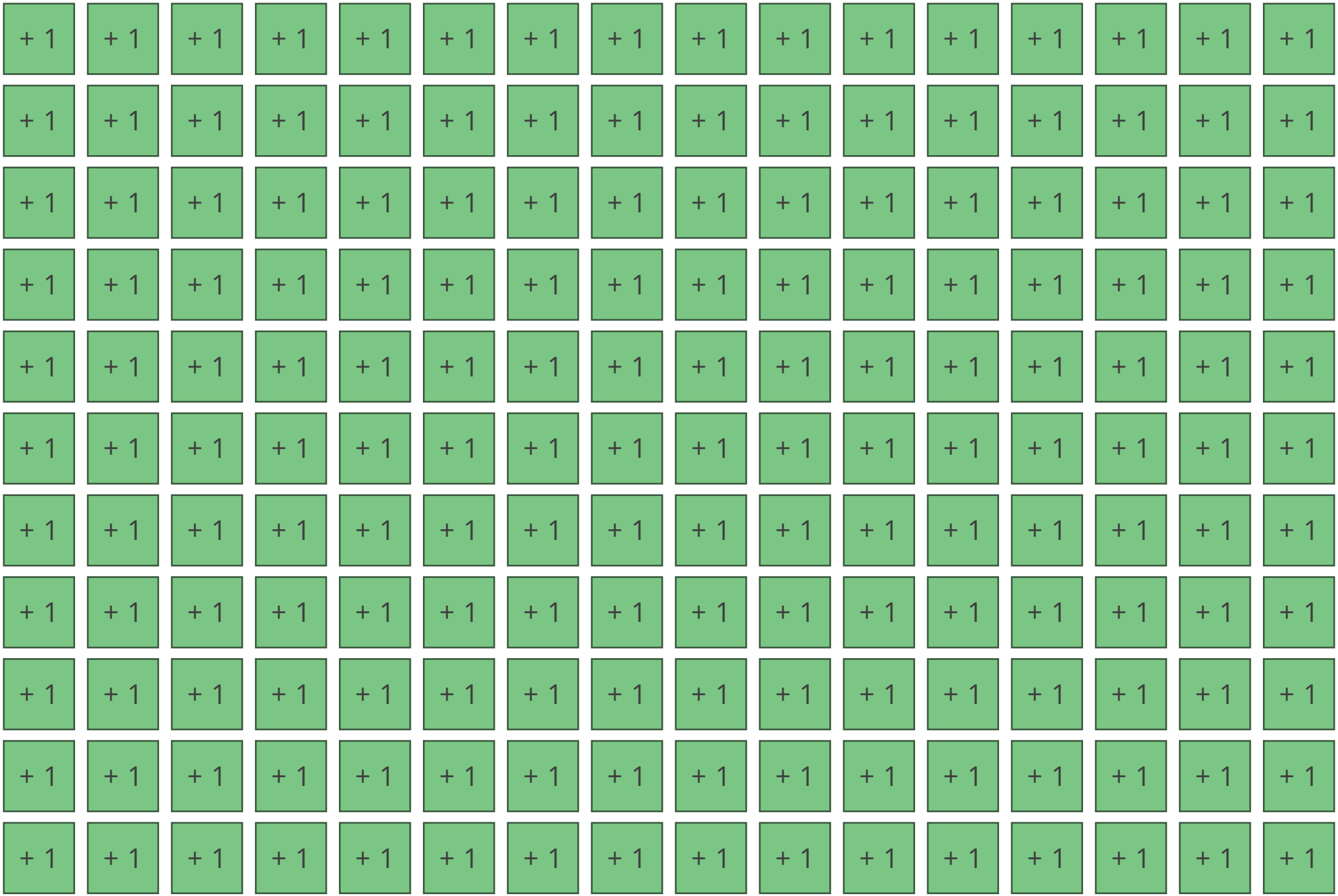
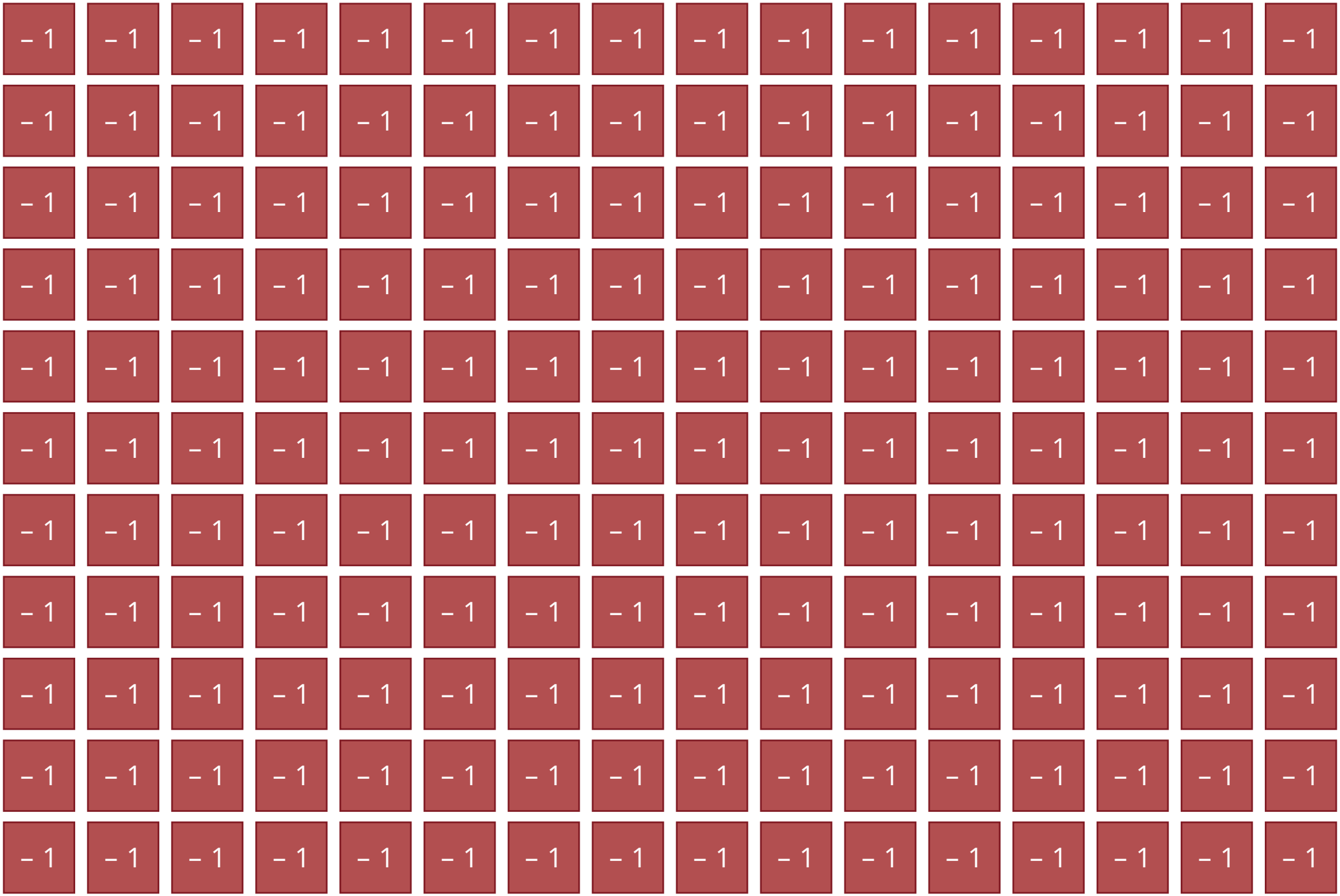
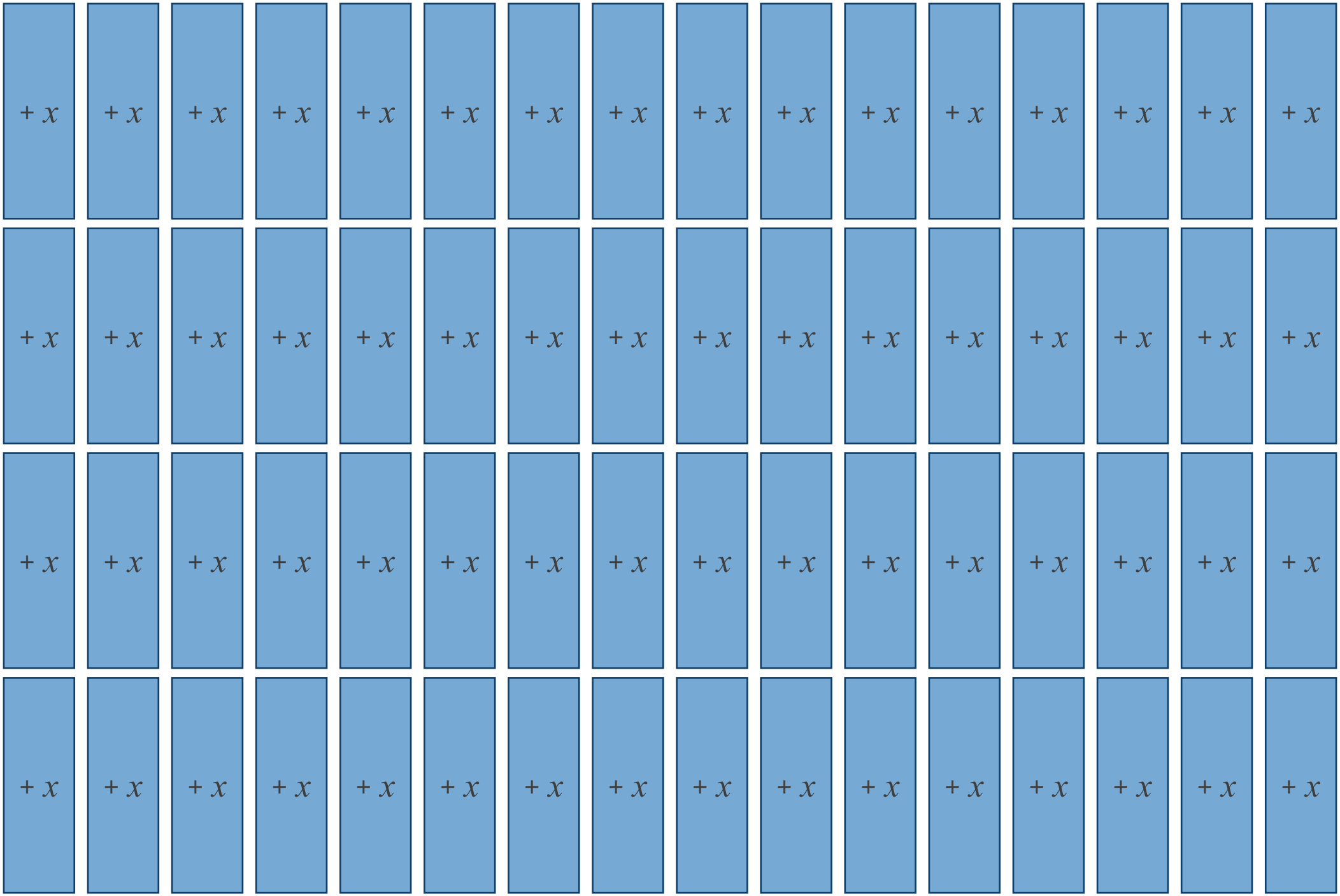
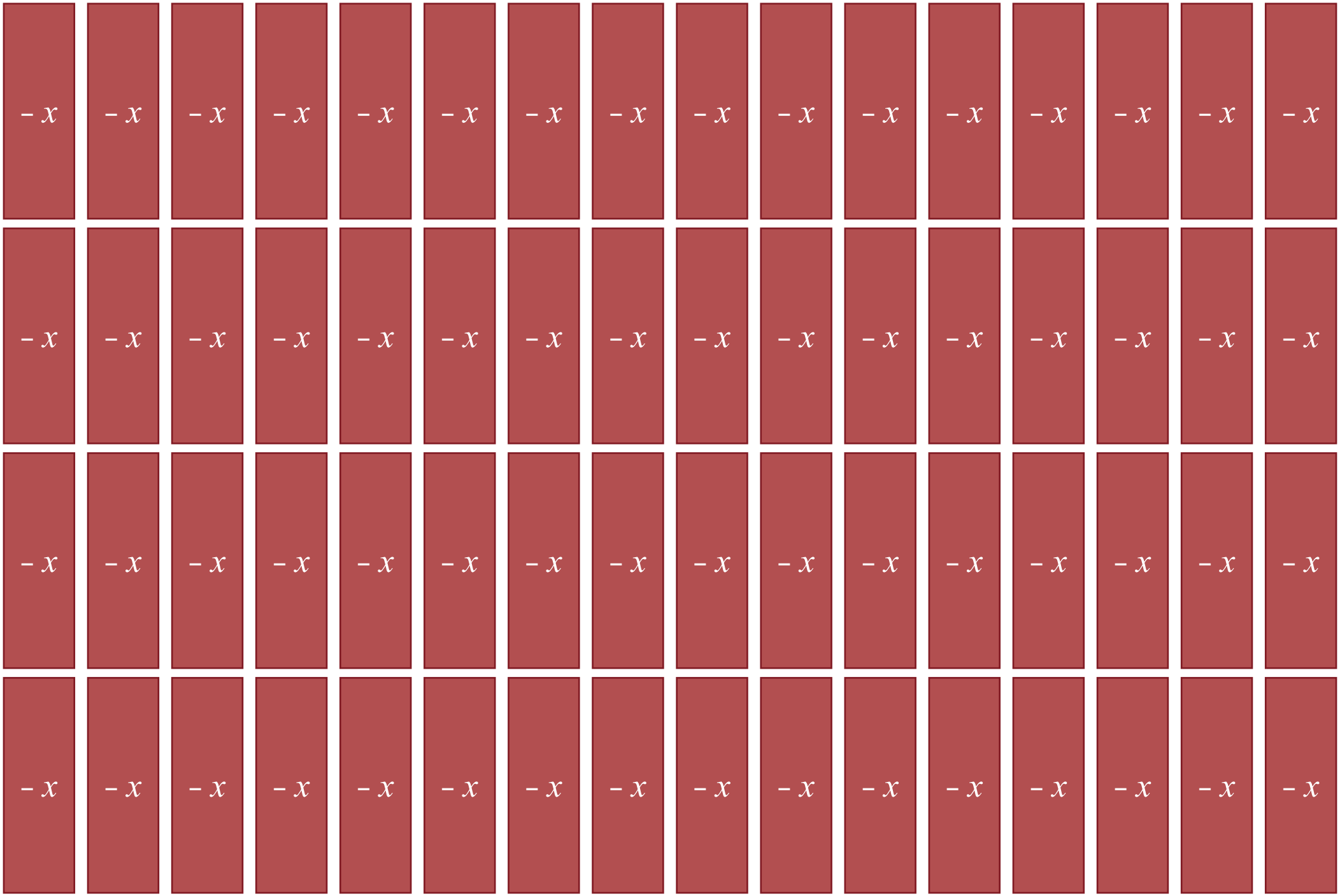

