

Year 7 Term 1

Number Sense

What do I need to be able to do?

By the end of this unit you should be able to:

- Know and use mental addition/ subtraction
- Know and use mental multiplication/ division
- Know and use mental arithmetic for decimals
- Know and use mental arithmetic for fractions
- Use factors to simplify calculations
- Use estimation to check mental calculations
- Use number facts
- Use algebraic facts

Keywords

Commutative: changing the order of the operations does not change the result

Associative: when you add or multiply you can do so regardless of how the numbers are grouped

Dividend: the number being divided

Divisor: the number we divide by

Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)

Equation: a mathematical statement that two things are equal

Quotient: the result of a division

Mental methods for addition/ subtraction

Addition is commutative



$$6 + 3 = 3 + 6$$

The order of addition does not change the result

Subtraction the order has to stay the same

$$360 - 147 = 360 - 100 - 40 - 7$$

- Number lines help for addition and subtraction
- Working in 10's first aids mental addition/ subtraction

Mental methods for multiplication/ division

Multiplication is commutative



$$2 \times 4 = 4 \times 2$$

The order of multiplication does not change the result

Partitioning can help multiplication

$$\begin{aligned} 24 \times 6 &= 20 \times 6 + 4 \times 6 \\ &= 120 + 24 \\ &= 144 \end{aligned}$$

Division is not associative

Chunking the division can help $4000 \div 25$
"How many 25's in 100" then how many chunks of that in 4000.

Mental methods for decimals

Multiplying by a decimal < 1 will make the original value smaller e.g. $0.1 = \div 10$

Methods for multiplication 12×0.03

$$\begin{array}{l} 12 \times 3 = 36 \\ 12 \times 3 = 36 \\ 12 \times 0.3 = 3.6 \\ 12 \times 0.03 = 0.36 \end{array} \quad \begin{array}{l} 12 \times 3 = 36 \\ +10 \downarrow +100 \downarrow +1000 \downarrow \\ 12 \times 0.03 = 0.36 \end{array}$$

Methods for addition $2.3 + 2.4$

$$\begin{array}{l} 2 + 2 = 4 \\ 0.3 + 0.4 = 0.7 \\ 4 + 0.7 = 4.7 \end{array}$$

Methods for division $15 \div 0.05$

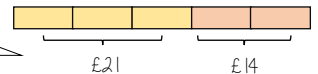
Multiply by powers of 10 until the divisor becomes an integer

$$\begin{array}{l} 1.5 \div 0.05 \\ \times 100 \downarrow \times 100 \downarrow \\ 150 \div 5 = 30 \end{array}$$

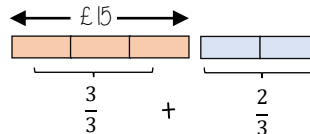
Mental methods for fractions

Use bar models where possible

I've spent $\frac{2}{5}$ of my money I have £21 left



How much did they have to begin with?



What is $\frac{5}{3}$ of £15?

Using factors to simplify calculations

$$30 \times 16$$

$$10 \times 3 \times 4 \times 4$$

$$10 \times 3 \times 2 \times 8$$

$$2 \times 5 \times 3 \times 2 \times 2 \times 2 \times 2$$

$$16 \times 10 \times 3$$

Multiplication is commutative
Factors can be multiplied in any order

Estimation

Estimations are useful — especially when using fractions and decimals to check if your solution is possible.

Most estimations round to 1 significant figure

Estimations are useful — especially when using fractions and decimals to check if your solution is possible.

$$210 + 899 < 1200$$

This is true because even if both numbers were rounded up, they would reach $300 + 900$.

The correct estimation would be $200 + 900 = 1100$.

Number facts

Use

$$124 \times 5 = 620$$

For multiplication, each value that is multiplied or divided by powers of 10 needs to happen to the result

$$620 \div 124 = 50$$

For division you must consider the impact of the divisor becoming smaller or bigger.
Smaller — the answer will be bigger (It is being shared into less parts)
Bigger — the answer will be smaller (It is being shared into more parts)

Algebraic facts

$$2a + 2b = 10$$

Everything $\times 2$

$$0.1a + 0.1b = 0.5$$

Everything $\div 10$

$$a + b = 5$$

Add 2 to the total

$$a + b + 2 = 7$$

The unknown quantity isn't changing but the variables change what is done to give the result

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Negative Numbers

What do I need to be able to do?

By the end of this unit you should be able to:

- Perform calculations that cross zero
- Add/ Subtract directed numbers
- Multiply/ Divide directed numbers
- Evaluate algebraic expressions
- Solve two-step equations
- Use order of operations with directed number

Keywords

Subtract: taking away one number from another.

