Maths HUBS Resources

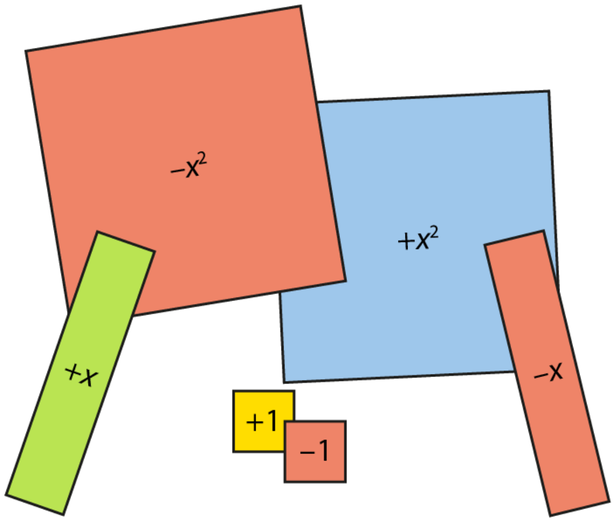
National Centre for Excellence in the Teaching of Mathematics

Mastery Professional Development

Mathematical representations

Algebra tiles

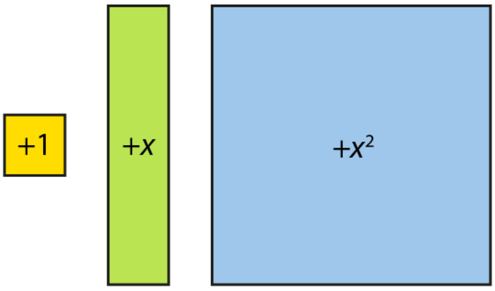
Guidance document | Key Stage 3



Please note that these materials are principally for professional development purposes. Unlike a textbook scheme they are not designed to be directly lifted and used as teaching materials. The materials can support teachers to develop their subject and pedagogical knowledge and so help to improve mathematics teaching in combination with other
high-quality resources, such as textbooks.

What they are

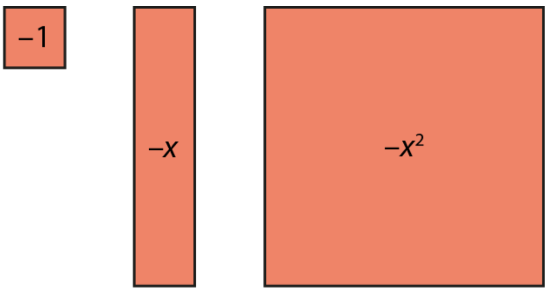
Algebra tiles are a collection of square and rectangular tiles that can be used to represent expressions containing both numerical and algebraic terms. There are three different tiles: a 1 tile (smaller square), an x tile (rectangular) and an x^2 tile (larger square). They are based on an area model of number, with the product of the dimensions of each tile giving the value of that tile.



It is important to be aware that the dimensions of the tiles are a mixture of numbers (i.e. a particular value of '1') and algebra (i.e. the variable 'x'). This might cause confusion unless handled carefully by the teacher. Care is usually taken in the design of these tiles to make sure that the '1' dimension is not a factor of the 'x' dimension and, therefore, that x should not be assumed to be any particular multiple of 1. However, the fact that x has, by necessity, been assigned a length, due to the concrete nature of the materials, can sometimes lead to students making incorrect assumptions about the value of x. While the benefits of the tiles (that they can be handled and manipulated by the student) may outweigh these difficulties, it is nonetheless important for the teacher to be aware of such possible incorrect assumptions.

N.B. An important awareness is that these manipulatives have the potential to offer students an accessible way of understanding and using symbolic algebra. Therefore, it is crucial that written symbols are used alongside the tiles, to enable a smooth transition (when the student is ready) to using symbols alone.

Each algebra tile is coloured red on its reverse side to denote the additive inverse of the original value.



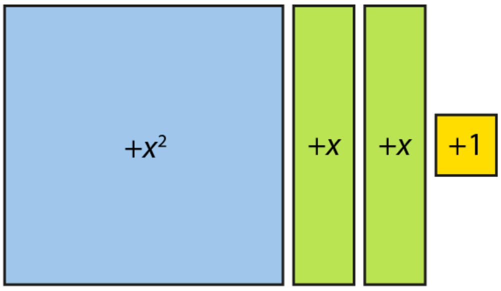
Whilst using the reverse side of the tiles to represent negative terms may be useful, having -1, $-x$ and $-x^2$ indicating the area of a tile is at odds with the concept of area as a positive value. Therefore, once an understanding of how the tiles are used for positive terms is secure, and generalisations have been made, it may be more appropriate for students to extend their thinking to negative values using symbolic notation only. Students can then apply the understanding they have gained from experience with the tiles and test this out in new situations that involve negative terms with the more abstract representations of expressions and equations.

(Examples of using the tiles with negative terms have been included in this document to provide a full overview of the capabilities of this representation, should such a use be deemed appropriate.)

Why they are important

Whilst their use is not without some conceptual difficulties (as described above), algebra tiles can provide a means by which students can visualise and represent algebraic expressions.

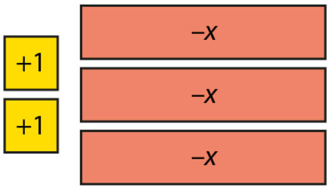
$x^2 + 2x + 1$



The reverse (negative) side of the tiles can be used to represent expressions involving negative terms, such as '$x - 4$' and '$2 - 3x$'. This can support students in understanding the idea that subtracting positive terms is equivalent to adding negative ones.

$x - 4$

$2 - 3x$



The key to using the tiles effectively is in connecting the action of flipping a tile (i.e. reversing it to show the other side) to multiplying by −1.

The 1 tiles can be used on their own, prior to using the full set and working with expressions and equations, to allow students to explore directed numbers.

As x is represented by an actual length and area and can, therefore, be seen as having a particular value relative to the '1', the algebra tiles are unable to offer a generalised image of a variable. However, the tiles can be used in a wide range of ways, and, when used alongside the algebraic symbols, they can support students in understanding and give meaning to certain symbolic manipulations.

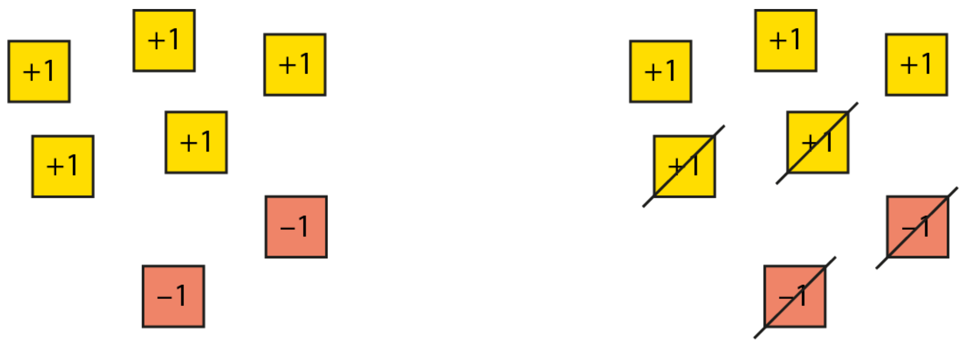
Providing students with a variety of algebraic expressions represented with the tiles, and asking them to identify the expressions, can help students to familiarise themselves with the tiles, before using them to represent expressions and equations for themselves.

How they might be used

Adding and subtracting directed numbers using zero pairs

A central idea in the use of algebra tiles in order to explore directed numbers, is that of zero pairs. Work with directed numbers at primary school is likely to have focused on the use of number lines (for example, thermometer scales), which offer students an ordinal (or positional) image of number. The introduction of positive and negative number tiles at Key Stage 3 is, in contrast, a cardinal (or quantity) image of number, and the notion of zero pairs (pairs of numbers that sum to zero) is likely to be a new way of thinking. It is important not to move too quickly to using the tiles for algebraic expressions and equations, but to spend adequate time establishing the concept of zero pairs with directed numbers first. Unless this idea is fully appreciated, the effectiveness of using algebra tiles may be limited.

