Bar Modelling for Key Stages 3 and 4
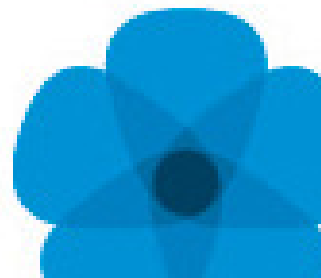
Equations

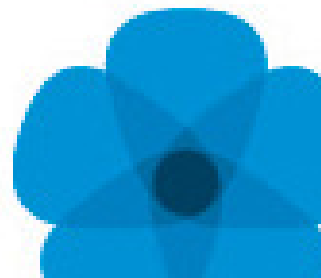Hampshire Maths Team
January 2019
Final version

Overview

In this document are some ideas to support the development of bar modelling in KS3 and 4 to solve equations.
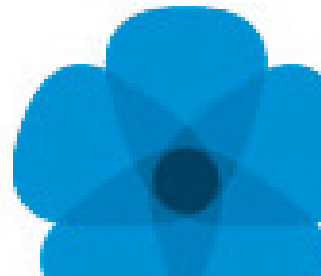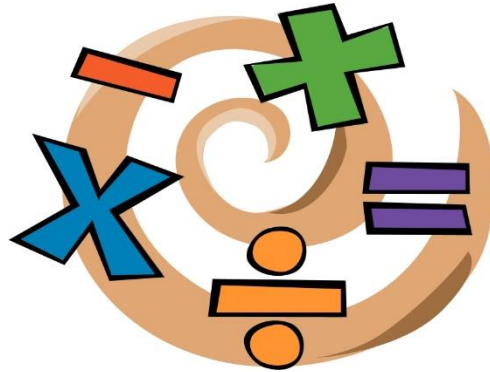
This can be used for staff training.

With thanks to the Hampshire Leading Maths Teachers.
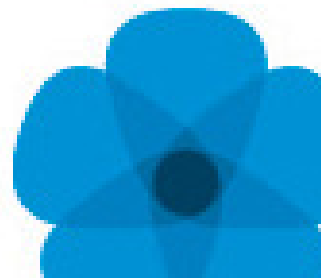
Bar Modelling

KS3 and 4

Why Bar Modelling ?

Core Competencies for Mastery:

➢ Visualisation
➢ Metacognition
➢ Generalisation
➢ Number-Sense
➢ Communication

The Part-Whole Model

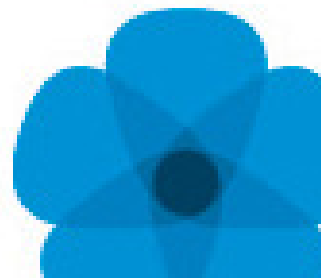**Can you….**

Say it ?

Make it ?

Draw it ?

Write it ?

Explain it?

1) Understand the problem

2) Model the problem situation
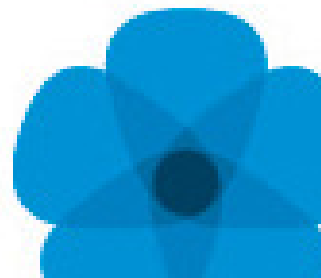
3) Draw the model

4) Solve the problem

Starter:

Out of the strips supplied measure and cut three different coloured strips……

One to a length of **3cm**

One to a length of **8cm**

One to a length of **11cm**

Creating and Rearranging Equations

Lesson Objectives:

To be able to use the Singapore bar method to model equations and then be able to use these models to rearrange simple and complex equations.

Skills for learning:

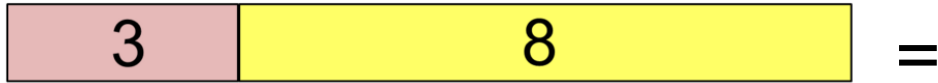Modelling with the Singapore bar method.

Visualising equations.

Rearranging equations.

