7.15 Quanyka's Quilts

A Develop Understanding Task

Quanyka is a quilt maker who has a booth in the Village of Yesteryear each year at the NC State Fair. She demonstrates the art of quilting and has several blankets for sale. She has noticed that over the past several years, interest in her craft has waned. In order to reach out to the younger generation, she decides to make a craft table where children can create their own mini-quilts that can be used with their dolls or stuffed animals.

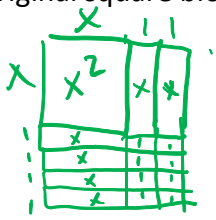
At first, Quanyka wants to keep it simple by only having the children sew together square blocks of material to make the quilts. She has a machine that can quickly cut the squares out of fabric material. Quanyka charges based on the number of square inches of material in the block. If the length of the side of a square block that is being made is x inches, then the area of the block can be found using the formula $A(x) = x^2$.

Some of the children want to make designs that include rectangular blocks as well. Quanyka can use sliders on her machine to change the shape being cut into a rectangle. To use the sliders to change the shape, she must describe each side of the rectangle in terms of how it has been modified from the original square shape. For example, one quilt block consists of starting with a square block and extending one side length by 5 inches and the other side length by 2 inches to form a new rectangular block. Quanyka determines how to modify her formula to calculate the area for these new blocks. In this case, she knows that the area of this new block can be represented by the expression: $A(x) = (x + 5)(x + 2)$. However, she does not feel that this expression gives the children a real sense of how much bigger this new block is (e.g., how much more area it has) when compared to the original square blocks.

1. Can you find a different expression to represent the area of this new rectangular block? You will need to convince the customers that your formula is correct using a diagram.

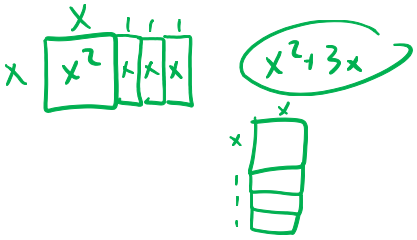
Here are some additional new rectangular block shapes that children have asked for. Find two different algebraic expressions to represent each rectangle, and illustrate with a diagram why your representations are correct.

2. The original square block was extended 2 inches on one side and 4 inches on the other.

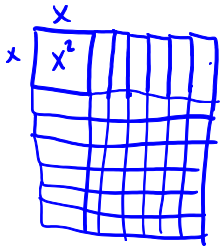


$x^2 + 6x + 8$

3. The original square block was extended 3 inches on only one side.

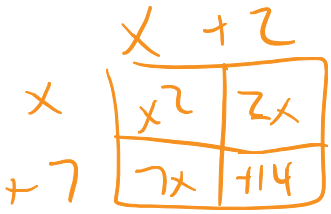


4. The original square block was extended 6 inches on each side.



$x^2 + 12x + 36$

5. The original square block was extended 2 inches on one side and 7 inches on the other.



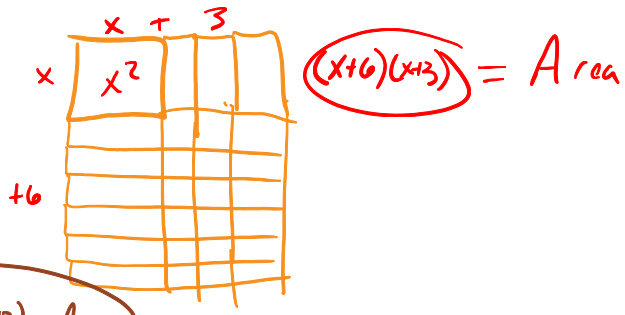
$(x+2)(x+7)$

Quanyka's idea takes off and she has so many children wanting to make quilts at her booth that she calls in her husband Quinn to help. Quinn starts taking orders for different rectangular block shapes. For each order, he asks how much additional area they want beyond the original area of x^2. Once an order is taken for a certain type of block, Quanyka needs to have specific

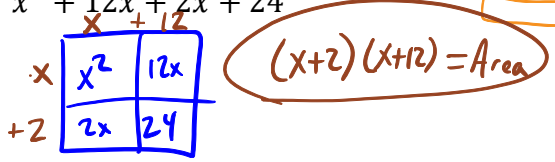
instructions on how to set the sliders on her machine. The instructions need to explain how to extend the sides of a square block to create the new rectangular block.

Quinn has placed the following orders on her table. For each, describe how to make the new blocks by extending the sides of a square block with an initial side length of x. Your instructions should include diagrams, written descriptions and algebraic descriptions of the area of the rectangles using expressions representing the lengths of the sides.

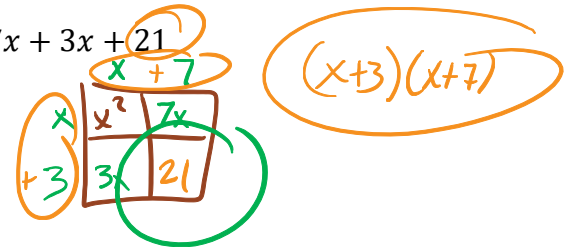
6. $x^2 + 3x + 6x + 18$



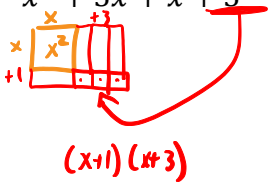
7. $x^2 + 12x + 2x + 24$



8. $x^2 + 7x + 3x + 21$



9. $x^2 + 3x + x + 3$



Some of the orders are written in an even more simplified algebraic code. Figure out what these entries mean by finding the sides of the rectangles that have this area. Use the sides of the rectangle to write equivalent expressions for the area.

10. $x^2 + 10x + 9$

11. $x^2 + 8x + 12$

12. $x^2 + 6x + 5$

13. $x^2 + 6x + 9$

14. $x^2 + 7x + 12$

15. $x^2 + 10x + 16$

16. $x^2 + 12x + 11$

17. What relationships or patterns do you notice when you find the lengths of the sides of the rectangles for a given area?

18. One of the orders that Quinn wrote down was the following: $x^2 + 7x + 9$. Quanyka says that she cannot make a rectangle with this area. Do you agree or disagree? How can you tell if a rectangle can be constructed from a given area?