Algebraic expressions

Lesson plan and teacher's notes · Form 1 Mathematics · 1 period of 40 minutes

School	(write school name)	**Teacher**	(write name)
Date	(date)	**Class**	Form 1
Subject	Mathematics	**Enrolment**	Boys ___ Girls ___ Total ___
Time	40 minutes	**Topic**	Algebraic expressions

Learners use letters to stand for unknown numbers, write expressions for real situations such as a school tour and a shop bill, name the parts of an expression, sort like and unlike terms, and simplify by adding and subtracting like terms.

Specific outcomes

By the end of the lesson, learners should be able to:

1. Write an algebraic expression for a real-life situation and say what each letter stands for
2. Identify terms, coefficients, variables and constants in an expression
3. Group like terms and unlike terms
4. Simplify an expression by adding and subtracting like terms

Prior knowledge

- Addition, subtraction, multiplication and division of whole numbers
- Using brackets in simple calculations
- Reading simple word problems

Teaching and learning materials

- chalk and board
- exercise books
- pictures or real examples of fruits or other goods with prices
- small cards for sorting terms

References

Ministry of Education (CDC) Form 1 Mathematics syllabus and module; 25Schools learners' note: Algebraic expressions.

Lesson development

Stage and time	Teacher activities	Learner activities
Introduction 5 min	Ask how a shopkeeper writes a bill when the price of an item is not yet known. Introduce the idea that a letter can stand for an unknown number.	Suggest situations where a number is not known in advance.
Development: forming expressions 10 min	Work the school tour: x transport, y ticket, z lunch, n learners, so n(x + y + z). Then 2n for pencils, n + 7 and 14x + 22.	Write an expression for two new situations and say what each letter stands for.
Development: parts of an expression 8 min	Use 4x + 5 to show terms, coefficient, variable and constant. Show that the coefficient of z is 1.	Name the parts of three expressions given on the board.
Development: like terms and simplifying 14 min	Use the fruit prices to show like and unlike terms. Add the three shoppers' bills and group like terms to get 14x + 9y + 13z.	Sort terms into like and unlike, then simplify two expressions.
Conclusion 3 min	Ask why unlike terms cannot be combined. Set the homework.	Answer and copy the homework.

Teacher's content notes

Read these before the lesson. They are what you need to know, not what to copy onto the board.

Forming expressions

To make an algebraic expression, choose a letter for the unknown quantity, then use numbers and the operations of addition, subtraction, multiplication and division to show how the quantities are related. Always say what each letter represents. One pencil costs K2, so n pencils cost 2n kwacha. A number increased by 7 is n + 7.

Terms, coefficients and constants

The parts of an expression that are added or subtracted are its terms. In 4x + 5 the terms are 4x and 5. The 4 is the coefficient, x is the variable and 5 is a constant. When no number is written before a variable, the coefficient is 1.

Like and unlike terms

Like terms have the same variable and the same power. Unlike terms have different variables, or the same variable with different powers. So 3x, x and 10x are like terms, and 5x and $25x^2$ are unlike terms.

Simplifying expressions

To simplify an expression, group the like terms and add or subtract their coefficients. Unlike terms cannot be combined, so they stay as separate terms in the answer.

Questions to ask during the lesson

Question	Expected answer
A trader sells pencils at K2 each and wants to write the cost for any number. (a) Say what the letter n stands for. (b) Write the cost of n pencils. (c) Find the cost of 12 pencils.	(a) The number of pencils. (b) 2n kwacha. (c) 2 × 12 = K24.
A learner reads the expression 4x + 5 in her exercise book. (a) Name the terms. (b) Name the coefficient and the constant. (c) State the coefficient of z in the expression z.	(a) 4x and 5. (b) The coefficient is 4 and the constant is 5. (c) 1.
A packet holds 14 plates, a family has 22 plates at home and buys x packets. (a) Write the total number of plates. (b) Find the total when x = 3. (c) Name the constant term.	(a) 14x + 22. (b) 14 × 3 + 22 = 42 + 22 = 64 plates. (c) 22.
The temperature at sunrise is T degrees, it rises by 5 degrees by noon and falls by 8 degrees by evening. (a) Write the noon temperature. (b) Write the evening temperature in simplest form. (c) Find the evening temperature when T = 24.	(a) T + 5. (b) T + 5 − 8 = T − 3. (c) 24 − 3 = 21 degrees.

Worked examples for the board

Example 1: a school tour

Let n be the number of learners, x the transport, y the ticket and z the lunch for one learner. One learner's cost is x + y + z, so the class pays n(x + y + z).

Example 2: simplifying the shoppers' bills

The total is 3x + 4y + 5z + x + 2y + z + 10x + 3y + 7z. The x terms give 3 + 1 + 10 = 14. The y terms give 4 + 2 + 3 = 9. The z terms give 5 + 1 + 7 = 13. The total bill is 14x + 9y + 13z.

Example 3: a discount

A shopper buys 10 bananas, 3 oranges and 7 apples and gets a discount equal to 2 bananas. The bill is 10x + 3y + 7z − 2x. Group the like terms: 10x − 2x = 8x. The new bill is 8x + 3y + 7z.

Board plan

Write the title. Left: how to form an expression, with what each letter stands for. Centre: the parts of 4x + 5. Right: the fruit prices, then grouping like terms step by step.

