

Form and solve inequalities



Two more than treble my number is greater than 11

Find the possible range of values

$$3x + 2 > 11$$

Solve

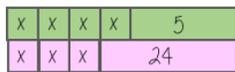
$$x \leftarrow -3 \leftarrow -2 \leftarrow 11$$

$$x > 3$$

Equations with unknown on both sides

$$4x + 5 = 3x + 24$$

$$-3x \quad -3x$$



$$x + 5 = 24$$

$$-5 \quad -5$$



$$x = 19$$

Solve equations with brackets

$$3(2x + 4) = 30$$

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Expand the brackets

$$6x + 12 = 30$$

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$$-12 \quad -12$$

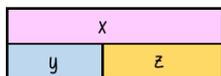
$$6x = 18$$

$$-6 \quad -6$$

$$x = 3$$



Rearranging Formulae (one step)



$$x = y + z$$

Rearrange to make y the subject

$$y = x - z$$

$$y \rightarrow +z \rightarrow x$$

$$y \leftarrow -z \leftarrow x$$

Using inverse operations or fact families will guide you through rearranging formulae

Rearranging can also be checked by substitution

Language of rearranging...

Make XXX the subject

Change the subject

Rearrange

Rearranging Formulae (two step)

In an equation (find x)

$$4x - 3 = 9$$

$$+3 \quad +3$$

$$4x = 12$$

$$\div 4 \quad \div 4$$

$$x = 3$$

In a formula (make x the subject)

$$xy - s = a$$

$$+s \quad +s$$

$$xy = a + s$$

$$\div y \quad \div y$$

$$x = \frac{a+s}{y}$$

The steps are the same for solving and rearranging

Rearranging is often needed when using $y = mx + c$

e.g Find the gradient of the line $2y - 4x = 9$

Make y the subject first $y = \frac{4x+9}{2}$

Gradient = $\frac{4}{2}$

Inequalities with unknown on both sides

Solving inequalities has the same method as equations

$$5(x + 4) < 3(x + 2)$$

$$5x + 20 < 3x + 6$$

$$2x + 20 < 6$$

$$2x < -14$$

$$x < -7$$

Check it!

$$5(-8 + 4) < 3(-8 + 2)$$

$$5(-4) < 3(-6)$$

$$-20 < -18$$

✓ -20 IS smaller than -18

Solutions on a number line



$$x < 1$$



$$x \leq 1$$

Both represent values less than 1

Includes the value 1



$$x > 1$$



$$x \geq 1$$

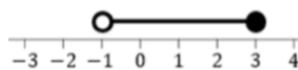
Both represent values more than 1

Includes the value 1

● Includes the value it sits above

○ Does NOT include the value it sits above

Values less than or equal to 3 but also more than -1



$$-1 < x \leq 3$$

This includes the integer values 0, 1, 2, 3

Inequalities with negatives

Method 1 Make x positive first

$$2 - 3x > 17$$

$$+3x \quad +3x$$

$$2 > 17 + 3x$$

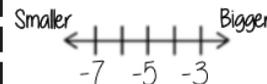
$$-17 \quad -17$$

$$-15 > 3x$$

$$\div 3 \quad \div 3$$

$$-5 > x$$

x is true for any value smaller than -5



✓ CHECK IT!
 $2 - 3(-6) = 20$
TRUE/ CORRECT

Method 2 Keep the negative x

$$2 - 3x > 17$$

$$-2 \quad -2$$

$$-3x > 15$$

$$\div -3 \quad \div -3$$

$$x > -5$$

x is true for any value bigger than -5

This cannot be true...

$$x < -5$$

When you multiply or divide x by a negative you need to reverse the inequality

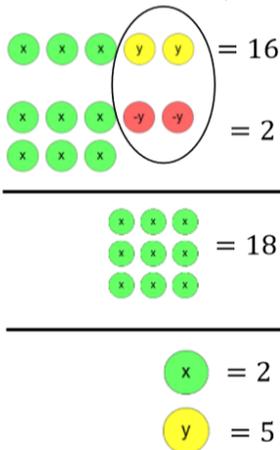


Solve by addition

$$\begin{array}{r} 3x + 2y = 16 \\ + 6x - 2y = 2 \\ \hline 9x = 18 \\ \div 9 \quad \div 9 \\ \hline x = 2 \end{array}$$

$$\begin{array}{r} 3x + 2y = 16 \\ 3(2) + 2(y) = 16 \\ 6 + 2y = 16 \\ -6 \quad -6 \\ \hline 2y = 10 \\ \div 2 \\ \hline y = 5 \end{array}$$