Key Words:

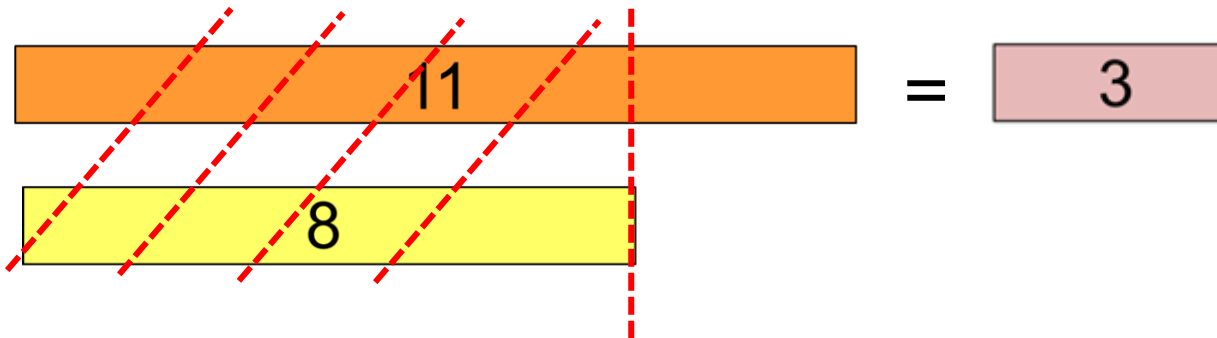Equal
Rearrange
Bar Method
Model
Visual

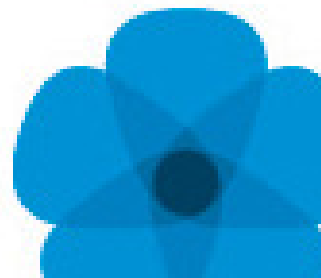**We can probably all agree on this fact…**
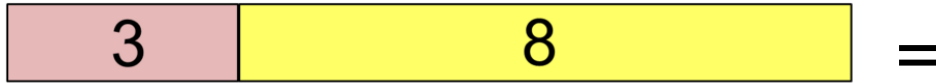(if we measured accurately)

| 3 | 8 | =

So 3 + 8 = 11

If we take the 11 bar, and chop off 8cm….

| 11 | = | 3 |

| 8 |

So 11 − 8 = 3

We can probably all agree on this fact…
(if we measured accurately)

| 3 | 8 | = |

So 3 + 8 = 11

If we take the 11 bar, and chop off 3cm….

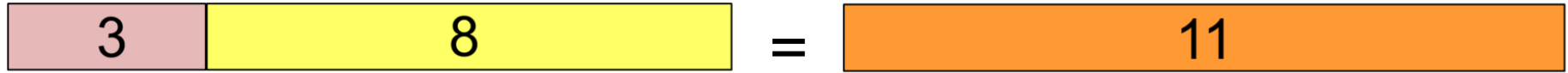| 11 | = | 8 |
| 3 | | |
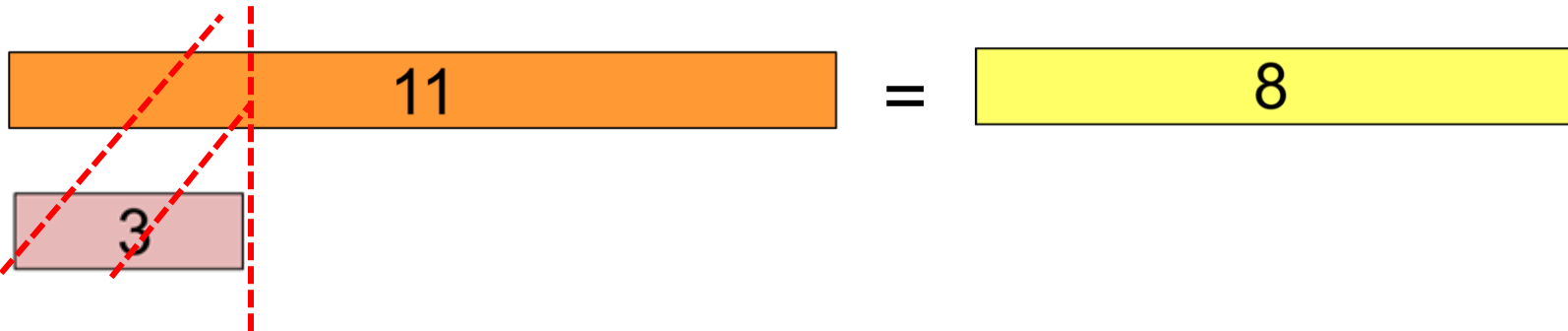
So 11 – 3 = 8
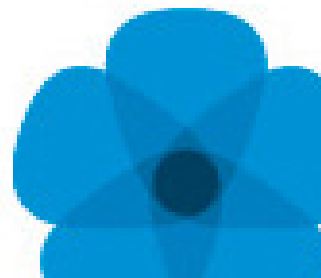
We can probably all agree on this fact…
(if we measured accurately)

