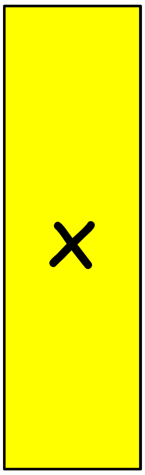
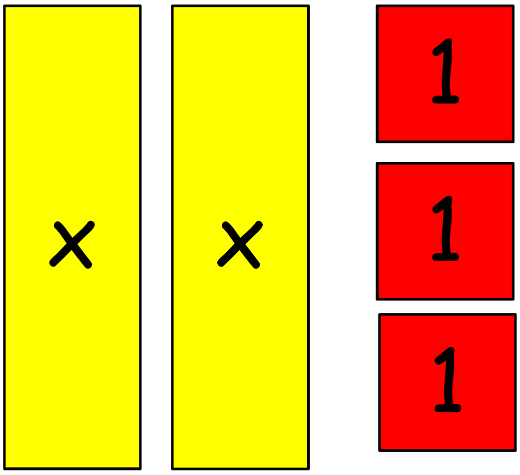
The Basics of Algebra Tiles

Each red tile represents 1.

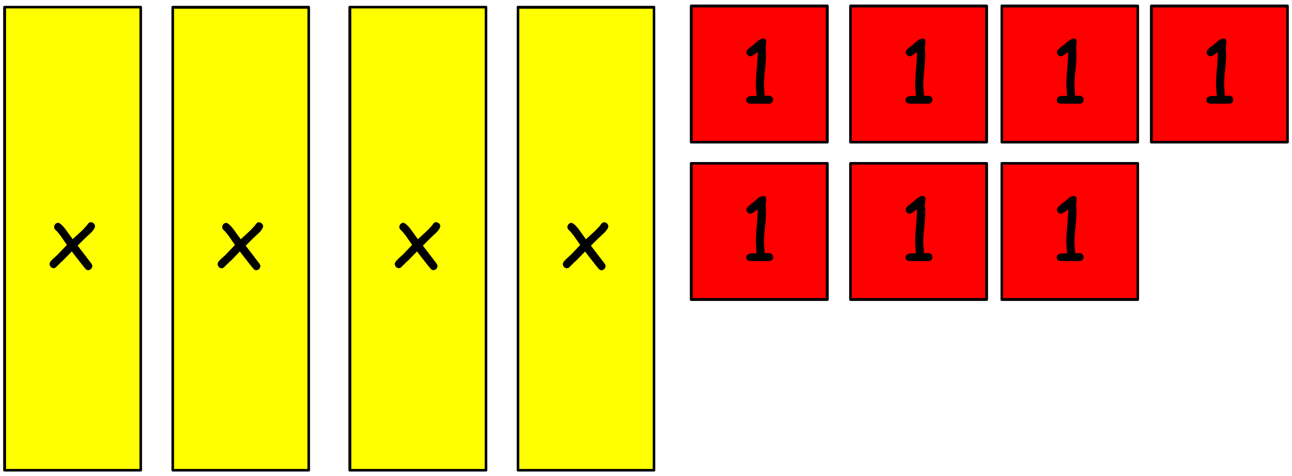


Each yellow tile represents x.

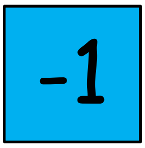
This set of tiles would represent the expression 2x + 3:



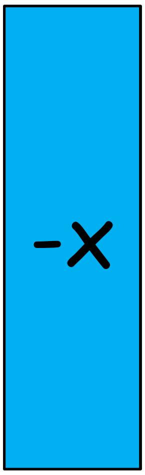
This set of tiles would represent 4x + 7:



Negative Numbers

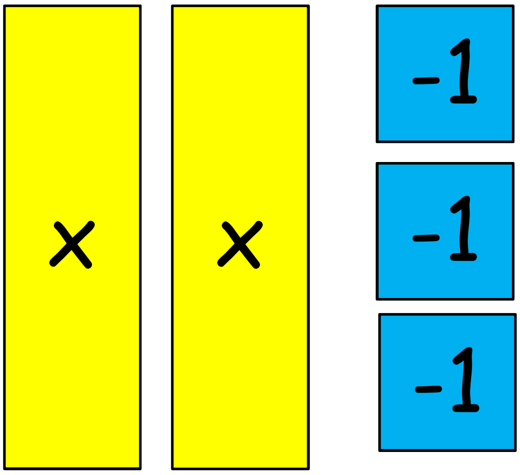


This tile represents -1.

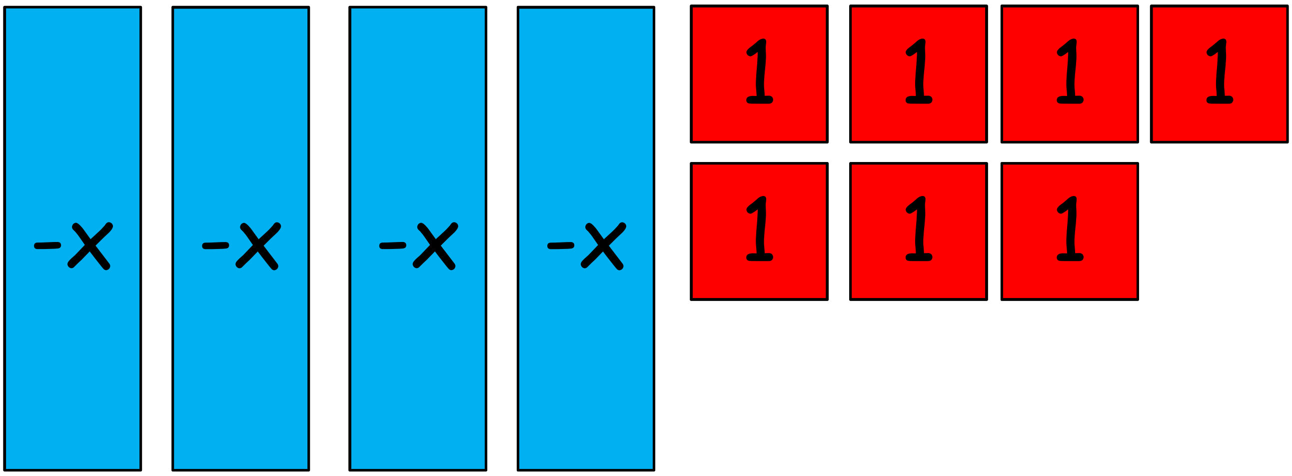


This tile represents –x.

