# Using letters instead of numbers

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

| | |
|---|---|
| 74 | 75 |
| 84 | 85 |

| | |
|---|---|
| 18 | 19 |
| 28 | 29 |

+10, +1

| | |
|---|---|
| $n$ | $n+1$ |
| $n+10$ | $n+11$ |

| | | |
|---|---|---|
| $n-1$ | $n$ | $n+1$ |
| $n+9$ | $n+10$ | $n+11$ |

| | | |
|---|---|---|
| $n$ | $n+1$ | $n+2$ |
| $n+10$ | $n+11$ | $n+12$ |

−1, +1

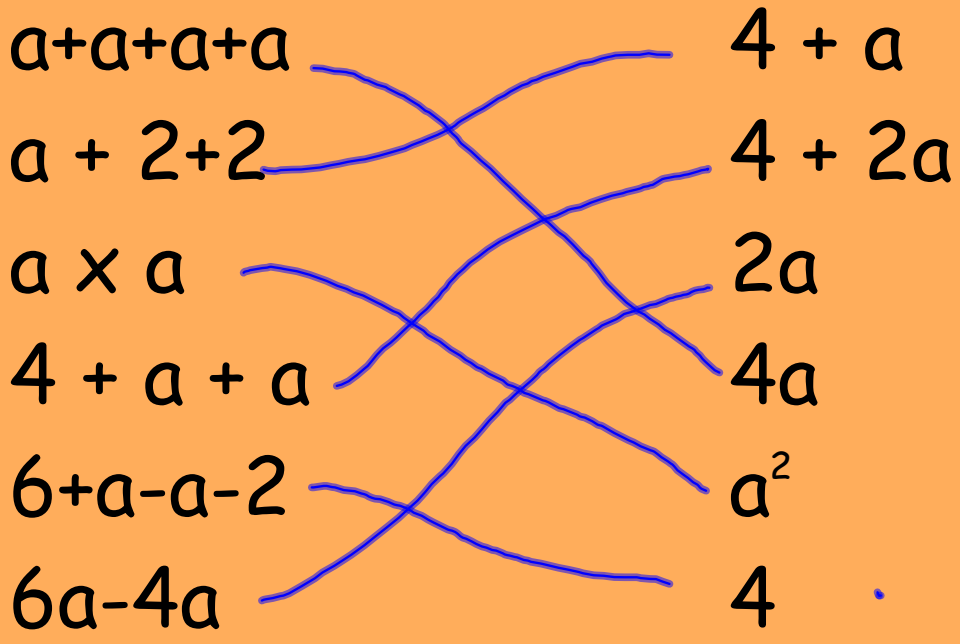
| | | |
|---|---|---|
| $n-11$ | $n-10$ | $n-9$ |
| $n-1$ | $n$ | $n+1$ |

| | | |
|---|---|---|
| $n-10$ | $n-9$ | $n-8$ |
| $n$ | $n+1$ | $n+2$ |

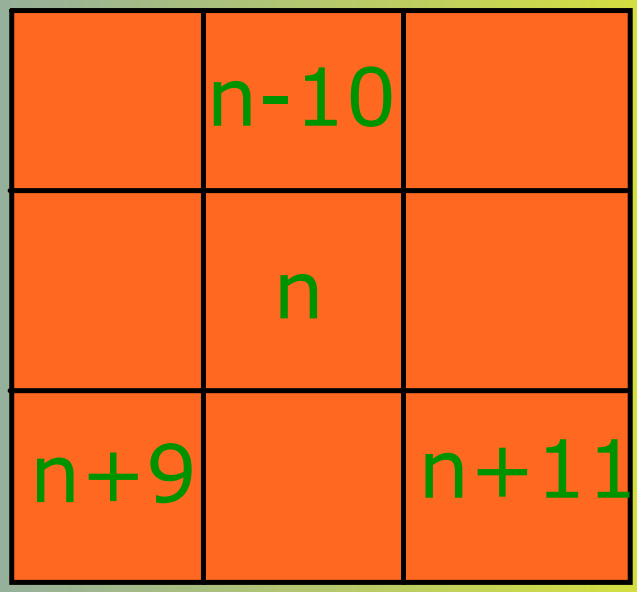
| | | |
|---|---|---|
| $n-11$ | $n-10$ | $n-9$ |
| $n-1$ | $n$ | $n+1$ |
| $n+9$ | $n+10$ | $n+11$ |

| | | |
|---|---|---|
| $n-10$ | $n-9$ | $n-8$ |
| $n$ | $n+1$ | $n+2$ |
| $n+10$ | $n+11$ | $n+12$ |

Match the expression to its partner.



