



Rutherglen High School

Numeracy Methodology Document

2019-2020

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1. Introduction: Rationale

Vision

To have a **consistent approach** to teach and support pupils in Numeracy across the whole school curriculum.

Aims

- **Reinforce** what pupils learn in Maths – using numbers in different contexts.
- Having a **consistent approach** helps to **minimise confusion** for our pupils.
- To help to **build links** in pupils' thinking with existing knowledge/skills.
- **Improve pupils' confidence** in using Maths in different contexts.
- For **staff to be more confident** in teaching and supporting pupils in Numeracy.
- To make staff aware of the **supports** that are available to pupils.

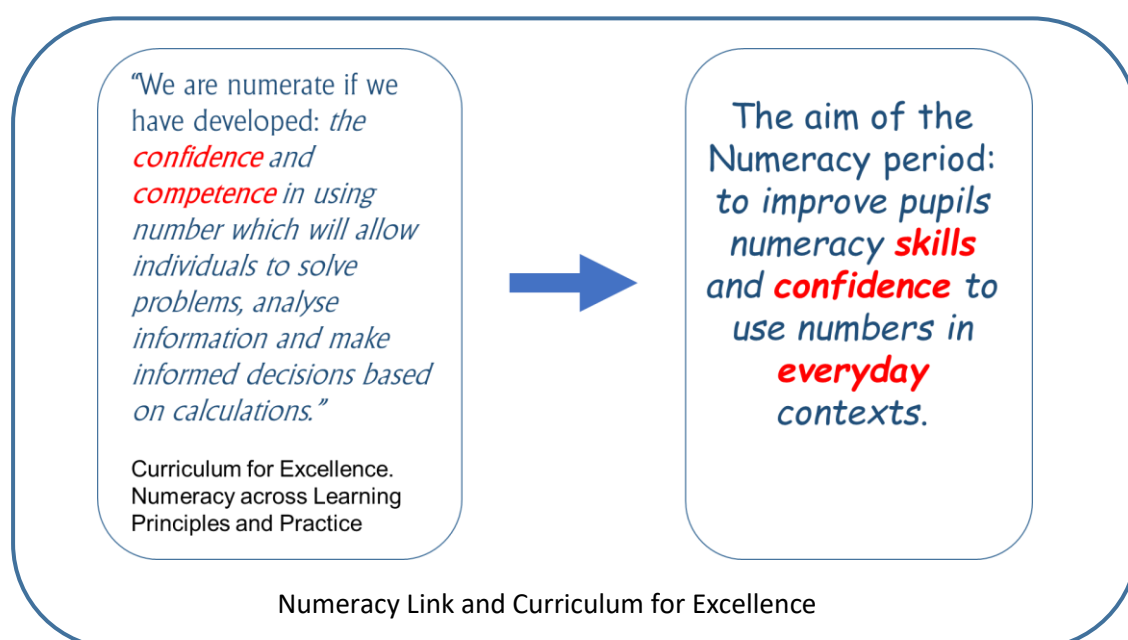
Rutherglen High School Activities

- Numeracy Period – one period a week for the whole school
- RHS Numeracy Methodology Document – this document
- Numeracy resources in all classrooms – see “Resources to Support Pupils Learning”

RHS Numeracy Methodology Document

This document ...

- Presents a **consistent approach** to teaching Numeracy that helps to make it more accessible to pupils with additional support needs.
- Details some of the **teaching methods** used in the Maths department
- Describes some of the ways that **we support the learning** of our pupils in Maths
- Endeavours to incorporate **good practice** in our teaching of Numeracy in the context of a school for pupils with additional support needs.