Negative: a value less than zero.

Commutative: changing the order of the operations does not change the result

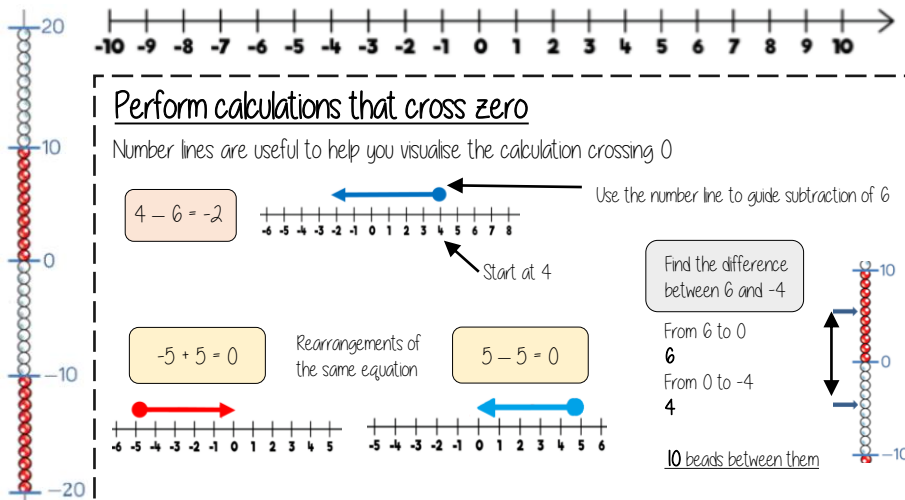
Product: multiply terms

Inverse: the opposite function

Square root: a square root of a number is a number when multiplied by itself gives the value (symbol $\sqrt{\quad}$)

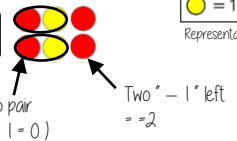
Square: a term multiplied by itself.

Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)



Add directed numbers

$$2 + -4 = -2$$



$$8 + -3 = 5$$



Partitioning

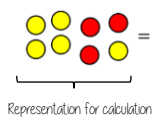
$$8 + -3 = 5$$

$$5 + 3 + -3 = 5$$

Partition the value to create a zero pair calculation

Generalisation
 $+ - = -$

Subtract directed numbers



2

"Subtract" - means take away or remove

$$2 - 1 = 1$$

Take away one

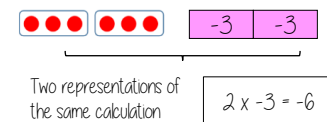
Start with the representation of 2

$$2 - -1 = 3$$

$$2 - -3 = 5$$

Generalisation
 $- - = +$

Multiply/ Divide directed numbers



Negative, Negative calculation

$$-2 \times -3$$

This is the negative of 2×-3

$$-2 \times -3 = 6$$

The act of making counters into their negative is turning them over

Divisions are the inverse operations

Evaluate algebraic expressions



$$a = 5$$

$$b = -4$$

$$a^2 = 5^2$$

$$a^2 = 25$$

$$b^2 = (-4)^2$$

$$b^2 = 16$$

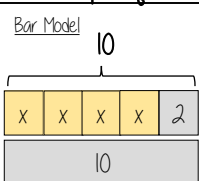
With negative numbers the brackets are important so that it performs -4×-4 .

Brackets around negative substitutions helps remove calculation errors

$$2a - b = 2 \times 5 - (-4) = 10 + 4 = 14$$

$$3b - 2a = 3(-4) - 2(5) = -12 - 10 = -22$$

Two-step equations

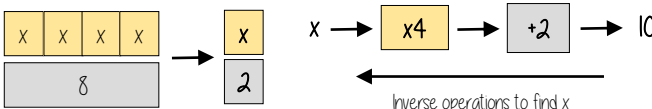


$$4x + 2 = 10$$

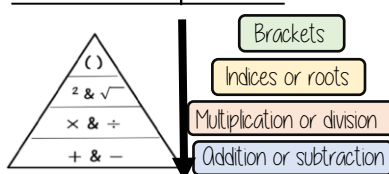
$$10 - 4x = 2$$

Representing the same question (use fact families)

Function machine



Use order of operations



Brackets around negative substitutions helps remove calculation errors

Remember square roots have a positive and negative value

x	-3	-2	-1	0	1	2	3
x ²	9	4	1	0	1	4	9
x ³	-27	-8	-1	0	1	8	27
1/x	-1/3	-1/2	-1	0	1	2	3
1/x ²	1/9	1/4	1	0	1	4	9
1/x ³	-1/27	-1/8	-1	0	1	8	27

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Expressions and Equations

What do I need to be able to do?