This is part of a 1-100 number grid:




n-9

n-21

n+1

n-1

n+2

n-20

n+20

n-2

n+10

n+22

n-22

n-11

$(3a)^2 = (3\times2)^2$
$= 36$

# Substitution

If a=2 work out:

$3a^2 = 3\times2^2$
$= 3\times4$
$= 12$

$5a^2 = 5\times4$
$= 20$

3a= 6

5a-3=
$10-3=7$

10-2a= 6
$10-4$

$\frac{a}{2} = 1$

$a^2 = 4$

$2a^3$

**B** rackets
**I** ndices (powers)
**D** ivision
**M** ultiplication
**A** ddition
**S** ubtraction.

$2+3\times5 = 2+15$
$= 17$

1. $4+5\times2 = 14$
2. $2\times4^2 = 32$
3. $5\times3^2+1 = 46$
4. $4+(2+1)^2 = 13$

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## Substitution practice

If a = 3 evaluate

1) $5a =$
2) $6a - 4 =$
3) $2(a+5) =$
4) $a^2 =$
5) $a^3 =$
6) $2a^2 =$
7) $10 - a =$
8) $15 - 2a =$
9) $5(2a - 3) =$

If a = 4 evaluate:

10) $5a =$
11) $6a - 4 =$
12) $2(a+5) =$
13) $a^2 =$
14) $5a + 9 =$
15) $2a^2 =$
16) $10 - a =$
17) $15 - 2a =$
18) $5(2a - 3) =$
19) $\sqrt{a}$

If a = 5 and b = 9 evaluate

20) $2(a+b) =$
21) $b^2 =$
22) $a^3 =$
23) $2a^2 =$
24) $10 - a + b =$
25) $15 - 2a =$
26) $5(2a - b) =$
27) $2a - b$
28) $3b - 2a$
29) $\sqrt{b} =$

If a = 1 and b = -2 evaluate

30) $2(3a+b) =$
31) $a^2 =$
32) $a^3 =$
33) $b^2 =$
34) $10 - a + b =$
35) $15 - 2a =$
36) $5(2a - b) =$
37) $2a - b$
38) $3b - 2a$
39) $\sqrt{a} =$

Let a= 2 and b=3. Work out:

**5a + b =** 13

**5a + 3b=** 19

**ab=** 6

**9a - 3b=** 9

**$3a^2$ =** 12

8 + 10

**$2a^2$+ 5a =** 18

13

1

12

If b = 4
write an expression with a value of 20.