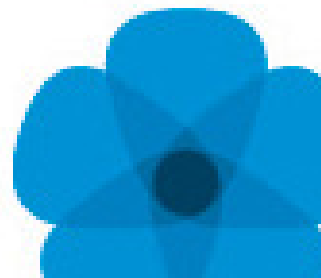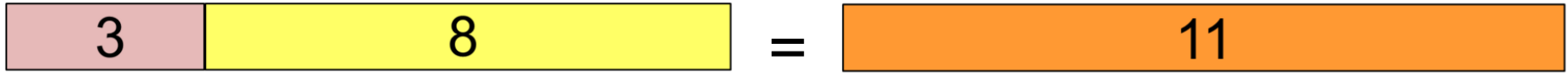| 3 | 8 | = | 11 |

From these three slips of paper we can now create three equations….

3 + 8 = 11 (and also 8 + 3 = 11)

11 − 8 = 3
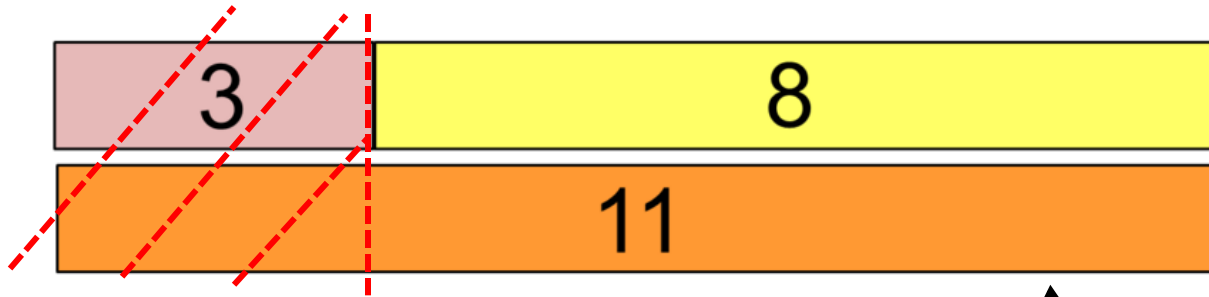
11 − 3 = 8

We can probably all agree on this fact…
(if we measured accurately)
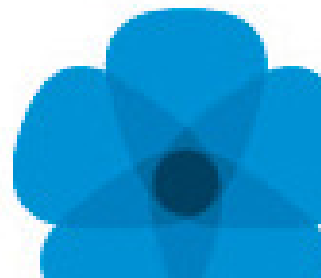

If we line the bars up like this…..

The three equations are easy to see!

E.g. 11 – 3 = 8

Glue it into your books like this!

This method can be used for algebra too!