+ 1


– 1

$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$
$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$
$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$
$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$	$+ x^2$

$-x^2$	$-x^2$	$-x^2$	$-x^2$	$-x^2$	$-x^2$
$-x^2$	$-x^2$	$-x^2$	$-x^2$	$-x^2$	$-x^2$
$-x^2$	$-x^2$	$-x^2$	$-x^2$	$-x^2$	$-x^2$
$-x^2$	$-x^2$	$-x^2$	$-x^2$	$-x^2$	$-x^2$

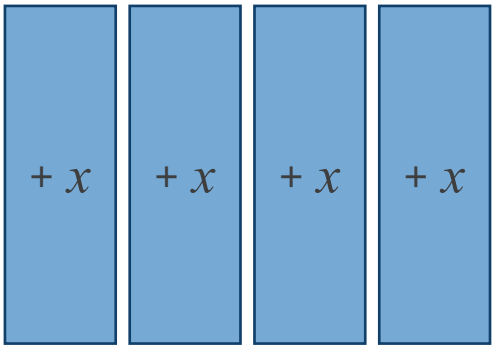

+ x


− x

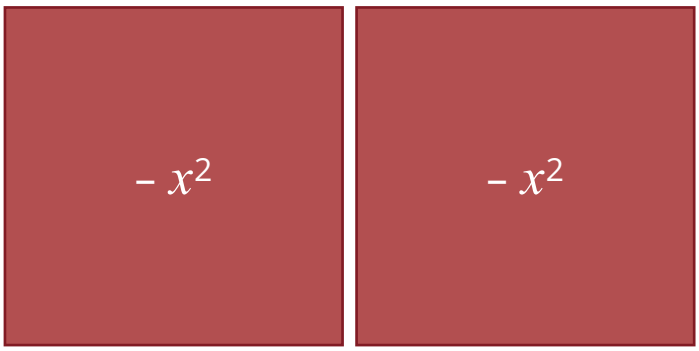
Writing and Simplifying Expressions with Tiles – **Showing Expressions**

The first step in using these tiles should be to use them to represent simple expressions.

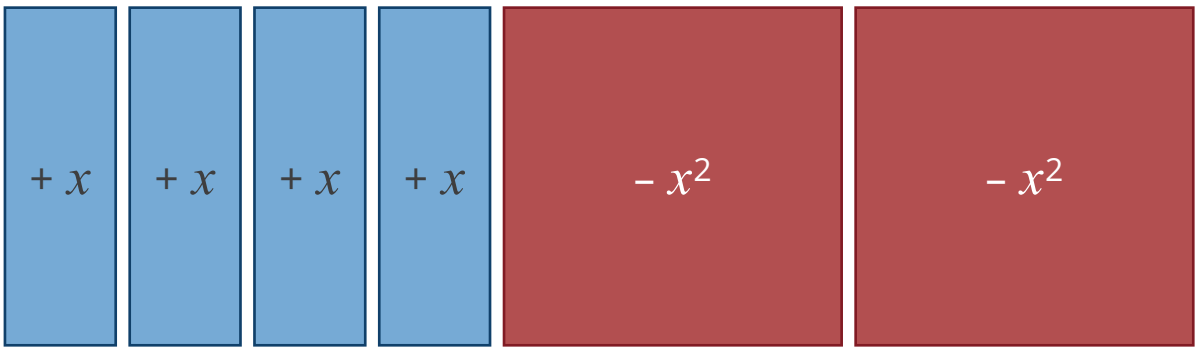
For example, $4x$ can be shown as four "+ x" tiles:



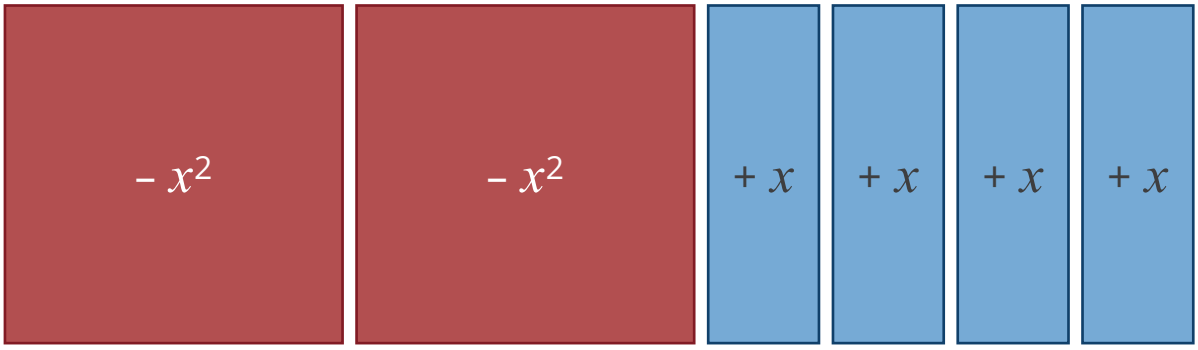
$-2x^2$ can be shown as two red "$-x^2$" squares:



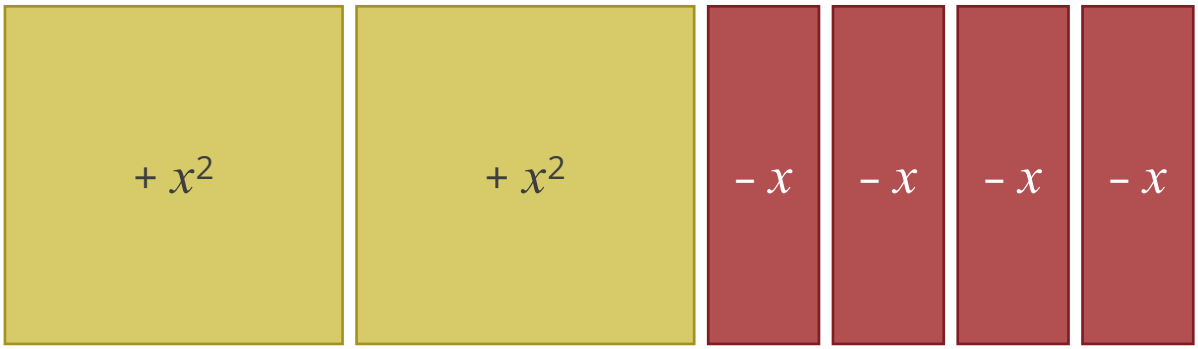
This can then be extended to longer expressions. $4x - 2x^2$ is:



At this stage, it is sensible to discuss different representations of the same expression. For example, is this equivalent to the expression above?

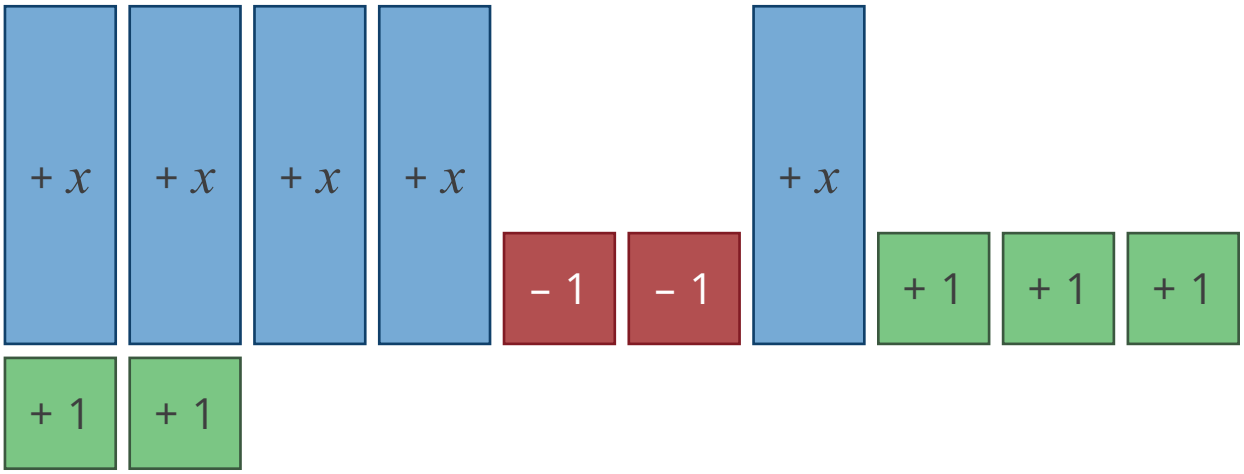


How about this?

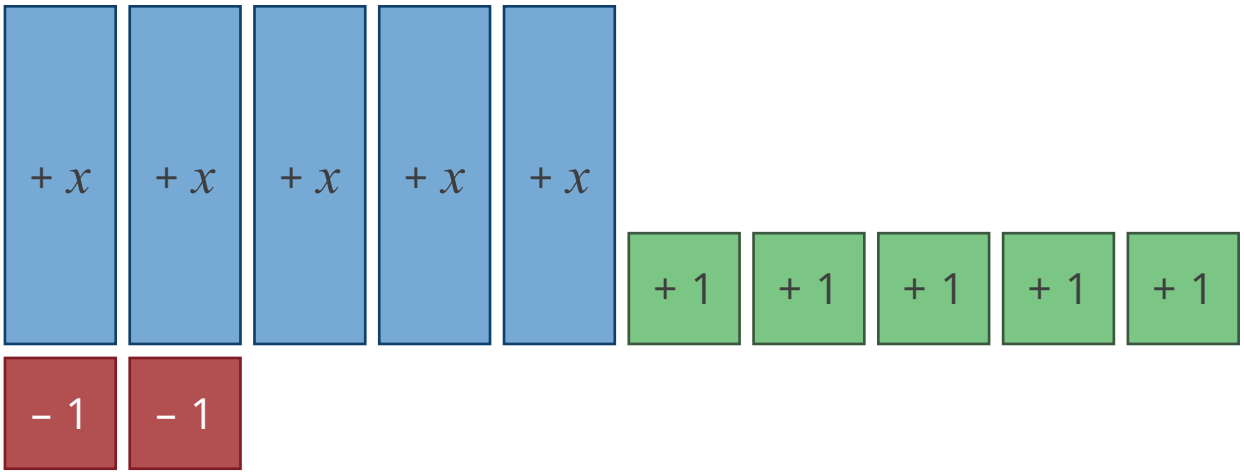


Students will quickly understand that rearranging the tiles doesn't change the expression, but changing the sign (or turning them over) does. Whilst doing this, ask students to write down the expressions they are representing.

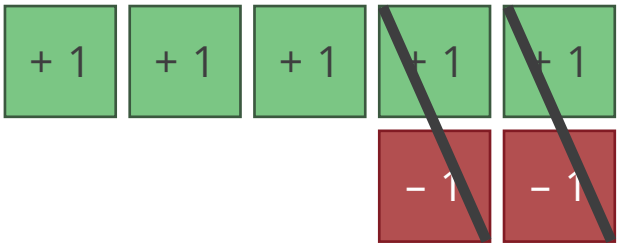
Once students have mastered this task, they can start to simplify expressions. For example, $4x - 2 + x + 5$ can be represented as:



Rearranging this gives:

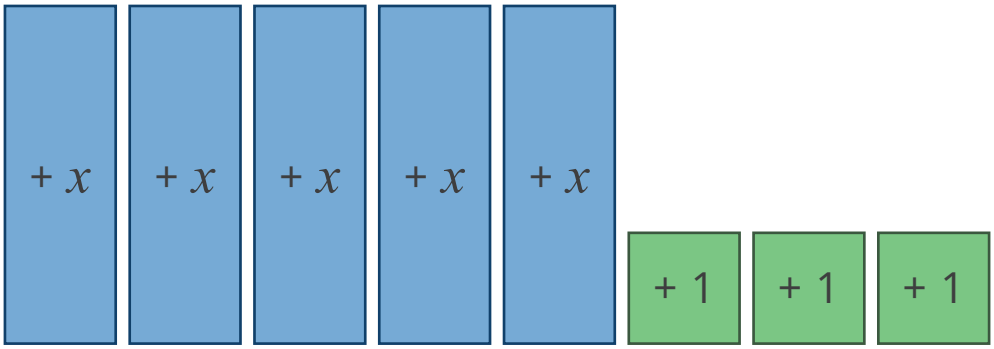


Students can use the concept of positive-negative pairs to cancel the units, to get + 3:

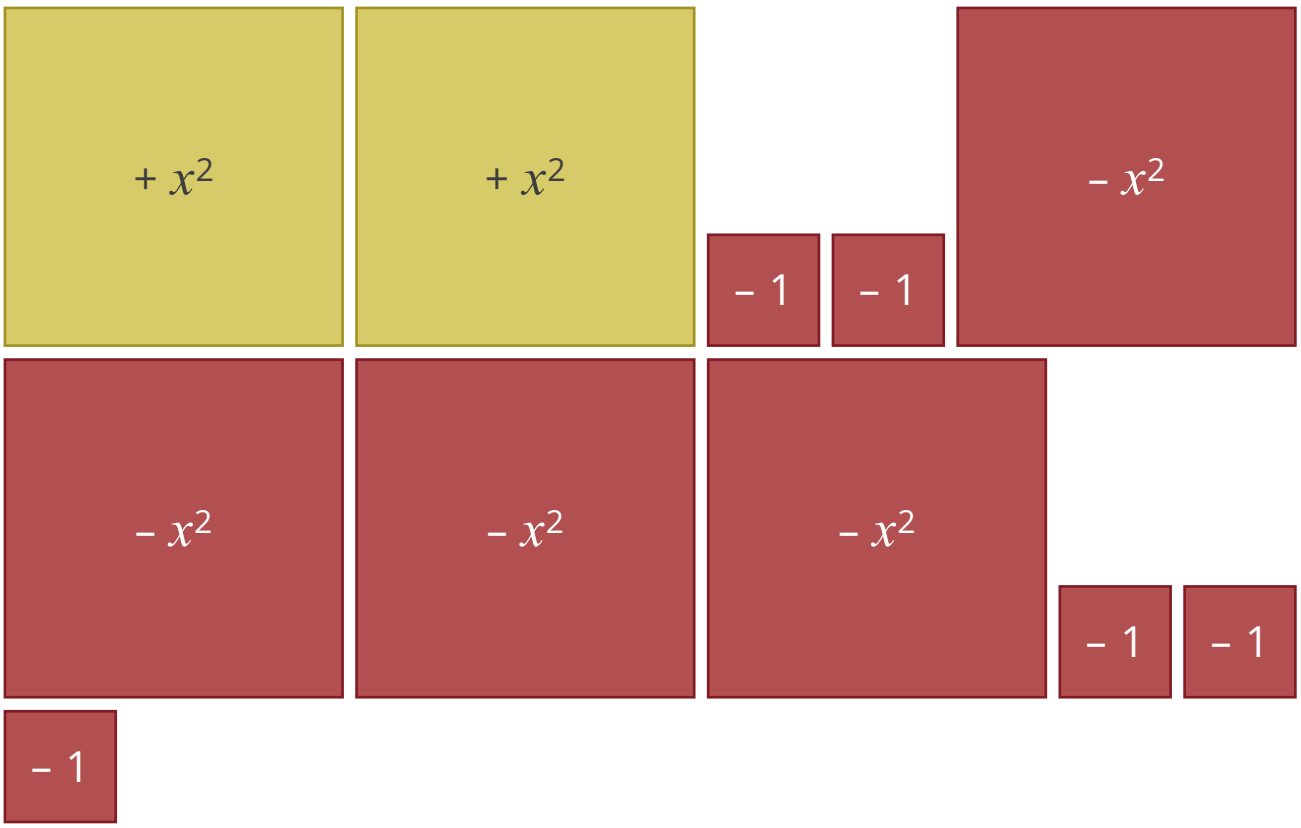


Alternatively, they can calculate 5 – 2 = 3.

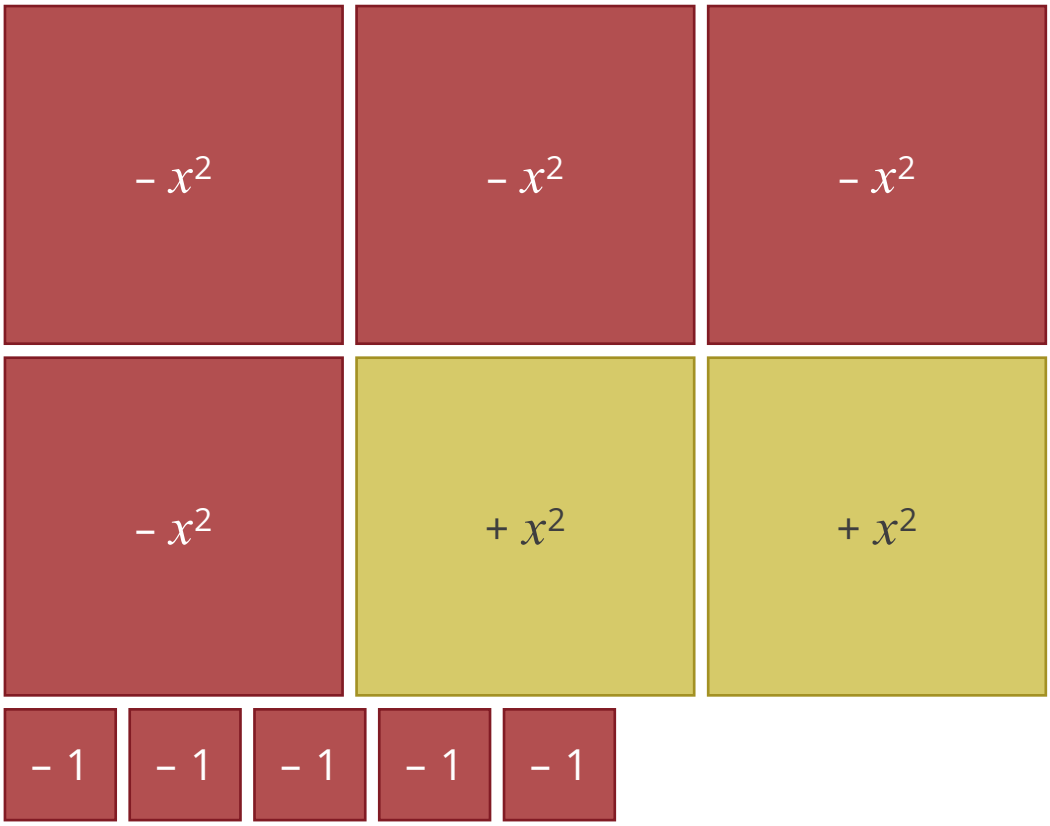
This results in a simplified answer of $5x + 3$:



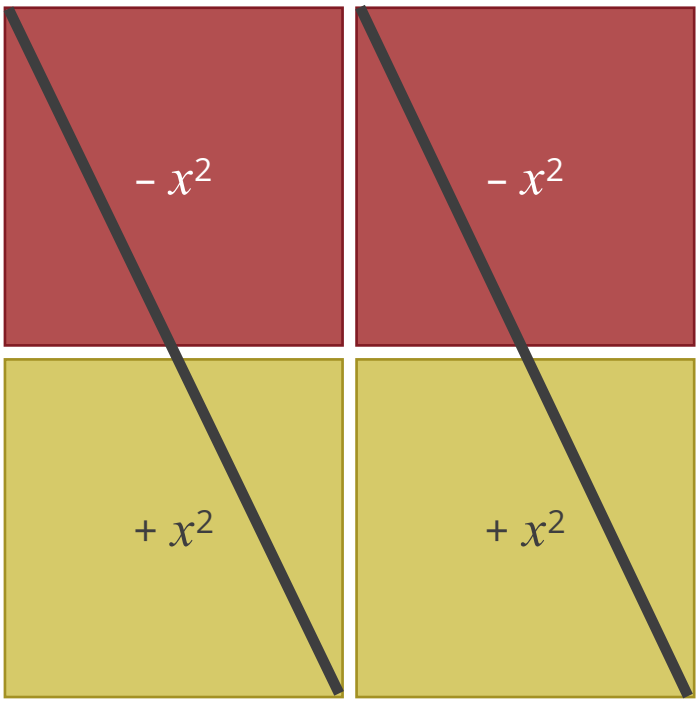
A similar method can be used for more complex problems. $2x^2 - 2 - 4x^2 - 3$ can be represented as:



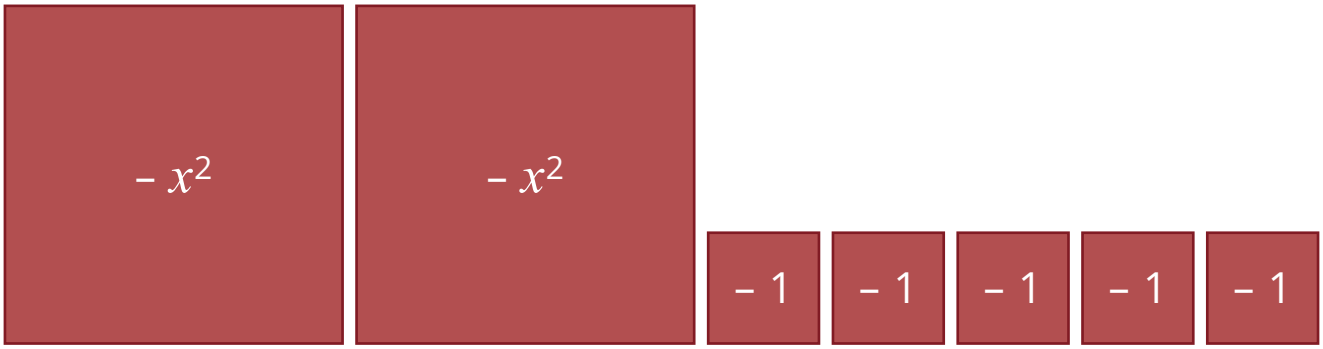
This can be rearranged to:



Then, x^2 and $-x^2$ tiles can be cancelled using positive-negative pairs:



This results in a simplified answer of:



Students should also write their answer as an algebraic expression:

$-2x^2 - 5$

Writing and Simplifying Expressions with Tiles – **Teaching Using Algebra Tiles**

Using algebra tiles provides an alternative method for teaching students who respond best to figurative or kinaesthetic methods. Algebra tiles use the area model to help explore algebraic terms and expressions. They can be used and manipulated by students to help simplify expressions, solve equations and expand brackets. It can take some time for students to get used to this method, so they should be ingrained throughout the topic, rather than used as a single lesson. It is also recommended, though not essential, that students learn to use positive and negative number tiles, along with the concept of finding positive-negative pairs, when learning directed number, before moving on to algebra tiles.