$5b = 20$

$b^2 + 4 = 20$

$16 + b = 20$

$4b + 2 + 2 = 20$

$4b + b = 20$

$6b - 4 = 20$

$24 - b = 20$

$3b + 2b = 20$

# Simplifying expressions

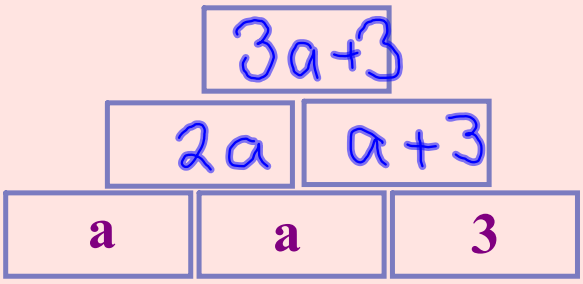
$a + a + b + b - a = 2b + 2a - a$

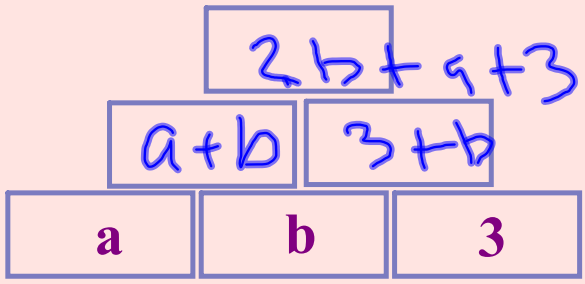
$= 2b + a$

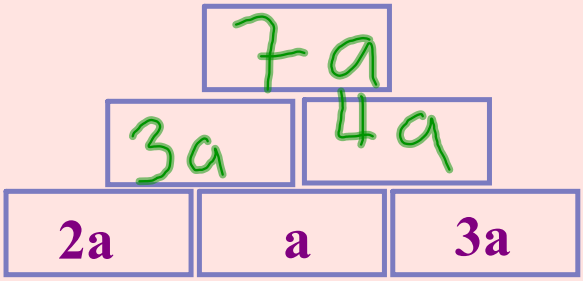
$a - a + b + 3b = 4b$

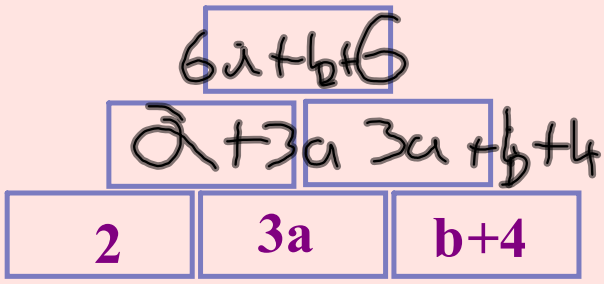
$3x + 3x - x + y + y = 3x + 2y$

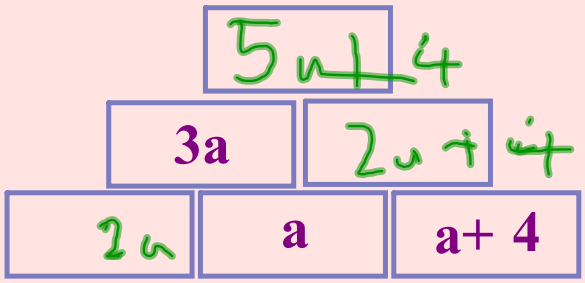
## Algebra Pyramids

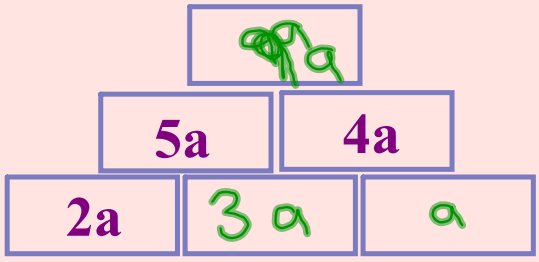


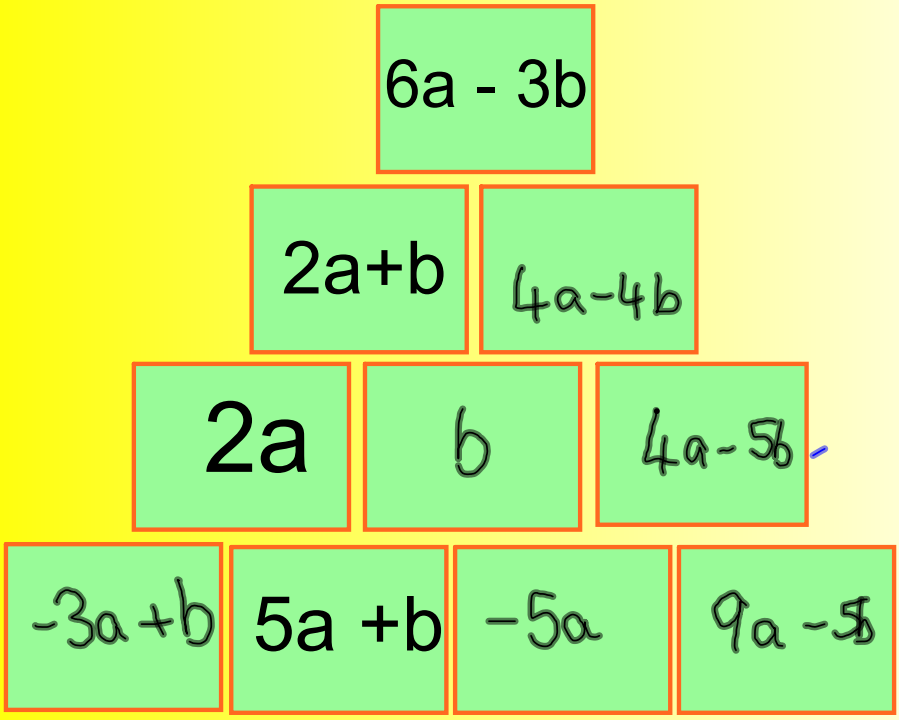




see worksheet
algebra pyramids




6a - 3b

2a+b | 4a-4b

2a | b | 4a-5b

-3a-b | 5a +b | -5a | 9a-5b

# Make 6 rectangular cards

| | | |
|---|---|---|
| $b$ | $b+2$ | $b-2$ |
| $2b$ | $b^2$ | $2b + 4$ |

b=3
b=10
b=-4
suppose I told you 2b = 10 ...
what do I get if I add these two cards together
What if I doubled b+2....