Using another three strips, can you model this equation?

$$a + b = c$$
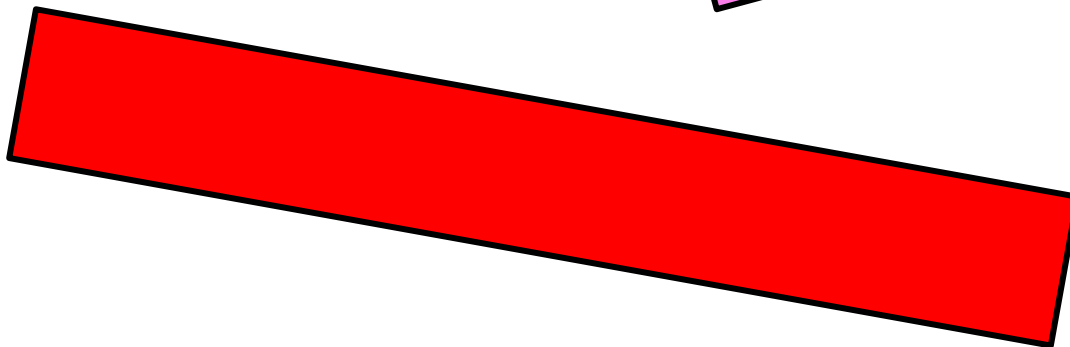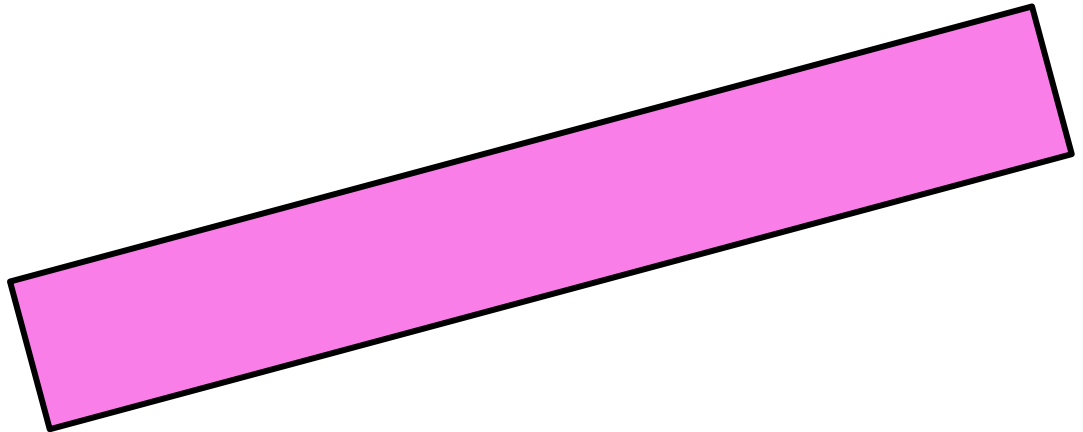
This method can be used for algebra too!
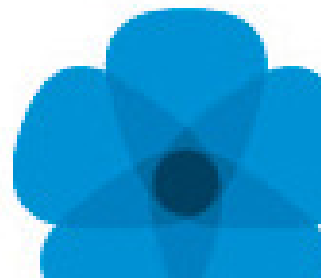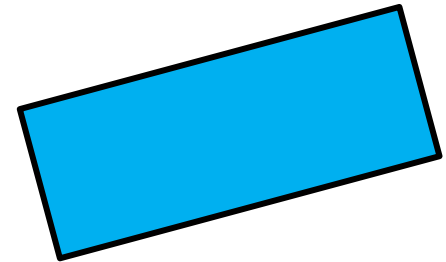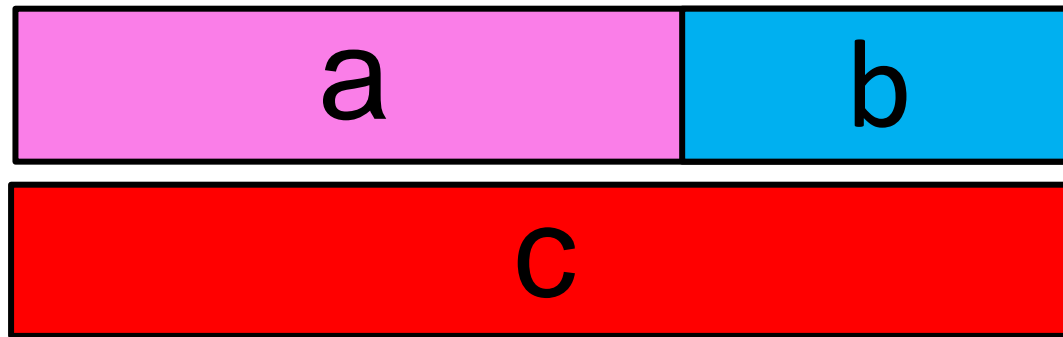
Glue it into your books like this!