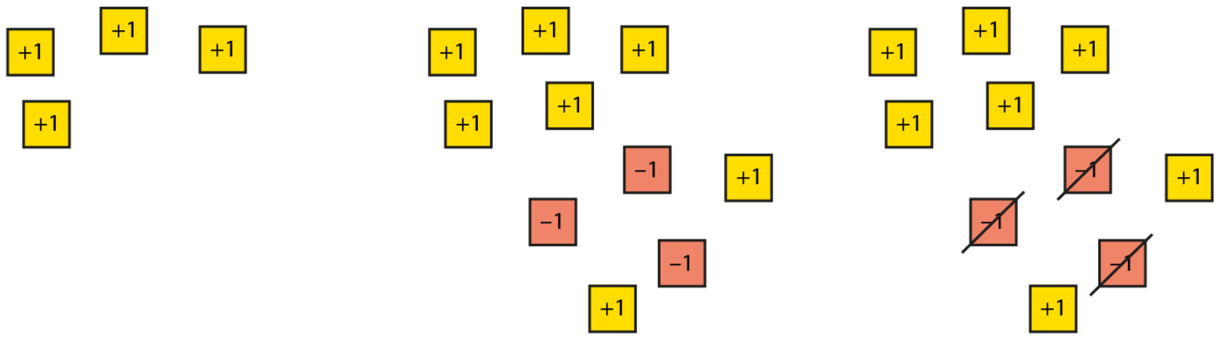
Since the value on the red face of a tile is the additive inverse of the value on the reverse side, combining a tile with its red counterpart can be seen to represent a value of zero. Using this idea, the addition and subtraction of directed numbers can be explored. For example, we can represent 5 + (−2) as five 1 tiles and two −1 tiles. Zero pairs can be identified and removed as their value is zero, leaving three 1 tiles and showing that 5 + (–2) = 3.



The above example is fairly straightforward, as the addend is represented directly with the tiles. When subtracting, we remove tiles to indicate the subtraction, and this can be seen easily when the subtrahend (the number to be subtracted) is contained within the minuend (the number from which the subtrahend is subtracted); for example, as in the case of 4 − 3.

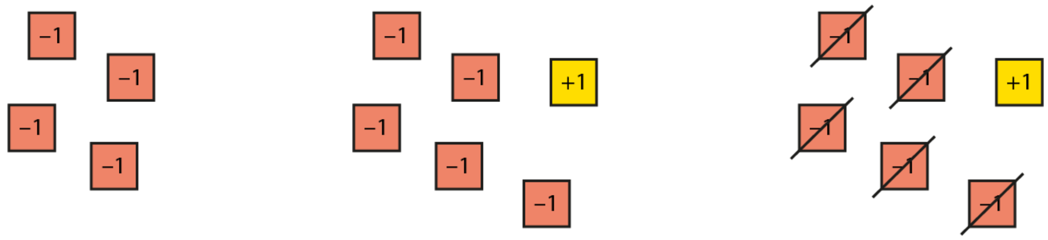
However, when representing 4 – (–3) with the tiles, we would first represent the minuend by laying down four 1 tiles. As the −3 is not visible in this collection of tiles, we can create it by adding three zero pairs. Doing so does not change the total value, but allows the subtrahend (of −3) to be subtracted, leaving +7.

Minuend of 4 | **Minuend plus three zero pairs** | **Three −1s subtracted, leaving seven +1s**



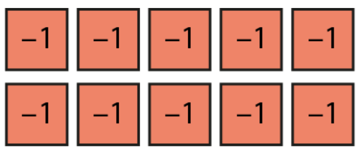
Similarly, when representing (−4) − (−5), it is not possible to subtract five −1s from the minuend of −4, but by adding a zero pair it is possible to remove the subtrahend of −5, leaving a solution of +1.

Minuend of −4 | **Minuend plus one zero pair** | **Five −1s subtracted, leaving +1**

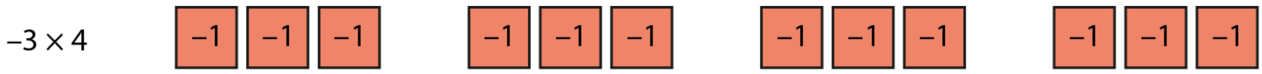


N.B. While adding only one zero pair to enable the subtraction of −5 is sufficient in this calculation (because there are already four −1s available), it will be important to discuss a more general approach with students. For example, when subtracting −5 **from any number**, you add five zero pairs and then subtract five −1s. In this way, students can reason why subtracting −5 is equivalent to adding +5.

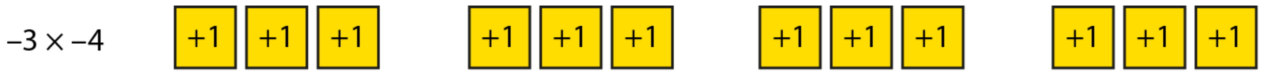
The use of algebra tiles to represent the multiplication and division of directed numbers may not be as intuitive as representing calculations with an additive structure. When multiplying a negative and a positive number together, for example, the commutative property of multiplication means that the negative value can be represented a positive number of times, e.g. 2 × (−5) and (−2) × 5 can be represented in the same way.



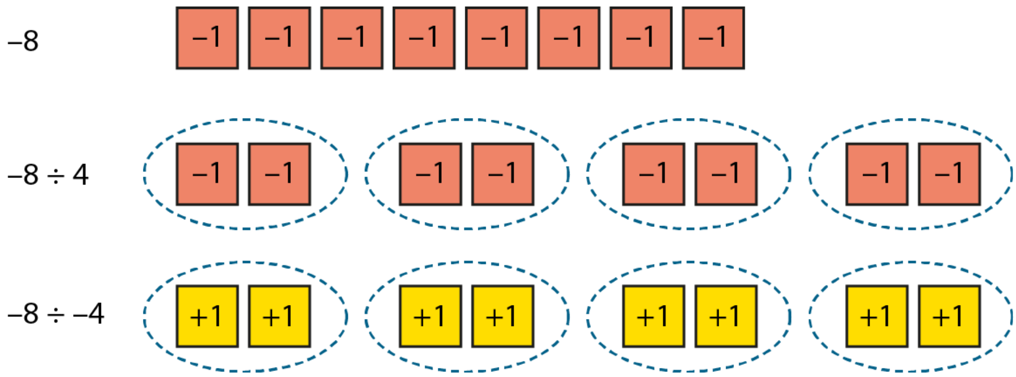
However, when multiplying two negative values, the process of flipping the displayed tile face to represent multiplying by −1 may not always be obvious to students, again demonstrating the possible limitations of using the tiles for negative terms. For example, when multiplying −3 by −4, we would first lay down three −1 tiles (to represent the −3) and repeat this four times to represent −3 × 4.



To obtain a representation for −3 × −4, the tiles would need to be flipped over to denote a multiplication by −1 and giving a solution of 12.



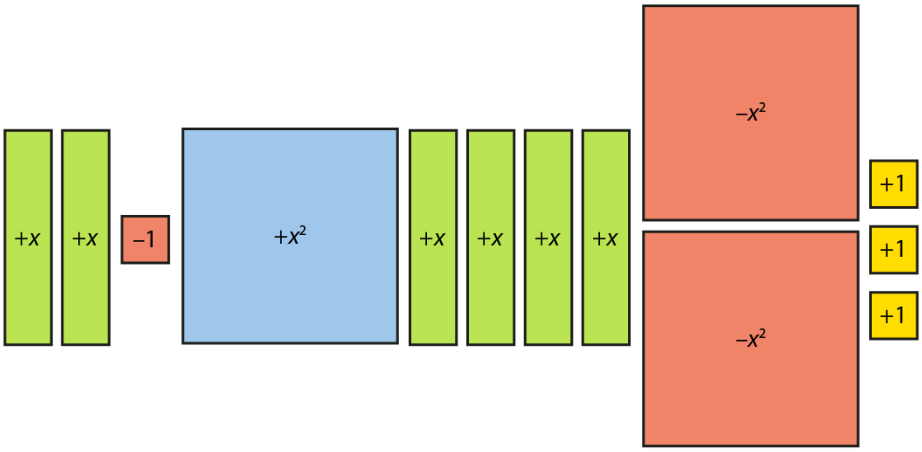
Similarly, when dividing a number by a negative number, e.g. −8 ÷ −4, dividing the tiles representing the first number into the absolute value of the second number of groups and then flipping the tiles, may not offer the most intuitive process for students to use as a model for representing division.



