Working with Quadratics

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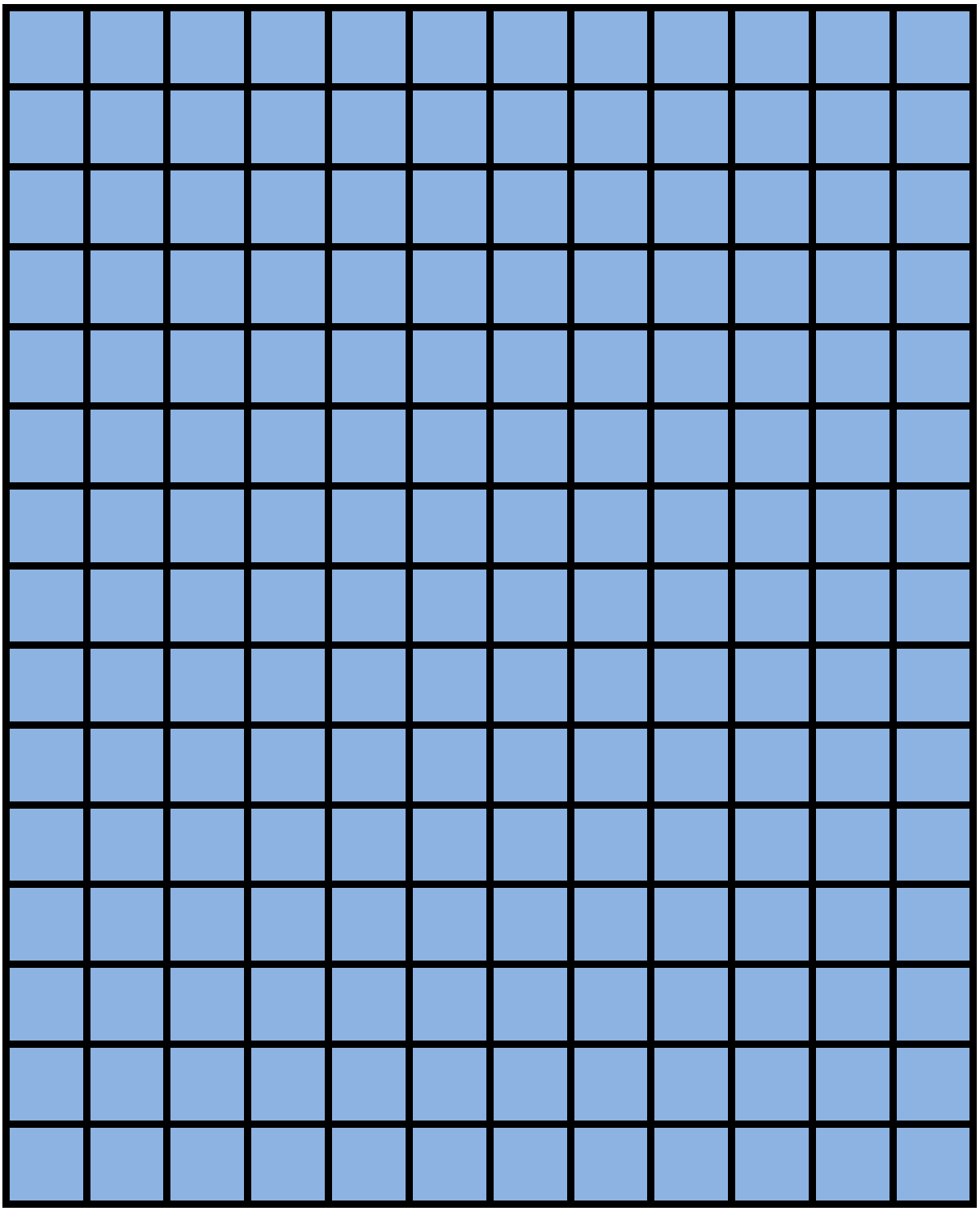
Aim	Quadratic equations are often treated as abstract algebraic entities instead of expressions of area. By showing students this concrete aspect, we support students in developing their understanding rather than merely applying rules. By encouraging students to use sketches to demonstrate their working, it is less likely that they will miss terms when expanding brackets. Responses could be demonstrated by using an enlarged set of tiles. Please note that tiles should be printed on white paper or card so that only one side is coloured. *This video uses materials and ideas from the FMSP's E&E PD programme.*
Activity: filling rectangles	Students are given the tiles and asked to give the areas of the three different sized tiles. They are then challenged to make up a rectangles of dimensions $(x + 2)$ and $(x + 1)$. Different responses are considered but students are shown that all correct solutions contain one x^2, $3x$ and 2 unit tiles. Students can practise this with different dimensions of the form $(x + a)$ until they feel confident.
Activity: creating rectangles	Students are given the total area $(x^2 + 4x + 3)$ and asked to create a rectangle using all of the pieces. Different responses are possible, but all rectangles will have the dimensions $(x + 3)$ by $(x + 1)$. Students should be encouraged to record their answers using sketches (which reinforces the 'grid method' for multiplication and could develop into expanding and factorising polynomials at A level) Students should practise this with positive terms until they feel confident.
Activity: using 'negatives'	So far students have been working with dimensions in the form $(x + a)$ and the extension into the form $(x – a)$ is not trivial. If placing a tile of area x next to a tile of area x_2 shows a rectangle with dimensions $x(x + 1)$ then by turning over the tile of area x and placing it over one end of the x_2 tile, we create a rectangle of area $x(x – 1)$ and when separating out the tiles we have $x^2 – x$. If we want a rectangle of dimensions $(x – 1)$ and $(x – 2)$ then we overlay three x tiles onto the x_2 tile, but this gives an overlap of 2 units where we have the 'positive' blue from the x_2 tile and a double overlap of the 'negative' white from the $–x$ tile; to get to 'zero' we need to add on two blue unit tiles so that when we separate out the tiles to give the area we have $x^2 - 3x + 2$ Students can practise this until they feel confident and should be encouraged to record answers using sketches. Students could investigate expressions for the difference of two squares.
The resources used in the video follow.	

Innovators in Mathematics Education

Quadratic Rectangles: shapes to cut out



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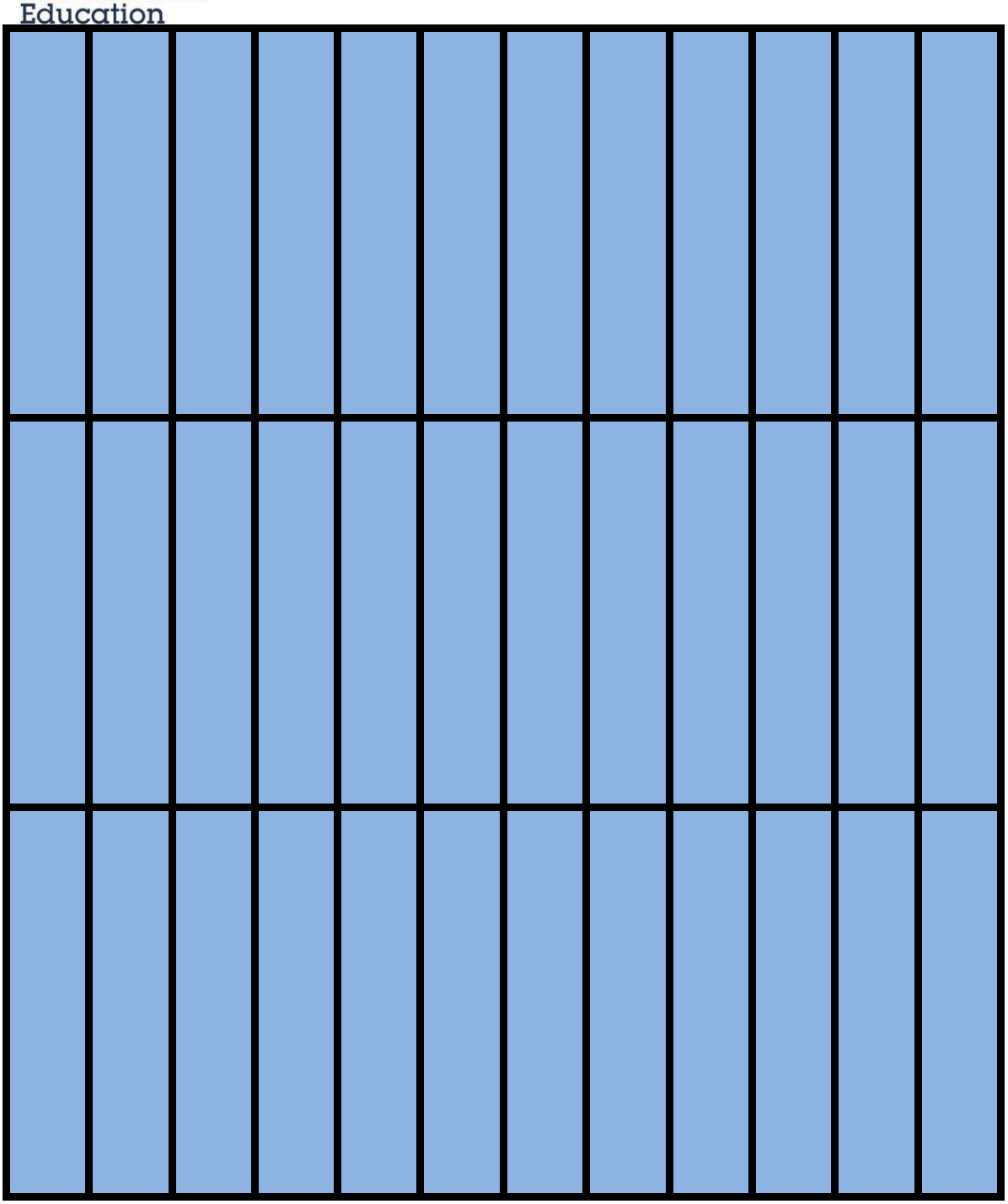

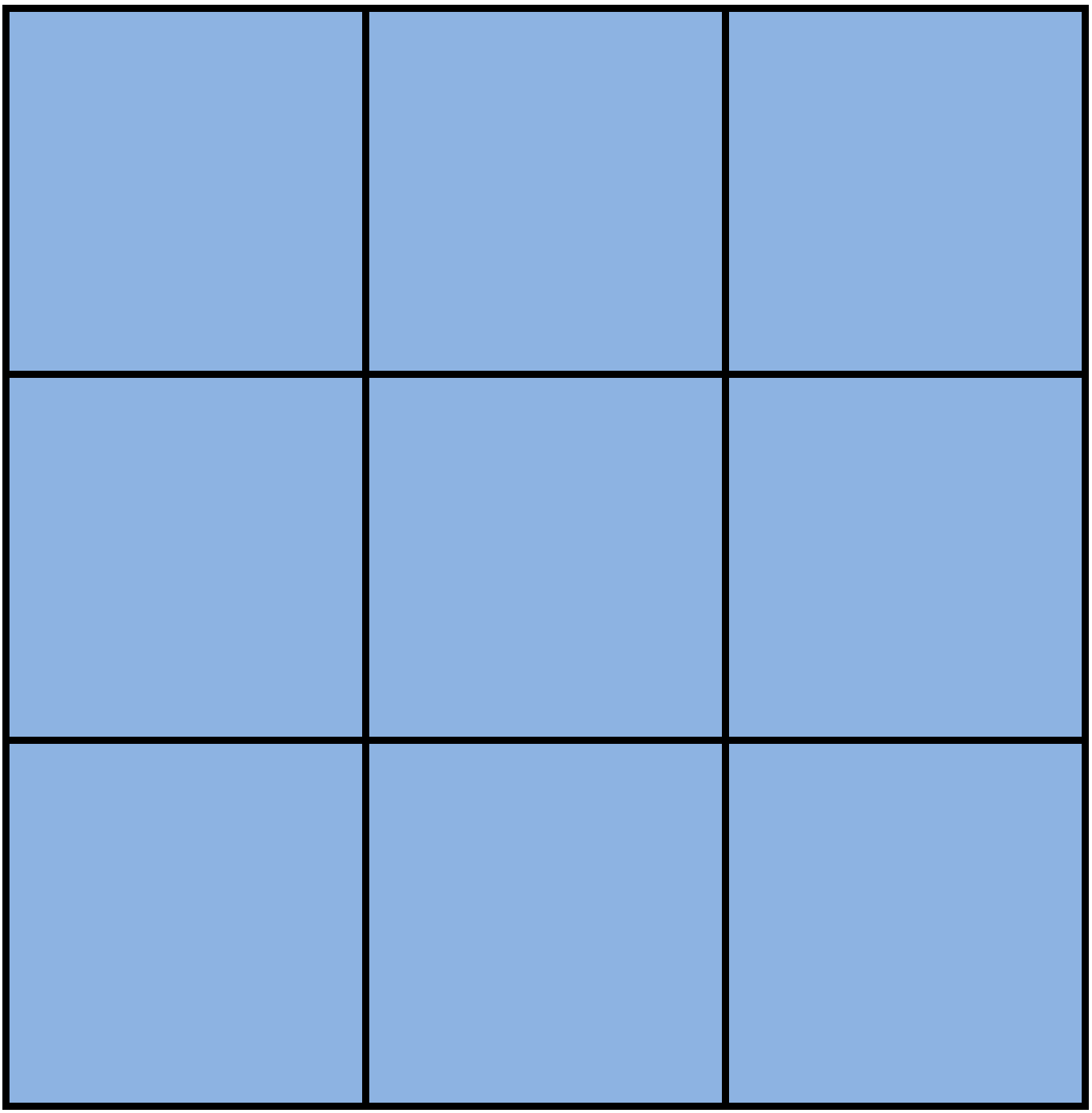

Thanks to Francis Bove for the improved, larger versions of the shapes.

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