Part	In 4x + 5	Meaning
Terms	4x and 5	Parts joined by addition or subtraction
Variable	x	A letter that stands for an unknown number
Coefficient	4	The number that multiplies the variable
Constant	5	A term that is just a number

The parts of the expression 4x + 5

Mistakes to expect

Learners often think	Put it right
When no number is written before a letter, it has no coefficient.	The coefficient is 1, so in z the coefficient is 1.
Changing 3x to 5x changes the letter.	Only the coefficient changes. The letter stays the same because the letter shows what is being counted.
5x and $25x^2$ are like terms because both have x.	Like terms have the same variable raised to the same power, so 5x and $25x^2$ are unlike terms.
Unlike terms can be added together into one term.	Unlike terms cannot be combined, so they stay as separate terms in the answer.

Differentiation

Learners who struggle

Give learners a card showing the four parts of 4x + 5 and use fruits or objects of different kinds to show which terms can be grouped. Let them say aloud what each letter stands for before writing.

Learners who finish early

Ask learners who finish early to write their own shopping situation with three different items, form the bill for two shoppers and simplify the total.

Hearing or visual impairment

For learners with hearing impairment, write each expression and say what each letter stands for on the board. For learners with visual impairment, read each expression aloud term by term and use objects of different kinds that can be felt and grouped.

No projector, no printing

Draw the fruits on the board and use seeds, stones or bottle tops of different kinds as items to group. Everything else is done in exercise books.

If time is short

Teach forming expressions and the parts of an expression. Leave simplifying for the next lesson.

Evaluation

Question or task	A correct answer shows
A class of n learners plans a tour where x is the cost of transport, y the cost of each ticket and z the cost of lunch for one learner. (a) Write the cost for one learner. (b) Write the cost for the class. (c) Find the class cost when n = 30, x = 10, y = 5 and z = 15 in kwacha.	(a) x + y + z. (b) n(x + y + z). (c) 30 × (10 + 5 + 15) = 30 × 30 = K900.
A shopkeeper writes a bill for Spiwe, who buys 3 bananas at x each, 4 oranges at y each and 5 apples at z each. (a) Write her bill. (b) Name the coefficient of each term. (c) Say whether any terms are like terms and give the reason.	(a) 3x + 4y + 5z. (b) 3, 4 and 5. (c) No, because each term has a different variable.
Three shoppers buy fruit and their bills are 3x + 4y + 5z, x + 2y + z and 10x + 3y + 7z. (a) Group the like terms. (b) Add the coefficients of each group. (c) Write the total bill.	(a) The x terms, the y terms and the z terms. (b) 3 + 1 + 10 = 14, 4 + 2 + 3 = 9 and 5 + 1 + 7 = 13. (c) 14x + 9y + 13z.

Homework

A shop sells pencils at K2 each and a trader also has plates in packets of 14 with 22 plates already at home. (a) Write the cost of n pencils. (b) Write the number of plates for x packets. (c) Find the cost of 15 pencils and the plates for 3 packets.

Extra practice with answers

Question	Answer
1. A learner buys 3 bananas at x each and 4 oranges at y each and writes her bill on the board. (a) Write the bill. (b) Name the coefficients. (c) Say why the bill cannot be written as one term.	(a) 3x + 4y. (b) 3 and 4. (c) x and y are different variables, so they are unlike terms.
2. A learner is given 5x, $25x^2$, 3x and 7y and is asked to sort them. (a) Pick the like terms. (b) Pick the unlike terms of 5x. (c) Give the reason for each.	(a) 5x and 3x. (b) $25x^2$ and 7y. (c) 5x and 3x have the same variable with the same power, while $25x^2$ has a different power and 7y has a different variable.
3. A shopkeeper has the bill 7a + 3b − 2a + 5b for two items. (a) Group the like terms. (b) Combine the coefficients. (c) Write the simplest form.	(a) 7a − 2a and 3b + 5b. (b) 5 and 8. (c) 5a + 8b.
4. A number n is increased by 7 and a learner writes the result on the board. (a) Write the expression. (b) Find its value when n = 9. (c) Find its value when n = 20.	(a) n + 7. (b) 16. (c) 27.
5. A shopper buys 10 bananas, 3 oranges and 7 apples and gets a discount equal to 3 bananas. (a) Write the bill before the discount. (b) Write the bill after the discount. (c) Simplify.	(a) 10x + 3y + 7z. (b) 10x + 3y + 7z − 3x. (c) 7x + 3y + 7z.

Answers to the learners' check-yourself questions

1. Write an expression for the cost of n pencils if one pencil costs K2.
   2n kwacha.
2. In the expression 4x + 5, name the coefficient and the constant.
   The coefficient is 4 and the constant is 5.
3. What is the coefficient of z in the term z?
   1.
4. Are 5x and $25x^2$ like terms? Give a reason.
   No, because the power of x is different.
5. Simplify 3x + 4y + 5z + x + 2y + z.
   4x + 6y + 6z.
6. A bus leaves Lusaka for Monze with 50 passengers. In Kafue, a passengers get on. In Mazabuka, b passengers get off. (a) Write an expression for the number of passengers who reach Monze. (b) State what each letter represents. (c) Find the number when a is 12 and b is 9.
   (a) 50 + a − b. (b) a is the number who get on at Kafue and b is the number who get off at Mazabuka. (c) 50 + 12 − 9 = 53 passengers.
7. Let a banana cost x, an orange y and an apple z. Spiwe buys 3 bananas, 4 oranges and 5 apples. She returns to the shop, keeps her list and adds 5 bananas and 2 apples. (a) Write her new total in its simplest form. (b) Name the like terms you grouped. (c) Explain why the 4y term did not change.
   (a) 3x + 4y + 5z + 5x + 2z = 8x + 4y + 7z. (b) The x terms 3x and 5x, and the z terms 5z and 2z. (c) No oranges were added, so there are no other y terms to combine it with.

Teacher's reflection

What went well:

What I will change next time:

Learners who need follow-up: