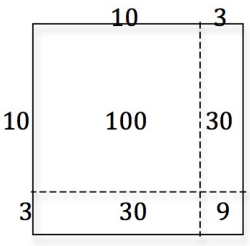
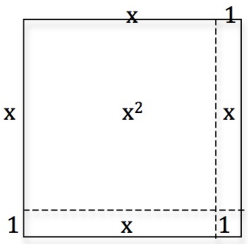
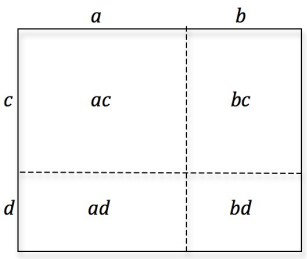
TITLE







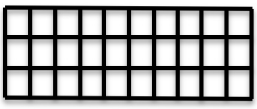
Explain how to work out
13 times 13 and
(x+1) times (x+1).

Draw similar diagrams for
15 times 15 and
(x+2) times (x+2).

Work out the expansion of $(a+b)(c+d)$.

Draw your own diagrams and use the same method to find the algebraic expressions for $(x+3)^2$ and $(2x+5)^2$.

HELP



Remember that area is the number of square units **inside the boundary** of the shape. For rectangles this means that, to count the squares (and hence find the area), you need to multiply the length by the breadth. What are the length and breadth of this rectangle? How many units of area (small squares) does it contain?

Do a few more numerical examples. It will help you to understand the connection between areas and multiplication.

Draw diagrams for working out 25^2 for 34^2 and for 25 x 34.

Then go on to do the algebraic examples given.

NEXT

Using the same method, calculate 125 x 34 and other products of 3-digit number by 2-digit numbers.

You could then draw the diagram and work out (a + b + c)(d + e). You are now using the sam method for multiplying expressions and removing the barckets.

Then make up a similar activity of your own.

NOTES FOR TEACHERS

SOLUTION

The first diagram shows a square of area 13x13 partitioned into two squares, one of area 10x10=100 and the other of area 3x3=9, and two rectangles with areas 3x10=30. So the total area is

$(10+3)(10+3) = 100 + 60 + 9 = 169$.

The second diagram shows a square of area $(x + 1)^2$ split into 4 parts. Adding these areas gives

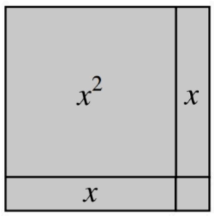
$(x + 1)^2 = x^2 + 2x + 1$.

Similarly $(x + 3)^2 = x^2 + 6x + 9$ and $(2x + 5)^2 = 4x^2 + 20x + 25$ and

$(a + b)(c + d) = ac + ad + bc + bd$

Diagnostic Assessment This should take about 5–10 minutes.

1. Write the question on the board, say to the class:
   "Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D".



What is the area of this shape?

A) $x^2 + 2x + 1$ B) $2x^2 + x + 1$

C) $4x + 4$ D) $3x + 4$

2.Notice how the learners responded. Ask a learner who gave answer A to explain why he or she gave that answer and DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.

3.Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.

3.Ask the class again to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers. It is important for learners to explain the reason for their answer otherwise many learners will just make a guess.

4.If the concept is needed for the lesson to follow, explain the right answer or give a remedial task.

The correct answer is A. The edges of the outer square are $x + 1$ and $x + 1$.
https://diagnosticquestions.com

Why do this activity?

This activity provides an opportunity for learners to build on what they already know about multiplication and areas *so they can discover for themselves the rules about multiplying two expressions* and removing brackets and simplifying the resulting product. Learners need a lot of practice in thinking algebraically and this activity provides a 'bridge' from number work to algebra and also practice in working with algebraic expressions.

The activity introduces a way of visualising the method for multiplying brackets that makes the rules easier to remember and it provides a starter for lessons on trinomials. It links the algebra to place value and to basic concepts of multiplication and geometry. It also serves to reinforce the understanding of area.

Learning objectives

In doing this activity students will have an opportunity to:

- practise using de-composition and area diagrams to work out products of numbers and algebraic expressions;
- develop an understanding of multiplying binomial expressions and using brackets;
- make connections between algebra and geometry.

Generic competences

In doing this activity students will have an opportunity to:

- **think mathematically,** reason logically and give explanations;
- **think flexibly**, be creative and innovative and apply knowledge and skills;
- **visualize** and develop the skill of creating visual images to represent concepts and situations.

Suggestions for teaching

You may want to return to this activity often with different examples as a lesson starter.

With younger learners you may want to spend more time on numerical examples before going on to the algebra. If you do this you should delay the use of the Diagnostic Quiz and use it later to assess how well the learners have understood the connection between the areas and algebraic expressions.

After learners have worked through the examples above, either sequentially or at different times, and after they have drawn diagrams and worked out the total areas, you may want to suggest that they check their answers with a partner, or with another pair of learners and try to resolve any differences they find between their answers.

Then get different learners to give the answers and go through the examples on the board. Using what the learners have already found out for themselves, you can summarise the rules for multiplying two binomial expressions and collecting like terms.

Key questions

- How do you work out the area of a square?
- How do you work out the area of a rectangle?
- How will you find the areas of the separate parts in that diagram?
- Can you find the total area in four different ways?

Follow up

Two by two puzzle https://aiminghigh.aimssec.ac.za/years-4-7-two-by-two-puzzle/
MD https://aiminghigh.aimssec.ac.za/years-4-7-md/
Algebrarea
https://aiminghigh.aimssec.ac.za/years-7-10-algebrarea-product-of-two-brackets-and-area/

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and up to Secondary 5 in East Africa. New material will be added for Secondary 6.
For resources for teaching A level mathematics see https://nrich.maths.org/12339
Note: The mathematics taught in Year 13 (UK) and Secondary 6 (East Africa) is beyond the school curriculum for Grade 12 SA.

	Lower Primary or Foundation Phase Age 5 to 9	Upper Primary Age 9 to 11	Lower Secondary Age 11 to 14	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6