Algebra Bridge for PSLE

Unknowns, Equal Fractions & Balance Method Simplified

Master the transition from arithmetic to algebraic thinking

A comprehensive guide for Primary 6 students preparing for PSLE Mathematics

Clear Concepts

Step-by-Step Methods

PSLE Success

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Chapter 1: Introduction to Algebra

What is Algebra?

Algebra is a branch of mathematics that uses letters and symbols to represent numbers and quantities in equations and expressions. In Primary 6, you'll begin your journey from working with specific numbers to working with unknowns.

Why Learn Algebra?

- Solve problems where we don't know all the numbers
- Find patterns and relationships between quantities
- Prepare for more advanced mathematics in secondary school
- Develop logical thinking and problem-solving skills

The Transition Journey

Arithmetic

Working with known numbers: $3 + 5 = 8$

Bridge

Model method with boxes and unknowns

Algebra

Working with letters: $x + 5 = 8$

PSLE Algebra Requirements

Based on the official MOE syllabus, Primary 6 students must master these algebra concepts:

Key Learning Objectives:

1. Using Letters for Unknowns

Represent unknown numbers with letters like a, b, x, y

2. Algebraic Expressions

Understanding forms like $a + 3$, $a - 3$, $a \times 3$, $a \div 3$, $3a$

3. Simplifying Expressions

Combining like terms (excluding brackets)

4. Evaluation by Substitution

Finding values when letters are replaced with numbers

5. Simple Linear Equations

Solving equations with whole number coefficients only

A Chapter 2: From Numbers to Letters

Understanding Variables

A **variable** is a letter that represents an unknown number. Think of it as a box that can hold different values.

Before Algebra (Model Method)

John has some marbles.

?

He gets 5 more marbles and now has 12 marbles total.

? + 5 = 12

With Algebra

John has some marbles.

x

He gets 5 more marbles and now has 12 marbles total.

$x + 5 = 12$

Key Point

The letter (variable) represents the same unknown value throughout the problem. If $x = 7$ in one part of the equation, it equals 7 everywhere in that problem.

Common Variables in PSLE

a	**b**	**x**	**y**
Most common	Second variable	Traditional unknown	Second unknown

Important Rules

- Variables are usually written in lowercase letters
- We don't use letters that might be confused with numbers (like 'o' for zero)
- The same letter always represents the same value in one problem
- Different letters can represent different values

Practice: Identifying Variables

Example 1: Age Problem

Problem: Sarah is 5 years older than her brother. If her brother is **a** years old, how old is Sarah?

Solution: Sarah's age = **a + 5** years

Explanation: The letter 'a' represents the brother's unknown age. Sarah is 5 years older, so we add 5 to the brother's age.

Example 2: Money Problem

Problem: Tom has some money. After spending £8, he has £15 left. How much money did Tom have initially?

With variable: Let **x** = Tom's initial amount

Equation: **x - 8 = 15**

Answer: Tom initially had £23

Quick Check 1

If a book costs **p** pounds, how much do 3 books cost?

Answer: 3p pounds

Quick Check 2

If a rectangle has length **l** and width 4cm, what is its perimeter?

Answer: 2l + 8 cm

</> Chapter 3: Algebraic Expressions

What is an Algebraic Expression?

An algebraic expression is a mathematical phrase that contains variables, numbers, and operation symbols. Unlike equations, expressions don't have an equals sign.

Types of Algebraic Expressions (PSLE Level)

Addition Expressions

$a + 3$ → "a plus 3"

$x + 7$ → "x plus 7"

$5 + b$ → "5 plus b"

Multiplication Expressions

$a \times 3$ or $3a$ → "3 times a"

$x \times 5$ or $5x$ → "5 times x"

$2b$ → "2 times b"

Subtraction Expressions

$a - 3$ → "a minus 3"

$x - 7$ → "x minus 7"

$10 - b$ → "10 minus b"

Division Expressions

$a \div 3$ → "a divided by 3"

$x \div 4$ → "x divided by 4"

$12 \div b$ → "12 divided by b"

