YEAR 7... Learning Journey

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Algebraic Thinking						Place Value and Proportion					
	Sequences		Understand and use algebraic notation		Equality and equivalence		Place value and ordering integers and decimals			Fraction, decimal and percentage equivalence		
Spring	Applications of Number						Directed Number			Fractional Thinking		
	Solving problems with addition & subtraction		Solving problems with multiplication and division			Fractions & percentages of amounts	Operations and equations with directed number			Addition and subtraction of fractions		
Summer	Lines and Angles						Reasoning with Number					
	Constructing, measuring and using geometric notation			Developing geometric reasoning			Developing number sense		Sets and probability		Prime numbers and proof	

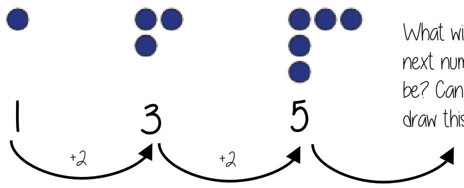
YEAR 7 – ALGEBRAIC THINKING... Sequences

Describe and continue a sequence diagrammatically

Keyword:

Sequence: items or numbers put in a pre-decided order

Count the number of circles or lines in each image

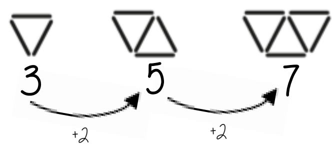


What will the next number be? Can you draw this?

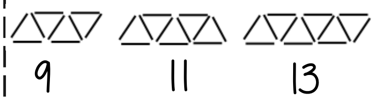
Predict and check terms

Keyword:

Term: a single number or variable



CHECK – draw the next terms



Predictions:
Look at your pattern and consider how it will increase.

e.g. How many lines in pattern 6?

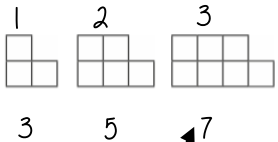
Prediction - 13
If it is increasing by 2 each time - in 3 more patterns there will be 6 more lines

Sequence in a table and graphically

Keyword:

Position: the place something is located

Position: the place in the sequence



"The **term** in **position** 3 has 7 squares"

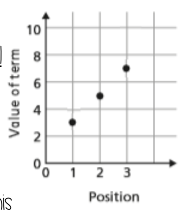
Term: the number or variable
(the number of squares in each image)

In a table

Position	1	2	3
Term	3	5	7

+2 +2

Graphical



Because the terms increase by the same addition each time this is **linear** – as seen in the graph

Linear and Non Linear Sequences

Keyword:

Difference: the gap between two terms

Linear Sequences – increase by addition or subtraction and the same amount each time

Non-linear Sequences – do not increase by a constant amount – quadratic, geometric and Fibonacci

- Do not plot as straight lines when modelled graphically
- The differences between terms can be found by addition, subtraction, multiplication or division

Fibonacci Sequence – look out for this type of sequence

0 1 1 2 3 5 8 ...

Each term is the sum of the previous two terms.

Continue Linear Sequences

Keyword Linear: the difference between terms increases or decreases by the same value each time

7, 11, 15, 19...

How do I know this is a linear sequence?
It increases by adding 4 to each term.
How many terms do I need to make this conclusion?
At least 4 terms – two terms only shows one difference not if this difference is constant. (a common difference).
How do I continue the sequence?
You continue to repeat the same difference through the next positions in the sequence.

Continue non-linear Sequences

Keyword Non-linear: the difference between terms increases or decreases in different amounts

1, 2, 4, 8, 16 ...

How do I know this is a non-linear sequence?
It increases by multiplying the previous term by 2 – this is a geometric sequence because the constant is multiply by 2
How many terms do I need to make this conclusion?
At least 4 terms – two terms only shows one difference not if this difference is constant. (a common difference).
How do I continue the sequence?
You continue to repeat the same difference through the next positions in the sequence.

Explain term-to-term rule

How you get from term to term

Keyword Rule: instructions that relate two variables

Try to explain this in full sentences not just with mathematical notation.
Use key maths language – doubles, halves, multiply by two, add four to the previous term etc.