What are the four equations we can make from this model?
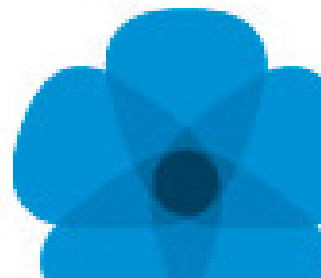
Using the Bar Method:
Write as many equations as you can from each.
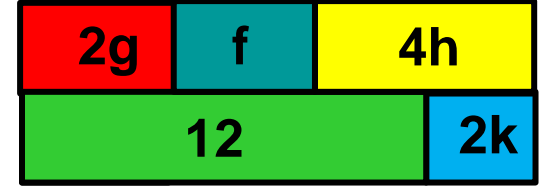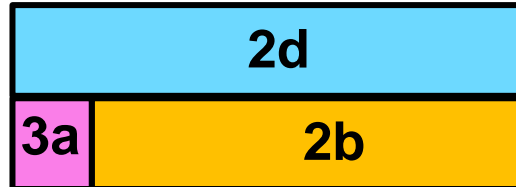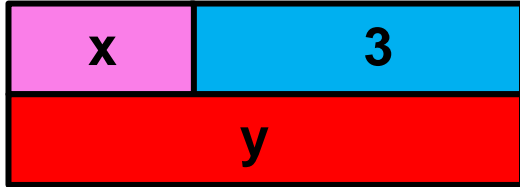
Using the Bar Method:

Model these equations and write as many equations as you can from each (you can draw them or cut and stick).

$x = y + 5$	$12 = z + w$	$2g + h = b$
$d - 3 = k$	$2j - 4 = p$	$3h = 2q - v$
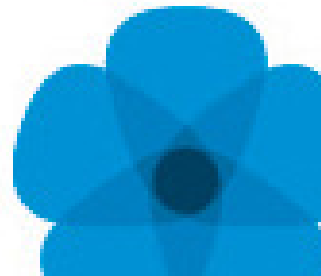
Using the Bar Method Solutions:

Remember, your bars don't need to be the same size as mine, as the quantities and proportions are unknown!