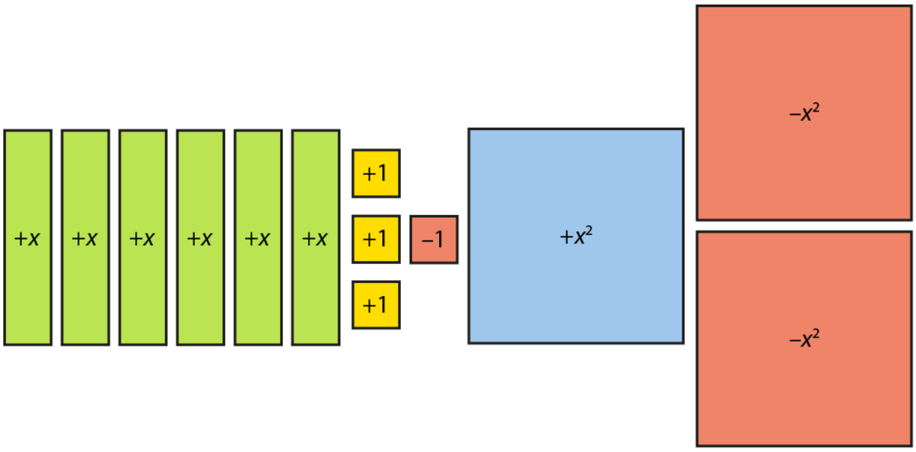
Simplifying expressions by collecting like terms

The idea of applying zero pairs using the 1 tiles can also be extended to include the x and x^2 tiles. For example, when considering the expression $2x - 1 + x^2 + 4x - 2x^2 + 3$, by recognising that ‘subtracting 1’ is the same as ‘adding −1’ and can be represented with one −1 tile (and similarly that the ‘$-2x^2$’ term can be represented with two $-x^2$ tiles), the expression can be represented using the tiles.

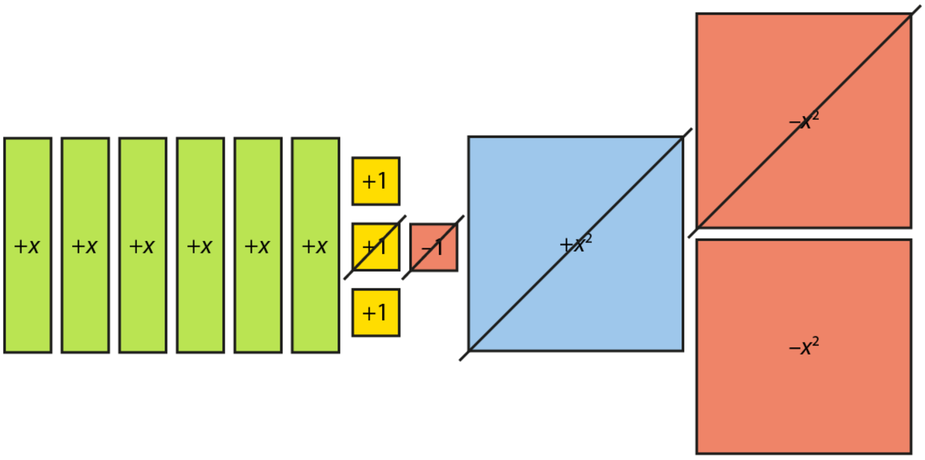
$2x - 1 + x^2 + 4x - 2x^2 + 3$



To simplify the expression, like terms need to be collected and the tiles can be rearranged to facilitate this. (Some students may choose to group the 1 (and −1), x (and $-x$) and x^2 (and $-x^2$) tiles when they represent the expression using the tiles initially and this should be encouraged.)

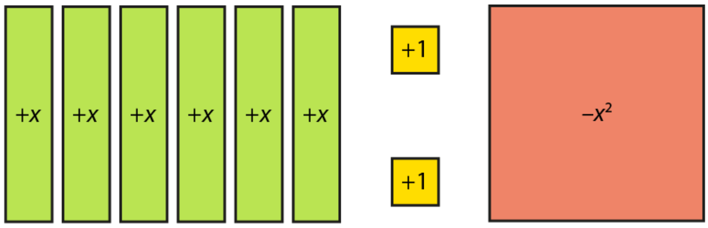


The tiles help to make like terms visible, in terms of their corresponding shapes, and support the identification of zero pairs.



With the zero pairs removed, the simplified expression of $-x^2 + 6x + 2$ is visible in the remaining tiles.

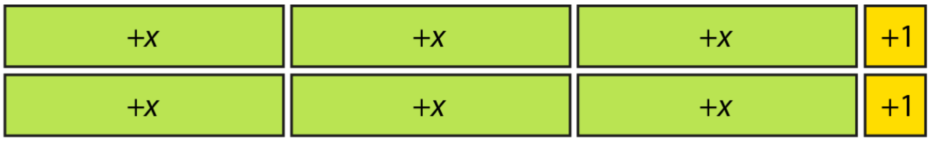
$2x - 1 + x^2 + 4x - 2x^2 + 3 = 6x + 2 - x^2$



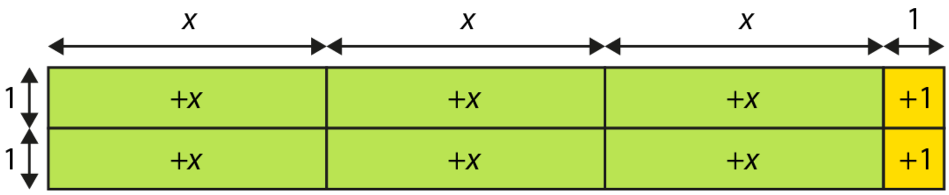
Expanding brackets

Algebra tiles can be used to represent the result of expanding brackets where the term in front of the bracket is a number, e.g. $2(3x + 1)$. The expression contained within the bracket is represented the appropriate number of times.

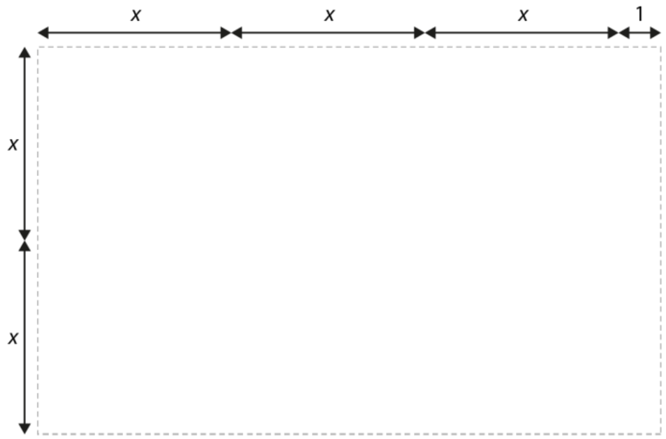
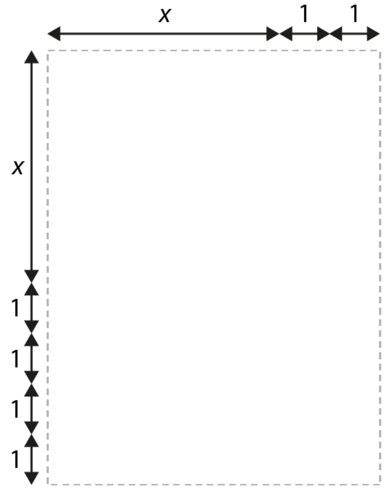
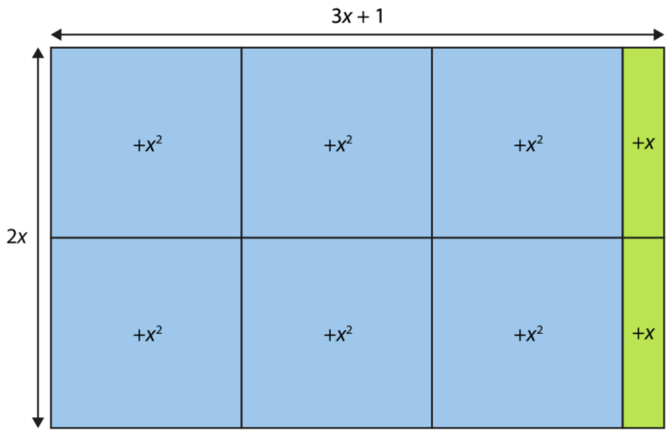
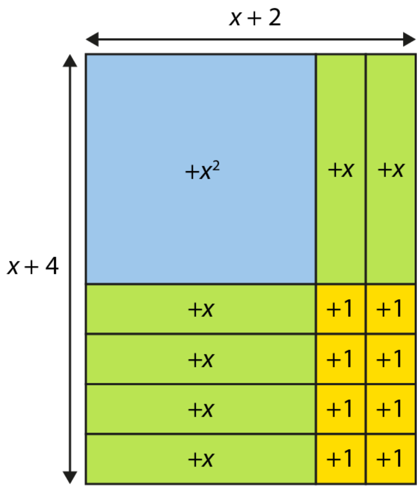
$2(3x + 1)$



Whilst highlighting the dimensions (i.e. the factors), as in the example below, may seem unnecessary here, it can help students when multiplying two algebraic terms together and when identifying factors. This provides a consistent approach that highlights the structure of both the expansion and factorisation processes.