To explain a whole sequence you need to include a term to begin at...

The next term is found by tripling the previous term. The sequence begins at 4.

4, 12, 36, 108...

x3 x3 x3

First term

YEAR 7 — ALGEBRAIC THINKING…

Algebraic notation

Single function machines

Keyword: Function: a relationship that instructs how to get from an input to an output

INPUT → [ ] → OUTPUT

The number that goes IN — The number that comes out

This box gives the calculation instruction

To find the input from the output
Use the INVERSE operation

Using letters to represent numbers

Keyword: Commutative: the order of the operations do not matter.

5 + 5 + 5	y + y + y + y	20 ÷ h
3 x 5	y x 4	$\frac{20}{h}$
5 x 3	4 x y	
	4y	

Addition and multiplication can be done in any order
Commutative calculations

4y — 4 lots of 'y'

$\frac{20}{h}$ — 20 shared into 'h' number of groups

Single function machines (algebra)

Keyword: Input: the number/ symbol put into a function.

INPUT: a → [x 10] → OUTPUT: 10a

3c → [x 10] → 30c

÷ 10

To find the input from the output
Use the INVERSE operation

Find functions from expressions

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

INPUT 7x → [?] → OUTPUT 14x

Find the relationship between the input and the output

Sometimes there can be a number of possible functions. e.g. +7x or x 2 could both be solutions to the above function machine

Substitution into expressions

Keyword: Substitute: replace one variable with a number or new variable.

4y ← 4 lots of 'y'

If y = 7 this means the expression is asking for 4 'lots of' 7

4 x 7 OR 7 + 7 + 7 + 7 OR 7 x 4 = 28

eg : y − 2
= 7 − 2 = 5

Two step function machines

Keyword: Inverse: the operation that undoes what was done by the previous operation. (The opposite operation)

INPUT → [ ] → [ ] → OUTPUT

Calculate the value at the end of each operation

For the input use the INVERSE operations

Two step function machines (algebra)

Keyword: Output: the number/ expression that comes out of a function.

b → [x 5] → 5b → [+ 4] → 5b + 4

÷ 5 — − 4

IMPORTANT
Calculate the value at the end of each operation

c → [+ 4] → c+4 → [x 5] → 5(c + 4) = 5c + 20

− 4 — ÷ 5

NOTE:
The whole first output is multiplied by 5

Find functions from expressions

Keyword: Operation: a mathematical process

$\frac{f + 5}{3}$ — f add 5 then divide by 3

f → [x 5] → [÷ 3]

NOTE: the difference in the two expressions

$\frac{f}{3} + 5$ — f divided by 3 then add 5

f → [÷ 3] → [+ 5]

Sometimes it helps to try to explain the expression in word — and consider what has happened to the input

Substitution into an expression

Keyword: Evaluate: work out

2(x + 3)

Add 3 to the input then times 2

Put the expression into a function machine

INPUT → [+ 3] → [x 2] → OUTPUT

If x = 10
10 + 3 = 13…. 13 x 2 = 26

Representing functions graphically

Keyword: Linear: the difference between terms increases or decreases by the same value each time

Take the function and generate a sequence 2(x + 3)

INPUT → [+ 3] → [x 2] → OUTPUT

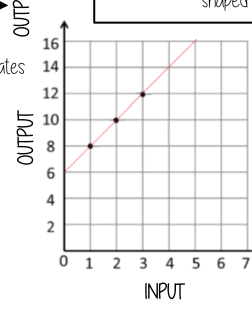
Not all graphs will be linear only those with an integer value for x.
Powers and fractions generate differently shaped graphs.