This set of tiles would represent the expression 2x - 3:

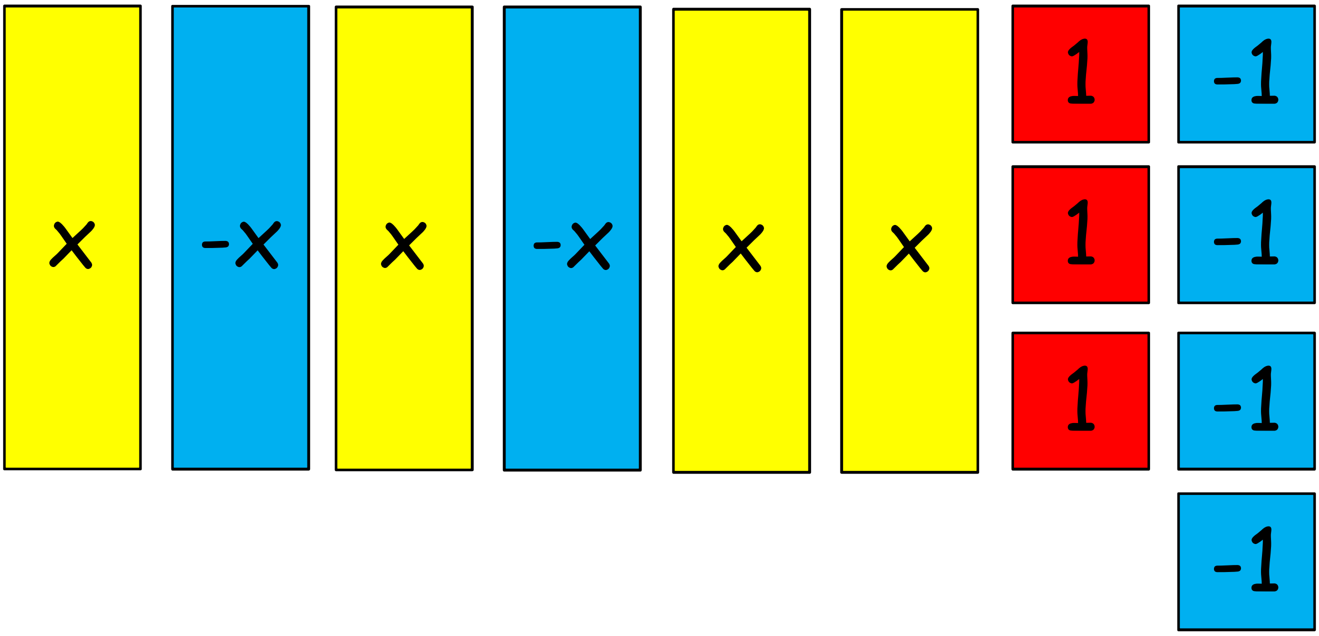


This set of tiles would represent 7 – 4x:

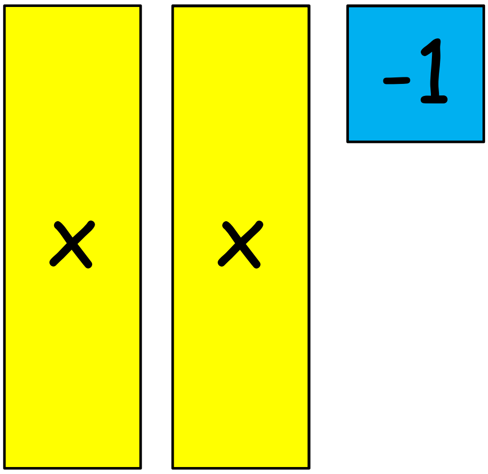


Positives and negatives cancel each other out.

This set of tiles represents 4x – 2x + 3 - 4

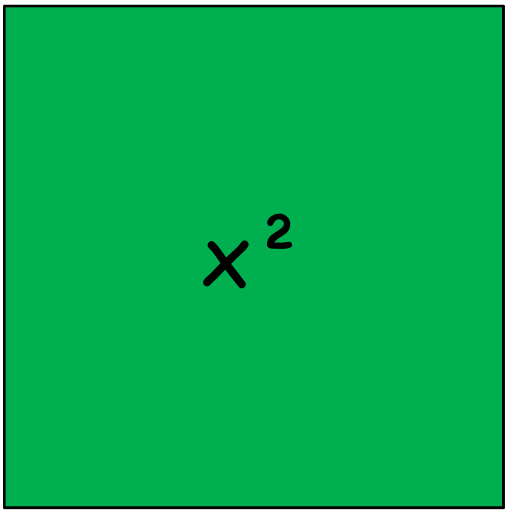


If we “cancel out” positives and negatives, we are left with:



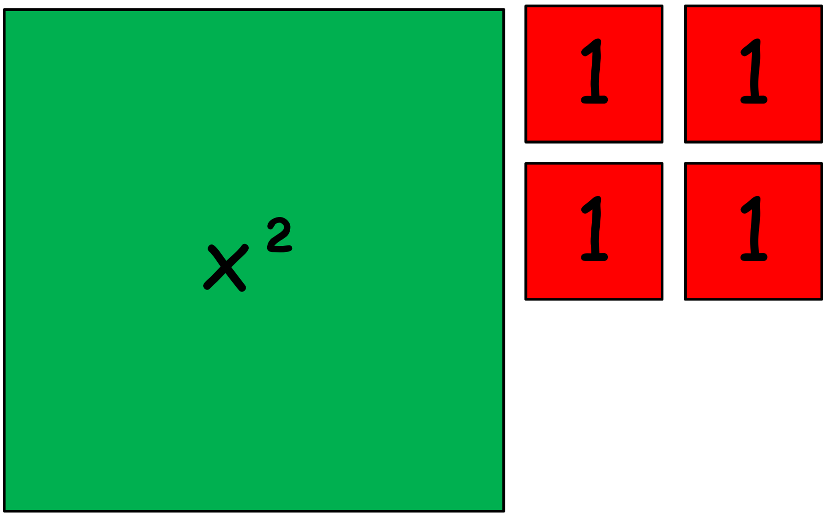
This represents 2x – 1, which is the simplified version of the starting set of tiles.

Quadratic Expressions

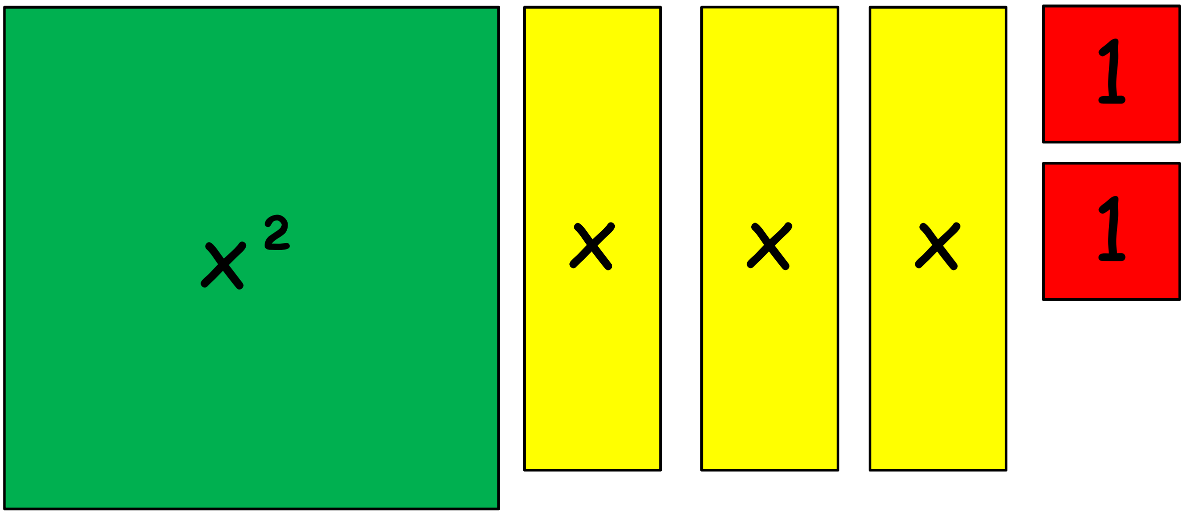


Each green tile represents x^2.