When expanding expressions, such as $2x(3x + 1)$ or $(x + 4)(x + 2)$, the x^2 tile is used to complete the array.

$2x(3x + 1)$ – labelling of dimensions and solution tile representation	**$(x + 4)(x + 2)$ – labelling of dimensions and solution tile representation**
	
	

Filling in the tiles to make completed rectangles for the two expressions $2x(3x + 1)$ and $(x + 4)(x + 2)$ gives the expanded products of $6x^2 + 2x$ and $x^2 + 6x + 8$ respectively.

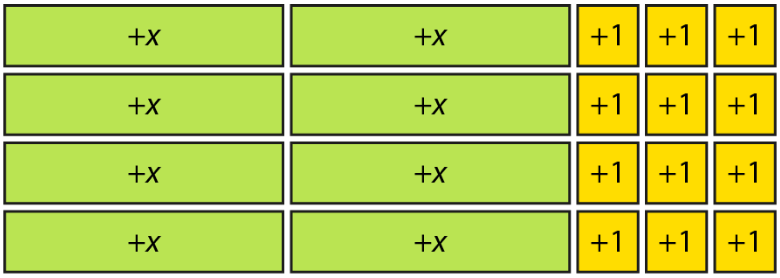
Recognising the role that the dimensions of the tiles play here, highlights the limited use of algebra tiles for expanding brackets containing negative terms. Using the same approach for the expression $3x(-2x - 4)$, for example, we would need to consider the dimensions of the $-x^2$ tile to be 'x' by '$-x$' to make the representation possible. This is not desirable, and using the tiles to represent such expressions should be avoided; instead, symbolic algebra should be used without the tiles.

It is important to recognise that when expanding products of more than two binomials, the algebra tiles no longer provide a suitable representation. It is also important to appreciate when the tiles offer a helpful representation, by providing concrete manipulatives that can be moved around, and when they might hinder students' conceptual understanding of the structure of expressions and the process of expanding (and factorising). The tiles should not be relied upon as a means of finding a solution, but instead used as an appropriate support (with their limiting features fully recognised) to help students to eventually use symbols fluently and with understanding.

Factorising expressions

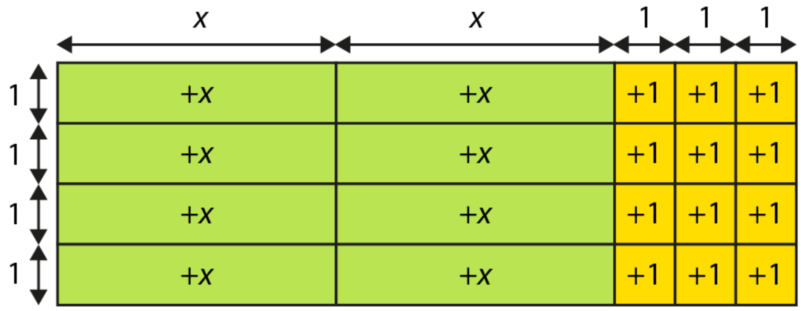
When factorising expressions where a numerical factor can be taken out, e.g. $8x + 12$, the algebra tiles representing the expression can be grouped, with the number of groups representing the common factor.

$8x + 12$



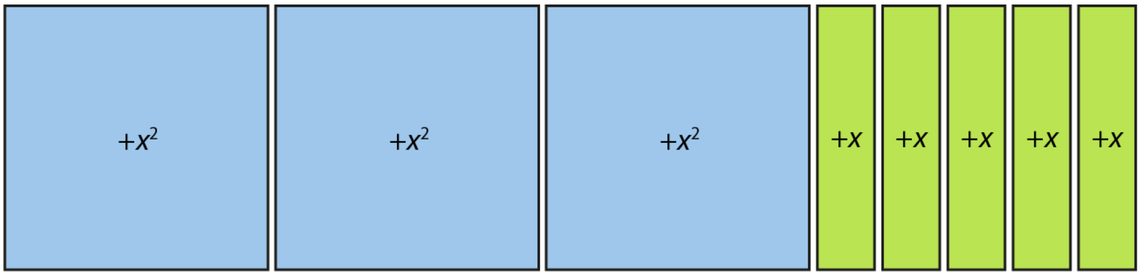
Labelling the lengths of the tiles to ensure that the factors are identified correctly should be encouraged and becomes increasingly important as the expressions get more complex.

$8x + 12 = 4(2x + 3)$



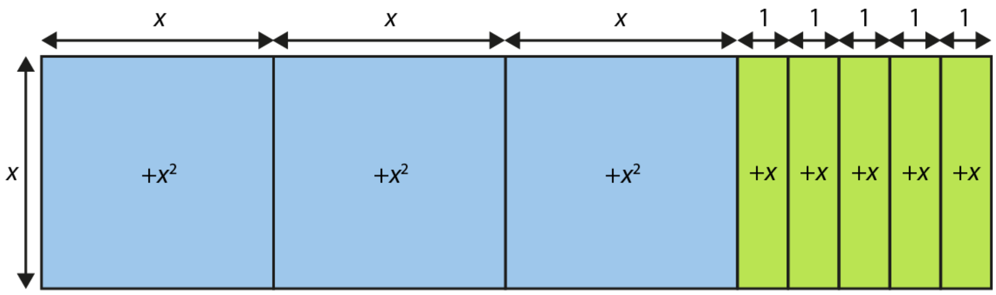
Where the terms in an expression contain a common algebraic factor, using lines to identify the dimensions of the array, and consequently the factors of the expression, becomes more crucial. For example, for the expression $3x^2 + 5x$, just by placing the tiles down next to each other, with minimal arrangement, the common factor of x becomes visible.

$3x^2 + 5x$



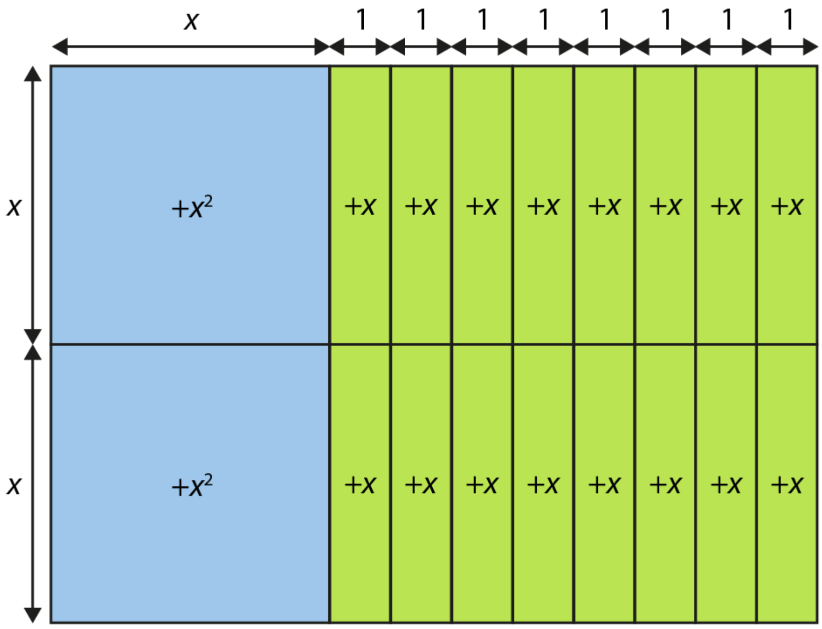
However, without identifying the dimensions of the tiles, it would be easy for students to rely purely on the appearance of the tiles, assuming, for example, that the five +1 tiles fit alongside the three $+x^2$ tiles and so place them horizontally rather than vertically. Using lines to identify the dimensions helps to prevent students from making mistakes such as this, and supports them in thinking about the structure of the expression to be factorised and its factorised form.