The algebra tiles in this pack can be printed on card, then laminated for repeated use, or on paper, for students to stick in their books. Using tactile tiles is initially more effective, as it allows students to move and manipulate their work. As students get more confident with the method, you can have students draw tiles in their exercise books. It is important that calculations carried out using the tiles are paired with traditional notation. This will allow students to transfer their concrete findings to more abstract problems.

Due to the concrete nature of these materials, the size of the x and $-x$ tokens are constant regardless of how their value varies. This can lead to students incorrectly assuming the value of x. To help with this, the length of the x tiles, and the length and width of the x^2 tiles, are not whole-number multiples of 1. Be aware of students making these assumptions and explain that the tiles represent, but are not equal to, the values of x and x^2.

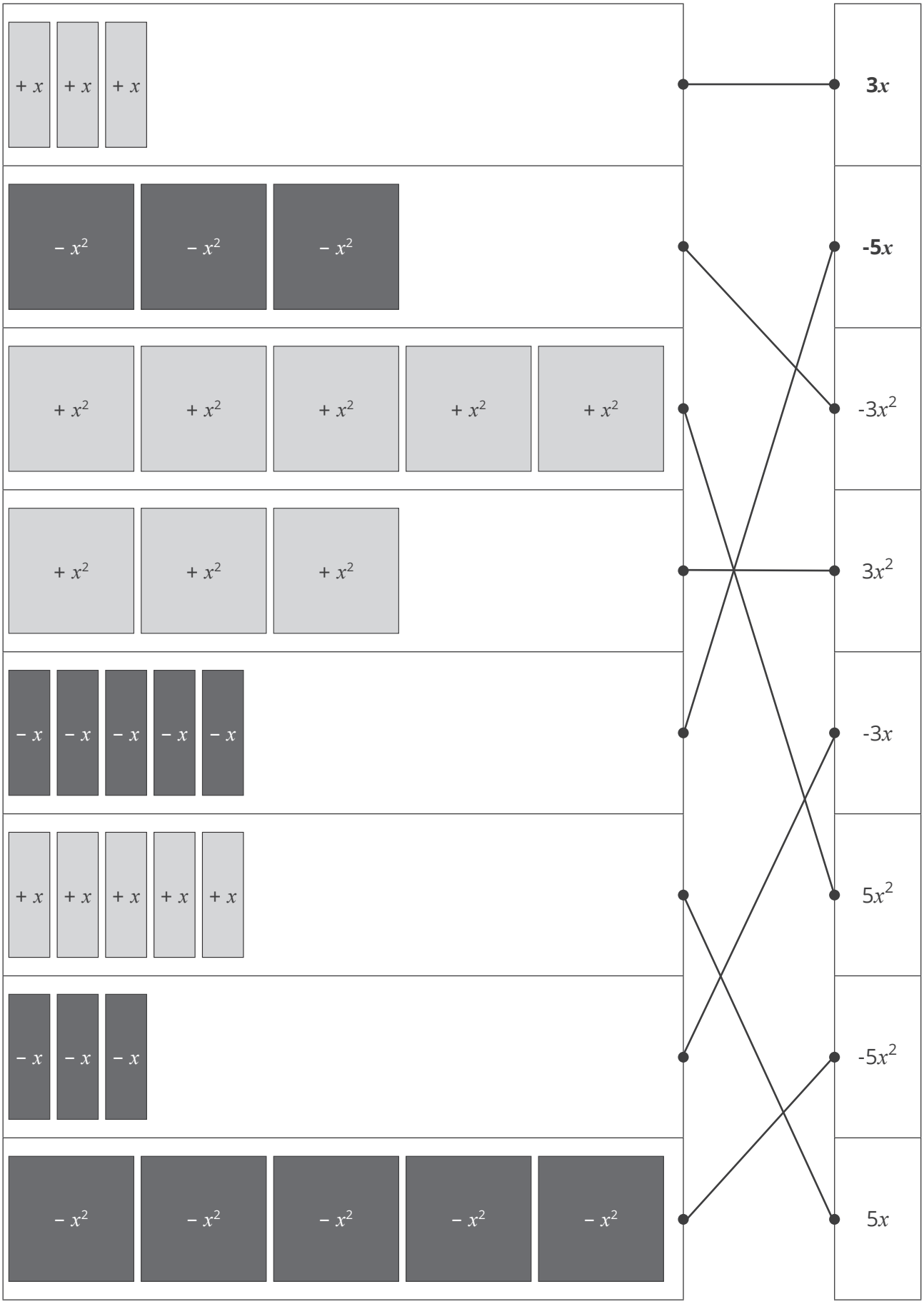
There are 3 types of tile:

- + 1 is a unit square tile
- + x^2 is a larger square tile
- + x is a rectangular tile with width equal to the +1 tile and height equal to the + x^2 tile.

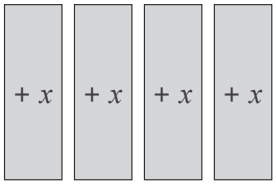
On the reverse of each is the negative version of that term.

Writing and Simplifying with Single Terms **Answers**

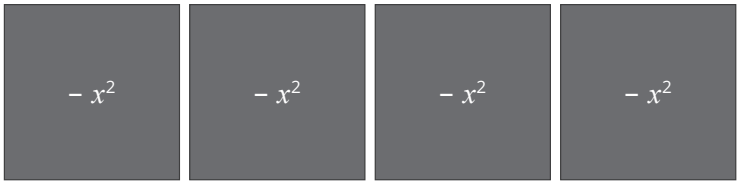
1. Match each of the diagrams with the correct algebraic term. Two of the diagrams don't have a pair – write the expressions in their matching boxes.



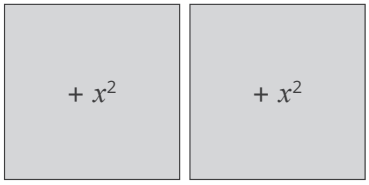
2. For each of the diagrams below, write out the simplified algebraic term.

a. 

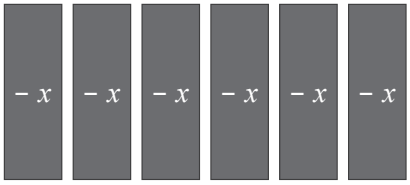
4*x*

c. 

-4*x*²

b. 

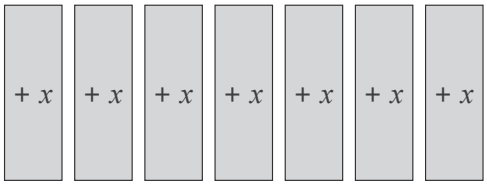
2*x*²

d. 

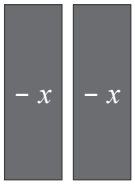
-6*x*

3. For each of the terms below, represent it using the algebraic tiles.

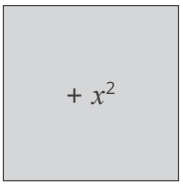
a. $7x$



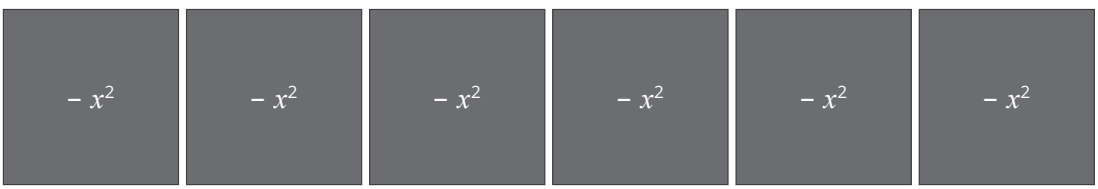
b. $-2x$

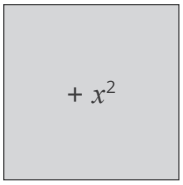


c. x^2

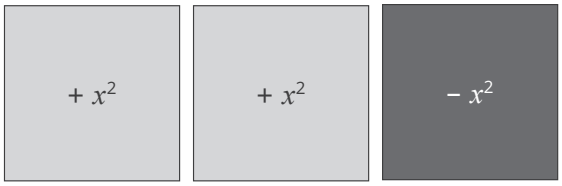


d. $-6x^2$

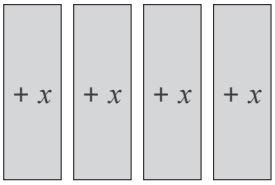


4. Consider this term: 

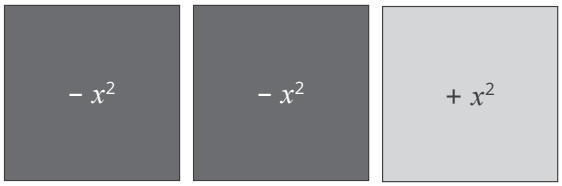
Which of the following are equivalent to this term?

a. 

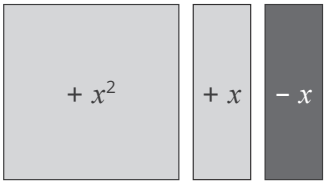
This is equivalent as the negative tile cancels out one of the positive tiles, leaving x^2.

c. 

This is not equivalent. This is $4x$.

b. 