This set of tiles represents the expression $x^2 + 4$:

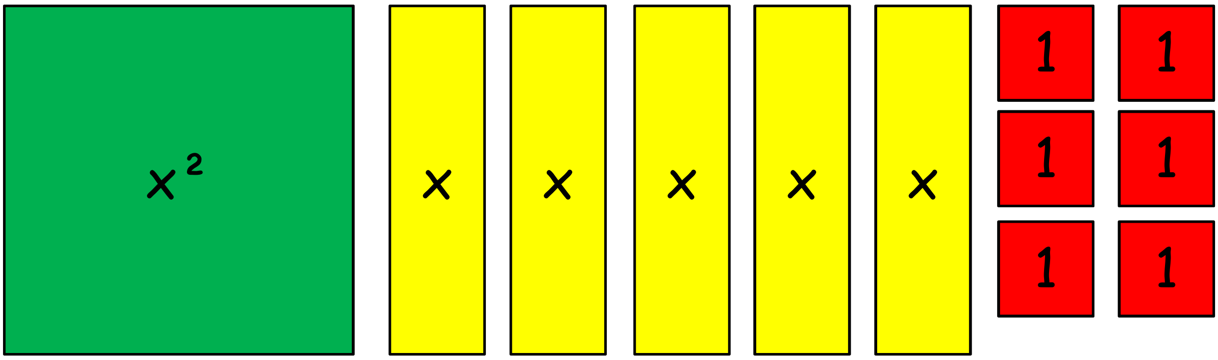


This set of tiles represents $x^2 + 3x + 2$:

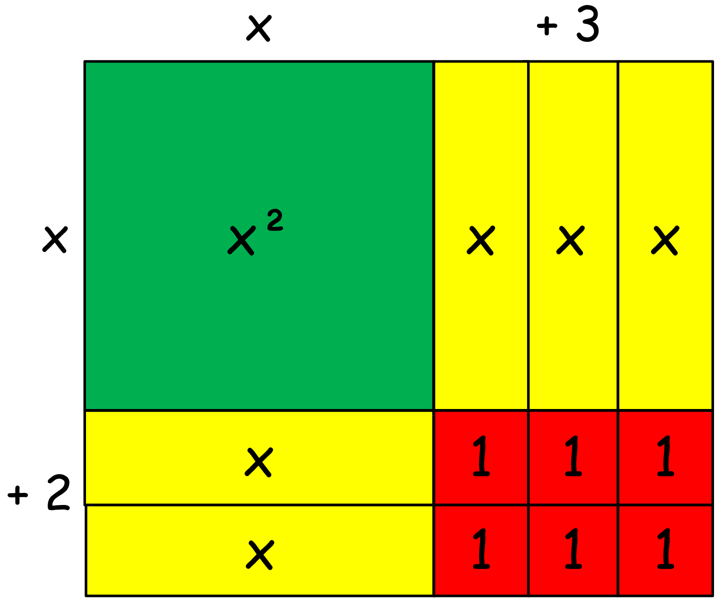


Factorising Quadratics (All Positives)

This set of tiles represents $x^2 + 5x + 6$.



To factorise, arrange the tiles into a complete rectangle.

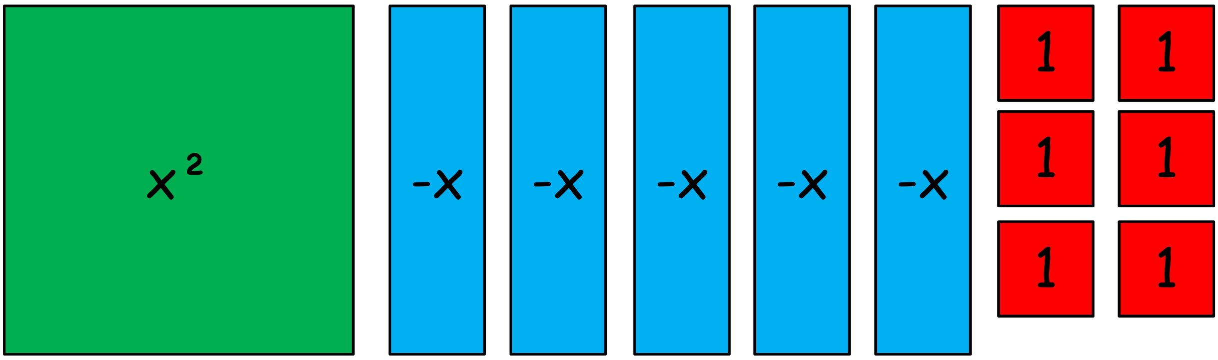


Look at the side lengths to find the factorised version.

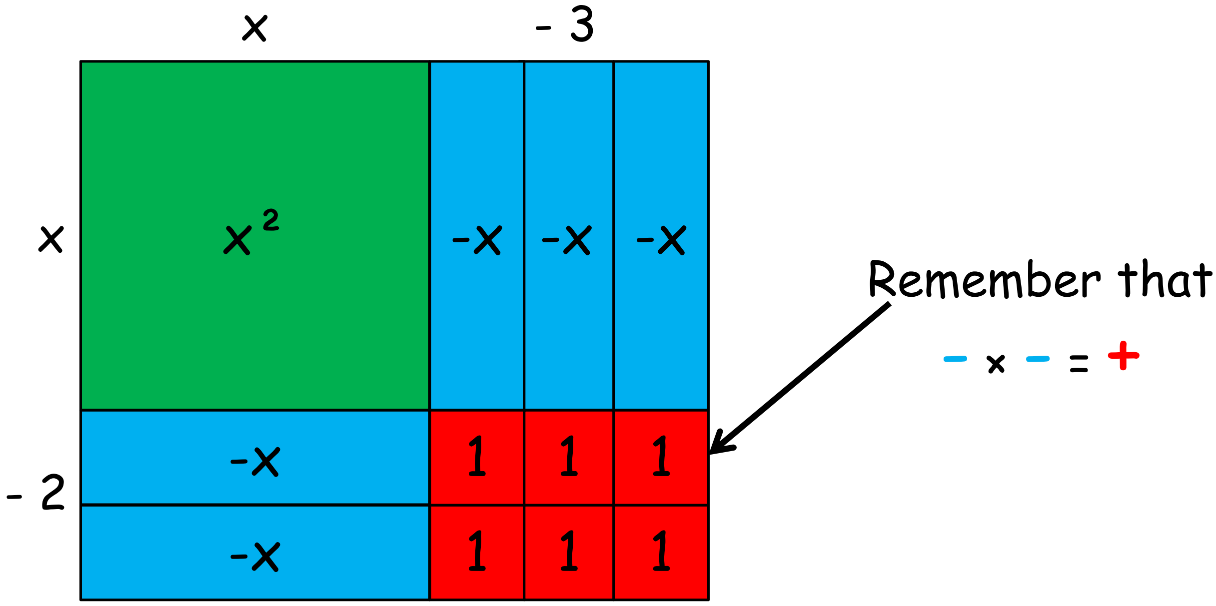
The answer is $(x + 3)(x + 2)$.