$3x^2 + 5x = x(3x + 5)$

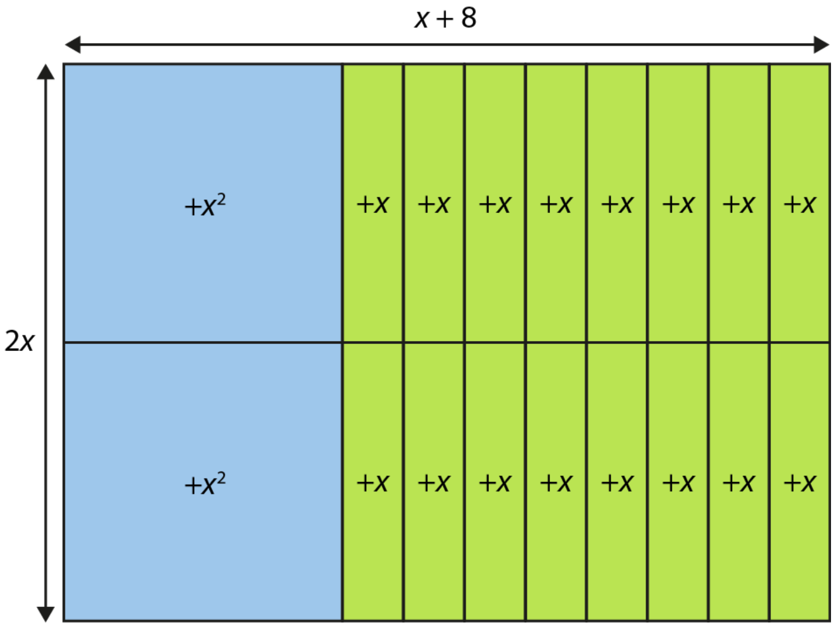


This method of using lines to label the dimensions of the rectangular array can also be helpful in checking that expressions are factorised fully and all common factors identified. For example, for the expression $2x^2 + 16x$, the two $+x^2$ tiles and sixteen $+x$ tiles can be arranged into a rectangular array consisting of two rows, with each row made up of one $+x^2$ tile and eight $+x$ tiles.

$2x^2 + 16x = 2x(x + 8)$



Without labelling the dimensions of the array, it would be easy for students to identify the two rows and give the factorised expression as $2(x^2 + 8x)$, failing to identify all common factors. Recognising the dimensions of the array as $2x$ and $x + 8$, as shown by the lines, however, makes the fully factorised expression of $2x(x + 8)$ visible.



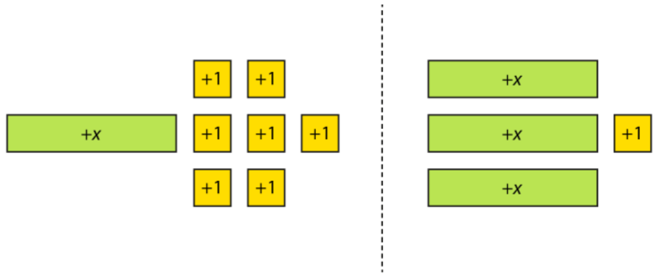
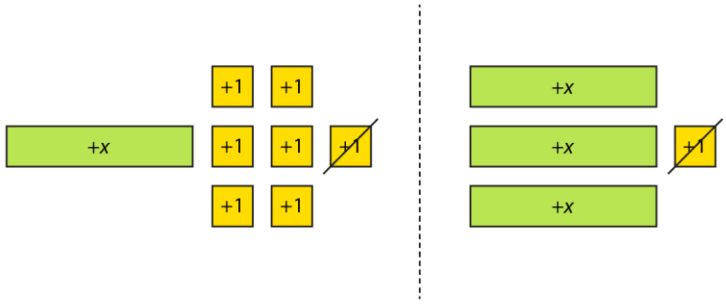
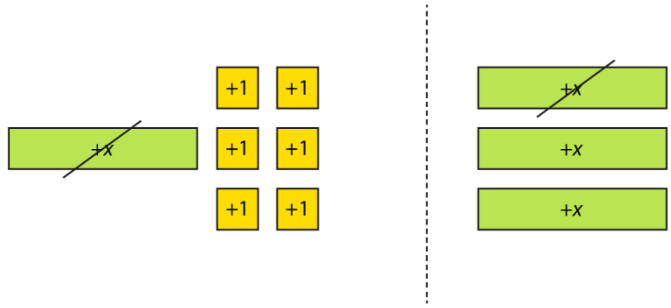
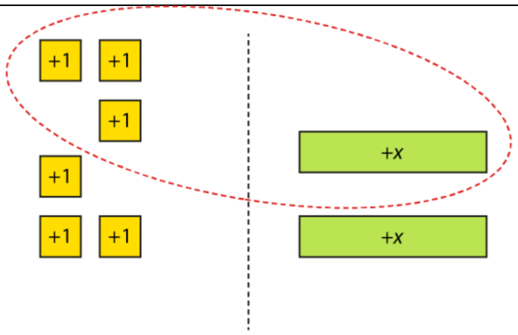
As with expanding brackets, the appropriateness of using algebra tiles when factorising expressions that include negative terms may need to be carefully considered. The use of tiles can be abandoned when they are no longer appropriate, and symbols alone can be used instead.

Solving linear equations

Using lines to label the dimensions of arrays when expanding and factorising expressions makes more explicit the x tiles' dimensions of '1' and 'x'. It is important for students to internalise the idea of the area of this tile as being anything they choose. Teachers may wish to work with students on the more general idea initially, for example, asking them, *'What would the area of the rectangle be if it had a length of 4 and a width of 3?'* or '*What if the rectangle had an area of 20, what might the length and width be?*', before moving on to fixing the width to 1. It will be helpful to consider some particular cases to help students appreciate the idea of a variable. For example: *'If the width is 1 and the length is 2, what is the area?'*, *'If the width is 1 and the length is 3, what is the area?'*, *'If the width is 1 and the length is 4.7, what is the area?'* and so on, building up to *'If the width is 1 and the length is x, what is the area?'*. It is not a trivial exercise for students to see that by keeping the width fixed and equal to 1, the area of the rectangle is always the same value as the value of the length of the rectangle.

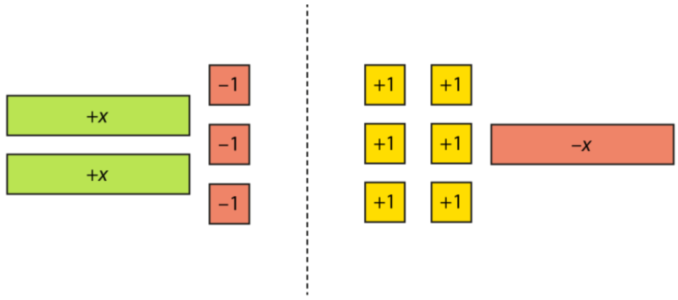
Once an understanding of the concept of the variable x tile has been grasped, it is important to emphasise that the actual dimensions of the x tiles are not related to any possible value they might have and that the tiles merely represent the idea of a variable. Using an online tool (Hooda Math Algebra Tiles, for example; see 'Further resources' section below) that allows tiles to be manipulated virtually and the length of x to be altered via a slider, may help students to grasp this, as well as supporting a move to the use of bar model diagrams, where the limitations of concrete tiles can be overcome by a more flexible, pictorial representation.

Algebra tiles can be used when solving linear equations, providing a 'bridge' to support students as they develop their fluency in algebraic symbolism. As before, it is important for the symbolic representation to be used alongside the tiles. When an equation has the same numerical and/or algebraic terms on both sides, the tiles representing these terms can be removed from both sides of the equation as part of the solution process. For example, when solving the equation $x + 7 = 3x + 1$, there is one +1 tile and one $+x$ tile on both sides that can be removed.