$x = y + 5$

y	5
x	

$12 = z + w$

12	
z	w

$2g + h = b$

b	
2g	h

$d - 3 = k$

d	
k	3

$2j - 4 = p$

2j	
4	p

$3h = 2q - v$

v	3h
2q	
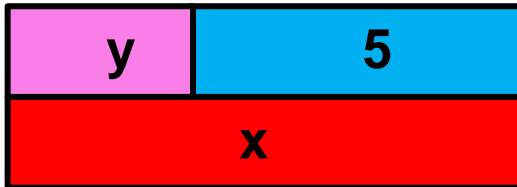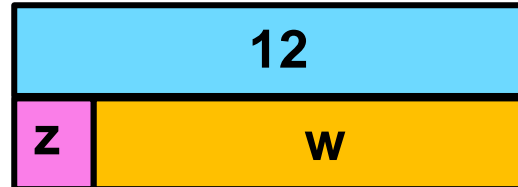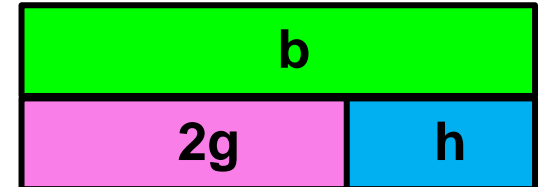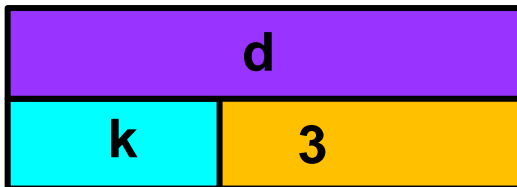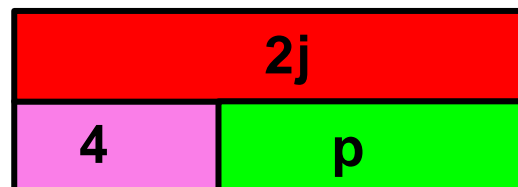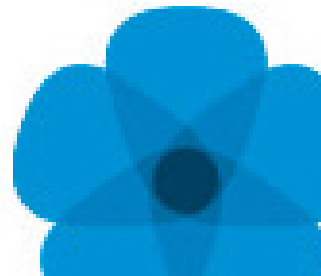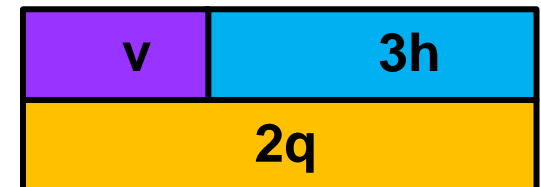
More Complex Equations:

p
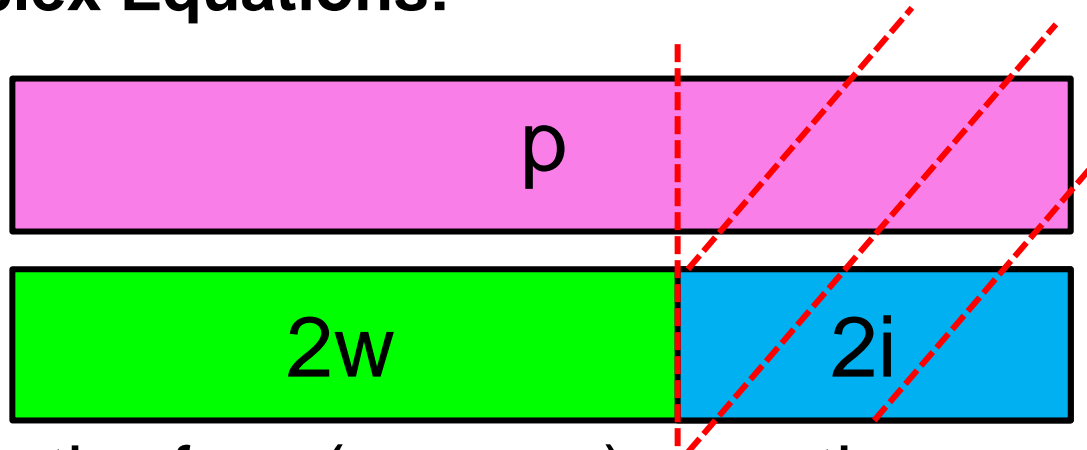
$2w$ $2i$

What are the four (or more) equations we can make from this model?

$p = 2w + 2i$

$2w + 2i = p$

$p - 2w = 2i$

$p - 2i = 2w$

What if **I** want to make **w** the subject of the formula?

We want **w** on its own…..so we have to divide both sides by 2!

$p - 2i = 2w$

$\div 2 \qquad \div 2$

$\dfrac{p - 2i}{2} = w$

Using the Bar Method:

Write as many equations as you can from each.