Factorising Quadratics (Negative b)

This set of tiles represents $x^2 - 5x + 6$.



To factorise, arrange the tiles into a complete rectangle.

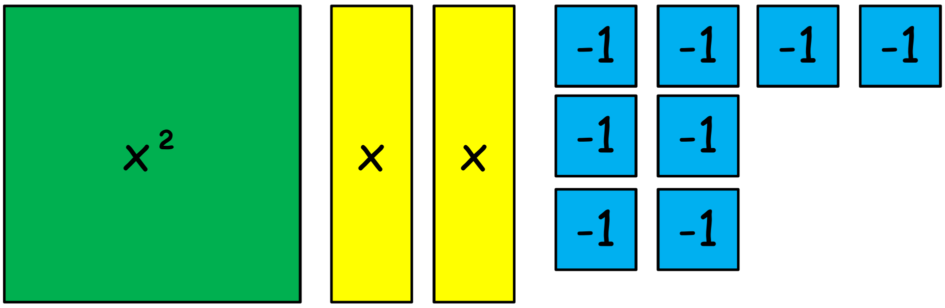


Look at the side lengths to find the factorised version.

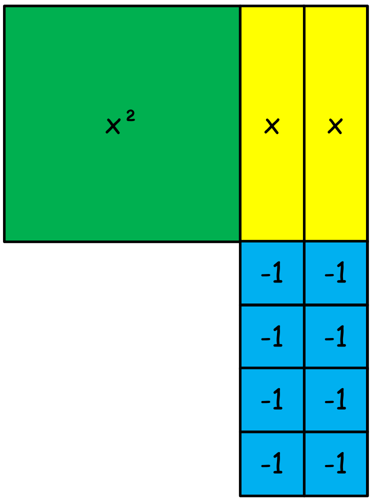
The answer is $(x - 3)(x - 2)$.

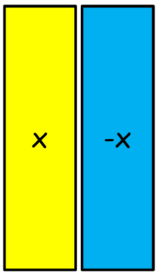
Factorising Quadratics (Negative c)

This set of tiles represents $x^2 + 2x - 8$.



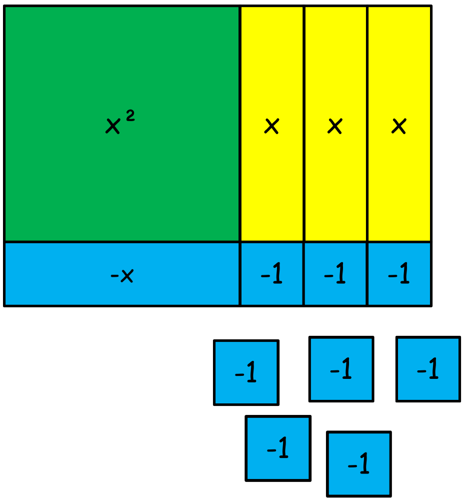
Arrange the x^2 and x tiles in the best rectangle possible.



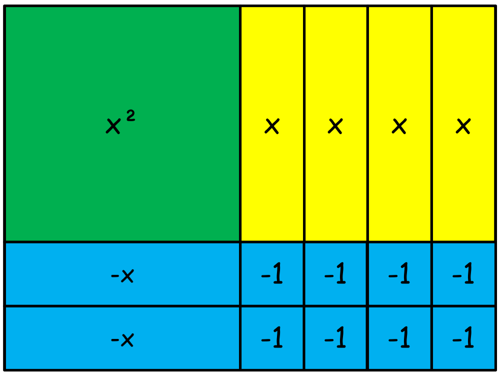


We can add in x and $-x$ blocks in pairs. Because they cancel each other out, this will not change our final answer.

Add pairs of x and $-x$ blocks until there is a complete rectangle. You may also need to move some of the unit blocks.



Stage 1
Not a rectangle

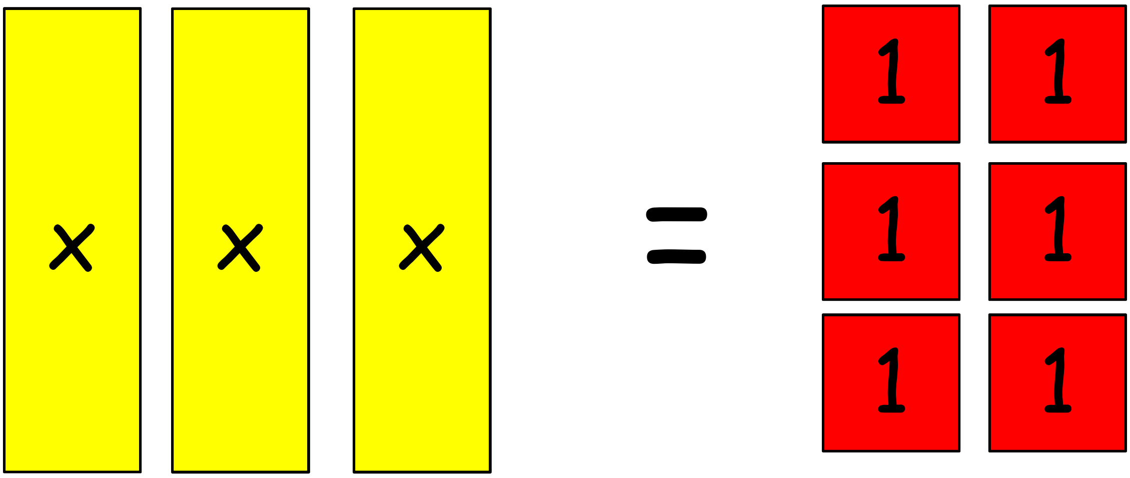


Stage 2
A complete rectangle

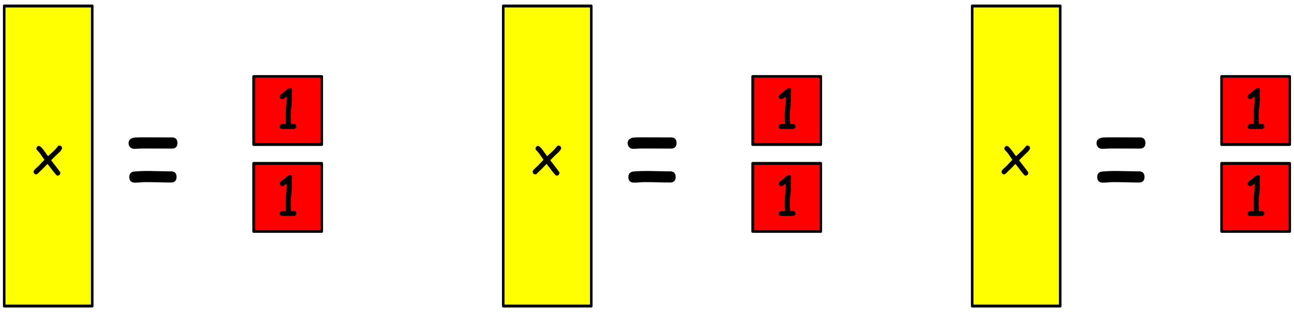
Use the side lengths to get your answer.
$(x + 4)(x - 2)$

Solving Simple Equations

This set of tiles represents the equation $3x = 6$.