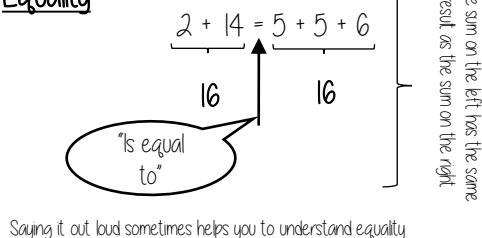
By the end of this unit you should be able to:

- Form and solve linear equations
- Understand like and unlike terms
- Simplify algebraic expressions

Keywords

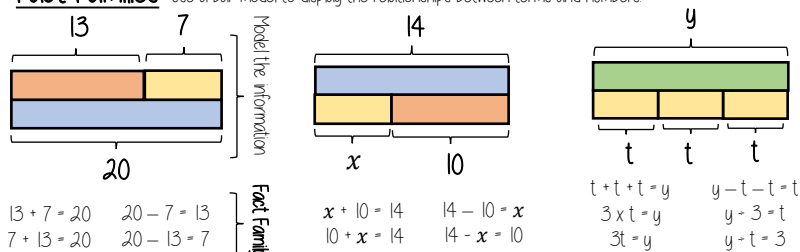
- Equality:** two expressions that have the same value
Equation: a mathematical statement that two things are equal
Equals: represented by '=' symbol – means the same
Solution: the set or value that satisfies the equation
Solve: to find the solution
Inverse: the operation that undoes what was done by 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



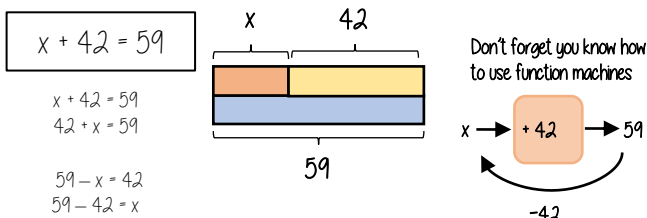
Fact Families

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

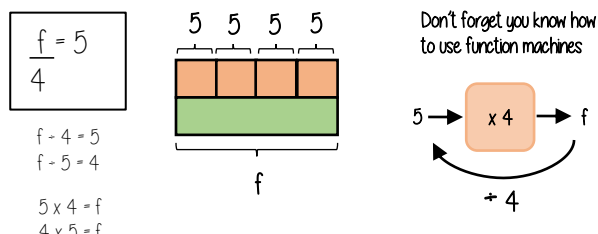


Solve one step equations (+/-)

There is more to this than just spotting the answer

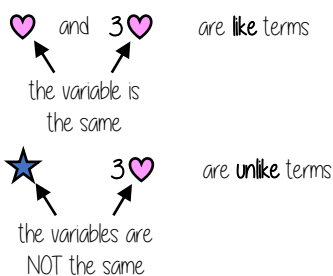


Solve one step equations (x/+)



Like and unlike terms

Like terms are those whose variables are the same



Examples and non-examples

Like terms

y , $7y$
 $2x^2$, x^2
 ab , $10ba$
 5 , -2

Un-like terms

y , $7x$
 $2x^2$, $2c^2$
 ab , $10a$
 5 , $-2t$

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

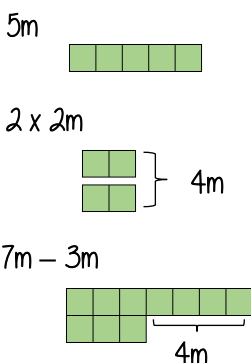
Equivalence

Check equivalence by substitution
 e.g. $m = 10$

$5m$ 5×10 $= 50$	$2 \times 2m$ $2 \times (2 \times 10)$ $= 2 \times 20$ $= 40$	$7m - 3m$ $(7 \times 10) - (3 \times 10)$ $= 70 - 30$ $= 40$
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Equivalent expressions

Repeat this with various values for m to check

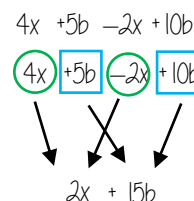


Collecting like terms $\equiv$ symbol

The $\equiv$ symbol means equivalent to
 It is used to identify equivalent expressions

Collecting like terms

Only like terms can be combined



Common misconceptions

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

Although they both have the x variable x^2 and x terms are unlike terms so cannot be collected