To represent graphically the input becomes x co-ordinates and the output becomes y co-ordinates

y=2(x + 3)

INPUT (x)	1	2	3
OUTPUT (y)	8	10	12

This becomes a co-ordinate pair (2, 10) to plot on a graph



NOTE:
Because this is a linear graph you can predict other values

Forming a sequence

Keyword: Sequence: items or numbers put in a pre-decided order

2(x + 3)

INPUT	1	2	3
OUTPUT	8	10	12

The substitution is the 'input' value
The OUTPUT becomes the sequence

YEAR 7 – ALGEBRAIC THINKING…

Equality and Equivalence

Equality

Keyword: Equality: two expressions that have the same value

$2 + 14 = 5 + 5 + 6$

16 | 16

"Is equal to"

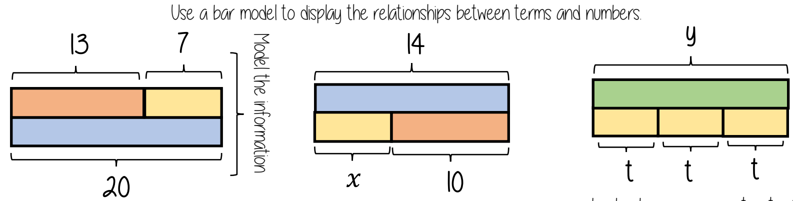
The sum on the left has the same result as the sum on the right

Saying it out loud sometimes helps you to understand equality

Fact Families

Keyword: Equals: represented by '=' symbol – means the same

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



Fact Family

$13 + 7 = 20$
$7 + 13 = 20$
$20 - 7 = 13$
$20 - 13 = 7$

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

$t + t + t = y$
$3 \times t = y$
$3t = y$
$y - t - t = t$
$y \div 3 = t$
$y \div t = 3$

Solve one step equations (+/-)

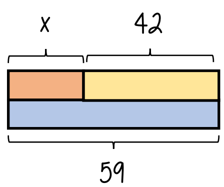
Keyword: Equation: a mathematical statement that two things are equal

There is more to this than just spotting the answer

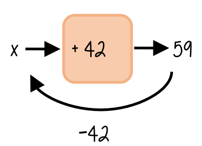
$x + 42 = 59$

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

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



Don't forget you know how to use function machines



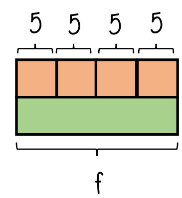
Solve one step equations (x/÷)

Keyword: Solution: the set or value that satisfies the equation

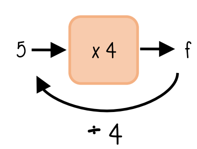
$\frac{f}{4} = 5$

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

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



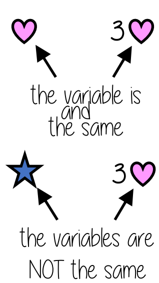
Don't forget you know how to use function machines



Like and unlike terms

Keyword: Like: variables that are the same are 'like'

Like terms are those whose variables are he same



are **like** terms

are **unlike** terms

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

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

Check equivalence by substitution

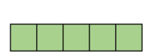
e.g. m = 10

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

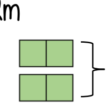
Equivalent expressions

Repeat this with various values for m to check

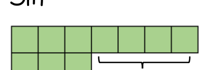
5m



2 x 2m



7m – 3m



Collecting like terms ≡ symbol

Keyword: Term: a single number or variable

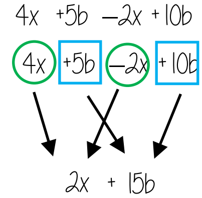
The ≡ symbol means equivalent to.

It is used to identify equivalent expressions

Collecting like terms

Only **like terms** can be combined

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



$2x + 15b$

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

YEAR 7 – PLACE VALUE AND PROPORTION

Ordering integers and decimals

Integer Place Value

Keyword: Place holder: We use 0 as a place holder to show that there are none of a particular place in a number

Billions			Millions			Thousands			Ones		
H	T	O	H	T	O	H	T	O	H	T	O
		3	1	4	8	0	3	3	0	2	9

Placeholder

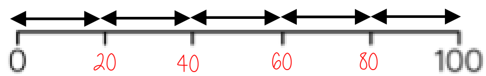
Three billion, one hundred and forty eight million, thirty three thousand and twenty nine