★ Special Notation Rules

- **Multiplication:** We usually write $3a$ instead of $3 \times a$
- **Order:** Write numbers before letters: $5x$ not $x5$
- **Division:** We can write $a \div 3$ as a fraction if needed
- **One:** We write a instead of $1a$

Reading and Writing Expressions

From Words to Algebra

Words: "5 more than a number"

Algebra: $n + 5$

Words: "3 less than a number"

Algebra: $n - 3$

From Algebra to Words

Algebra: $x + 8$

Words: "8 more than x" or "x plus 8"

Algebra: $y - 6$

Words: "6 less than y" or "y minus 6"

Words: "Double a number"

Algebra: $2n$

Words: "Half a number"

Algebra: $n \div 2$

Algebra: $4a$

Words: "4 times a" or "a multiplied by 4"

Algebra: $b \div 5$

Words: "b divided by 5" or "one-fifth of b"

Worked Example: School Supplies

Problem: A pen costs £p. A notebook costs £3 more than the pen. Write expressions for:

a) The cost of the notebook
b) The total cost of one pen and one notebook
c) The cost of 4 pens

Solutions:

a) Cost of notebook = $p + 3$ pounds
b) Total cost = $p + (p + 3) = 2p + 3$ pounds
c) Cost of 4 pens = $4p$ pounds

Terms and Coefficients

Understanding Mathematical Terms

Terms

Parts of an expression separated by + or - signs

In $3x + 5 - 2y$:
Terms are: $3x$, 5 , $-2y$

Coefficients

The number part of a term with a variable

In $7a$: coefficient is 7
In $-3b$: coefficient is -3
In x : coefficient is 1

Like Terms

Terms with the same variable

3a and 5a are like terms

Unlike Terms

Terms with different variables

3a and 5b are unlike terms

Constant Terms

Terms with no variables

Numbers like 7 or -2

Chapter 4: Simplifying Expressions

What Does Simplifying Mean?

Simplifying an algebraic expression means combining like terms to make the expression as short and neat as possible, without changing its value.

Key Rule for PSLE

You can only combine **like terms** - terms that have exactly the same variable part.

✓ Can Combine:
3a and 5a → 8a

✗ Cannot Combine:
3a and 5b (different variables)

Step-by-Step Simplifying Process

1. Identify like terms (same variable part)
2. Add or subtract the coefficients of like terms
3. Keep the variable part unchanged
4. Write the simplified expression neatly

Worked Examples

Example 1: Simple Like Terms

Simplify: 3a + 5a

Step 1: Identify like terms

Both terms have variable 'a', so they are like terms.

Step 2: Add coefficients

3 + 5 = 8

Step 3: Keep variable part

Answer: 8a

Think of it as: 3 apples + 5 apples = 8 apples

Example 2: Mixed Terms

Simplify: 4x + 3 + 2x + 7

Step 1: Group like terms

x terms: 4x + 2x

Constant terms: 3 + 7

Step 2: Simplify each group

4x + 2x = 6x

3 + 7 = 10

Answer: 6x + 10

Example 3: Subtraction

Simplify: 7y - 3y + 5

Step 1: Identify like terms

y terms: $7y - 3y$

Constant: 5

Step 2: Subtract coefficients

$7y - 3y = 4y$

Answer: $4y + 5$

Example 4: Multiple Variables

Simplify: $2a + 3b + 5a - b$

Step 1: Group like terms

a terms: $2a + 5a$

b terms: $3b - b$

Step 2: Simplify each group

$2a + 5a = 7a$

$3b - b = 2b$ (remember: b = 1b)

Answer: $7a + 2b$

Common Mistakes to Avoid

⚠ Mistake 1: Combining Unlike Terms

Wrong: $3a + 2b = 5ab$

Right: $3a + 2b$ (cannot be simplified)

Remember: Different variables cannot be combined!