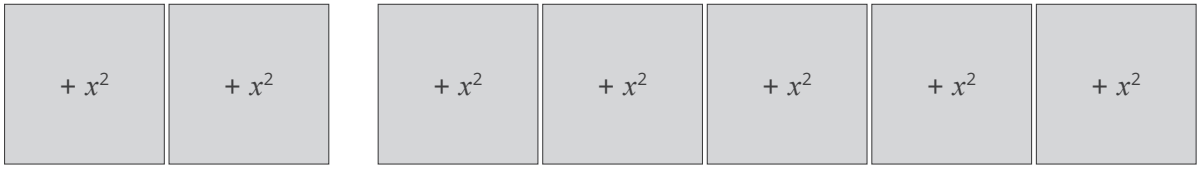
This is not equivalent as the positive tile cancels out one of the negatives tiles, leaving $-x^2$.

d. 

This is equivalent as the '– x' tile cancels out the '+ x' tile, leaving x^2.

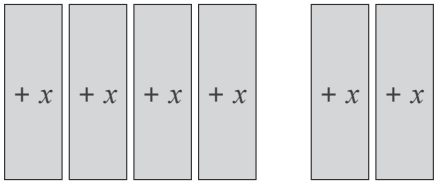
5. Use the diagrams to help simplify each of the expressions.

a. $2x^2 + 5x^2$



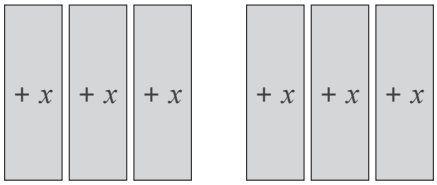
$7x^2$

b. $4x + 2x$



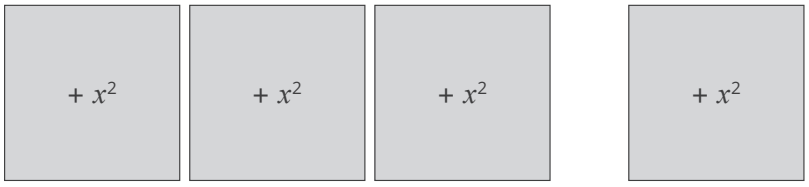
$6x$

c. $3x + 3x$



$6x$

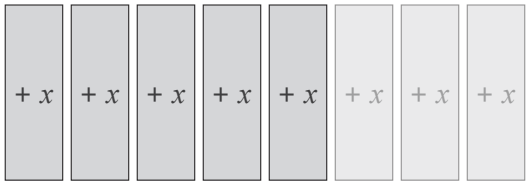
d. $3x^2 + x^2$



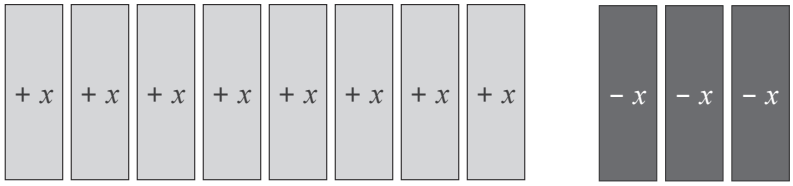
$4x^2$

6. Alexander and Aaron are trying to use tiles to simplify $8x - 3x$.

Alexander sets up the following diagram:



Aaron sets up this diagram:



Which diagram do you think is correct? You must justify your answer.

Both diagrams are correct.

Alexander has taken $3x$ from the original $8x$, leaving him with $5x$.

Aaron has added $-3x$ to the original $8x$. The 3 negative tiles will cancel out 3 positive tiles, leaving 5 positive x tiles.

7. Simplify each of these expressions, using the algebraic tiles to help you.

a. $3x + 7x$

$10x$

b. $12x - 5x$

$7x$

c. $10x^2 - 3x^2$

$7x^2$

d. $4x^2 + 3x^2$

$7x^2$

e. $x^2 + x^2 + x^2$

$3x^2$

f. $4x + 6x - 2x$

$8x$

g. $x - 5x + 2x$

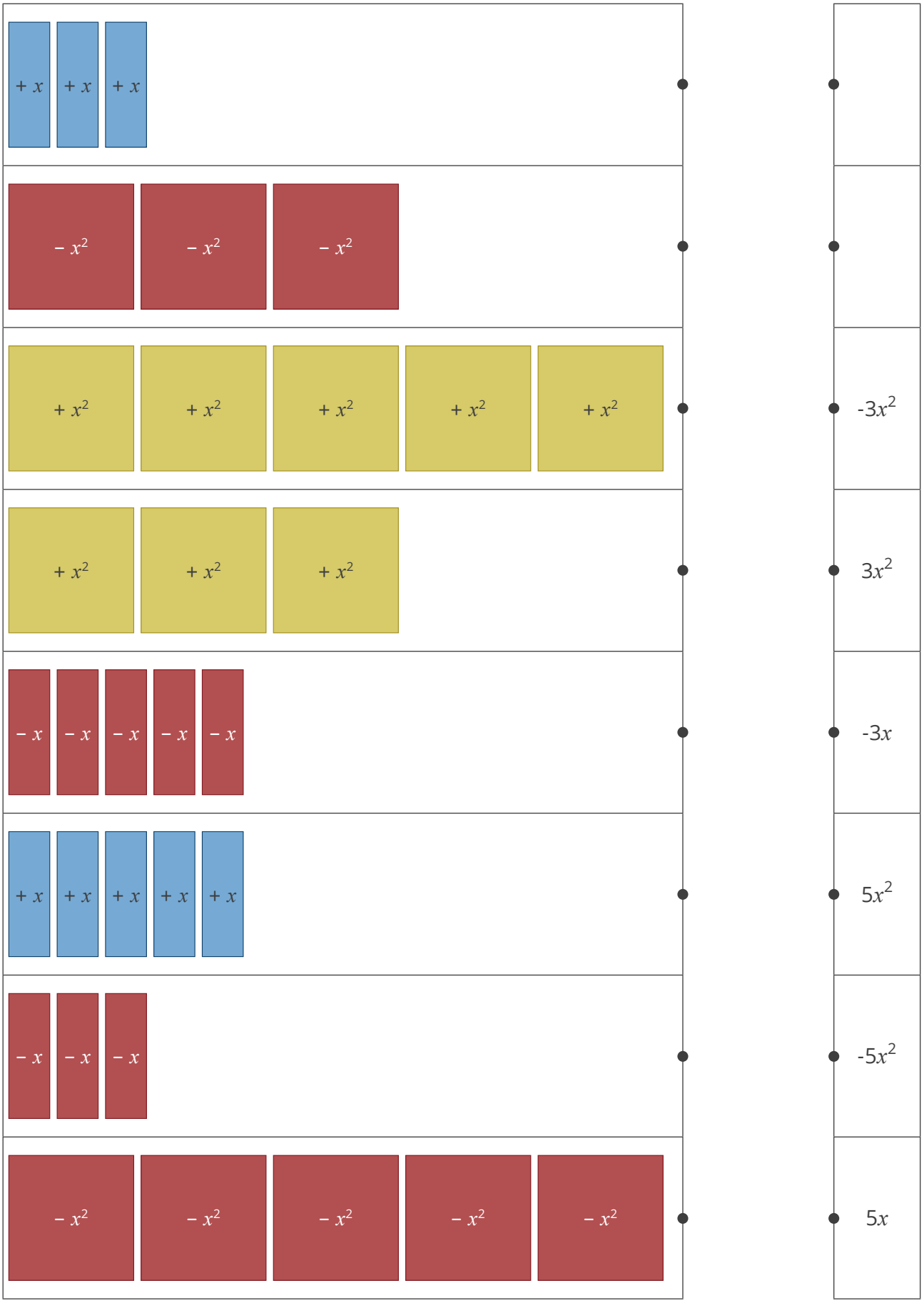
$-2x$

h. $5x^2 - x^2 - 4x^2$

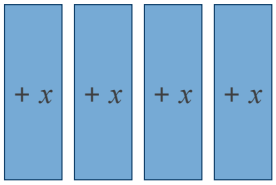
0

Writing and Simplifying with Single Terms

1. Match each of the diagrams with the correct algebraic term. Two of the diagrams don't have a pair – write the expressions in their matching boxes.



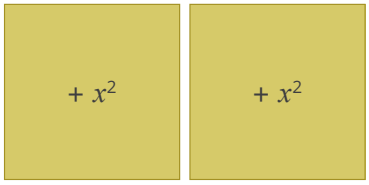
2. For each of the diagrams below, write out the simplified algebraic term.

a. 

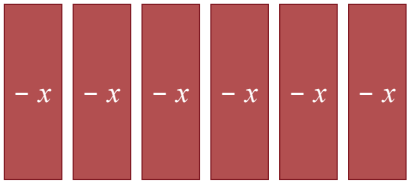
_____

c. 

_____

b. 

_____

d. 

_____

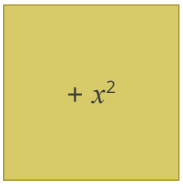
3. For each of the terms below, represent it using the algebraic tiles.

a. $7x$

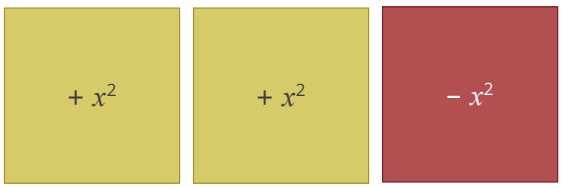
b. $-2x$

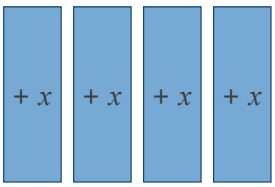
c. x^2

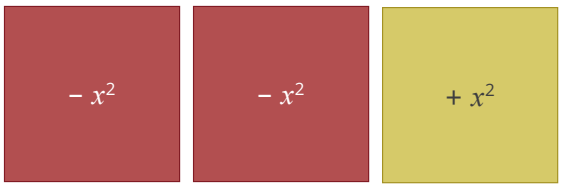
d. $-6x^2$

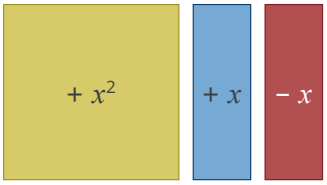
4. Consider this term: 

Which of the following are equivalent to this term?

a. 

