Introduction

In our everyday lives , we are presented with many problems and situations which can be solved with mathematical processes.

To solve a problem we have to pose a question, "What is the best way to tackle this problem, what rule and what formula is best to use?" When we decide on a suitable formula we have to think what strategy to use to apply the formula to work out the problem.

"What else do we need to solve the problem?" To solve a problem we may need to apply two or more formulas. The processes in problem solving are interrelated. By practising the skills we learn to tackle new mathematical problems and arrive at the correct solution using the most appropriate methods.

When we are using formulas, we are using algebra. Algebraic expressions are part of every mathematical formula we use. Finding a pattern or rule is a very useful problem solving technique. Once you find the rule or formula you can use substitution to use the same rule with different numbers.

When working out areas we use formulas such as πr^2, $\frac{a+b}{2} \times h$, $L \times W$, etc.

We need algebra. We have to learn to use and apply formulas using algebra to solve problems.

Algebra is a mathematical system that uses pronumerals to stand for unknown values. A pronumeral takes place of a numeral. The most commonly used pronumerals are lower case letters.

Groups of pronumerals separated by '+' or '−' signs are called terms. Groups of terms make up expressions, $4a + 3a + a$, $2b + m + 3b$.

Expressions can be written in a more simple form, they can be simplified. When simplifying expressions we add or subtract like (alike, the same) terms. Like terms contain the same pronumeral parts. $3x + 4x + x = 8x$ $4x + y + y = 4x + 2y$

Expressions with unlike terms cannot be simplified. $3a + 2b + m$

To be able to solve mathematical problems quickly and accurately we have to be skilled in simplifying algebraic expressions. Hence this workbook.

By practising the skills involved in simplifying algebraic expressions the students will learn to tackle the mathematical problems with confidence and become ready for the next stage, solving problems using equations.

The worksheets are designed to be used with or without the *LUK 24 tiles self checking system*. When using the LUK box students can check their answers as they go or after they have finished the worksheet.

The advantage of the LUK system is that the students can work independently, check their answers and correct their mistakes.

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When multiplying terms with powers, add the indices (powers) of the like pronumerals.

$m^6 \times m^2 = m^{6+2} = m^8$ $\quad$ $m^2 \times m \times m^{2+1+3} = m^6$

Note that $m = m^1$. Pronumerals without an index have an index 1.

Pages **19** to **24** Simplify expressions by division.

Pages 19, 20, 21, 22

To simplify algebraic division, divide the numbers first and then divide (or cancel) the pronumerals. Writing the division as a fraction can make the division easier.

$\frac{8f}{2} = 4f$ $\quad$ $30p \div 5 = 6p$ $\quad$ $\frac{\cancel{15}^{5}a\cancel{b}}{\cancel{3}\cancel{b}} = 5a$

Pages 23, 24

When dividing terms with powers, subtract the indices (powers) of the like pronumerals.

$8p^5 \div 2p^2 = 8 \div 2p^{5-2} = 4p^3$ $\quad$ $10r^4 \div 5r = 10 \div 5r^{4-1} = 2r^3$

$\frac{20w^6}{5w^3} = 4w^{6-3} = 4w^3$ $\quad$ $20w^6 \div 5w^3 = 4w^{6-3} = 4w^3$

Pages **25** to **29** Simplify expressions by expanding.

Pages 25, 26, 27, 28, 29

Expanding algebraic expressions using the distributive law turns a product into a sum. Every term inside the bracket is multiplied by the value outside the bracket.

$3(4x + 5)$ $\quad$ $3 \times 4x + 3 \times 5 = 12x + 15$

Pages **30** to **32** Simplify expressions by substitution.

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To find the value of an expression replace (substitute) pronumerals with a numbers.

$y = 5$ $\quad$ $7 + 6 + y =$ $\quad$ $7 + 6 + 5 = 18$ $\quad$ $y + y + y =$ $\quad$ $5 + 5 + 5 = 15$

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Replace ***a*** with ***5*** and ***b*** with ***3***.

$a = 5$ $\quad$ $b = 3$ $\quad$ $50 - a - b =$ $\quad$ $50 - 5 - 3 = 42$

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Replace ***m*** with ***5*** and ***d*** with ***4***.

$m = 5$ $\quad$ $d = 4$ $\quad$ $3m + 4d = 3 \times m + 4 \times d =$ $\quad$ $3 \times 5 + 4 \times 4 = 15 + 16 = 31$

Rules and Strategies to Simplify Algebraic Expressions

Algebra is a mathematical system that uses Pronumerals to stand for unknown values.

Example:

3 friends have 30 stickers.
Peter has 12 stickers, David has 8.
Ben has n stickers

$12 + 8 + \square = 30$
$12 + 8 + n = 30$ **n** is an unknown value.

Instead of an unknown number we use a pronumeral.
In this case we used n.

A **pronumeral** takes place of a numeral. The most commonly used pronumerals are lower case letters.

Pronumerals are often called **variables**.

Example:
4 x n is written as 4n, 3 x a x b x c is written 3abc.

When numbers and pronumerals are multiplied, they form a **term**. A term is a single unit containing one or more pronumerals.

Example: ab, 2c, 3abc, $2a^2b$, $\frac{4m}{3d}$

The number written before a pronumeral is called the **coefficient**.

Example:
In 6a "6" is the coefficient and "a" is the pronumeral.

The number (the coefficient) has to be written in front of the pronumeral (the letter), not behind it. Thus we write 5a not a5.

We do not write 1 (one) in front of any pronumerals.

Terms joined by + or by − signs make an algebraic sentence, they are called an **expression**.

Example:

5a + 2a - a are expression
term term term