1 billion 1, 000, 000, 000

1 million 1 000, 000

Intervals on a number line

Keywords: Interval: between two points or values

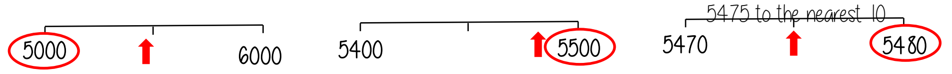


Divide the difference by the number of intervals (gaps).
Eg 100 ÷ 5 = 20

Rounding to the nearest power of ten

Keyword: Approximate: To estimate a number, amount or total often using rounding of numbers to make them easier to calculate with

If the number is halfway between we "round up"



Compare integers using <, >, =, ≠

Keyword: Integer: a whole number that is positive or negative

< less than
> greater than
= equal to
≠ not equal to

Two and a half million = 2 500 000
300 000 000 = Three billion
Six thousand and eighty < 68 000

Range

Keyword: Range: The difference between the largest and smallest numbers in a set

Spread of the values

Difference between the biggest and smallest

3 9 8 12

Range: Biggest value – Smallest value

12 – 3 = 9

Range = 9

Median

Keyword: Median: A measure of central tendency (middle, average) found by putting all the data values in order and finding the middle value of the list

The middle value

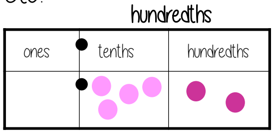
Example 1
4 3 9 8 12
Median: put the in order 3 4 8 9 12
find the middle number 3 4 8 9 12

Example 2
150 154 148
137 160 158
Median: put the in order
137 148 150 154 158 160
There are 2 middle numbers
Find the midpoint
152

Decimals

Keyword: Decimal: a number with a decimal point used to separate ones, tenths, hundredths etc.

Five tenths and two hundredths



We say "nought point five two"

0 ones, 5 tenth and 2 hundredths

0 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.01 + 0.01

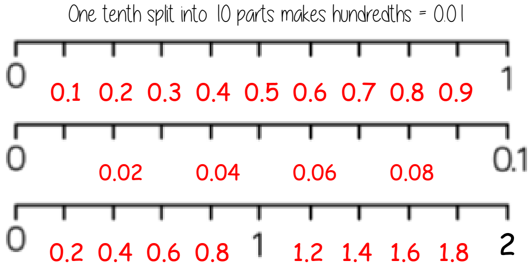
= 0 + 0.5 + 0.02

= 0.52

Decimal intervals on a number line

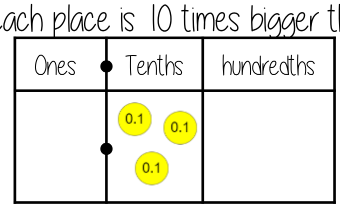
Keyword: Negative: Any number less than zero; written with a minus sign

One whole spit into 10 parts makes tenths = 0.1
One tenth split into 10 parts makes hundredths = 0.01



Comparing decimals

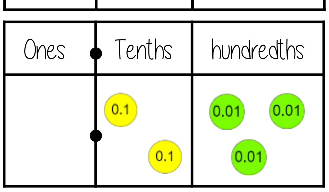
Keyword: Place value: The value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right



Which the largest of 0.3 and 0.23?

$0.3 > 0.23$

"There are more counters in the furthest column to the left"



0.30
0.23

Comparing the values both with the same number of decimal places is another way to compare the number of tenths and hundredths

Round to 1 significant figure

Keyword: Significant figure: A digit that gives meaning to a number. The most significant digit (figure) in an integer is the number on the left. The most significant digit in a decimal fraction is the first non-zero number after the decimal point.

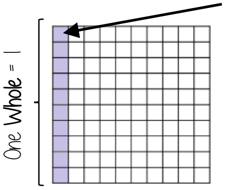
370 to 1 significant figure is 400
37 to 1 significant figure is 40
3.7 to 1 significant figure is 4
0.37 to 1 significant figure is 0.4
0.00000037 to 1 significant figure is 0.0000004

Round to the first non zero number

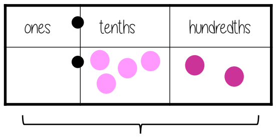
YEAR 7 — PLACE VALUE AND PROPORTION…
FDP equivalence

