Knowledge Organiser: Mathematics
Year 7 Autumn 1

Suggested websites: Maths Genie, Save My Exams and Corbett Maths

Big idea: Algebraic thinking

Key skills:

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

- Describe and continue both linear and non-linear sequences
- Explain term to term rules for linear sequence
- Find the missing terms in a linear sequence

Keywords

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

Term: a single number or variable

Position: the place something is located

Rule: instructions that relate two variables

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

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

Difference: the gap between two terms

Arithmetic: a sequence where the difference between the terms is constant

Geometric: a sequence where each term is found by multiplying the previous one by a fixed non zero number

Linear and Non Linear Sequences

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 non-linear Sequences

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?

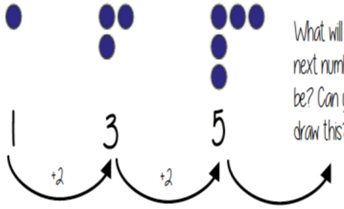
At least 4 terms – two terms only shows one difference not if this difference is constant (a common difference)

How do I continue the sequence?

You continue to repeat the same difference through the next positions in the sequence.

Describe and continue a sequence diagrammatically

Count the number of circles or lines in each image



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

Explain term-to-term rule

How you get from term to term

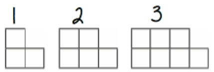
3 8 13 18 23
+5 +5 +5

1. Find the *difference* between each term: 5
2. Always put 'n' next to it (n = term number) 5n
3. Add or subtract to get the first term in the sequence? 5-2 = 3

The n^{th} term is 5n -2

Sequence in a table and graphically

Position: the place in the sequence



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

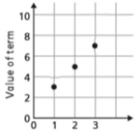
"The term in position 3 has 7 squares"

In a table

Position	1	2	3
Term	3	5	7

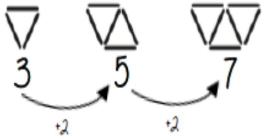
+2 +2

Graphically

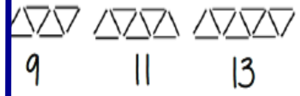


Because the terms increase by the same addition each time this is linear – as seen in the graph

Predict and check terms



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

Big idea: Algebraic thinking

Key skills:

- Be able to use inverse operations and operation families
- Find functions from expressions
- Be able to substitute into single and two-step function machines
- Form sequences from expressions
- Represent functions graphically

Keywords

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

Input: the number/ symbol put into a function

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

Operation: a mathematical process

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

Commutative: the order of the operations do not matter.

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

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

Evaluate: work out

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

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

Single function machines

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

Find functions from expressions

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

Forming a sequence

2(x + 3)

INPUT	1	2	3
OUTPUT	8	10	12

The substitution is the 'input' value

The OUTPUT becomes the sequence

Using letters to represent numbers

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

4 lots of 'y'

20 shared into 'h' number of groups

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Key skills:

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

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

Keywords

Equality: two expressions that have the same value

Equation: a mathematical statement that two things re 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)

Index: the power

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

Like and unlike terms

Like terms are those whose variables are he same

♡ and 3♡ are like terms — the variable is the same

♡ and 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

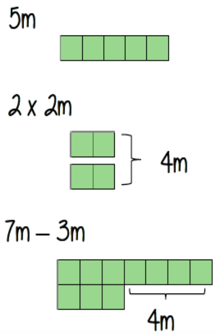
Check equivalence by substitution

e.g. m = 10

5m	2 x 2m	7m – 3m
5 x 10	2 x (2x10)	(7x10) – (3x10)
= 50	= 2 x 20	= 70 – 30
	= 40	= 40

Equivalent expressions

Repeat this with various values for m to check



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

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

$2x + 15b$

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

Representing functions graphically

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

INPUT → + 3 → x 2 → OUTPUT

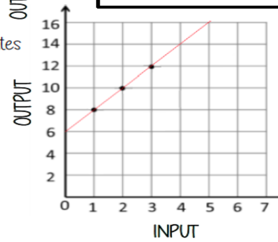
To represent graphically the input becomes x co-ordinates and the output becomes y co-ordinates

$y = 2(x + 3)$

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

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

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



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

Substitution into expressions

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

e.g.: $y - 2$

$= 7 - 2 = 5$

Substitution into an expression

$2(x + 3)$

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

Single function machines (algebra)

INPUT		OUTPUT
a	x 10	10a
3c		30c

÷ 10

To find the input from the output

Use the INVERSE operation

Equality

$2 + 14 = 5 + 5 + 6$

16   16

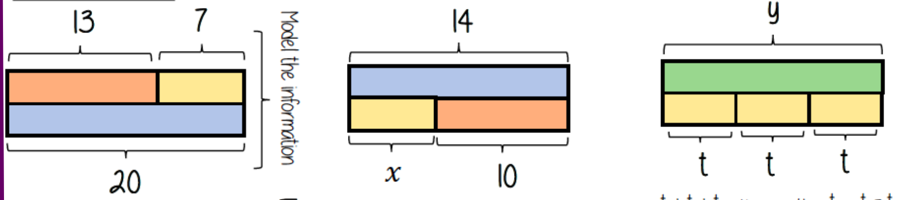
"Is equal to"

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.



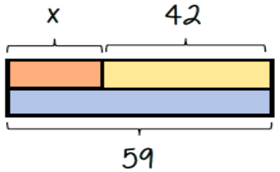
Fact Family

13 + 7 = 20	20 – 7 = 13	x + 10 = 14	14 – 10 = x	t + t + t = y	y – t – t = t
7 + 13 = 20	20 – 13 = 7	10 + x = 14	14 - x = 10	3 x t = y	y ÷ 3 = t
				3t = y	y ÷ t = 3

Solve one step equations (+/–)

There is more to this than just spotting the answer

$x + 42 = 59$



$x + 42 = 59$

$42 + x = 59$

$59 - x = 42$

$59 - 42 = x$

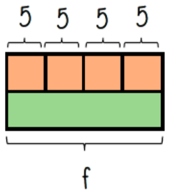
Don't forget you know how to use function machines

x → + 42 → 59

–42

Solve one step equations (x/÷)

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



f ÷ 4 = 5

f ÷ 5 = 4

5 x 4 = f

4 x 5 = f

Don't forget you know how to use function machines

5 → x 4 → f

÷ 4