We can solve the equation by sharing out into 3 equal groups.



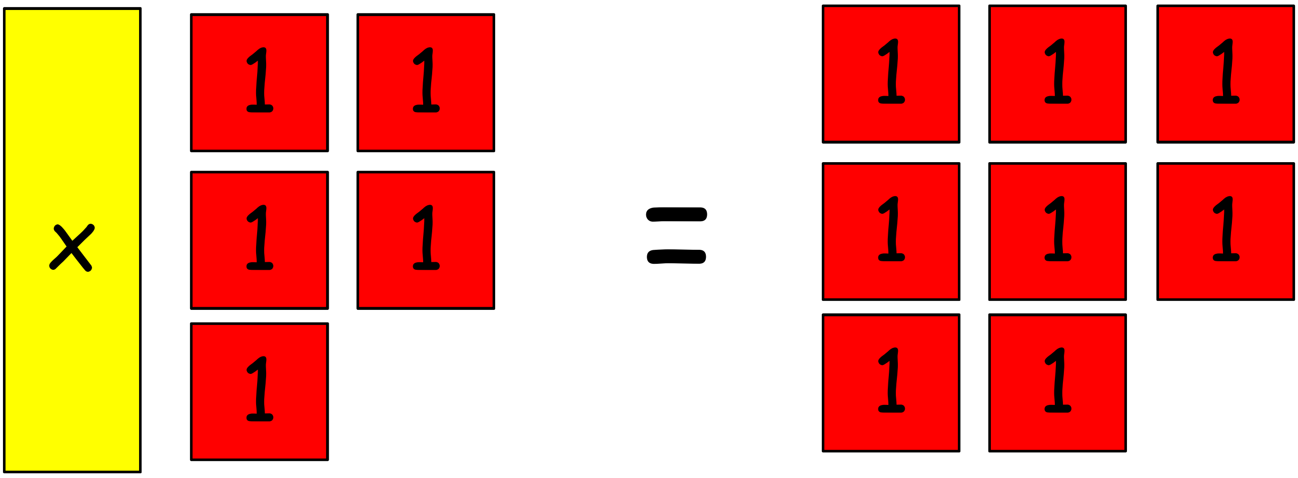
Each x block has 2 red units when they are shared out equally. This means that $x = 2$.

Algebraic representation

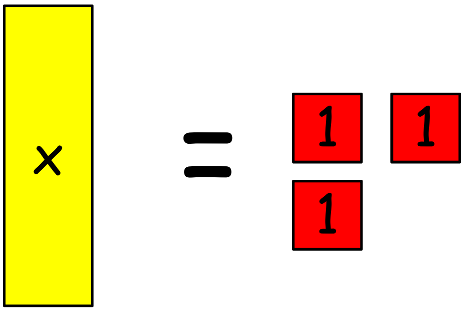
$$\left.\begin{aligned} 3x &= 6 \\ x &= 2 \end{aligned}\quad\right| \div 3$$

Solving Simple Equations

This set of tiles represents the equation $x + 5 = 8$.



We can solve the equation taking the same number of tiles from each side.



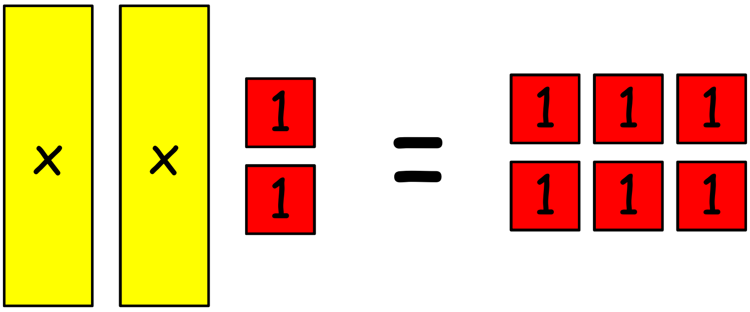
We can take 5 red tiles off each side. This means that $x = 3$.

Algebraic representation

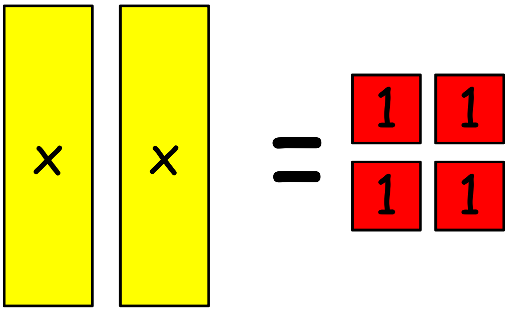
$$\begin{aligned} x + 5 &= 8 \\ x &= 3 \end{aligned} \quad \Bigg|\; -5$$

Solving Two-Step Equations

This set of tiles represents the equation $2x + 2 = 6$.

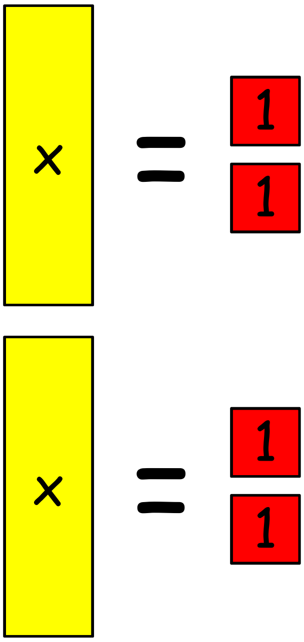


We can take 2 red unit tiles off both sides of the equation.



This leaves $2x = 4$.

Each x block has 2 red units when they are shared out equally.
This means that $x = 2$.

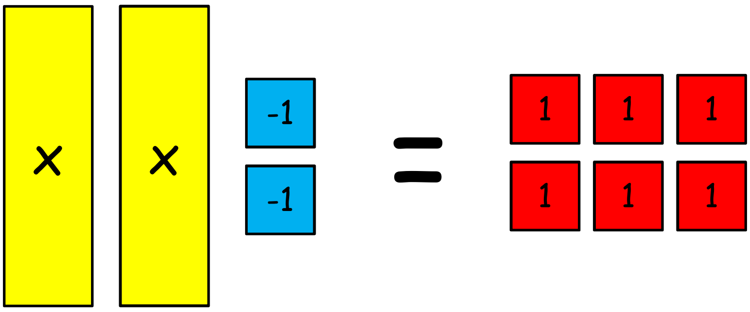


Algebraic representation

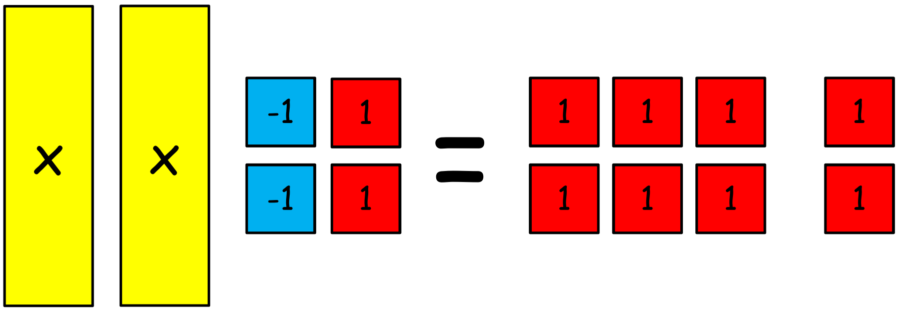
$$\begin{array}{rcl|l} 2x + 2 & = & 6 & \\ & & & -\ 2 \\ 2x & = & 4 & \\ & & & \div\ 2 \\ x & = & 2 & \end{array}$$

Solving Two-Step Equations with Negative Units

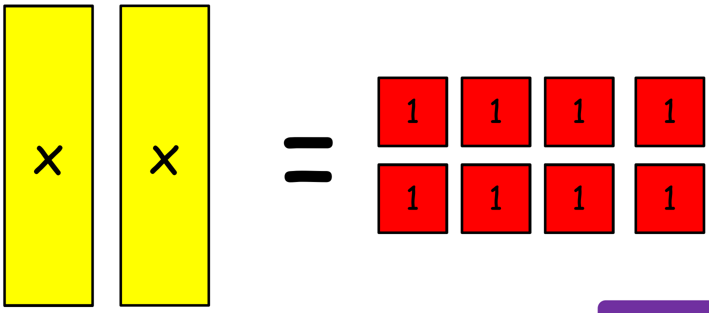
This set of tiles represents the equation $2x - 2 = 6$.



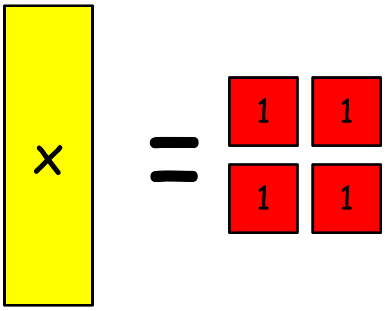
We can add red units to cancel out the blue units. We must do the same thing to both sides.



The blocks on the left cancel out to leave:



Sharing out equally means:

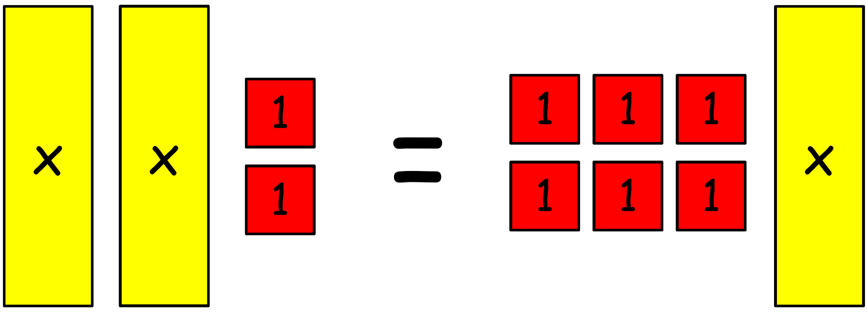


Algebraic representation

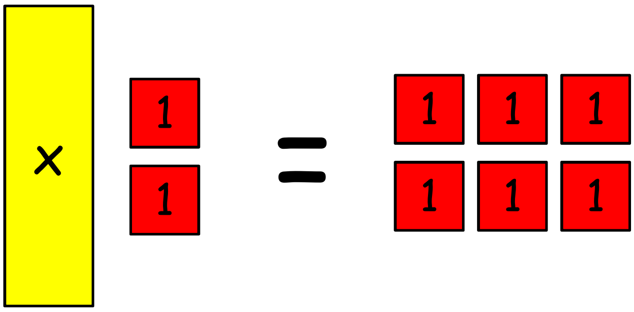
$$\begin{array}{rcl|l} 2x - 2 & = & 6 & \\ & & & + 2 \\ 2x & = & 8 & \\ & & & \div 2 \\ x & = & 4 & \end{array}$$

Solving Equations with Unknowns on Both Sides

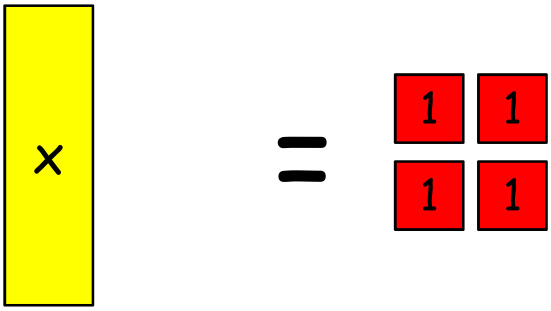
This set of tiles represents the equation $2x + 2 = 6 + x$.



We can take a yellow x tile off both sides to leave:



We can then take 2 red unit tiles off both sides to leave:



So the solution is $x = 4$.

Algebraic representation

$$\begin{array}{rcl|l} 2x + 2 & = & 6 + x & \\ & & & -\ x \\ x + 2 & = & 6 & \\ & & & -\ 2 \\ x & = & 4 & \end{array}$$

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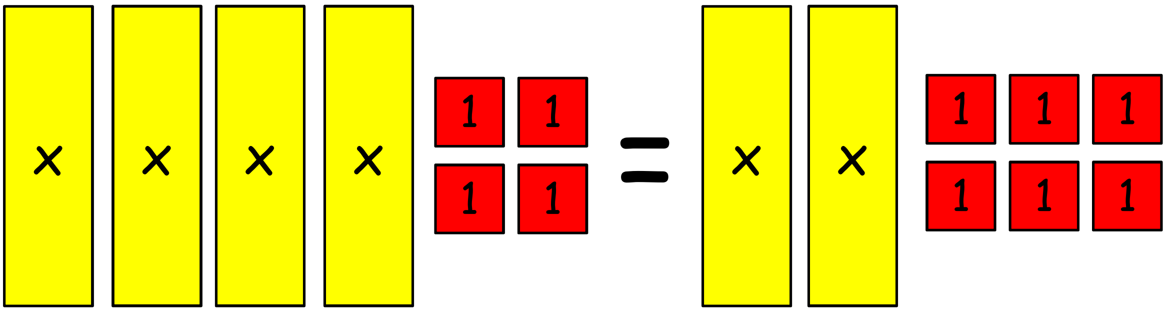
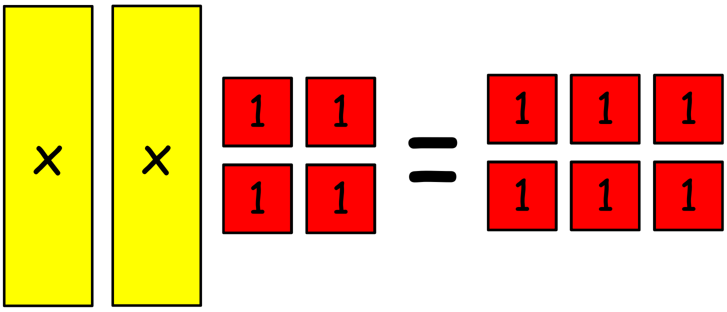
Solving Equations with Unknowns on Both Sides