Tenths and hundredths

Keyword: Tenth: one whole split into 10 equal parts



$= \frac{1}{100} = 0.01$



0 ones, 5 tenth and 2 hundredths

0 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.01 + 0.01

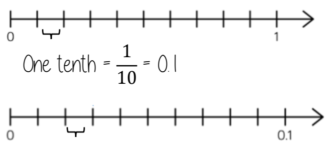
= 0 + 0.5 + 0.02

= 0.52

One tenth (one whole split into 10 equal parts) = $\frac{1}{10}$ = 0.1

On a number line

Keyword: Hundredth: one whole split into 100 equal parts



One whole – split into 10 equal parts

One tenth = $\frac{1}{10}$ = 0.1

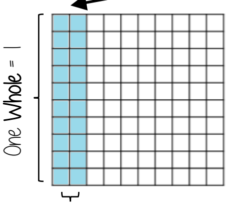
One tenth – split into 10 equal parts

One hundredth = $\frac{1}{100}$ = 0.01

Fifths

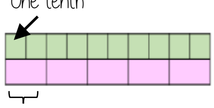
Keyword: Fraction: how many parts of a whole we have

Twenty hundredths



One Whole = 1

One tenth



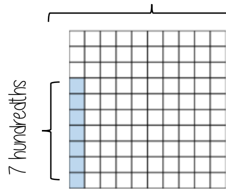
Two tenths = one fifth

One fifth (one whole split into 5 equal parts) = $\frac{1}{5}$ = 0.2

Percentages on a hundred grid

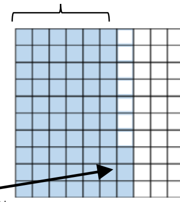
Keyword: Percentage: a proportion of a whole represented as a number between 0 and 100

100% = a whole = 100 hundredths



7 hundredths
7 out of 100
7%

6 tenths



6 tenths and 3 hundredths
63 hundredths
63%

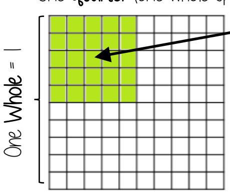
3 hundredths

Quarters

Keyword: Decimal: a number with a decimal point used to separate ones, tenths, hundredths etc.

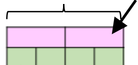
One quarter (one whole split into 4 equal parts) = $\frac{1}{4}$ = 0.25

Twenty five hundredths



One whole

One half = 0.5



One quarter = 0.25

Simple pie charts

Keyword: Sector: a part of a circle between two radius (often referred to as looking like a piece of pie)

A pie chart has 360° so all FDP calculations are out of 360

Split into 10 parts = 10% = 36°

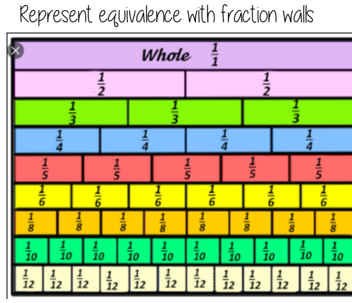
Split into 2 parts = 50% = 180°

Split into 5 parts = 20% = 72°

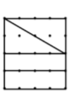
Equivalent fractions

Keyword: Place value: the numerical value that a digit has decided by its position in the number

Represent equivalence with fraction walls

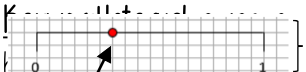


Fractions – on a diagram



The denominator is represented by EQUALLY sized parts – this is split into quarters

Fractions – on a number line



One whole split into 18 equal parts

18 is the **denominator**

This point is at the 6th part

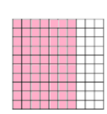
6 is the **numerator**

$\frac{6}{18}$ ← $\frac{3}{9}$ ← $\frac{1}{3}$

Convert FDP

Keyword: Recurring: a decimal that repeats in a given pattern

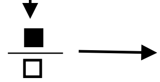
$\frac{70}{100}$ → This also means 70 out of 100 squares →



→ 70 hundredths = 70%

70 "hundredths" = 7 "tenths" 0.7

Using a **calculator**



This will give you the answer in the simplest form

Convert to a decimal

× 100 converts to a percentage

Be careful of recurring decimals

e.g $\frac{1}{3}$ = 0.3333333

= $0.\dot{3}$

The dot above the 3