3x	z	y
6g		

ab	3	4h
7		6w
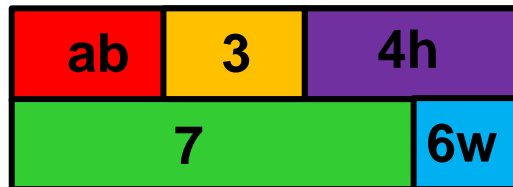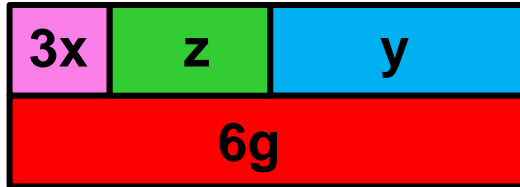
2ut	at²
2s	

Extension:

Make **x** the subject of the equation

Extension:

Make **w** the subject of the equation

Extension:

Make **u** the subject of the equation
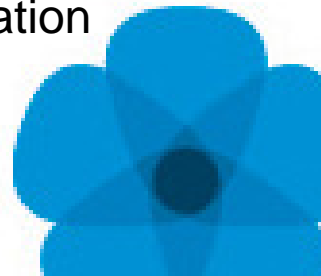
Bar vs Balance

Make **u** the subject of the equation

$$2s = 2ut + at^2$$
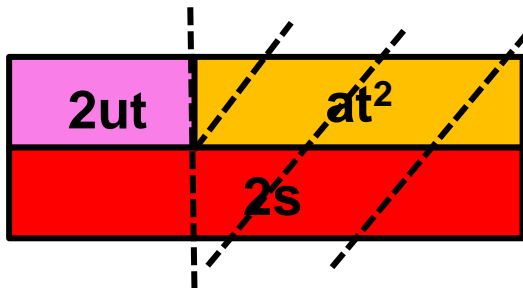
2ut	at²
	2s

When we draw a bar model we see…

$$2s - at^2 = 2ut$$

$$\div 2t \quad \div 2t$$

$$\frac{2s - at^2}{2t} = u$$

$$2s = 2ut + at^2$$

$$-at^2 \quad -at^2$$

$$2s - at^2 = 2ut$$

$$\div 2t \quad \div 2t$$

$$\frac{2s - at^2}{2t} = u$$

Remember 2ut means 2 x u x t so to get u alone we divide by 2t
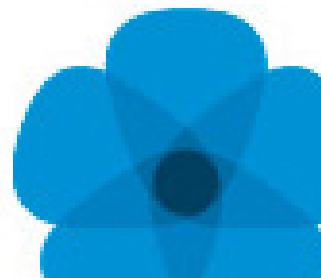
$3x = 2y + z + e$