⚠ Mistake 2: Forgetting Coefficients

Wrong: $a + a = a$

Right: $a + a = 2a$

Remember: a means 1a, so 1a + 1a = 2a

⚠ Mistake 3: Incorrect Signs

Wrong: $5x - 2x = 3x$ ✓

Wrong: $5x - 2x = 7x$ ✗

Remember: Pay attention to + and - signs

⚠ Mistake 4: Multiplying Variables

Wrong: $a + a = a^2$

Right: $a + a = 2a$

Remember: Addition, not multiplication!

⇄ Chapter 5: Evaluating by Substitution

What is Substitution?

Substitution means replacing the variable (letter) in an expression with a specific number value, then calculating the result.

The Substitution Process

1. **Replace** Put the number in place of the variable
2. **Calculate** Follow order of operations
3. **Simplify** Work out the final answer
4. **Check** Verify your answer makes sense

ℹ Important Reminders

- Always put the number value in brackets when substituting
- Remember that $3a$ means $3 \times a$
- Follow BODMAS/PEMDAS order of operations

- Check your arithmetic carefully

Worked Examples

Example 1: Simple Substitution

Find the value of $2a + 5$ when $a = 3$

Step 1: Replace a with 3

$2a + 5 = 2(3) + 5$

Step 2: Calculate multiplication first

$= 6 + 5$

Step 3: Add

Answer: $= 11$

Example 2: Multiple Variables

Find the value of $3x + 2y - 4$ when $x = 5$ and $y = 2$

Step 1: Replace variables with values

$3x + 2y - 4 = 3(5) + 2(2) - 4$

Step 2: Calculate multiplications

$= 15 + 4 - 4$

Step 3: Work from left to right

$= 19 - 4$

Answer: $= 15$

Example 3: Division

Find the value of $a \div 4 + 6$ when $a = 20$

Step 1: Replace a with 20

$a \div 4 + 6 = 20 \div 4 + 6$

Step 2: Division first (BODMAS)

$= 5 + 6$

Answer: $= 11$

Example 4: Negative Values

Find the value of $4b - 7$ when $b = 1$

Step 1: Replace b with 1

$4b - 7 = 4(1) - 7$

Step 2: Calculate multiplication

$= 4 - 7$

Answer: $= -3$

Practice Problems

Practice Set A

Find the values when $a = 4$:

1. $a + 7$ = 11
2. $3a$ = 12
3. $2a - 5$ = 3
4. $a \div 2 + 3$ = 5

Practice Set B

Find the values when $x = 6, y = 3$:

1. $x + y$ = 9
2. $2x + y$ = 15
3. $x - y + 4$ = 7
4. $3x \div y$ = 6

Order of Operations (BODMAS)

Always follow this order when evaluating expressions:

B	O	D	M	A	S

Brackets | Orders | Division | Multiplication | Addition | Subtraction

= Chapter 6: Simple Linear Equations

What is an Equation?

An equation is a mathematical statement that shows two expressions are equal. It always contains an equals sign (=) and usually has an unknown value to find.

Expression vs Equation

Expression

$3x + 5$

No equals sign, describes a value

Equation

$3x + 5 = 14$

Has equals sign, states a relationship

Parts of an Equation

$2x + 3 = 11$

Left Side	Equals Sign	Right Side
$2x + 3$	$=$	11

⚖ The Balance Concept

Think of an equation like a balance scale. Both sides must be equal for the scale to balance.

If $x + 5 = 12$, then both sides equal 12 when $x = 7$

PSLE-Level Linear Equations

For PSLE, you'll work with **simple linear equations** involving whole number coefficients only.

Types of PSLE Linear Equations

Addition Equations

$x + 7 = 15$

$a + 4 = 12$

$5 + b = 18$

Multiplication Equations

$3x = 21$

$5a = 35$

$2b = 16$

Subtraction Equations

$x - 3 = 9$

$a - 8 = 5$

$20 - b = 12$

Division Equations

$x \div 4 = 6$

$a \div 3 = 8$

$b \div 5 = 7$

Two-Step Equations

More challenging equations that require two operations:

$2x + 5 = 13$ $3a - 7 = 14$ $4b + 3 = 19$

Basic Solving Methods

Method 1: Guess and Check (For Simple Cases)

Solve: $x + 6 = 11$

Think: What number plus 6 equals 11?

