WAGGA WAGGA HIGH SCHOOL

Learning together for the future

Numeracy Across The Curriculum

The Mathematics department at Wagga Wagga High School have produced this booklet to help parents and carers to support their children with their homework or classwork where it involves numeracy. Many subjects involve the use of Mathematics – such as science, design and technology, geography, computing.

Numeracy is an important life skill. Being numerate allows us to function responsibly in everyday life. As we get older, being numerate becomes more important to hold down a good job as well as taking on responsibilities as a householder – paying the bills, finding the right deals etc.

This booklet is designed to show you the basics of numeracy and how we teach it at WWHS. We will all have been taught different ways of doing a particular mathematical calculation and sometimes a barrier to parents helping their children with homework than involves mathematics is that parents are either unfamiliar with or have forgotten the methods used.

If you have any questions or concerns with numeracy or Mathematics, please contact me in school using my email marcus.chittick4@det.nsw.edu.au

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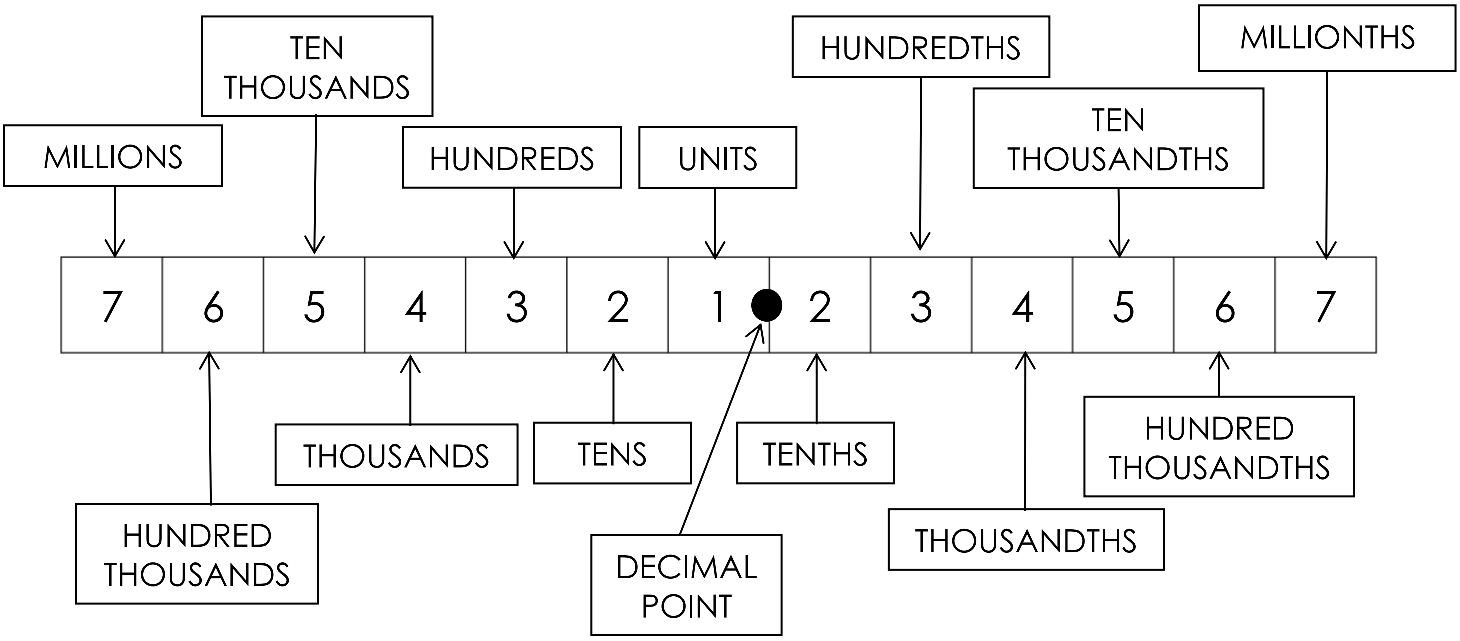
Place Value

Pupils need to understand what each digit of a number actually means. This allows them to understand what the numbers are telling them and allows them to approximate and do further calculations in a much more efficient fashion.