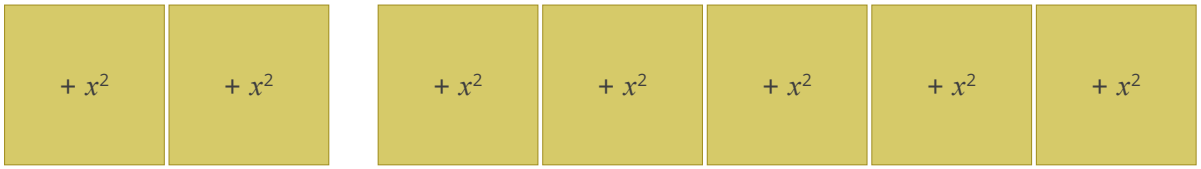
c. 

b. 

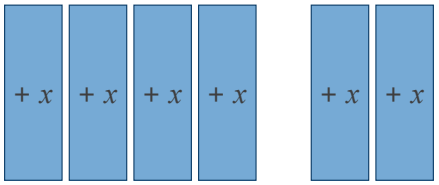
d. 

5. Use the diagrams to help simplify each of the expressions.

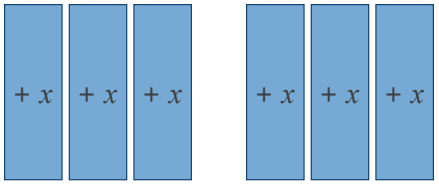
a. $2x^2 + 5x^2$



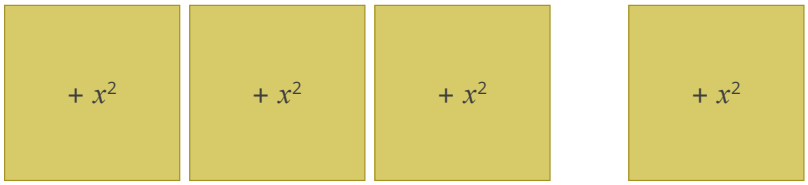
b. $4x + 2x$



c. $3x + 3x$

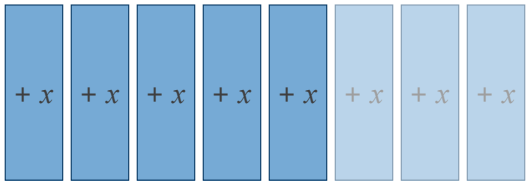


d. $3x^2 + x^2$

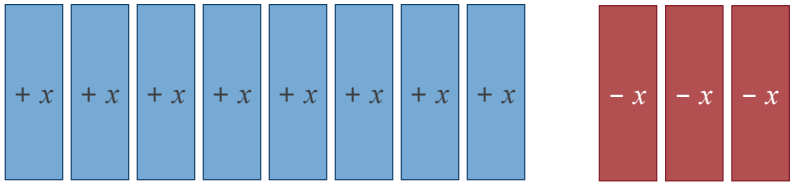


6. Alexander and Aaron are trying to use tiles to simplify $8x - 3x$.

Alexander sets up the following diagram:



Aaron sets up this diagram:



Which diagram do you think is correct? You must justify your answer.

7. Simplify each of these expressions, using the algebraic tiles to help you.

a. $3x + 7x$

b. $12x -$

c. $10x^2 - 3x^2$

d. $4x^2 + 3x^2$

e. $x^2 + x^2 + x^2$

f. $4x + 6x - 2x$

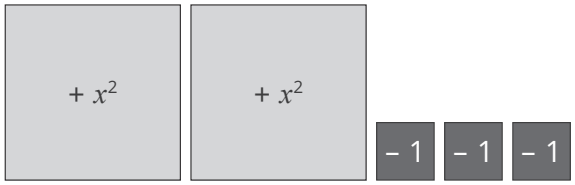
g. $x - 5x + 2x$

h. $5x^2 - x^2 - 4x^2$

Writing and Simplifying with Two Terms **Answers**

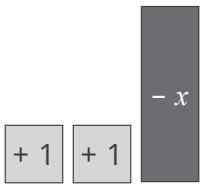
1. For each of the diagrams below, write the algebraic expression in its simplest form.

a.



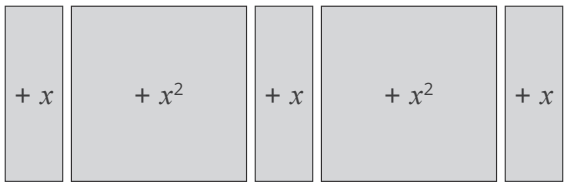
$2x^2 - 3$

b.



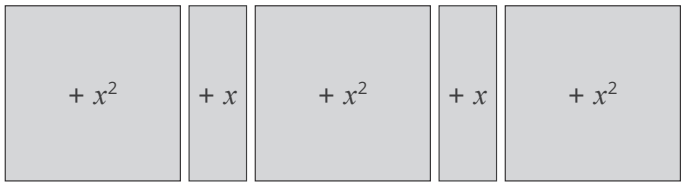
$-x + 2$

c.



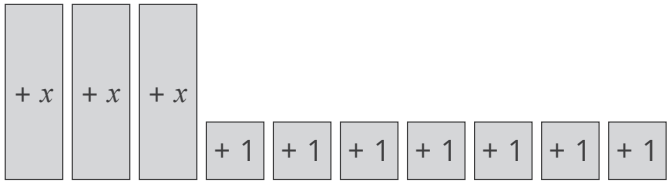
$2x^2 + 3x$

d.



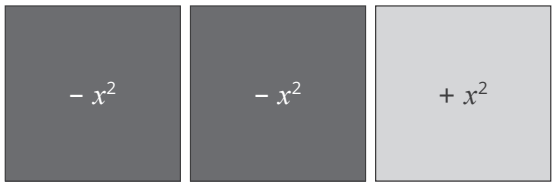
$3x^2 + 2x$

e.



$3x + 7$

f.



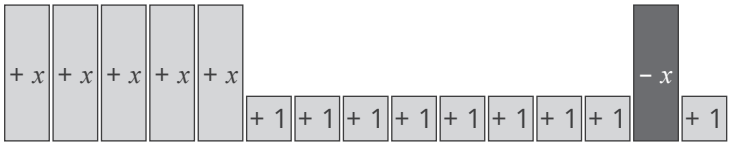
$-x^2$

2. Represent each of these expressions using algebraic tiles. Use your diagram to simplify the expressions.

a. $2x - 4 - 5x + 8$

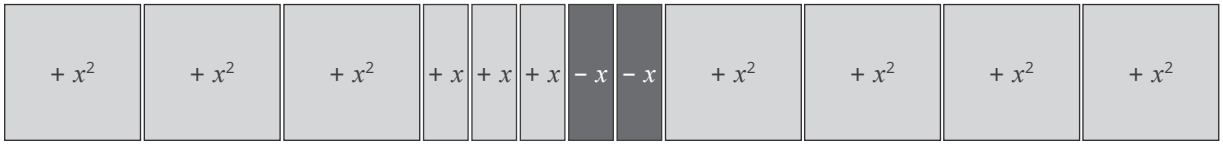
$-3x + 4$

b. $5x + 8 - x + 1$



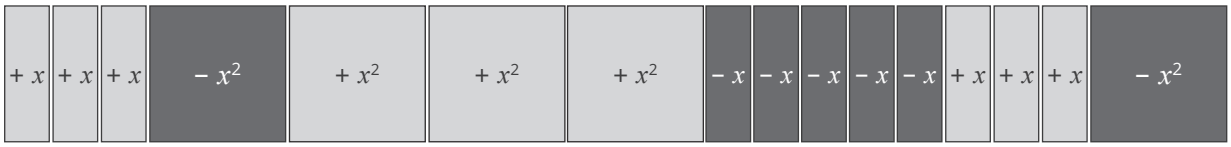
$4x + 9$

c. $3x^2 + 3x - 2x + 4x^2$



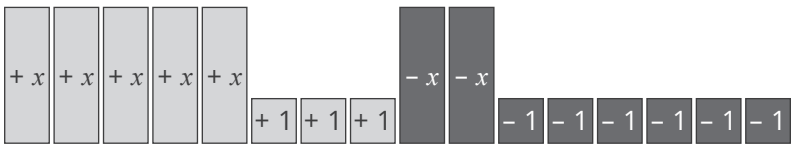
$7x^2 + x$

d. $3x - x^2 + 3x^2 - 5x + 3x - x^2$



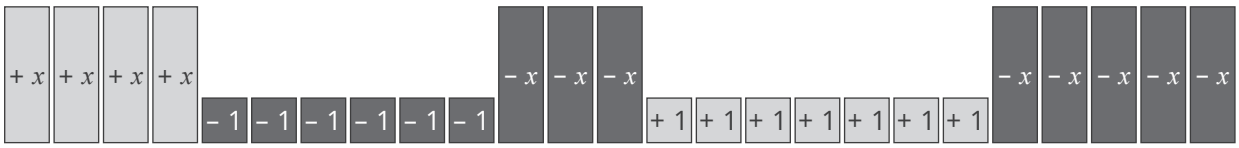
$x^2 + x$

e. $5x + 3 - 2x - 6$



$3x - 3$

f. $4x - 6 - 3x + 7 - 5x$



$-4x + 1$

3. Simplify each of these expressions, using algebraic tiles to help you.

   a. $4x + 2x + 5 + 7$

   $6x + 12$

   b. $6x^2 - 4x^2 - 6x + 4x$

   $2x^2 - 2x$

   c. $7x + -2 - 8x + 2$

   $-x$

   d. $3x + 2 - 7 + 5x - 1 - x$

   $7x - 6$

   e. $7x^2 + 3x - 8x^2 + 2x - x^2$

   $-2x^2 + 5x$

4. An expression contains 4 terms, all of which are positive, and simplifies to $4x + 6$. Find 3 possible expressions that meet these requirements.