2. Number Skills

<u>Number Skills</u>	<u>Supports available</u>
Counting <ul style="list-style-type: none"> Counting in 1s, 2s, 5s, 10s, 20s. 	Ruler, Number line, number grid, Numicon, counters, "MathsBase" online, games and activities.
Addition <ul style="list-style-type: none"> Different ways (mental, horizontal, vertical) "carrying" 	
Subtraction <ul style="list-style-type: none"> Different words (eg takeaway, difference), "borrowing" 	
Multiplication <ul style="list-style-type: none"> Basis of further work, doubling, x10, x100 etc 	Times tables grids, counters, "MathsBase" online, games and activities.
Division <ul style="list-style-type: none"> Halving, "sharing", "grouping", $\div 10$, $\div 100$ 	

Number Skills: Counting

You can use anything to practice counting: coins, cubes, counters (opaque or clear), cars, paperclips - anything really!

Number lines, Number Grids

In maths we use number lines up to 20. We also use rulers - we normally use the centimetre scale to count. Also available is a number grid that goes up to 100. The 100 Number Grid is where we are aiming for with the pupils who need support with counting as it's the most flexible of the supports mentioned and allows them to work as independently as they can.

Use of a ruler to count in 2s, 5s, 10s.

Counting in 1s to start with, but more able pupils need to count in 2s, 5s, 10s and 20s as this is great preparation for counting coins and notes in money. You can use a ruler to help count in 2s, 5s, or 10s. So for example, counting in 5s out loud, you point to the ruler whenever you say a number, and when you get to the correct number of 5s on the ruler then the number you just said is the number you want.

Number Skills: The four operations + - x ÷

We aim to help pupils to

- develop the skills (mental and written),
- understand the vocabulary (see the Numeracy dictionary)
- and then how to use their skills in real life situations and problem solving..

+ + + + + + + + + **Adding** + + + + + + + + +

- Words that mean addition include: Add, total, sum, plus, carry, altogether
- Addition can be done in any order, so when adding mentally it is good practice to start with the biggest number.

- - - - - - - - - **Takeaway** - - - - - - - - -

- Words that mean subtraction include: Takeaway, difference, minus, borrow, change (money)
- Biggest number first (usually). Takeaway **cannot** be done in any order.

Some examples of adding and takeaway:

$\begin{array}{r} 597 \\ + 85 \\ \hline 682 \\ \hline 11 \end{array}$	$\begin{array}{r} 51 \\ \cancel{60} \\ - 46 \\ \hline 14 \end{array}$	$\begin{array}{r} 491 \\ \cancel{507} \\ - 458 \\ \hline 049 \end{array}$
Adding with carry	Subtraction with borrow 1	Subtraction with borrow 2

$$\begin{array}{r}
 \overset{1}{\cancel{2}}\overset{9}{\cancel{0}}\overset{9}{\cancel{0}}\overset{1}{\cancel{0}} \\
 - 589 \\
 \hline
 1411
 \end{array}$$

Subtraction with borrow 3

$$\begin{array}{r}
 \overset{0}{\cancel{1}}\overset{9}{\cancel{0}}\overset{9}{\cancel{0}}\overset{1}{\cancel{0}} \\
 - \pounds 7.63 \\
 \hline
 \pounds 2.37
 \end{array}$$

Subtraction with borrow 4

× × × × × × × × × **Multiply** × × × × × × × × ×

- Words that mean multiplication include: “Times”, “doubling”, “trebling”, “total”, “altogether”
- Multiplication can be thought of as adding many times
- Like addition it can be done in any order
- Times tables should be learnt if possible. (Some pupils really struggle with this, however, so the time stable grid is available for them to use) This is because mental work is much quicker, division is easier and fractions make more sense when times tables are remembered rather than having to be looked up.

÷ ÷ ÷ ÷ ÷ ÷ ÷ ÷ ÷ **Divide** ÷ ÷ ÷ ÷ ÷ ÷ ÷ ÷ ÷

- Division is the hardest concept and skill to learn
- The main word to use to describe division is “sharing”. Other words than can be used are – “grouping”, “halving”, “splitting”
- Biggest number first (usually). Division **cannot** be done in any order.

Some examples of multiply and divide:

Multiplying with carry:

$$\begin{array}{r}
 734 \\
 \times 5 \\
 \hline
 3670 \\
 \hline
 12
 \end{array}$$

Rule: To multiply a whole number by 100, put on 2 zeros at the end.

$$83 \times 100 = 8300$$

Rule: To divide a whole number (with a 0 on the end) by 10, remove 1 zero from the end

$$760 \div 10 = 76$$

Rule: To multiply a number like 20, 50, put a zero at the end and then multiply by the digit 2, 5 etc..

$$\begin{array}{r} 597 \\ \times 20 \\ \hline 11940 \\ \hline 11 \end{array}$$

Rule: To multiply a number like 200, 500, put two zeros at the end and then multiply by the digit 2, 5 etc..

$$\begin{array}{r} 597 \\ \times 200 \\ \hline 119400 \\ \hline 11 \end{array}$$

Division: without a remainder

$$\begin{array}{r} 1140 \\ 3 \overline{) 3420} \end{array}$$

Division: with a remainder

$$\begin{array}{r} 1238 \text{ r } 1 \\ 6 \overline{) 7429} \end{array}$$

3. Numbers in Context





<u>Numbers in context</u>	<u>Supports available</u>
Tell the time <ul style="list-style-type: none"> • Does 1200 mean noon or midnight? 	→ Clocks, timers, Calendars, "Teaching Time" online, games and activities
Handle money <ul style="list-style-type: none"> • Counting coins, working out change, estimating 	→ Fake money, "Teaching Money" online, games and activities
Measuring <ul style="list-style-type: none"> • What are we measuring? • What do we use to measure? • What units do we use? • Length/height/distance, Weight, Volume/Capacity, Temperature 	} → Measuring equipment, Games, online games

Numbers in Context: Telling the Time

There are four different ways that we tell the time.

- Clock face (analogue time)
- Words (quarter past etc)
- Digital time
- 24 hour time (similar to digital)

We teach all four in school, usually leaving 24 hour until they are confident changing to/from the other three. Some examples ...

Clock face (Analogue)				
Words	5 o'clock in the morning	Half past 1 in the afternoon	Quarter past 6 in the evening	Quarter to 8 in the morning
Digital	5.00am	1.30pm	6.15pm	7.45am
24 hour digital	0500	1330	1815	0745

Telling the Time: Common issues:

- 1200 (24 hour time) = 12.00 pm noon
- 0000 (24 hour time) = 12.00 am midnight
 - Note that this is sometimes shown as 2400, which isn't strictly correct. Should just be 0000 for midnight in 24 hour time
- We teach in this order – “o'clock”, “half past” then “quarter past” then “quarter to”.
- “To the hour” is more difficult to understand than “past”.
- The “Teaching Time” online school resource has great worksheets and games to help support pupils' learning.

Time: The calendar

- Days of the week
- Months of the year
- Seasons

These are facts that simply have to be remembered so we use the following: worksheets, colouring sheets, posters, quizzes, word searches, songs and rhymes from the internet. Also jigsaws and games.

Time: Numbers of hours, days, weeks, months

There are 60 seconds in 1 minute.

There are 60 minutes in 1 hour.

There are 24 hours in 1 day.

There are 7 days in 1 week.

There are 4 weeks in 1 month.

There are 12 months in 1 year.

There are 52 weeks in 1 year.

There are 365 days in 1 year.

Two ways to memorise the number of days in each month:

Days in Month: Knuckle Method

A knuckle is "31 days",
and in between each
knuckle it isn't.

And where your hands
meet, the two knuckles
are "July, August", which
both have 31 days. The
last knuckle isn't used.

Days in months: poem

30 days has September,
April, June and November.

All the rest have 31
Except February alone,
Which has 28 days clear
And 29 in each leap year.

Numbers in context: Money

- Grouping coins to help counting a total amount
- Using fake money helps a lot, but it's good to have examples of real money too
- Changing from “pence” to “pounds and pence”
 - 132p = £1.32
 - there is no need for a “p” if you put a “£”, ie £1.32p is wrong
- Set up a context for using money, eg
 - Shop with items to pay for, Café menu, working out change
- The “Teaching Money” online school resource has great worksheets and games to help support pupils' learning.

The “Two taps” method is a useful start to counting 1p and 2p coins...

- To count 1p and 2ps you can use tapping.
- One tap for 1p and 2 taps for 2p
- Example ...



- Each time you say a number tap the coin the correct number of times
- Some pupils find it easier to put small marks that they can go back and count up

Numbers in context: Measure - Length

What are we measuring?

- Length, distance, height, breadth, width, depth

What do we use to measure?

- Ruler, tape measure, trundle wheel, micrometer, mileometer (odometer)

What units do we use?

- Millimeters (mm), centimeters (cm), meters (m), kilometres (km) (also inches, feet, yards, miles)

Need to think about what is the best units and best instrument to use to measure a particular thing.

Item	Units	Alternative units	Use a
Pencil	cm or mm	inches	ruler
Whiteboard	cm or m	feet and/or inches	tape measure
A person's height	cm or m	feet and/or inches	height measurer
A person's waist	cm	inches	tape measure
Head of a nail	mm	inches	micrometer
Corridor	m	feet and yards	trundle wheel
Distance to Hamilton	km	miles	odometer

How to use a ruler

To measure the length of the pencil:

- Place the ruler against the pencil
- With one end of the pencil in line with the zero on the ruler
- Read from the zero:
 - 8.5cm
 - 85mm
 - 8cm and 5 mm
 - All of these are correct



Numbers in context: Measure - Weight

What are we measuring?

- Weight, how heavy something is

What do we use to measure?

- Kitchen scales, bathroom scales, balances, all of which can be either analogue or digital

What units do we use?

- grammes (g), kilogrammes (kg) (also stones and pounds)

Need to think about what is the best units and best instrument to use to measure a particular thing.

Item	Units	Alternative units	Use
Butter	g	ounces	Kitchen scales
Flour	g or kg	ounces, pounds	Kitchen scales
A person's weight	kg	stones, pounds	Bathroom scales
A cars weight	kg, tonne	ton	Weigh machine

Measure: How to use a set of scales or balances

Analogue scales

- Before weighing:
 - Always zero the scales using the knob at the back
 - Be careful reading the scale to get the correct number and units.



Digital scales

- Before weighing:
 - Always zero the scales by pressing the zero button
 - Check scales are in the correct mode (usually grammes in Home Economics)



Measure: Checking the mode on digital scales



ounces



ounces



grammes



grammes



pounds and ounces



millilitres

Numbers in context: Measure – Volume

What are we measuring?

- Volume, capacity, the amount of liquid like water or milk for example

What do we use to measure?

- Measuring jug, measuring spoons (eg for measuring spices in Home Economics)

What units do we use?

- Millilitres (ml), cubic centimetres (cm³), Litres, (l) (also fluid ounces, gallons)
- Note that 1 ml = 1 cm³

Need to think about what is the best units and best instrument to use to measure a particular thing.

Item	Units	Alternative units	Use
spices	ml	cm ³ , fluid ounces	Measuring spoons
Volume of a cup	ml	cm ³ , fluid ounces	Measuring jug
Vase	ml, l	cm ³ , fluid ounces, pint	Measuring jug,
Bath	l	pint, gallon	Bucket
Swimming pool	l	gallon	V=lengthxwidthxdepth

Numbers in context: Measure – Temperature

What are we measuring?

- Oven temperature, weather

What do we use to measure?

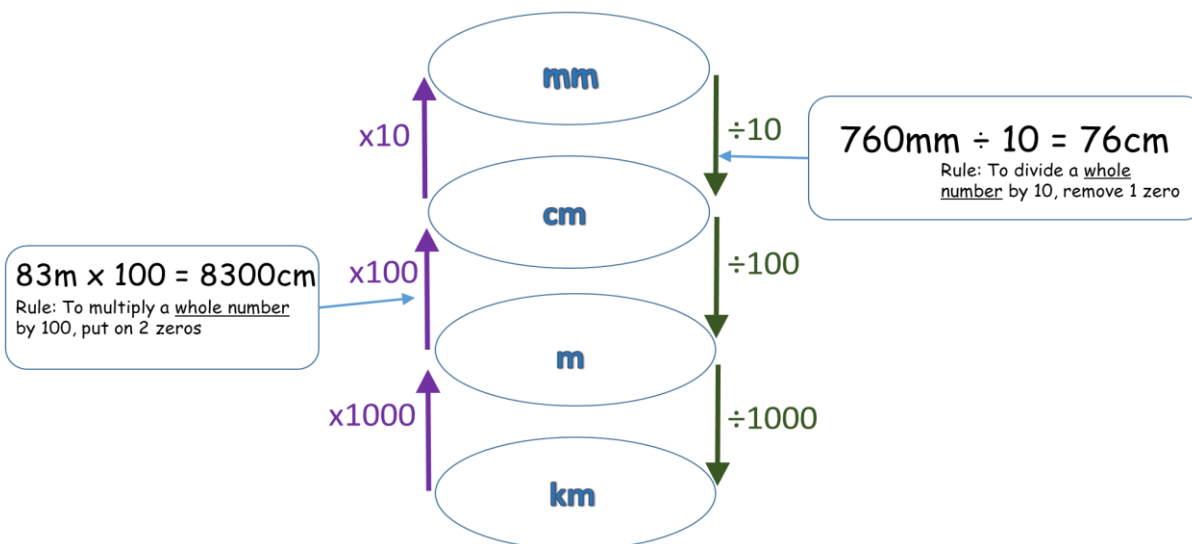
- Thermometer, thermostat,

What units do we use?

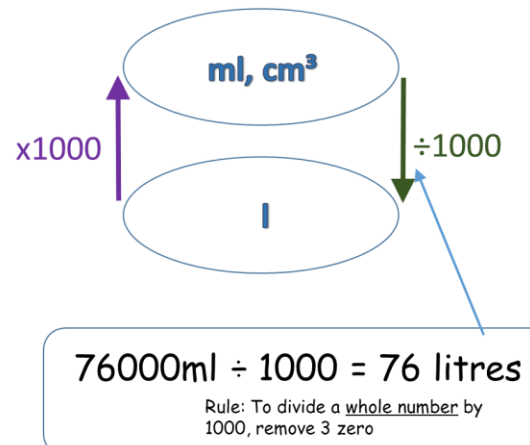
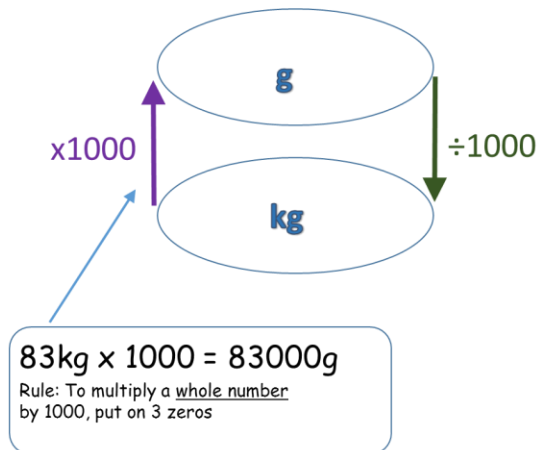
- Degrees Celsius (°C) (we also speak about degrees Fahrenheit (°F))
- Measuring temperature is one application of negative numbers

Numbers in context: Measure conversions

Measure: conversions - Length



Measure: conversions - weight, volume



4. Further Number work

Further Number work

Supports available

Using a calculator

- Problem solving
- Assessments: pupils are allowed to use a calculator in the National 2 and National 3 unit assessments and in all except one of the National 4 units.

Calculators

Fractions, Decimals, Percentages

- Simple fractions
- How to convert between them

Games, cards,
online games

Further Number Work: Using a calculator

It's really important that pupils know how to use a calculator.

- For calculating wages
- Costs of bills
- Shopping lists

National exams: National 2, National 3 and National 4 allow calculators in all the assessments. National 4 has a calculator and a non-calculator exam paper in the final unit.

Some pupils need a calculator with bigger buttons

Pupils should be encouraged to:

- Double check the answers on the calculator, especially for longish calculations
- Think if the answer makes sense in the context

Dividing

$$\begin{array}{r} 114 \\ 3 \overline{) 342} \end{array}$$

... means 342 divided by 3 ...

... so on a calculator write it this way ...

$$3 \ 4 \ 2 \ \div \ 3 \ =$$

Money

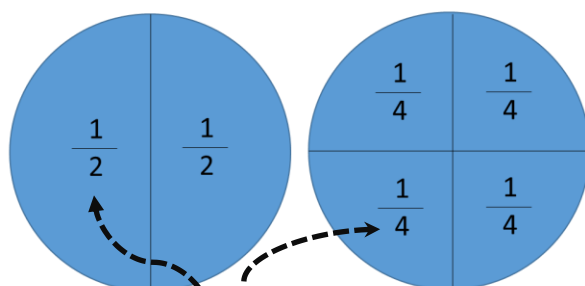
Pupils need to be careful when interpreting the answers on the calculator when it represents money. Examples:

- 1.2 = £1.20
- 1.02 = £1.02
- 10 = £10.00
- 0.5 = £0.50 or 50p
- 0.05 = 5p

Further Number Work: Decimals, Fractions, Percentages

Introduction to fractions

To understand the fractions terminology - use "pizza" or "chocolate" split up into a number of equal-sized bits.



The bottom number shows the number of bits it's been split up into.

$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$
$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$
$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$
$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$

$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$

Simple Fractions:

Half–

- The obvious way to take a half is to divide by 2, which is fine as long as pupil knows the 2 times table.
- If they understand how to use a times table grid, then they can still use this method and use the grid instead of doing it mentally.
- If it's things that you can count, then they can be put into two equal groups "one to you, one to me .." and count how many is in each group.
- Aim to get to the stage where they can mentally know that half of 2 is 1, half of 4 is 2 etc

Quarter –

- To work out a quarter mentally - take a half then take a half again
- If the pupil knows the times tables then divide by 4, or use a grid.
- It's also possible to put items into four equal groups, one to you, etc This only works for things you can count.

Decimals:

- **Adding, subtracting, dividing**
 - Make sure that the decimal points are lined up
 - Then work as normal
- **Multiplying**
 - Multiply ignoring the decimal point
 - At the end add up the number of numbers after the decimal point and that should be the same after the decimal point in the answer.

$$\begin{array}{r}
 7.34 \\
 \times 5 \\
 \hline
 36.70 \\
 \hline
 12
 \end{array}$$

Converting between Percentages, fractions and Decimals:

Percentage	Fraction	Decimal
1%	$\frac{1}{100}$	0.01
10%	$\frac{1}{10}$	0.1
20%	$\frac{1}{5}$	0.2
25%	$\frac{1}{4}$	0.25
50%	$\frac{1}{2}$	0.5
75%	$\frac{3}{4}$	0.75
100%	1	1

5. Number Dictionary

The Numeracy Dictionary gives basic definitions for some of the more common terms used in Maths and Numeracy.

Addition (+)	To combine numbers to get one number (sum, total, plus)
After	The numbers to the right on the number line. Bigger numbers.
am	From 12 midnight to 12 noon. Morning time.
Average	Add up all the numbers to get a total and divide this total by the amount of numbers. Example ..
Before	The numbers to the left on the number line, the smaller numbers
Calculate	Find the answer to a problem usually using the one or more of the 4 operations. (does not mean you've to use a calculator!)
Data	A collection of information like numbers, measures, facts, tables, graphs.
Difference (-)	The amount between two numbers (takeaway, subtract)
Division (÷)	Share a number into equal amounts, or split something into equal parts
Double	Multiply by 2 or add a number to itself
Equals (=)	Is the same amount as something
Estimate	To get a rough answer or a guess. Often by rounding numbers.
Even Number	A number that can be divided into 2, or halved (ends in 0, 2, 4, 6, or 8)
Fraction	A part of a whole – written like this: $\frac{1}{2}$
Least	The lowest number in a group
Less than (<)	A number is smaller or lower than another
Maximum	The highest or largest in a group of numbers
Mean	The average of a group of numbers
Minimum	The smallest or lowest in a group
Minus (-)	To takeaway or subtract
More than (>)	One number is larger than another

Most	The largest or highest number in a group
Multiply (x)	Multiply is like adding a number many times. Use times tables or grid
Odd number	A number that can't be divided by 2. Ends in 1,3,5,7, or 9
operations	The four basic ones are add, takeaway, multiply, divide
plus	To add numbers together
p.m.	From 12noon to 12 midnight – afternoon and evening
Remainder	The amount left over when dividing a number
Rounding	To make a number bigger or smaller. Good for estimating. Example ...
Share	To divide into equal sized groups
Subtract (-)	To take one number off another number (takeaway)
Sum	You add numbers together to get the sum
Takeaway (-)	To take one number off another number (subtract, difference)
Total	You add numbers together to get the total

6. Useful websites and resources

Numeracy Period On line activities

This is a list of some of the websites that you might find useful to help pupils with their numeracy skills.

Link	Topic	Comments
http://www.bbc.co.uk/skillswise/maths/games	Various - number, money, time, measure. Also Literacy.	This is good for older pupils as it is aimed at adult learners with poor numeracy and literacy skills.
https://www.topmarks.co.uk/maths-games	Various topics and stages	Really good selection of games for all abilities starting at a very basic level and building up in difficulty. Don't go too strictly by the ages at the top of the tabs - our pupils are more likely to be operating at a younger age that stated.
https://www.topmarks.co.uk/maths-games/hit-the-button	Number processes* (also halving/doubling)	Good for practicing number skills. Activities are timed, so help pupils speed up their mental work
http://www.arcademics.com/games/meteor/meteor.html	Multiplication	Good for practicing multiplication skills
http://www.arcademics.com/games/demolition/demolition.html	Division	Good for practicing division skills
http://www.arcademics.com/games/alien/alien.html	Addition	Good for practicing mental addition
http://www.arcademics.com/games/mission/mission.html	Subtraction	Good for practicing mental subtraction
https://www.varsitytutors.com/plusmath/games	Number processes* (bingo, memory games, hidden picture)	Good for practicing mental maths.
http://www.playkidsgames.com/games/mathfact/mathFact.htm	Number processes*	Good for more able pupils
http://www.transum.org/Software/Game/	Various	A variety of different games and activities

https://www.mathsisfun.com/games/math-match-game.html	Various (includes problem solving)	Good for more able pupils
http://coolsciencelab.com/ https://www.mathplayground.com/games.html http://www.arcademics.com/ https://www.coolmath4kids.com	Lots of activities to choose from. (American sites)	All classes

* Number processes covers addition, subtraction, multiplication, division

Numeracy Period Worksheets

Link	Topic	Age/stage
http://www.mathgametime.com/math-worksheets	Various	All classes
http://www.worksheetfun.com/ This is a good site.	Various	All classes
https://www.mathsisfun.com/worksheets/index.php	Various	All classes
http://www.kidzone.ws/math/index.htm	Various	All classes