When someone sees a number written in digits, they need to be able to say or spell the number and vice versa.



To read a large whole number (an integer), break the number up into groups of three digits from right hand side and then read it in groups from the left…

74194 ⟶ 74,194 ⟶ Seventy four thousand, one hundred and ninety four

9301049 ⟶ 9,301,049 ⟶ Nine million, three hundred and one thousand, and forty nine

Spelling numbers….

1	One	11	Eleven	30	Thirty
2	Two	12	Twelve	40	Forty
3	Three	13	Thirteen	50	Fifty
4	Four	14	Fourteen	60	Sixty
5	Five	15	Fifteen	70	Seventy
6	Six	16	Sixteen	80	Eighty
7	Seven	17	Seventeen	90	Ninety
8	Eight	18	Eighteen	100	One hundred
9	Nine	19	Nineteen	1000	One thousand
10	Ten	20	Twenty	1,000,000	One million
				0	Zero or nought

Times Tables

Knowing your times tables is so important.
Our memory has two distinct parts – working (or short term) memory and long term memory.
Long term memory is limitless and is where we store things we know or have become habits. Working memory is where we do the mental work for things that aren't familiar. For example if you were asked to remember seven random words in a specific order, this is where you would store these words. The problem with working memory is that it is quite small and things don't stay there for long.
When you are doing calculations, if you don't know your times tables (in other words, they aren't stored in your long term memory) you have to use your precious working memory to try to work it out. If you know your tables and are fluent with them you don't use up your working memory with them and it allows you to do calculations more quickly and more accurately.

Pupils are expected to know their times tables up to 12 x 12. One thing a parent could do regularly with their children is test them on their tables.

Below is a times tables grid we often use with students who haven't as yet memorised them…

×	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

There is a really good, free app and programme you can use to regularly practice times tables.
It can be downloaded from

https://completemaths.com/teaching-tools/digital-manipulatives/timestables

Addition, Subtraction, Multiplication, Division

We teach the basic column methods for addition and subtraction of large numbers. We try to get students to use partition of numbers to help them to mentally add and subtract numbers and this skill can work well with multiplication as well.

Addition and subtraction

By partition…

Example: 77 + 28

Break the 77 into a 70 and a 7
Break the 28 into a 20 and an 8
70 + 20 = 90
7 + 8 = 15
90 + 15 = 105

93 – 48

Think of the 48 as 50
Subtract the 50 from 93 to give 43
Now add back on the 2 extra to give 45

Using columns…

Example 5293 + 924

	5	2	8	3
	+ 1	9 1	2	4
	6	2	0	7

1) 3 + 4 = 7

2) 8 + 2 = 10
Write the units (0) and carry the tens (1) into the next column

3) 2 + 9= 11 plus the carry gives 12
Write the units (2) and carry the tens (1) into the next column

4) 5 + 0= 5 plus the carry gives 6

Example 3138 – 1445

	3	1	3	8
–	1 1	4 1	4	5
	2	-3	-1	3

1) 8 – 5 = 3
This means 3 units

2) 3 – 4 = -1
This means subtract 1 ten (as we are in the 10s column)

3) 1 – 4 = -3
This means subtract 3 hundreds as we are in the 100s column

4) 3 – 1 = 2
This means 2 thousands.

5) 2000 – 300 = 1700
1700 – 10 = 1690
1690 + 3 = **1693**

Multiplication

We teach the column method for multiplication where we set the question out in the same way we did for addition and subtraction…

Example 94 x 28

		9	4
	x	2	8
	7	5_3	2
1_1	8_1	8	0
2	6	3	2

We are doing 94 x 8 on this row

We are doing 94 x 20 on this row so we add a 0 at the end because we are multiplying by a tens digit

1) 4 x 8 = 32 – write down the units (2) carry the tens (3). Then 8 x 9 = 72 + carry of 3 = 75.

2) Write a 0 first because we are multiplying by a 10s digit. Then 2 x 4 = 8. Then 2 x 9 = 18

3) Add the two rows together

Division

Pupils use two types of division – short and long. Short division is often used when you are dividing a number by a number that is small (12 or below) and you know its times table.