# Substitution

If $x=4$ work out:

$\frac{x}{2} = 2$

$2x = 8$

$x+6 = 10$

$\sqrt{x} = 2$

$x-6 = -2$

$2x+3 = 11$

$x^2 = 16$

## Multiplying out Brackets

$5(x+4) = 5x+20$

$3(2a-7) = 6a-21$

$2(n+1) = 2n+2$

$3(5n+1) = 15n+3$

$5(n-6) = 5n-30$

$10(3n+2) = 30n+20$

$12(2n-3) = 24n-36$

$2(3n+1) = 6n+2$

$4(5n-2) = 20n-8$

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B1 $2(x+4) = 2x+8$

Find the value of a

$a^2 = 36$

$4+a = 7$

$2a+1 = 21$

$8-a = 3$

$a-10 = 5$

# Terminology

$2x$ TERM

$5x+2=7x$

$2x+5=4$ EQUATION

$3x+8=16$

$2x+y$ EXPRESSION

Simplify:

$2x - x + y - 2y = x - y$

$4a - 5b + 3a - b = 7a - 6b$

**I am thinking of a number, add 5 to it, x by 2 and the answer is 16.**

**What was my number?**

**I am thinking of a number, add 10 to it, x by 3 and the answer is 45.**

**What was my number?**

**I am thinking of a number, x it by 4 and add 3. The answer is 11.**

**What was my number?**

**I am thinking of a number, subtract 7, x by 3 and the answer is 9.**

**What was my number?**

Make up your own
"I'm thinking of a number".

Ask someone near you to solve it.

I'm thinking of a number sheet.

**How many of these equations can you solve?**

$5x - 2 = 8$

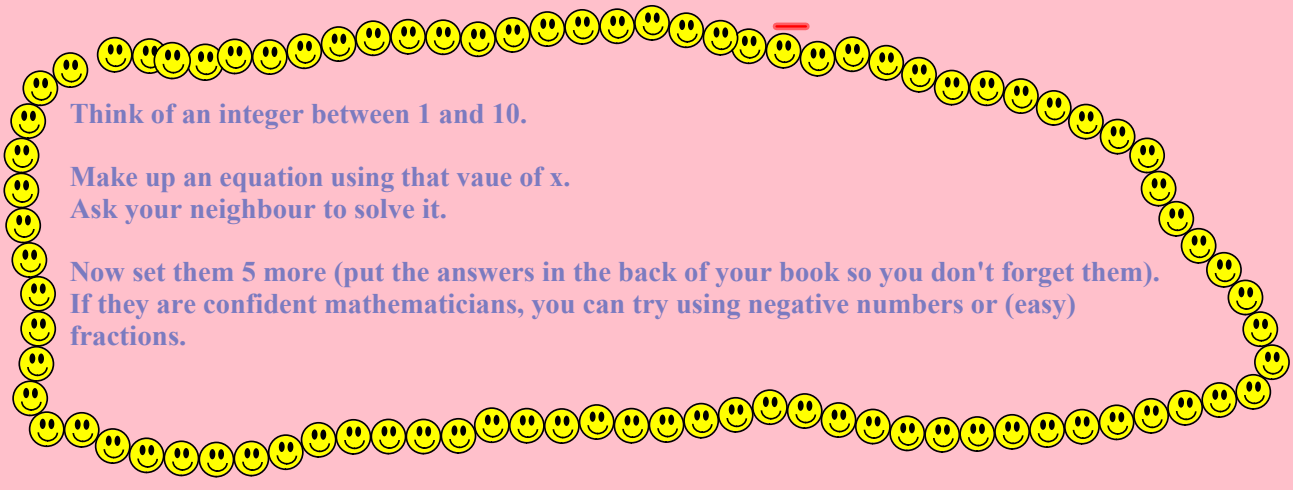
$2x + 1 = 7$

$8 + 3x = 14$

$6 + 10x = 11$

$9 - x = 2$

$4x + 10 = -2$

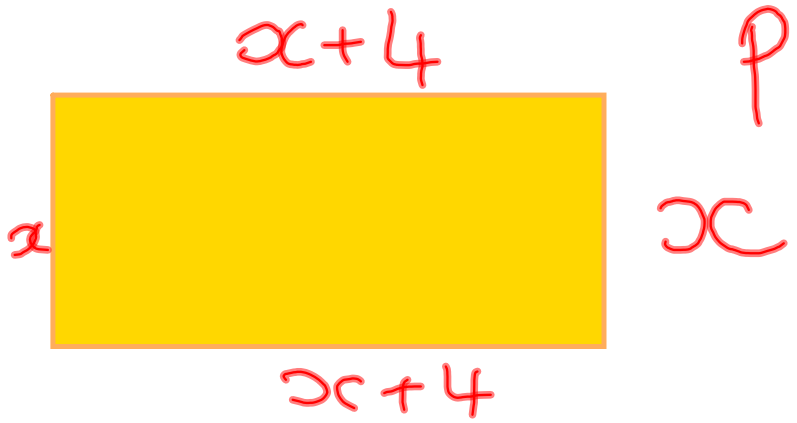


Think of an integer between 1 and 10.