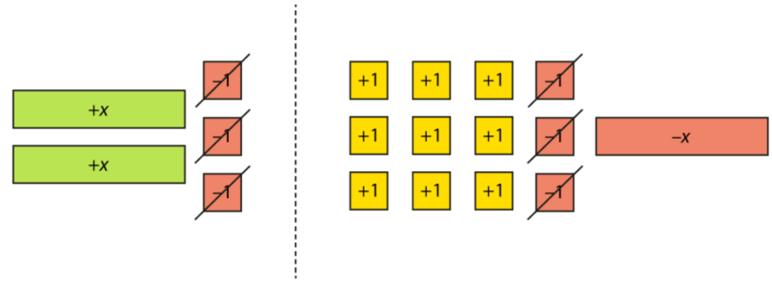
	$x + 7 = 3x + 1$
	$x + 6 = 3x$
	$6 = 2x$
	$3 = x$ or $x = 3$

It is important that students recognise that subtracting the 1 and the x terms can be done in either order and that grouping the tiles (or dividing by the number of x terms) gives the solution of $x = 3$. Whilst a solution given as $x = 3$ (rather than $3 = x$) is preferred, students should be exposed to working with equations with more x terms on the right-hand side than the left-hand side in order to recognise that this format of equation, whilst sometimes considered unconventional, can be solved in just the same way.

When the two sides of the equation do not contain any of the same tiles, the idea of zero pairs can be applied to the solution process. For example, in the equation $2x - 3 = 6 - x$, zero pairs can be applied to both the numerical and algebraic terms.



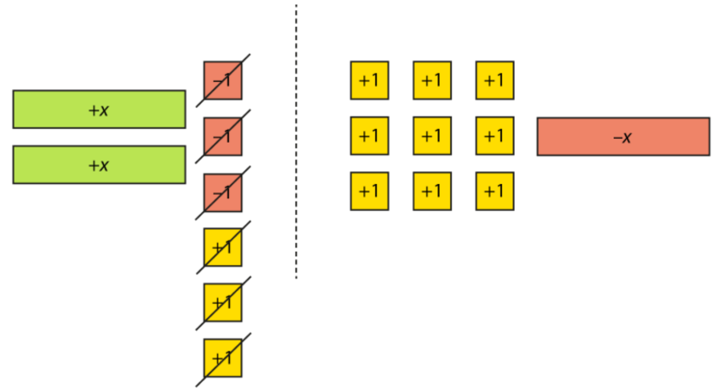
$2x - 3 = 6 - x$



Method 1

$2x - 3 = 6 - x + 3 - 3$

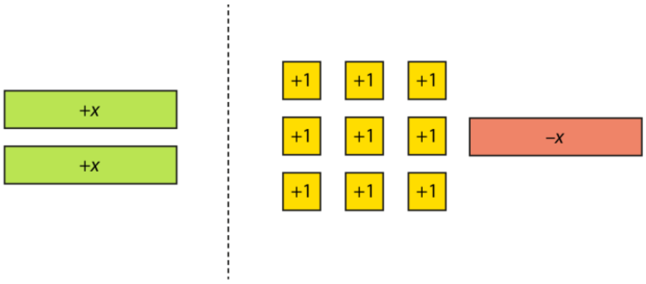
or



or

Method 2

$2x - 3 + 3 = 6 - x + 3$



$2x = 9 - x$

Students have a choice in how to 'remove' the '−3' from the left-hand side. They can either add zero pairs to the right-hand side, so that −3 can be subtracted from both sides, or create zero pairs by adding 3 to both sides of the equation. Whilst the equations $2x - 3 = 6 - x + 3 - 3$ and $2x - 3 + 3 = 6 - x + 3$ clearly describe what is happening in the tiles representation, students should be encouraged to omit the symbolic representation for these steps, recognising that regardless of the method adopted to remove the '−3' from the left-hand side of the equation, the resulting equation of $2x = 9 - x$ can be obtained directly from $2x - 3 = 6 - x$.

It is important to notice that adding zero pairs (as in method 1) has no effect on the symbolic representation, because the equation being represented is still $2x - 3 = 6 - x$ after the zero pairs have been introduced to the right-hand side of the equation. Whilst this should be obvious due to the nature of a zero pair, it is important to check that students are happy with this and understand why this is the case.

When removing the $-x$ from the right-hand side of the equation, students again have the choice of either adding a zero pair (to the left-hand side), so that $-x$ can be subtracted from both sides of the equation, or creating a zero pair (on the right-hand side) by adding x to both sides.

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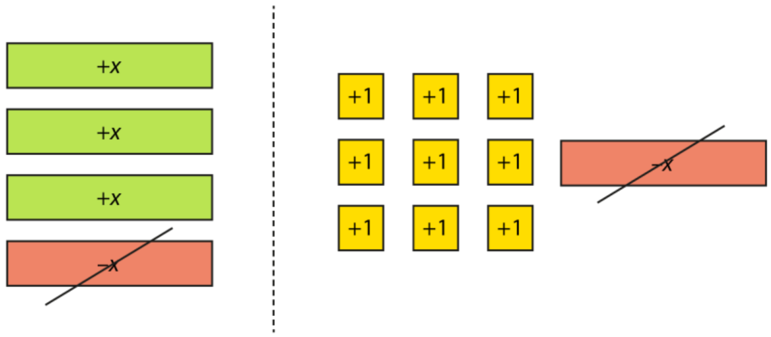
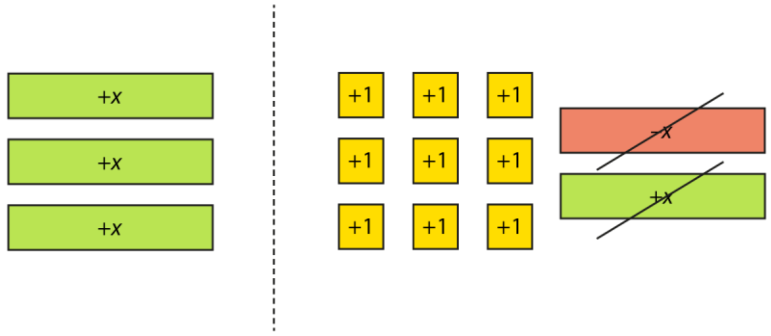
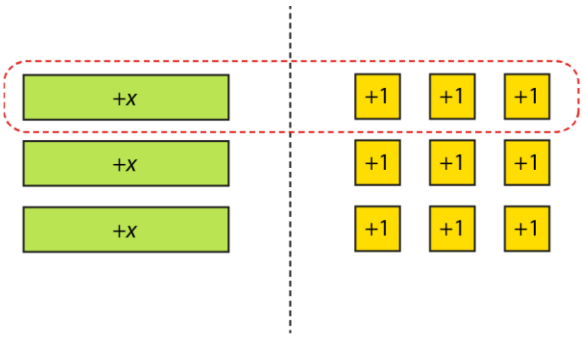


or



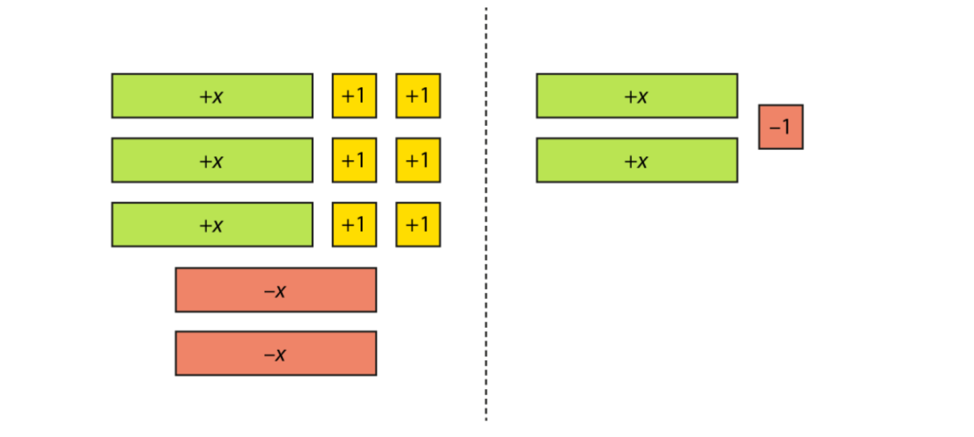
</td>
<td>$3x = 9$</td>
</tr>
<tr>
<td>


</td>
<td>$x = 3$</td>
</tr>
</table>

Grouping or dividing by the number of x terms gives the solution to the equation of $x = 3$.

As students use the tiles to introduce and create zero pairs, so that the physical act of removing the same kind and number of tiles is possible, they may begin to recognise the simple manoeuvre of moving a tile to the other side of the equation and flipping it to give its additive inverse. For example, moving the $-x$ tile from the right-hand side of the equation $2x - 3 = 6 - x$ and flipping it to become a $+x$ tile on the left-hand side of the equation, to give $3x - 3 = 6$, provides an alternative approach and the reasons why this occurs are worth exploring with students.

Equations that contain brackets can be solved using the tiles, in a similar way. The complexity of the term(s) outside the bracket(s) will determine whether the bracket expansion/removal needs to be carried out as an extra step, or whether it can be addressed within the solution process itself. For example, the equation $3(x + 2) - 2x = 2x - 1$ has a simple numeric term outside the $(x + 2)$ bracket and so can be represented easily within the first step of the solution.

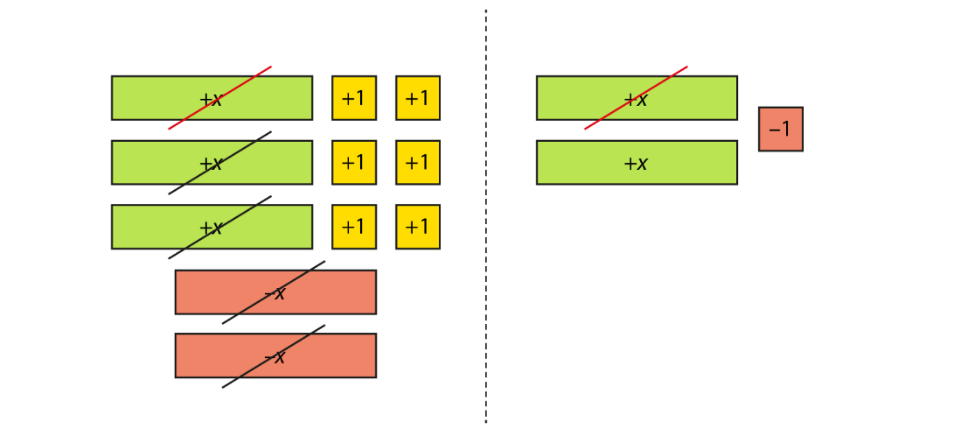


$3(x + 2) - 2x = 2x - 1$

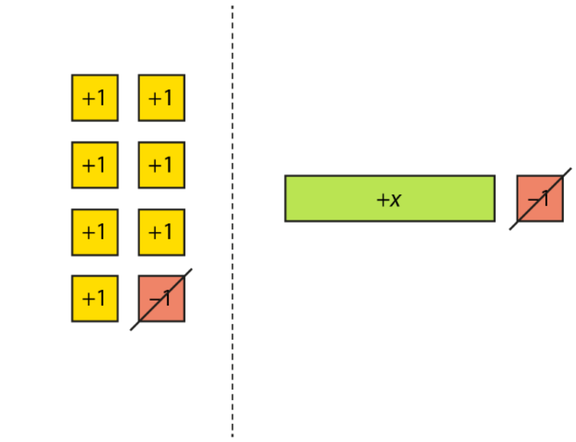
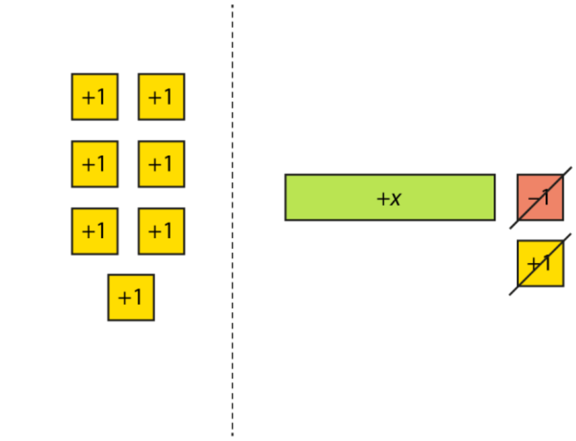
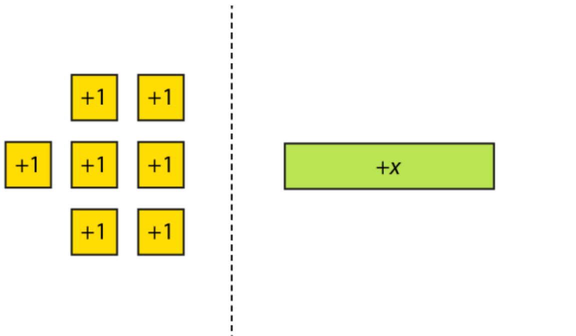
becomes

$3x + 6 - 2x = 2x - 1$

By expanding the bracket, the presence of two zero pairs can immediately be seen on the left-hand side of the equation, and these can be removed (as shown by the black strikethroughs in the first representation below) before subtracting an $+x$ term from both sides of the equation (as shown by the red strikethroughs).



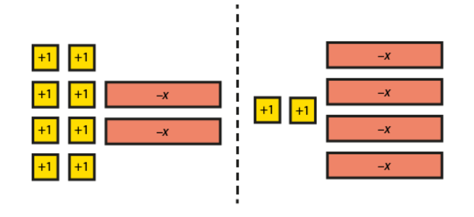
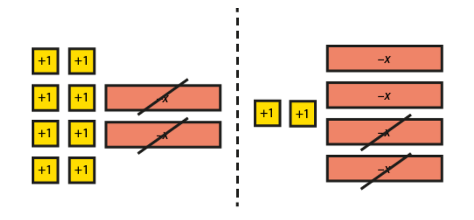
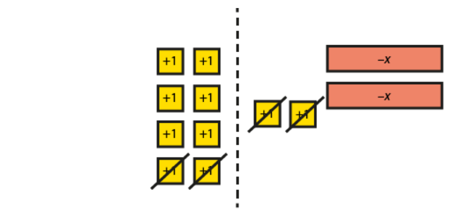
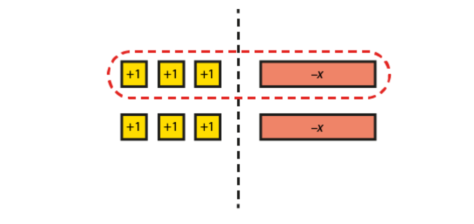
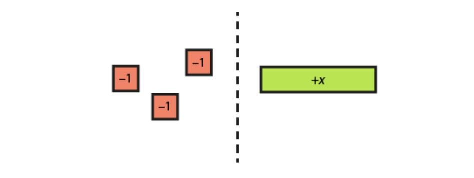
$6 = x - 1$

 or	$6 + 1 - 1 = x - 1$ or
	$6 + 1 = x - 1 + 1$
	$7 = x$ or $x = 7$

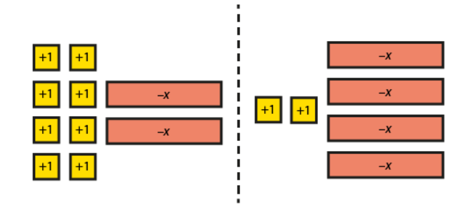
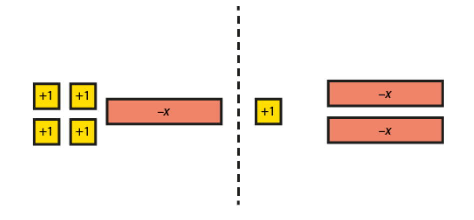
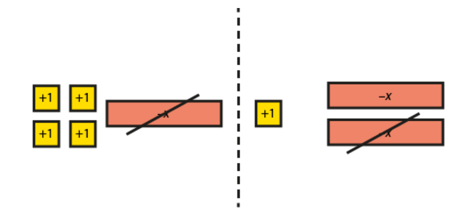
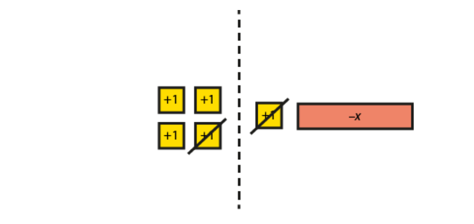
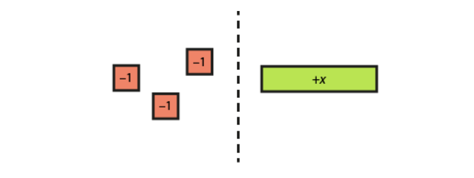
Students again have the choice of either adding a zero pair, so that −1 can be subtracted from both sides of the equation, or creating a zero pair by adding 1 to both sides, to give the solution of $x = 7$.

Algebra tiles provide a way of representing equations with a negative solution, something that other representations (for example, bar models) can struggle to do. It is not always obvious from a cursory look at an equation that the solution will be negative, and so having a representation that can be used for both positive and negative solutions can be beneficial. When solving some linear equations, there can be multiple ways of approaching the solution process, with choices to be made on whether to carry out a multiplicative step first or an additive step first. The equation $8 - 2x = 2 - 4x$ provides an example of this.

Method 1 – additive step first

	$8 - 2x = 2 - 4x$
	$8 = 2 - 2x$
	$6 = -2x$
	$3 = -x$
	$x = -3$

Method 2 – multiplicative step first

	$8 - 2x = 2 - 4x$
	$4 - x = 1 - 2x$
	$4 = 1 - x$
	$3 = -x$
	$x = -3$

Solving the equation by carrying out the additive step first and subtracting two $-x$ tiles and two +1 tiles, before recognising that both sides of the equation can be divided by two, is one possible solution strategy. Alternatively, identifying both sides of the equation as being divisible by two (multiplicative step) first and then subtracting one $-x$ tile and one +1 tile from both sides (additive step) is another possible solution strategy. For some equations, the choice of solution method may affect the efficiency of the solution process or be dictated by the nature of the terms contained within the equation. Whilst this is not the case for this equation, students should recognise the benefits of particular solution strategies over others for some equations. Even within these two solution processes, there are alternative steps that can be taken to solve the equation (for example, dividing both sides of the equation $8 = 2 - 2x$ by 2, rather than subtracting 2 from both sides) and the algebra tiles can be used to support students in exploring these. The final step of finding a solution for x – requiring recognising the need to reverse which face of the tiles is showing – may not come naturally to students. It is therefore important, when using the tiles with equations where the value of x is not easily exposed without flipping the tiles, to check that students understand the process of identifying the value of $+x$, when $-x$ is known.

There will come a point when using the tiles to represent equations becomes less effective, and it is important to continually assess the appropriateness of algebra tiles as a representation. The importance of always having the symbols shown alongside the tiles is crucial, as it allows students to 'switch' between the two, aiding them in developing an understanding of what the symbols are representing. The tiles (as with all concrete representations) should be used to support students in securing an understanding of the structure of linear equations and their solution process, which, when the use of the tiles becomes cumbersome, unhelpful and eventually unnecessary, can then be represented purely symbolically.

Further resources

Physical algebra tiles are often used in classrooms; however, there are several free online resources that enable tiles to be generated and arranged on screen.

See, for example:

CPM Tiles
https://technology.cpm.org/general/tiles/
Selecting the 'Algebra Tiles' tab on the left-hand side of the screen gives access to x, x^2, y, y^2, 1 and xy tiles, which can be dragged and dropped into the work area. The size of the x, x^2, y, y^2 and xy tiles can be adjusted using a slider. Clicking a tile once changes it from positive to negative (and vice versa), and clicking the x, y and xy tiles twice rotates them by 90 degrees.

The Mathenæum: introduction to algebra tiles
http://thewessens.net/ClassroomApps/Models/Tiles/basicalgebratiles.html?topic=models&id=1
Drag and drop 1, x, x^2, -1, $-x$ and $-x^2$ tiles. There are four problem types: 'Match Expression', 'Zero Pairs', 'Like Terms' and 'Explore'. A click on an x or $-x$ tile rotates it from vertical to horizontal orientation (and vice versa). The 'Arrange' button groups tiles of the same type together, the 'Cancel' button identifies zero pairs and deletes them, and the 'Flip' button flips over all tiles on the screen (i.e. from positive to negative and vice versa). A '×3' button, when pressed, supplies three times the selected tile on the screen.

On the 'Match Expression' screen, target expressions are given, and, as the tiles are dragged into the work area, the corresponding expression is displayed on screen.

On the 'Zero Pairs' screen, a target expression is given and some tiles are displayed on the screen. The task is to get to the target by cancelling existing tiles. Zero pairs can be created by placing the additive inverse of a tile over the existing tile, causing both tiles to disappear (alternatively, the 'Cancel' button can be used to remove zero pairs after the additive inverse of a tile has been placed anywhere in the work area).

On the 'Like Terms' screen, a number of tiles are displayed on the screen, with zero pairs included. The zero pairs need to be identified and removed (by placing one tile on top of another) to get to a given target expression.

The 'Explore' screen allows for free play with an additional feature of being able to drag zero pairs onto the work area (i.e. a 1 and −1 tile together, an x and $-x$ tile together and an x^2 and $-x^2$ tile together). The expression that corresponds to the tiles on the screen is displayed.

Virtual algebra tiles

http://media.mivu.org/mvu_pd/a4a/homework/applets_applet_home.html#top

Selecting the 'Virtual Algebra Tiles Applet List' on the left-hand side of the screen gives access to eight virtual tiles activities:

1. Modelling Expressions
2. Simplifying Expressions
3. Adding Polynomials
4. Solving One-Step Equations
5. Solving Two-Step Equations
6. Multiplication
7. Factoring Trinomials
8. Completing the Square

1, x, x^2, −1, $-x$ and $-x^2$ tiles are available to drag and drop into the work area for all activities except activities 4 and 5, where just the 1, x, −1 and $-x$ tiles are available. Tiles can be removed from the work area by dragging them into the bin at the bottom right-hand corner of the work area. In activities 6, 7 and 8, the x and $-x$ tiles can be rotated by clicking on the arrow in the top right-hand corner of the tile. For activities 1, 2, 3 and 7, a difficulty level can be selected from a drop-down menu (Easy, Medium, Hard or Random). In activity 6, a choice of problem type is available, and the user can select from Terms, Distribute, Binomials or Random.

Hooda Math

http://www.hoodamath.com/mobile/games/algebratiles.html

Clicking on a tile at the bottom of the screen makes it appear in the work area. Tiles available are: 1, 5 (a row of five 1 tiles), x, y, x^2, y^2 and xy. No negative tiles are available. The lengths of x and y can be adjusted via sliders. Clicking and dragging the upper left of any tile rotates the tile by 90 degrees. Tiles can be removed from the work area by dragging them into the bin at the bottom right-hand corner of the work area.

GeoGebra digital algebra tiles

https://www.geogebra.org/m/x3c5S6Nd

GeoGebra animation is specifically set up for finding the product of two binomials (although sliders allow contents of a bracket to be set to zero). x^2 tiles are generated but not labelled and do not appear in the key. Although this is a free-play activity, there are some questions posed at the bottom of the screen:

- When do the x tiles cancel out?
- What's the biggest quadratic you can make?
- When are the product tiles all positive?
- All negative?

One of the benefits of using an online resource, similar to those described above, is that physical equipment is not necessary, so does not need to be stored, given out or collected in. It also means that the number of tiles available to a student is unrestricted. However, it is important, when choosing an online resource, to ensure that it provides a helpful experience of algebra tiles, so that use of the representation is supporting students in gaining a deeper understanding of the mathematics in a way that is as good as, if not better than, the use of physical tiles.

Examples of videos

NCETM secondary mastery professional development materials

https://www.ncetm.org.uk/classroom-resources/secmm-using-mathematical-representations-at-ks3/

Included in the secondary mastery professional development materials is a series of six videos on algebra files, covering and expanding on the contents of this guidance document.

How to use algebra tiles
https://www.youtube.com/watch?v=mIlSU7jyVCk
An introductory video for using algebra tiles that looks at what each tile represents in an area model.

How algebra tiles can be used to support the solution of the equation 3*x* + 2 = 8
https://www.youtube.com/watch?v=1bRMbkjceOA
This video demonstrates how to model solving an equation using an algebra tiles virtual manipulative.

The NCETM is not responsible for the content or security of external sites, nor does the listing of an external resource indicate endorsement of any kind.