to find the total price we have to multiply the price of each ticket by the number of tickets. Take note that since x+10 is the quantity of adult tickets, we must put it in parentheses! So, when you multiply by the price of S5 you have to distribute the 5.

- Once we solve for x, we know the number of children's tickets and we can take the expression that we wrote for a &b and substitute 50 for x to figure out how many adult and senior tickets were sold.

2. You have S60 and your sister has S120. You are saving S7 per week and your sister is saving S5 per week. How long will it be before you and your sister have the same amount of money? Write an equation and solve.

Solution:

Let x=number of weeks

$$7x + 60 = 5x + 120$$

$7x = 60$ Your money S7 per week + 60
$5x + 120$ Your sister's money S5 per week + 120

Solve. This is an equation with variables on both sides.

$$7x + 60 + 5x + 120$$
$$7x + 5x + 60$$
$$\frac{2x}{2} \times \frac{60}{2}$$
$$x = 30$$

Thus, in 30 weeks you and your sister will have the same amount of money.

Notes:

- S60 and S120 are constants because this is the amount of money that they each have to begin with. This amount does not change.
- S7 per week and S5 per week are rates. The key word "per" in this situation means to multiply.
- The key word "same" in this problem means that I am going to set my two expressions equal to each other.
- When we set the two expressions equal, we now have an equation with variables on both sides.
- After solving the equation, you find that x=30, which means that after 30 weeks, you and your sister will have the same amount of money.

3. The sum of two numbers is 16. The difference is 4. What are the two numbers?

Solution

Let x be the first number. Let y be the second number

$x + y = 16$
$x - y = 4$

Adding the left sides and the right sides gives:

$$x + x + y - y = 16 + 4$$
$$2x = 20$$
$$x = 10$$

Since

$$x + y = 16$$
$$10 + y = 16$$
$$y = 6$$

The numbers are 10 and 6.

4. Carla is 12 years older than Dave. Five years ago, the sum of their ages was 28. How old are they now?

Solution:

- The first sentence tells us that Carla is 12 years older than Dave (this is the current age)
- The second sentence tells us the age change for both Carla and Dave is five years ago (-5)

If we are going to have this in a chart:

Person or Object	Current Age	Age change (-5)
Carla (C)	D +12	D +12-5D +7
Dave (D)	D	D – 5

The last statement gives us the equation to solve:

Five years ago, the sum of their ages was 28

$$D + 7 + D - 5 = 28$$
$$2D + 2 = 28$$
$$2D = 28 - 2$$

$$2D = 26$$
$$\frac{2D}{2} = \frac{26}{2}$$
$$D = 23$$

Therefore, Carla is Dave's age (13) + 12 years = 25 years old.

5. The sum of the ages of Raven and Zachary is 32. In two years, Raven will be three times as old as Zachary. How old are they now?

Solution:

- The first sentence tells us that the sum of the ages of Raven and Zachary is 32. So, R + Z = 32, which means that R = 32 - Z or Z = 32 - R (we will use these equations to eliminate one variable in our final equation)
- The second sentence tells us that the age change for both Raven and Zachary is in two years (+2)

If we are going to have this in chart:

Person or Object	Current Age	Age Change (+2)
Raven (R)	R	R+2
Zachary (Z)	32-R	(32-R) +234-R

The last statement gives us the equation to solve:

In two years, Raven will be three times as old as Zachary.

$$R + 2 = 3\,(\,34 - R\,)$$
$$R + 2 = (\,102 - 3R\,)$$
$$3R + R = 102 - 2$$
$$4R = 100$$
$$\frac{4R}{4} + \frac{100}{4} = 25$$

If Raven is 25 years old, then Zachary is 32 -25 = 7 years' old.

6. Tanya is 28 years older than Marcus. In 6 years, Tanya will be three times as old as Marcus. How old is Tanya now?

Solution:

In this problem, we are only asked to find Tanya's current age. However, the problem also gave us a lot of other information which can be overwhelming. To help us organize the important details, let's create a table to list what we know so far.

Since we are only given details about their current ages and what they will be 6 years from now, we'll go ahead and gray out the past column.

Name	Past	Present	Future (in 6 years)
Tanya			
Marcus			

You may notice that Tanya's current age is defined using the age of Marcus. However, Marcus's present age is currently unknown. So, let's express Marcus's age using the variable x. Since Tanya is 28 years older than Marcus, then Tanya's present age must be x + 28.

Name	Past	Present	Future (in 6 years)
Tanya		x + 28	
Marcus		x	

Next, let's fill in the Future column which will consist of their ages in 6 years. All we have to do is add 6 to Tanya and Marcus's present or current ages. Therefore, we have:

- Tanya : $x + 28 + 6 = x + 34$
- Marcus: $(x + 6)$

Name	Past	Present	Future (in 6 years)
Tanya		x + 28	x + 34
Marcus		x	x + 6

Now that our table is filled out, we can go ahead and create our equation based on the information provided. The problem states the following:

Here we are trying to find the relationship between their ages in the future. We can simply say that,

Tanya's age in 6 years = 3 (Marcus's age in 6 years)

With that in mind, we can easily construct our equation:

$$x + 34 = 3 (x + 6)$$

Solution:

$$x + 34 = 3 (x + 6)$$
$$x + 34 = 3x + 18$$

$$34 = 3x - x + 18$$
$$34 = 2x + 18$$
$$34 - 18 = 2x$$
$$16 = 2x$$
$$\frac{16}{2} = \frac{2x}{2}$$
$$8 = x$$

Now that we have the value for x, let's find out what Tanya and Marcus's current ages are. We can do this by simply replacing the x's with 8.

Current ages (present)

- Marcus: x=8 years old
- Tanya: x+28=8+28=36 years old

Going back to the problem's question, how old is Tanya now?

Answer: Tanya is 36 years old

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