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FREE LEARNING NOTES FOR ZAMBIA

FORM 2

Mathematics

Expanding algebraic expressions

Lesson notes for learners · Competence-Based Curriculum

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In Form 1 you met variables, constants, coefficients and terms. Now you use them to rewrite expressions in a different but equal form. This helps when you work out costs, like buying exercise books and pens at a shop, or areas, like the size of a vegetable garden. In this note you learn to expand a bracket and to multiply two brackets.

AFTER THESE NOTES YOU SHOULD BE ABLE TO

- Say what monomials, binomials and quadratic expressions are
- Expand a monomial multiplied by a binomial
- Expand the product of two binomials using First, Outer, Inner, Last
- Use expanded expressions to solve problems on cost and area

KEY WORDS

monomial	an expression with a single term, such as 4 or 3x
binomial	an expression with two terms, such as 2x + 3
linear expression	an expression where the variable has power 1, such as 8x + 12
quadratic expression	an expression where the highest power of the variable is 2, such as x2 + 8x + 15
expanding	removing brackets by multiplying out
simplification	writing an expression in a shorter equal form by combining like terms

1 Monomial times binomial

To expand a single term (a monomial) times a two-term expression (a binomial), multiply each term inside the brackets by the single term. Chanda buys 4 pens at k3 each and some exercise books at k8 each. If she buys x books, the total cost is 8x + 12 kwacha. The same cost can be written as 4(2x + 3), and expanding that bracket takes us back to 8x + 12.

WORKED EXAMPLE

Expand 4(2x + 3).

Multiply 4 by the first term: 4 x 2x = 8x

Multiply 4 by the second term: 4 x 3 = 12

Add the results: 8x + 12

2 Binomial times binomial

To multiply two binomials, multiply every term in the first bracket by every term in the second. A helpful way to remember is FOIL: multiply the First terms, then the Outer terms, then the Inner terms, and last the Last terms. Then add and simplify like terms.

A rectangular garden with length (x + m) metres and width (x + n) metres has area x2 + mx + nx + mn. This shows that the product of the two lengths and the expanded form are the same expression.

Step	Multiply	Result
First	x times x	x2
Outer	x times 5	5x
Inner	3 times x	3x
Last	3 times 5	15

Figure 1. FOIL for (x + 3)(x + 5)

3 Worked problem: a garden

A farmer in Chipata has a rectangular vegetable garden. Use the length and width to find the area as an expanded expression.

WORKED EXAMPLE

The garden has length (x + 5) metres and width (x + 2) metres. Write the area as an expanded expression.

Area = length times width = (x + 5)(x + 2)

First: x times x = x2. Outer: x times 2 = 2x

Inner: 5 times x = 5x. Last: 5 times 2 = 10

Add: x2 + 2x + 5x + 10

Combine like terms: x2 + 7x + 10

TRY THIS

Work in pairs. Draw a rectangle on paper and label its length as (x + 3) and its width as (x + 2). Split it into four smaller rectangles, write the area of each, and add them up. Check that your answer matches what you get by using FOIL.

REMEMBER

- Expanding means removing brackets by multiplying
- For a monomial times a binomial, multiply each term inside the brackets
- For two binomials use FOIL: First, Outer, Inner, Last
- Combine like terms after expanding
- Expanded expressions help us solve cost and area problems

? Check yourself

1. What is a binomial? Give one example.
2. Expand 3(x + 7).
3. Expand (x + 1)(x + 9).
4. What does the letter F stand for in FOIL?
5. Expand (x + 2)(x + 6).
6. A group of students at a school near Feira hires 2x taxis to travel to Lusaka. Each taxi charges (y + 50) kwacha. (a) Write the total cost as a product. (b) Expand it. (c) Find the cost when x = 3 and y = 100.
7. A farmer's rectangular garden has length (x + 5) metres and width (x + 4) metres. (a) Write the area as an expanded expression. (b) Find the area when x = 3. (c) Check your answer by multiplying the length and width directly.

ANSWERS

1. An expression with two terms, for example 2x + 3.
2. 3x + 21.
3. x2 + 9x + x + 9 = x2 + 10x + 9.
4. Multiply the First terms.
5. x2 + 6x + 2x + 12 = x2 + 8x + 12.
6. (a) 2x(y + 50). (b) 2xy + 100x. (c) 2xy + 100x = 2(3)(100) + 100(3) = 600 + 300 = K900.
7. (a) x2 + 4x + 5x + 20 = x2 + 9x + 20. (b) 9 + 27 + 20 = 56 square metres. (c) (3 + 5)(3 + 4) = 8 x 7 = 56 square metres.

Written by 25Schools to follow the Form 2 Mathematics syllabus of the Zambian competence-based curriculum. Free for learners to read, download and share. More notes and quizzes at 25schools.com.