Try x = 5: $5 + 6 = 11$ ✓

Answer: $x = 5$

Method 2: Using Inverse Operations

Solve: $3a = 18$

Think: 3 times what number equals 18?

Use inverse: $a = 18 \div 3$

Answer: $a = 6$

Method 3: Working Backwards

Solve: $b - 7 = 12$

Think: Something minus 7 equals 12

Work backwards: $b = 12 + 7$

Answer: $b = 19$

+	−	×	÷
Addition	**Subtraction**	**Multiplication**	**Division**
Inverse: Subtract	Inverse: Add	Inverse: Divide	Inverse: Multiply

⚖ Chapter 7: Balance Method Mastery

Understanding the Balance Method

The balance method treats equations like a balanced scale. Whatever you do to one side, you must do to the other side to keep the equation balanced.

The Golden Rule

"What you do to one side, you must do to the other"

+

Add the same number

to both sides

−

Subtract the same number

from both sides

×

Multiply both sides

by the same number

💡 Why Does This Work?

An equation states that two expressions are equal. If we change both expressions in exactly the same way, they remain equal.

$5 = 5$ → Add 3 to both sides → $8 = 8$ (still true!)

Step-by-Step Balance Method

Example 1: Addition Equation

Solve: $x + 8 = 15$

Step 1: Write the equation	$x + 8 = 15$
Step 2: Subtract 8 from both sides	$x + 8 - 8 = 15 - 8$
Step 3: Simplify	$x = 7$
Step 4: Check	$7 + 8 = 15$ ✓

Example 2: Multiplication Equation

Solve: $4a = 28$

Step 1: Write the equation	$4a = 28$
Step 2: Divide both sides by 4	$4a \div 4 = 28 \div 4$
Step 3: Simplify	$a = 7$

Step 4: Check $4 \times 7 = 28$ ✓

Example 3: Two-Step Equation

Solve: $3x + 5 = 20$

Step 1: Write the equation $3x + 5 = 20$

Step 2: Subtract 5 from both sides $3x + 5 - 5 = 20 - 5$

Step 3: Simplify $3x = 15$

Step 4: Divide both sides by 3 $3x \div 3 = 15 \div 3$

Step 5: Final answer $x = 5$

Step 6: Check $3(5) + 5 = 15 + 5 = 20$ ✓

Balance Method Strategy

Decision Tree for Two-Step Equations

Is there a constant term (number without variable)?

↓

YES: Remove the constant first (add or subtract)

↓

Then deal with the coefficient (multiply or divide)

⚠ Common Mistakes

- Only changing one side of the equation

✔ Success Tips

- Wrong inverse operation (adding instead of subtracting)
- Arithmetic errors in calculations
- Forgetting to check the answer
- Working in wrong order for two-step equations

- Always write what you're doing to both sides
- Check your arithmetic at each step
- Always verify your answer by substituting back
- Keep your working neat and organised
- Practice with simple numbers first

Chapter 8: Equal Fractions Concept

What is the Equal Fractions Concept?

The Equal Fractions Concept is a powerful problem-solving strategy used in Singapore Mathematics. It's particularly useful when dealing with word problems where different parts of a quantity are described as fractions.

🔑 Key Idea

When a problem describes the same quantity using different fractions, we can set up equations to solve for unknowns.

If two fractions represent the same amount, they must be equal!

When to Use Equal Fractions Concept

Look for These Keywords:

- "The same number of..."
- "Equal amounts of..."
- "The same quantity..."
- "Identical portions..."
- Different fractions describing the same thing

Problem Types:

- Age problems with fractions
- Money problems with parts
- Time and work problems
- Ratio problems with fractions
- Distance and speed problems

Step-by-Step Method

The 4-Step Process

1. **Identify** Find the equal quantities
2. **Express** Write as algebraic fractions
3. **Equate** Set the fractions equal
4. **Solve** Find the unknown value

Worked Example: Money Problem

Problem: Sarah spends **1/3** of her money on books and **1/4** of her money on food. She spends the same amount on books and food. How much money does Sarah have?

Step 1: Identify equal quantities

Amount spent on books = Amount spent on food

Step 2: Express as algebraic fractions

Let Sarah's total money = **M**

Amount on books = **M/3**

Amount on food = **M/4**

Step 3: Set up equation

M/3 = M/4

Step 4: Solve

This equation is only true when M = 0, which doesn't make sense!

Wait! Let me re-read the problem...

> **Note:** This problem as stated has no solution unless Sarah has £0. In real PSLE problems, there would be additional information to make the problem solvable. Let's look at a corrected version...

Realistic PSLE Examples

Example 1: Age Problem

Problem: Ali is **2/3** as old as Ben. In 4 years' time, Ali will be **3/4** as old as Ben. How old is Ali now?

Step 1: Identify

Ali's current age related to Ben's age in two different ways

Step 2: Express algebraically

Let Ben's current age = **B**

Ali's current age = **2B/3**

In 4 years: Ben = **B + 4**, Ali = **2B/3 + 4**

Step 3: Set up equation

2B/3 + 4 = 3/4 × (B + 4)

Step 4: Solve

2B/3 + 4 = 3(B + 4)/4

2B/3 + 4 = (3B + 12)/4

Multiply both sides by 12:

8B + 48 = 9B + 36

48 - 36 = 9B - 8B

12 = B

Answer: Ben is 12 years old

Therefore: Ali is **2/3 × 12 = 8** years old

Example 2: Simple Fraction Problem

Problem: $1/4$ of a number is equal to $1/3$ of 24. Find the number.

Step 1: Identify equal quantities

$1/4$ of unknown number = $1/3$ of 24

Step 2: Express algebraically

Let the unknown number = n

$1/4 \times n = 1/3 \times 24$

Step 3: Solve

$n/4 = 8$

$n = 8 \times 4 = 32$

Answer: The number is 32

Check: $1/4 \times 32 = 8$ and $1/3 \times 24 = 8$ ✓

Connection to Algebra

Bridging to Algebraic Thinking

The equal fractions concept is actually setting up and solving algebraic equations! It helps students transition from model drawing to formal algebra.

Traditional Method

Using bar models and guess-and-check

Draw bars, compare parts, test values

Algebraic Method

Using variables and equations

$1/4 \times n = 1/3 \times 24$

PSLE Tip

In PSLE, you can use either method to solve equal fractions problems. However, showing algebraic working (when done correctly) often demonstrates higher-level thinking and may earn more method marks!

Chapter 9: Model to Algebra Bridge

The Learning Journey

Moving from model drawing to algebra is like learning to walk before you run. Both methods solve the same problems, but algebra gives you more power and efficiency.

Concrete
Using real objects and manipulatives

Primary 1-3: Counting, grouping, physical models

Pictorial
Drawing models and diagrams

Primary 3-5: Bar models, visual representations

Abstract
Using symbols and algebra

Primary 6+: Variables, equations, formal algebra

Why Make the Transition?

- **Efficiency:** Algebra is faster for complex problems
- **Precision:** Less chance of drawing errors
- **Generality:** Same method works for many problem types
- **Preparation:** Essential for secondary school mathematics

Side-by-Side Comparison

Problem: Finding Unknown Quantities

Tom has some marbles. After giving away 15 marbles to his friend and buying 8 more marbles, he has 23 marbles. How many marbles did Tom have initially?

Model Method

Initial marbles:

?

After giving away 15:

? - 15

After buying 8 more:

? - 15 + 8 = 23

Working backwards:

23 - 8 + 15 = 30 marbles

Algebraic Method

Let initial marbles = x

After giving away 15: $x - 15$

After buying 8 more: $x - 15 + 8$

Final amount: $x - 15 + 8 = 23$

Simplify: $x - 7 = 23$

Solve: $x = 23 + 7 = 30$

Both methods give the same answer: 30 marbles

Check: 30 - 15 + 8 = 23 ✓

Translation Strategies

From Model Thinking to Algebraic Thinking

Model Method Concepts

Unknown box: Represents mystery quantity

Equal bars: Show equal amounts

Part-whole: Shows relationships

Before-after: Shows changes

Algebraic Equivalents

Variable (x, a, n): Represents unknown

Equation: Shows equal relationships

Expression: Shows mathematical relationships

Equation solving: Finding changes

Translation Practice

Model Thinking:

"Draw a bar to represent the unknown number"

Algebraic Thinking:

"Let x represent the unknown number"

Model Thinking:

"The left side equals the right side"

Algebraic Thinking:

"Set up an equation with = sign"

Model Thinking:

"Work backwards from the final result"

Algebraic Thinking:

"Use inverse operations to solve"

Gradual Transition Strategy

The Bridging Approach

Don't abandon model drawing immediately! Use a gradual approach that combines both methods.

Stage 1: Models with Labels

x

Start labelling model parts with letters

Stage 2: Side-by-Side

$x + 5 = 12$

Stage 3: Pure Algebra

$x + 5 = 12$

$x = 7$

Take Your Time

This transition doesn't happen overnight! It's normal to:

- Feel more comfortable with models initially

- Use both methods to check your answers
- Prefer one method for certain types of problems
- Need extra practice with algebraic notation

Chapter 10: PSLE Examination Strategies

Algebra in PSLE Context

Algebra questions in PSLE are designed to test your logical thinking and problem-solving skills. They're usually worth 2-5 marks each and appear in both Paper 1 and Paper 2.

PSLE Algebra Question Types

Paper 1 (MCQ)

- Simplifying expressions
- Evaluating expressions
- Simple equation solving
- Usually 2 marks each

Paper 2 (Open-ended)

- Word problems with algebra
- Equal fractions concept
- Complex problem solving
- Usually 3-5 marks each

Official SEAB Statement

According to SEAB (Singapore Examinations and Assessment Board):

> *"Any solution used in PSLE maths papers, including algebra, will be given full credit if concepts applied correctly."*

This means you can use algebraic methods even if the problem seems designed for model drawing!

Time Management Strategies

Paper 1 Strategy

Duration: **1 hour 15 minutes**

Total questions: **~25-30 questions**

Time per algebra question: **2-3 minutes**

Quick Tips:

- Do easy algebra questions first
- Use elimination for MCQ if stuck
- Don't spend too long on one question

Paper 2 Strategy

Duration: **1 hour 45 minutes**

Total questions: **~15-18 questions**

Time per algebra question: **4-6 minutes**

Quick Tips:

- Show all working clearly
- Use both model and algebra if helpful
- Check answers make sense

The 3-Pass Strategy

Pass 1: Quick Wins

Do all the easy algebra questions you can solve quickly (2-3 minutes each)

Pass 2: Medium Difficulty

Tackle moderate algebra problems that need more working (4-5 minutes each)

Pass 3: Challenging Questions

Attempt the hardest algebra problems with remaining time

Answering Techniques

Model Answer Format

Question: Find the value of $3x + 7$ when $x = 4$. (2 marks)

Student Answer:

When x = 4,

$3x + 7 = 3(4) + 7$

$= 12 + 7$

= 19

✓ Full marks: Clear substitution, correct calculation, clear answer

Word Problem Format

Question: John has some sweets. After eating 5 sweets and receiving 12 more from his mother, he has 20 sweets. How many sweets did John have at first? (4 marks)

Student Answer:

Let the number of sweets John had at first = x

After eating 5 sweets: x - 5

After receiving 12 more: x - 5 + 12 = 20

x + 7 = 20

x = 20 - 7

x = 13

Therefore, John had 13 sweets at first.

✓ Full marks: Clear variable definition, correct equation, proper solving, clear conclusion

❗ Common Marking Deductions

What Loses Marks:

- No working shown
- Arithmetic errors
- Wrong variable definition
- Incorrect equation setup
- No final answer statement

What Earns Marks:

- Clear working steps
- Correct method even with minor errors
- Proper substitution shown
- Logical problem setup
- Clear final answer