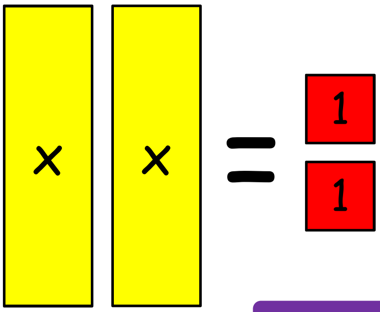
This set of tiles represents the equation $4x + 4 = 2x + 6$.



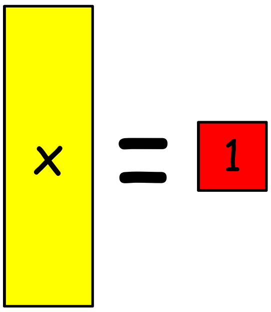
We can take 2 yellow x tile off both sides to leave:



We can then take 4 red unit tiles off both sides to leave:



Sharing equally gives:

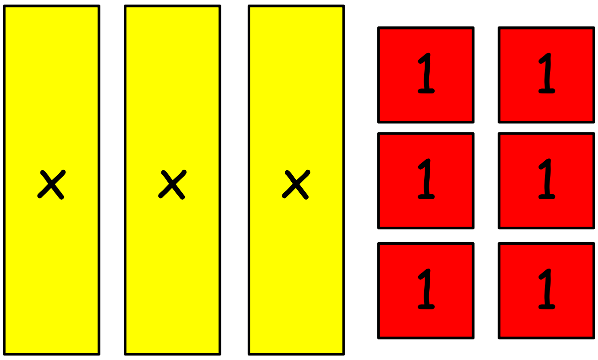


Algebraic representation

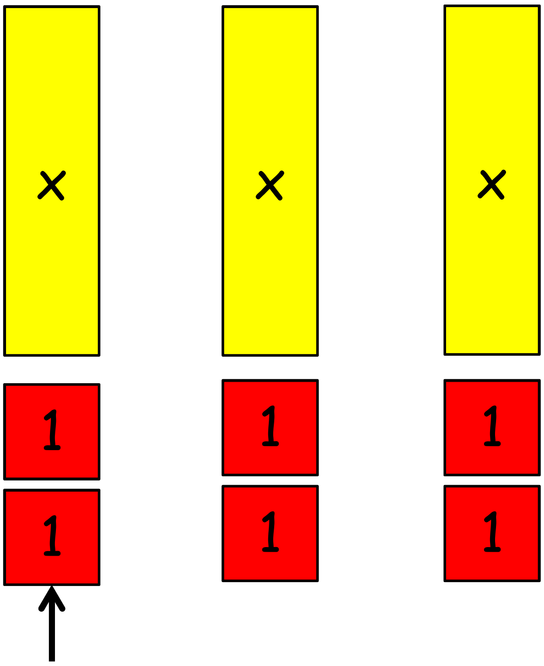
$$\begin{array}{rcl|l} 4x + 4 & = & 2x + 6 & \\ & & & -\ 2x \\ 2x + 4 & = & 6 & \\ & & & -\ 4 \\ 2x & = & 2 & \\ & & & \div\ 2 \\ x & = & 1 & \end{array}$$

Factorising Linear Expressions

This set of tiles represents 3x + 6.



To factorise, arrange the tiles into identical groups.



There are 3 identical groups.

Each group has an x tile and 2 red units.

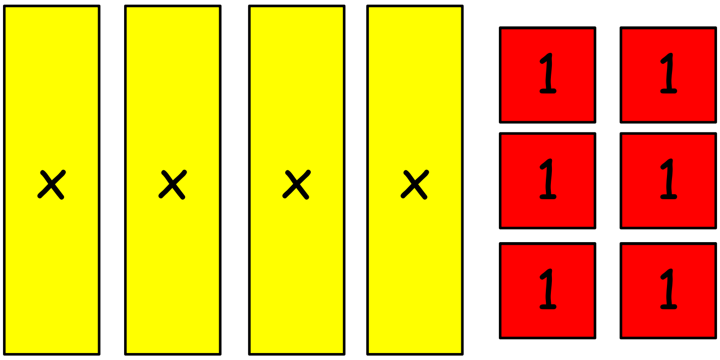
This is written as x + 2.

We have 3 groups of x + 2.

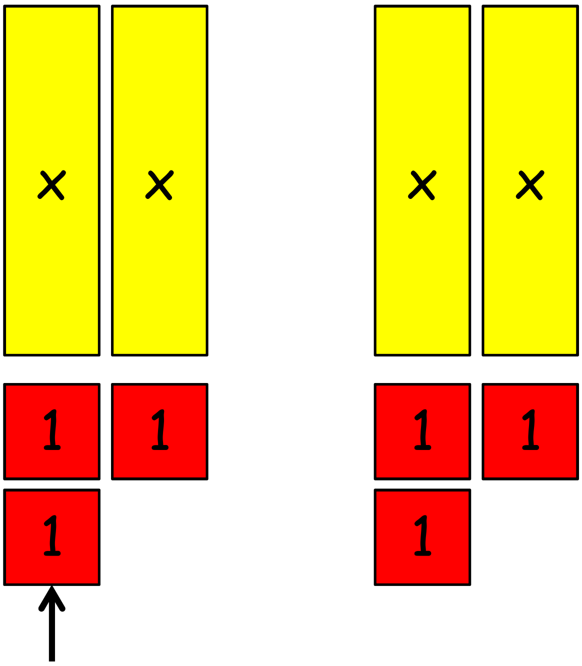
Algebraic representation

$$\underset{\text{Number of groups}}{3}(\underset{\text{What's in each group}}{x + 2})$$

This set of tiles represents 4x + 6.



Arrange into identical groups.



There are 2 identical groups.

Each group has 2 x tiles and 3 red units.

This is written as 2x + 3.

We have 2 groups of 2x + 3.