In both methods you but the number of the left of the divide sign (the **dividend**) inside the 'bus-stop' and the number of the right (the **divisor**) outside. The answer is called the **quotient**.

Example 1736 ÷ 8

	0	2	1	7
8	1	$^{1}7$	$^{1}3$	$^{5}6$

Start on the left hand side of the number
1) 8 doesn't go into 1, so put a 0 in the answer line (top) and carry the 1 into the next column. As it is 10x bigger it becomes a 10s digit in the next column to give 17

2) 8 goes into 17 twice with a remainder of 1. Write 2 in the answer line and carry the 1 into the next column (to give 13)

3) 8 goes into 13 once with a remainder of 5. Write 1 in the answer line and carry the 5 into the next column (to give 56)

4) 8 goes into 56 seven times exactly. Write 7 in the answer line.
The answer is 217

Long division is particularly useful when dividing by a large number.
It is also a useful technique to know as it is used in more advance mathematical work.

You will need to know the times table of the divisor up to 9 times. You probably won't know this automatically so it is useful to write to down on the side – just keep adding the divisor on each time.

Example   4048 ÷ 23

23 times table:
(Add 20 then add 3)
1) 23
2) 46
3) 69
4) 92
5) 115
6) 138
7) 161
8) 184
9) 207

			1	7	6
2	3	4	0	4	8
		2	3		
		1	7	4	
		1	6	1	
			1	3	8
			1	3	8
					0

1) 23 doesn't go into 4, so include the next digit to make 40. 23 does go into 40 once. Write 1 in the answer line. 1x23=23 which is written underneath and then subtracted from 40 to give 17

2) Bring the next digit down (the 4) to make 174. 23 goes into 174 seven times, so write 7 in the answer line.
7 x 23 = 161 which is written underneath and subtracted from 174 to give 13

3) Bring the final digit down, the 8, to make 138. 23 goes into 138 six times exactly, so write 6 in the answer line.
There is no remainder and we've no more digits to bring down so the answer is 176.

Estimating

Being able to estimate a quantity or calculation is a particularly important skill to have. Imagine estimating the size of your floor so you can buy the right amount of carpet.

Students need to be able to approximate numbers and estimate calculations.

They need to know three ways of estimating numbers:

- Rounding to a particular place value
- Rounding to a particular number of decimal places (d.p.)
- Rounding to a particular number of significant figures (s.f.)

The difference between the three types is how the digit to be rounded is located. The method of rounding is the same – once you have located the digit, look at the next digit – if it is 5 or above, the digit to be rounded goes up 1. If it is less than 5 the digit to be rounded stays as it was.

Rounding to place value

Example: Round 8395 to (a) the nearest thousand (b) the nearest ten

The thousands digit is the 8 so this will either stay as an 8 or round up to a 9.

Th	H	T	U
8	3	9	5
8	0	0	0

The next digit is a 3. This is less than 5 so the 8 does not round up.

The 8 stays as it is and the rest of the digits after this go to 0.

The tens digit is the 9 so this will either stay as an 9 or round up to 10.

Th	H	T	U
8	3	9	5
8	4	0	0

The next digit is a 5. This is 5 or above so the 9 rounds up to 10. A column can't hold 10 or higher so write a 0 and carry the tens digit into the next column to turn the 3 into a 4

This gives 840 and the units digit goes to a 0 as well to give 8400.

Rounding to decimal places

You start counting decimal places from the first digit after the decimal point.

	1st d.p,	**2nd d.p,**	**3rd d.p,**	**4th d.p,**	**5th d.p,**
9 ●	1	2	3	4	5

Example Round 3.2382 to 2 decimal places (2 d.p.)

3 ●	2	3	8	2
3 ●	2	4		

The 2nd d.p. is the 3. This will either stay as a 3 or round up to a 4.

The next digit is an 8 – this is 5 or higher so the 3 rounds up to a 4.

Everything after the digit that has been rounded is ignored – the answer is 3.24

Significant figures

The first significant figure (s.f.) is the first non-zero digit. The 2nd, 3rd, 4th etc s.f. can be a 0. You start counting from the 1st significant figure.

