

Saint Ninian's Cluster



Parent and Pupil Guide to Algebraic Thinking



Overview

Algebra is a way of thinking; it is a method of seeing and expressing relationships between numbers and generalising patterns. Algebraic thinking is not just about symbols and equations.

From Primary One, children begin to lay **the foundations for algebra**. This includes:

- Writing equations and calculations e.g. 16 add 8 equals?
- Solving equations e.g. $2 + \square = 7$
- Identifying number patterns
- Expressing relationships
- Understanding the commutative ($6 + 3 = 3 + 6$) and associative laws ($7 + 4 + 2 = 4 + 7 + 2$)

Key Vocabulary

Expression	An Expression is a group of terms (the terms are separated by + or - signs)
Equation	An equation says that two things are equal. It will have an equals sign "="
Method line	The strategy we use to solve equations. It is a list of steps we follow and apply to both sides of the equation.
Variable	A Variable is a symbol for a number we don't know yet. It is usually a letter like x or y.
Operator	An Operator is a symbol (such as +, x, etc) that shows an operation (ie we want to do something with the values).

Early Level

As children begin to develop their maths skills in nursery and the early stages of primary school, they will be forming an understanding of 'algebraic thinking'

This begins with being able to:

- Recognise "+" as the addition sign, "-" as the subtraction sign and "=" as the equals sign.
- Record addition / subtraction equations within ten.

Example:

$$4 + 6 = 10$$

$$6 - 4 = 2$$

$$3 + 2 = 5$$

$$5 - 2 = 3$$

- Identify missing digits from a sequence.

Examples

1. Which number is missing?

1, 2, 3, __, 5,

2. Which numbers are missing?

1, __, 3, __, 5, 6, __, 8

3. Which number is next?

1, 2, 3, 4, __

4. Which number is next?

6, 7, 8, 9, __

Key vocabulary at this stage is the word 'equals' instead of 'makes'.

First Level

The next stages in developing algebra skills include being able to:

- Identify the missing number in a calculation.
- Recognise that the equals sign signifies balance or equality in a number sentence.

Introduce the term "algebra" when symbols are used for unknown numbers or operators.

Examples:

Identify missing numbers in calculations:

1. $2 + \square = 7$ (Read this as "Two add what makes seven?")
2. $2 \square 6 = 8$ (Read this as "What sign is missing?")
3. $6 = 3 + \square$ (Read this as "Six is equal to three add what?")
4. $10 - 4 = \square$ (Read this as "Ten subtract four equals what?")
5. $12 + \square = 20$ (Read this as "Twelve plus what equals twenty")
6. $20 - \square = 11$ (Read this as "Twenty minus what equals eleven")
7. $13 \square 7 = 20$ (Read this as "What sign is missing?")
8. $9 + 11 \square 20$ (Read this as "What sign is missing?")

Use the word 'something' or 'what' to represent numbers or operators rather than 'box' or 'square' when solving these equations.

Second Level

At this stage pupils will build upon their previous maths and algebraic thinking skills to tackle function machines and more "traditional" algebra.

This includes being able to:

- Use "in" and "out", raising awareness of the terms "input" and "output".
- Apply a given rule to an input in terms of +, -, \times or \div using a single digit.

Examples:

Rule : Add 2

In	→	Out
4	→	6
6	→	
8	→	

Rule: Subtract 5

In	→	Out
10	→	5
8	→	
7	→	

Rule: Multiply by 5

In	→	Out
4	→	20
	→	15
	→	10

Rule: Divide by 2

In	→	Out
8	→	4
	→	6
	→	8

What is the rule?

In	→	Out
12	→	4
18	→	6
24	→	8

Simplifying algebraic expressions

This is also known as 'gathering like terms'. This simply means that we can collect all the same variables (letters) and numbers together to make things easier.

Examples:

1. $a + a + a + a = 4a$

2. $b + b + b = 3b$

3. $2y + 2y - y = 3y$

4. $3t + t + t = 5t$

5. $5k + k + 7 + 2 = 6k + 9$

6. $4x + 2x - 7 = 6x - 7$

Pupils will also begin to develop an understanding:

- That letters and symbols can represent numbers.
- That the equals sign signifies balance in an equation.
- That the value of a symbol or letter can vary depending on the equation.

Demonstrate a knowledge of algebraic notation

Example:

1. $3 \times t = 3t$
2. $5 \times k = 5k$
3. $6y = 6 \times y$

Solve simple equations

We solve equations by using a "method line". The method line is a list of steps taken in trying to solve an equation. When solving an equation we do the same to both sides of the equation in order to keep it **balanced**.

Basic Equations

1. $x + 2 = 6$ | $- 2$ (subtract 2 from both sides of the equation to find the value of x)
 $x = 4$
2. $b - 5 = 12$ | $+ 5$ (add 5 to both sides of the equation to find the value of b)
 $b = 17$
3. $2e = 8$ | $\div 2$ (divide both sides of the equation by 2 to find the value of e)
 $e = 4$
4. $5t = 30$ | $\div 5$ (divide both sides of the equation by 5 to find the value of t)
 $t = 6$

Useful Websites

<http://www.math-play.com/Algebra-Math-Games.html>

http://www.mathplayground.com/index_prealgebra.html

<http://www.topmarks.co.uk/Flash.aspx?f=FunctionMachinev3>

<http://www.mathplayground.com/functionmachine.html>

<http://www.littlefishsw.co.uk/card/functionmachine.html>