Main: Make **z** the subject of the equation

Extension: Make **y** the subject of the equation

$4b + 2d = a + c + e$

Main: Make **c** the subject of the equation

Extension: Make **d** the subject of the equation

$a - 2pz = 3f + s$

Main: Make **f** the subject of the equation

Extension: Make **p** the subject of the equation

$g = a + 3b - zfq$

Main: Make **b** the subject of the equation

Extension: Make **f** the subject of the equation

$3a^2 + 2b - 6 = tr$

Main: Make **b** the subject of the equation

Extension: Make **a** the subject of the equation

$a^2 + 4b^2 = 6ts - 5$

Main: Make **t** the subject of the equation

Extension: Make **b** the subject of the equation

Rearranging equations: Use the method that suits you…

$3x = 2y + z + e$

2y	z	e

3x
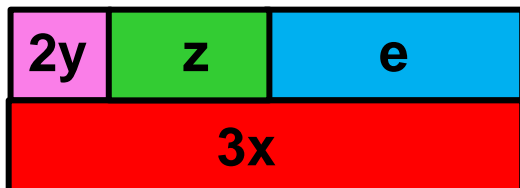
$z = 3x - 2y - e$

$y = \dfrac{3x - z - e}{2}$

$4b + 2d = a + c + e$

a	c	e
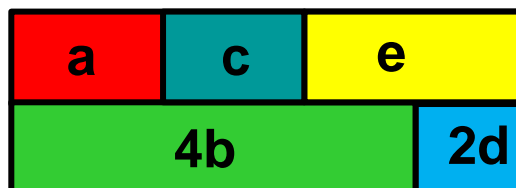
4b	2d

$c = 4b + 2d - a - e$

$d = \dfrac{a + c + e - 4b}{2}$

$a - 2pz = 3f + s$

a
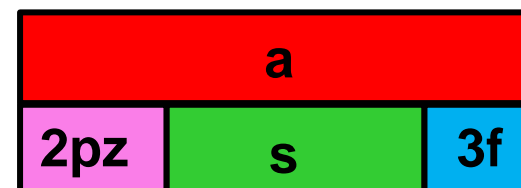
2pz	s	3f

$f = \dfrac{a - 2pz - s}{3}$

$p = \dfrac{a - s - 3f}{2z}$

$g = a + 3b - zfq$

g	zfq

a	3b

$b = \dfrac{g + zq - a}{3}$

$f = \dfrac{a + 3b - g}{zq}$

$3a^2 + 2b - 6 = tr$

3a²	2b

tr	6
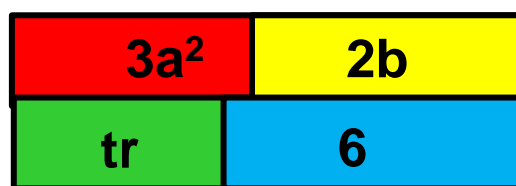
$b = \dfrac{tr + 6 - 3a^2}{2}$

$a = \sqrt{\left(\dfrac{tr + 6 - 2b}{3}\right)}$

$a^2 + 4b^2 = 6ts - 5$

a²	4b²	5

6ts

$t = \dfrac{a^2 + 4b^2 + 5}{6s}$

$b = \sqrt{\left(\dfrac{6ts - a^2 - 5}{4}\right)}$
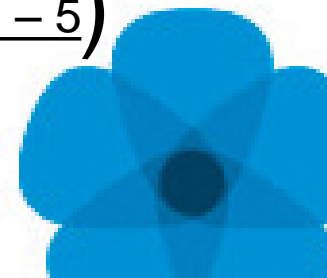
Plenary Check:

What can you tell me about this?

Extension: Think of other formulas we know that could be modelled and rearranged using this method…
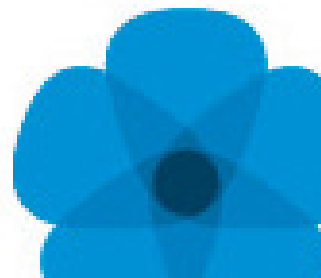
Stretch B – Draw a bar picture and write the equation for each question.

1) The total cost of six apples and one banana is £5.

2) A cheese sandwich and two bags of crisps costs £4.50.

3) Joe has £20. He buys a CD and a chocolate bar. He has £8 left.

4) Sam has £50. He buys three books, a t-shirt and a pair of socks. He has £X left.
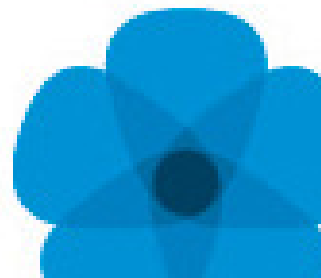
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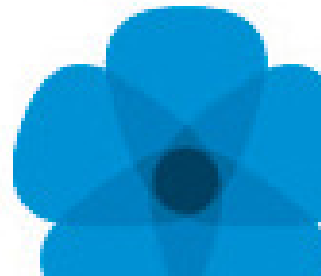
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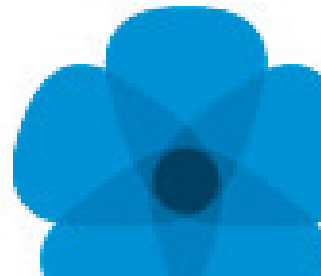Moodle+ subscribers are licenced to access and use this resource and have agreed to pay the annual subscription fee. This authority starts when the fee is paid and ends when the subscription period expired unless it is renewed. This file is for personal or classroom use only. By using it, you agree that you will not copy or reproduce this file except for your own personal, non-commercial use. HIAS have the right to modify the terms of this agreement at any time; the modification will be effective immediately and shall replace all prior agreements.

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