   For example:

   $2x + x + x + 6$

   $2x + 2x + 5 + 1$

   $2x + 2x + 4 + 2$

   $2x + 2x + 3 + 3$

   $3x + x + 5 + 1$

   $3x + x + 4 + 2$

   $3x + x + 3 + 3$

   $4x + 2 + 2 + 2$

5. Below are some questions on simplifying expressions. Complete the missing terms.

   a. $3x +$ **3** $+$ **$2x$** $- 7 = 5x - 4$

   b. $2x^2 +$ **$7x$** $- x^2 - 3x =$ **x^2** $+ 4x$

   c. **x^2** $- 4x^2 + 4 - 2 = -3x^2 +$ **2**

   d. **$3x$** $+$ **7** $- 5x - 2 = -2x + 5$

   e. $7x^2 -$ **5** $+ 8 -$ **$3x^2$** $= 4x^2 + 3$

   f. $3x +$ **$4x$** $- 2x^2 + 3x^2 =$ **x^2** $+ 7x$

6. Each expression in the pyramids below is made by adding the two expressions below it. Complete each pyramid.

a.

	$8x + 2$	
$5x + 4$		**$3x - 2$**
$3x + 7$	$2x - 3$	$x + 1$

b.

	$4x^2 + 18x$	
$5x^2 + 4x$		**$14x - x^2$**
$8x^2 - 3x$	$7x - 3x^2$	$2x^2 + 7x$

c.

	$5x^2 - 2$	
$4x^2 + 7$		**$x^2 - 9$**
$2x^2 + 7$	$2x^2$	**$-x^2 - 9$**

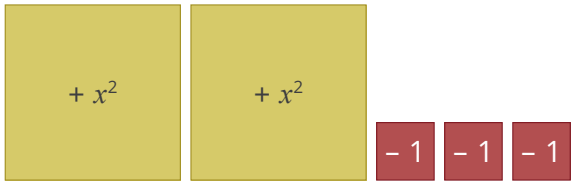
d.

	$x^2 + 2x + 1$	
$x^2 + x$		**$x + 1$**
x^2	x	1

Writing and Simplifying with Two Terms

1. For each of the diagrams below, write the algebraic expression in its simplest form.

a.



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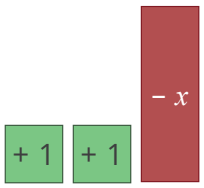
b.



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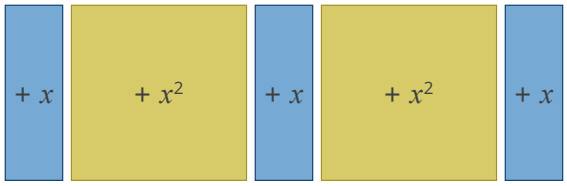
c.



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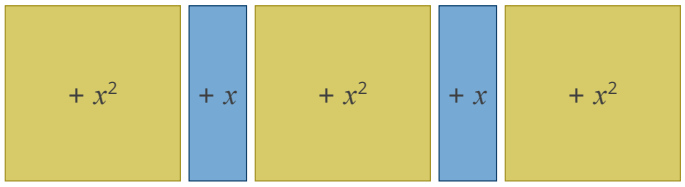
d.



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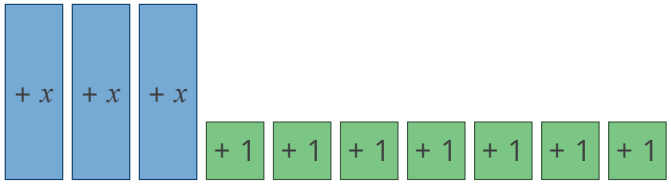
e.



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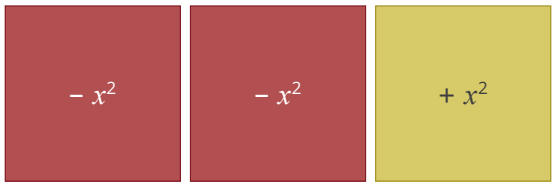
f.



_____

2. Represent each of these expressions using algebraic tiles. Use your diagram to simplify the expressions.

   a. $2x - 4 - 5x + 8$

   b. $5x + 8 - x + 1$

   c. $3x^2 + 3x - 2x + 4x^2$

d. $3x - x^2 + 3x^2 - 5x + 3x - x^2$

e. $5x + 3 - 2x - 6$

f. $4x - 6 - 3x + 7 - 5x$

3. Simplify each of these expressions, using algebraic tiles to help you.

   a. $4x + 2x + 5 + 7$

   _____

   b. $6x^2 - 4x^2 - 6x + 4x$

   _____

   c. $7x + -2 - 8x + 2$

   _____

   d. $3x + 2 - 7 + 5x - 1 - x$

   _____

   e. $7x^2 + 3x - 8x^2 + 2x - x^2$

   _____

4. An expression contains 4 terms, all of which are positive, and simplifies to $4x + 6$. Find 3 possible expressions that meet these requirements.

   _____

   _____

   _____

   _____

5. Below are some questions on simplifying expressions. Complete the missing terms.

   a. $3x +$ ☐ $+$ ☐ $- 7 = 5x - 4$

   b. $2x^2 +$ ☐ $- x^2 - 3x =$ ☐ $+ 4x$

   c. ☐ $- 4x^2 + 4 - 2 = -3x^2 +$ ☐

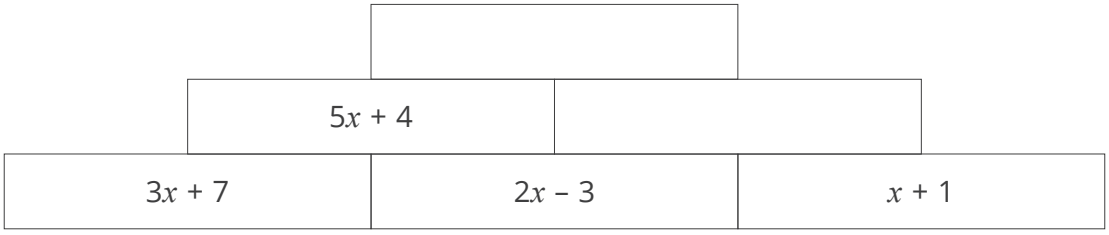
   d. ☐ $+$ ☐ $- 5x - 2 = -2x + 5$

   e. $7x^2 -$ ☐ $+ 8 -$ ☐ $= 4x^2 + 3$

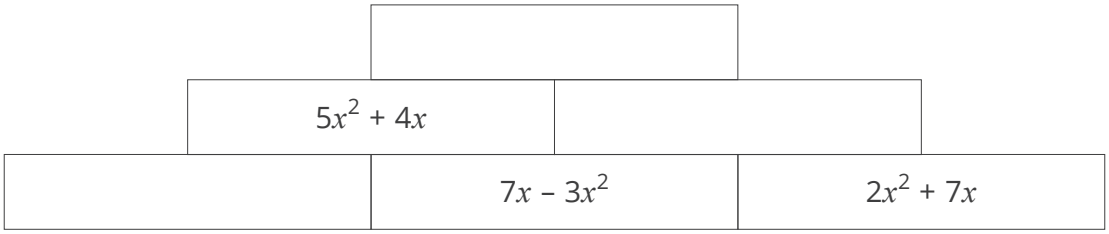
   f. $3x +$ ☐ $- 2x^2 + 3x^2 =$ ☐ $+ 7x$

6. Each expression in the pyramids below is made by adding the two expressions below it. Complete each pyramid.

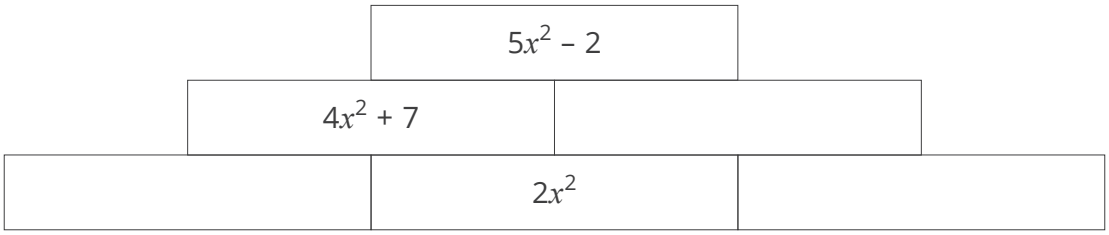
a.



b.



c.



d.