# Equality and Equivalence

## What do I need to be able to do?

Understand the meaning of equality
Understand and use fact families, numerically and algebraically
Understand the meaning of like and unlike terms
Understand the meaning of equivalence
Simplify algebraic expressions by collecting the like term using the ≡ symbol
Solve one-step linear equations involving addition and subtraction using inverse operations
Solve one-step linear equations involving multiplication and division using inverse operations
Introduction to two-step equations
Solve two-step equations

## Keywords & definitions:

**Equality:** two expressions that have the same value
**Equation:** a mathematical statement that two things are equal
**Equals:** represented by '=' symbol – means the same
**Equivalence:** represented by the ≡ symbol - means always the same
**Solution:** the set or value that satisfies the equation
**Solve:** to find the solution.
**Inverse:** the operation that undoes what was done by the previous operation. (The opposite operation)
**Term:** a single number or variable
**Like:** variables that are the same are 'like'
**Coefficient:** a multiplicative factor in front of a variable e.g. 5x (5 is the coefficient, x is the variable)
**Expression:** a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)

## Equality

$2 + 14 = 5 + 5 + 6$

16 16

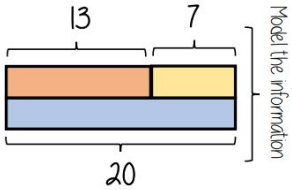
"Is equal to"

The sum on the left has the same result as the sum on the right

Saying it out loud sometimes helps you to understand equality

## Fact Families

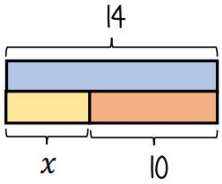
Use a bar model to display the relationships between terms and numbers



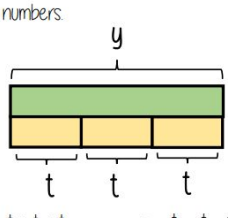

Model the information

13 + 7 = 20 20 – 7 = 13
7 + 13 = 20 20 – 13 = 7

Fact Family




$x + 10 = 14$ $14 - 10 = x$
$10 + x = 14$ $14 - x = 10$




t + t + t = y y – t – t = t
3 x t = y y - 3 = t
3t = y y - t = 3

## Like and unlike terms

Like terms are those whose variables are he same

♡ and 3♡ are **like** terms

the variable is the same

★ 3♡ are **unlike** terms

the variables are NOT the same

Examples and non-examples

| Like terms | Un-like terms |
|---|---|
| y, 7y | y, 7x |
| $2x^2$, $x^2$ | $2x^2$, $2c^2$ |
| ab, 10ba | ab, 10a |
| 5, -2 | 5, -2t |

Note here ab and ba are commutative operations, so are still like terms

## Equivalence

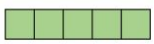
Check equivalence by substitution
e.g. m= 10

| 5m | 2 x 2m | 7m – 3m |
|---|---|---|
| 5 x 10 | 2 x (2x 10) | (7x 10) – (3x 10) |
| = 50 | = 2 x 20 | = 70 – 30 |
| | = 40 | = 40 |

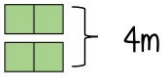
Equivalent expressions

Repeat this with various values for m to check

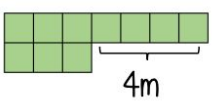
5m



2 x 2m




7m – 3m




## Collecting like terms ≡ symbol

The ≡ symbol means equivalent to
It is used to identify equivalent expressions

Collecting like terms

Only **like terms** can be combined

$4x + 5b - 2x + 10b$

$4x + 5b - 2x + 10b$

$2x + 15b$

Common misconceptions

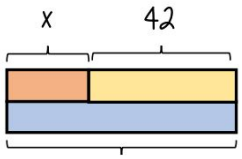
$2x + 3x^2 + 4x \equiv 6x + 3x^2$

Although they both have the x variable x2 and x terms are un-like terms so can not be collected

## Solve one step equations (+/-)

There is more to this than just spotting the answer

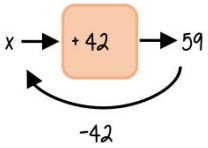
$x + 42 = 59$




$x + 42 = 59$
$42 + x = 59$

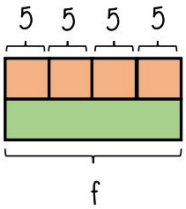
$59 - x = 42$
$59 - 42 = x$

Don't forget you know how to use function machines




## Solve one step equations ( x/÷)

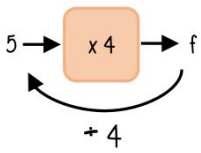
$\frac{f}{4} = 5$




$f \div 4 = 5$
$f \div 5 = 4$

$5 \times 4 = f$
$4 \times 5 = f$

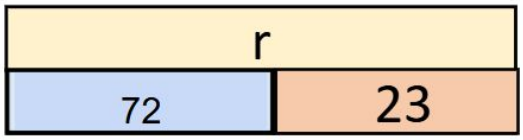
Don't forget you know how to use function machines




## Solve one step equations (+/-)

**Solve the equation**

$$r - 72 = 23$$

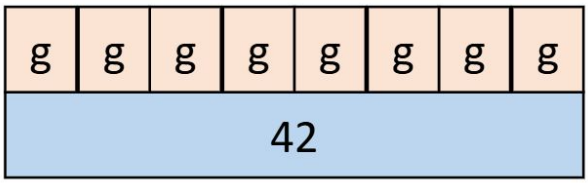



$r - 72 = 23$
$72 + 23 = r = 95$
$23 + 72 = r = 95$
$r - 23 = 72$

## Solve one step equations (×/÷)

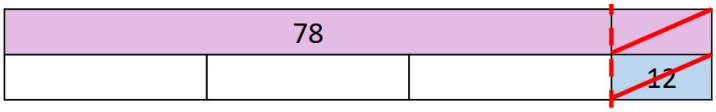
**Solve the equation**

$$8g = 42$$




$8 \times g = 42$
$g \times 8 = 42$
$42 \div 8 = g = 5.25$
$42 \div g = 8$

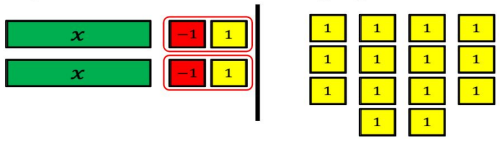
## Solve Two Step Equations




Solve $3f + 12 = 90$

$3f + 12 = 90$
$-12 \quad -12$
$3f = 78$
$\div 3 \quad \div 3$
$f = 26$

Represent $2x - 2 = 12$ using algebra tiles.




Solve $2x - 2 = 12$
$+2 \quad +2$
$2x = 14$
$\div 2 \quad \div 2$
$x = 7$

$$\frac{x}{3} + 9 = 11.1$$

$-9$ $-9$

$$\frac{x}{3} = 2.1$$

$\times 3$ $\times 3$

$$x = 6.3$$

$$\frac{x + 7}{4} = 2.1$$

$\times 4$ $\times 4$

$$x + 7 = 8.4$$

$-7$ $-7$

$$x = 1.4$$

# Retrieval Quiz

Answers