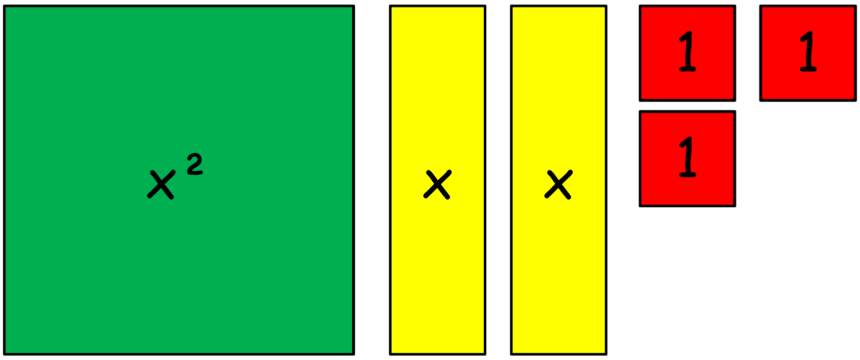
Algebraic representation

2(2x + 3)

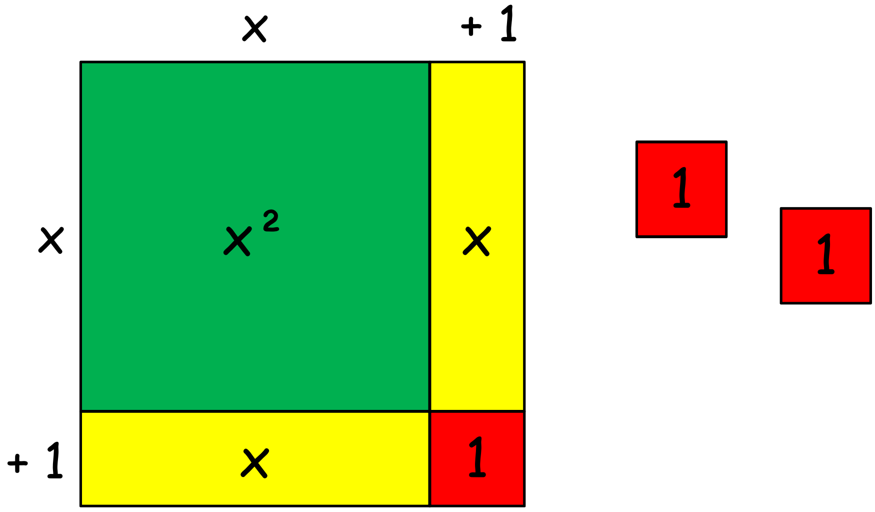
Number of groups ↗ ↖ What's in each group

Completing the Square

This set of tiles represents $x^2 + 2x + 3$.



Arrange into the biggest possible square.



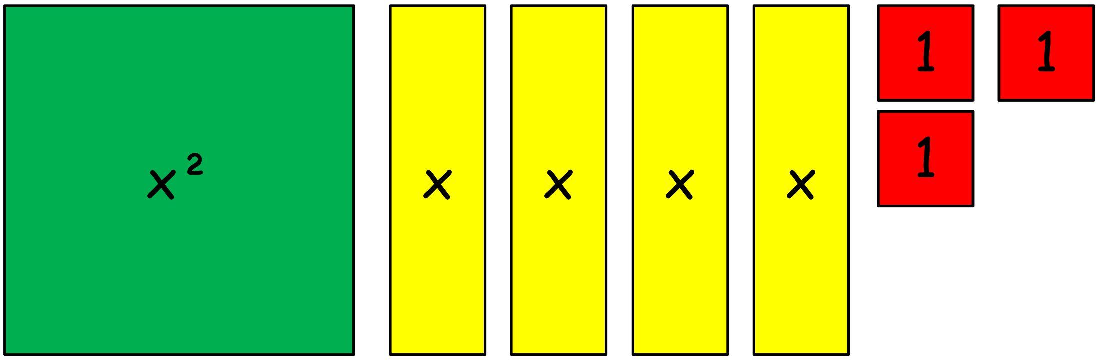
The square has side length $(x + 1)$. There are 2 red units left.

The answer is $(x + 1)^2 + 2$.

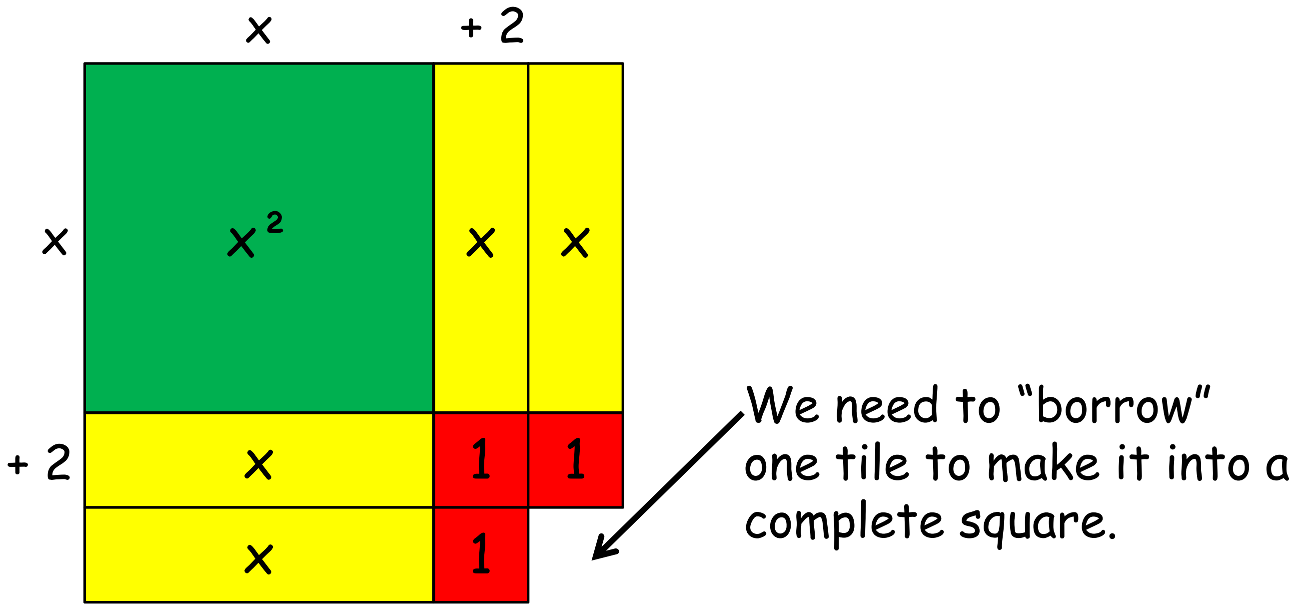
+ 2 because we have 2
red tiles left over.

Completing the Square

This set of tiles represents $x^2 + 4x + 3$.



Arrange into the biggest possible square.



We need to "borrow" one tile to make it into a complete square.

The square has side length $(x + 2)$. We need to borrow 1 tile.

The answer is $(x + 2)^2 - 1$.

- 1 because we need to "borrow" 1 red tile to make a full square.