Make up an equation using that vaue of x.
Ask your neighbour to solve it.

Now set them 5 more (put the answers in the back of your book so you don't forget them).
If they are confident mathematicians, you can try using negative numbers or (easy) fractions.

## Forming Equations to solve problems




$P = 4x + 8$

**A rectangle has width x cm and the length is 4cm more than the width.**
**Write an expression for the perimeter.**

**If the perimeter is 48cm, find the length and width of the rectangle.**

$4x + 8 = 48$

$4x = 40$

$x =$

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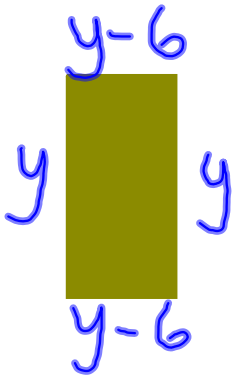
**Forming expressions**

# Form an expression for the perimeter of each shape.

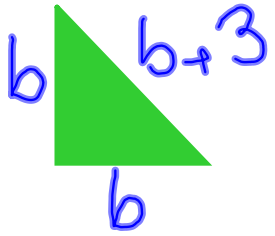

width = x
length is 4cm more

$P = 4x + 8$



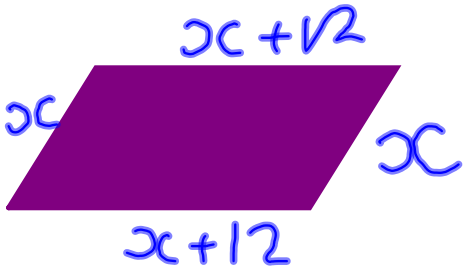

length is y
width is 6cm less

$P = 4y - 12$




$P = 3b + 3$

An isosceles triangle
two sides are b cm
the third side is 3 cm more




short side is x cm
long side is 12 cm more

$P = 4x + 24$

## Making expressions

Jack has x pencils.
He lends out 3.
How many does he have now?

$x - 3$

Ben has n books.
He picks up another 4.
How many does he have altogether?

$n + 4$

Holly has n scarves. $n$
Maria has twice as many $2n$
How many do they have altogether?

$3n$

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This square has side length x cm

1. Write down an expression for its perimeter.
2. Write down an expression for its area.
3. The area of the square is $36cm^2$.

a)Write down an equation to show its area.

b)Find the length of one side.

4. Find the perimeter of the square.

## Using a spreadsheet to create number square

### Task 1: a 1-100 square.

Open a new excel document.
Type 1 into cell A1
Type =A1+1 into cell B1,
find the cross, and drag across 9 squares.
Think about what you need to type into A2.
Remember to include the = sign.
Drag down.

### Task 2: A 100-1 square

This time start with 100, and have the numbers descending.

### Task 3: Create this number square:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 |
| 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 60 |
| 62 | 64 | 66 | 68 | 70 | 72 | 74 | 76 | 78 | 80 |
| 82 | 84 | 86 | 88 | 90 | 92 | 94 | 96 | 98 | 100 |
| 102 | 104 | 106 | 108 | 110 | 112 | 114 | 116 | 118 | 120 |
| 122 | 124 | 126 | 128 | 130 | 132 | 134 | 136 | 138 | 140 |
| 142 | 144 | 146 | 148 | 150 | 152 | 154 | 156 | 158 | 160 |
| 162 | 164 | 166 | 168 | 170 | 172 | 174 | 176 | 178 | 180 |
| 182 | 184 | 186 | 188 | 190 | 192 | 194 | 196 | 198 | 200 |

## The NC says you need to be able to:

- Begin to distinguish the different roles played by letter symbols in equations, formulae and functions; know the meanings of the words *formula* and *function*.
- Construct and solve linear equations with integer coefficients (unknown on either or both sides, without and with brackets) using appropriate methods (e.g. inverse operations, transforming both sides in the same way).
- Use formulae from mathematics and other subjects; **substitute integers into simple formulae,** including examples that lead to an equation to solve; derive simple formulae.

## Attachments

Algebra pyramids.doc

Algebra pyramids answers.doc

I'm thinking of a number.doc

1-100 square.xls