Addition makes zero pairs



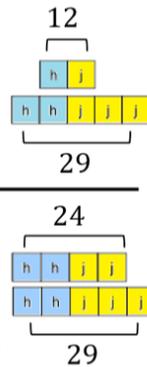
Solve by adjusting one

$$\begin{array}{r} h + j = 12 \\ 2h + 2j = 29 \end{array}$$

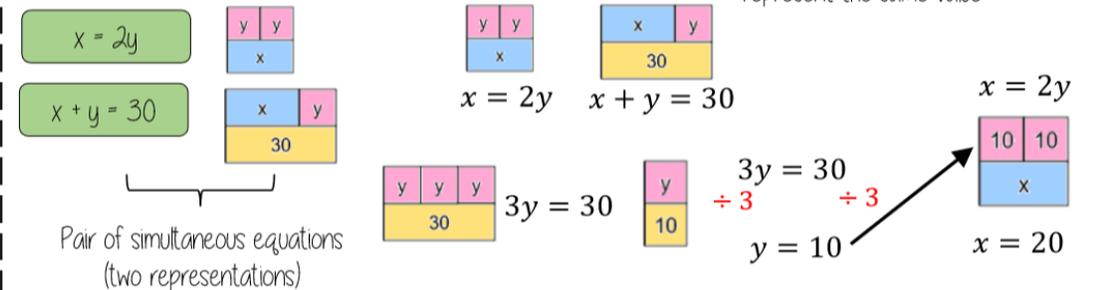
No equivalent values

$$\begin{array}{r} 2h + 2j = 24 \\ 2h + 2j = 29 \end{array}$$

By proportionally adjusting one of the equations – now solve the simultaneous equations choosing an addition or subtraction method



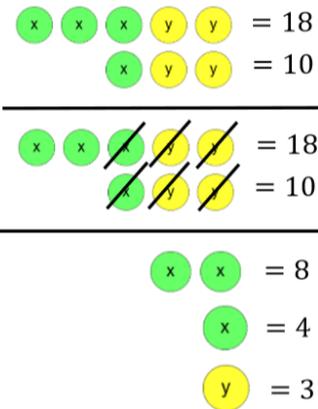
Substituting in an expression



Solve by subtraction

$$\begin{array}{r} 3x + 2y = 18 \\ - x + 2y = 10 \\ \hline 2x = 8 \\ \div 2 \quad \div 2 \\ \hline x = 4 \end{array}$$

$$\begin{array}{r} x + 2y = 10 \\ (4) + 2y = 10 \\ -4 \quad -4 \\ \hline 2y = 6 \\ \div 2 \quad \div 2 \\ \hline y = 3 \end{array}$$



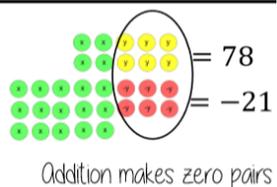
Solve by adjusting both

$$\begin{array}{r} 2x + 3y = 39 \\ 5x - 2y = -7 \end{array}$$

Use LCM to make equivalent x OR y values
Because of the negative values using zero pairs and y values is chosen choice

$$\begin{array}{r} 4x + 6y = 78 \\ 15x - 6y = -21 \end{array}$$

Now solve by addition



Solving Quadratics - by factorising

$$x^2 + 4x + 12 = 0$$

First you must factorise the quadratic (if you aren't sure how look at last units knowledge organizer)

$$(x + 6)(x - 2) = 0$$

Let's solve each bracket separately.

$$\begin{array}{r} x + 6 = 0 \\ x = -6 \end{array}$$

$$\begin{array}{r} x - 2 = 0 \\ x = 2 \end{array}$$

Therefore the solutions are $x = -6, x = 2$