Example Round (a) 52911 to 2 s.f. (b) 0.0861 to 1 s.f.

The 1st s.f. is the 5, the 2nd s.f. is the 2. This will either stay as a 2 or round up to a 3

5	2	9	1	1
5	3	0	0	0

The next digit is an 9 – this is 5 or higher so the 2 rounds up to a 3.

Everything after the digit that has been rounded up to where the decimal point would be changes to 0.

The 1st s.f. cannot be a 0 so the 1st s.f. is the 8. This will either stay as an 8 or round up to 9

0 ●	0	8	6	1
0 ●	0	9		

The next digit is an 9 – this is 5 or higher so the 2 rounds up to a 3.

The digit being rounded is after the decimal point so everything after it is ignored.

Estimating calculations

When we estimate calculations we usually round each number involved in the calculation to 1 significant figure.

This means that the numbers are much easier to do mental calculations with.

Example   Estimate 481.3 x 18.34

481.3: The 1st s.f. is the 4 – the next digit is 8 which means round the 4 up to 5.
So 481.3 to 1 significant figure is 500

18.34: The 1st s.f. is the 1 – the next digit is 8 which means round the 1 up to 2.
So 18.34 to 1 significant figure is 20

So 481.3 x 18.34 is approximately 500 x 20.

To calculate 500 x 20 in your head quickly:
Ignore the 0's first   This gives 5 x 2 = 10
We ignored 3 0's which we need to add on the end.
So 500 x 20 = 10000

Example   Estimate 4192 ÷ 4.93

4192: The 1st s.f. is the 4 – the next digit is 1 which means leave the 4 alone.
So 4192 to 1 significant figure is 4000

4.93: The 1st s.f. is the 4 – the next digit is 9 which means round the 4 up to 5.
So 4.93 to 1 significant figure is 5

So 4192 ÷ 4.93 is approximately 4000 ÷ 5.

4 ÷ 5 isn't a whole number, but 40 ÷ 5 is 8. We haven't dealt with the extra 2 0's so we tag these on to the end to give 800.

Order of Operations

What do you think the answer to 4 + 3 x 5 is??

If you think the answer is 35 you don't understand the order you do operations.

An operation in mathematics is a mathematical process such as adding or multiplying. When you have a calculation involving a variety of operations, you have to perform the operations in a particular order.

There is a mnemonic to help remember the order:

Brackets
Indices
Division
Multiplication
Addition
Subtraction

(Sometimes the mnemonic BODMAS is used where the O is the 2nd letter of powers)

So brackets take priority over anything else – if you see brackets whatever operation(s) is inside them must be performed first – then indices (powers) are next and so on.

In our calculation 4 + 3 x 5 if you got 35 you did the 4 + 3 first (because you performed the calculation the way you read it – from left to right).

There are no brackets or indices or division but there is a multiplication so this must be done first – 3 x 5 = 15.
Then we do the addition – 4 + 15 = 19.

Example *What is the value of* $5 \times (12 - 5) + 3^2$

Brackets come first $12 - 5 = 7$
So the calculation becomes $5 \times 7 + 3^2$

Indices come next $3^2 = 3 \times 3 = 9$
So the calculation becomes $5 \times 7 + 9$

Next comes multiplication $5 \times 7 = 35$
So the calculation becomes 35 + 9 **= 44**

Fractions

Students need to know about fractions – what one is, how to find the fraction of a quantity as well as add, subtract, multiply and divide fractions.
A fraction is a part of a whole. The words associated with a fraction are:

$$\text{Vinculum} \longrightarrow \frac{3 \;\longleftarrow\; \text{Numerator}}{5 \;\longleftarrow\; \text{Denominator}}$$

Finding the fraction of a quantity

To find the fraction of a quantity:

- Divide by the denominator
- Multiply by the numerator

Example *Find* $\frac{4}{9}$ *of \$108*

Divide by the denominator: \$108 ÷ 9 = \$12
Multiply by the numerator: \$12 x 4 **= \$48**

Adding and subtracting fractions

You can only add or subtract fractions when they have the same denominators

Example *Find* $\frac{3}{7}+\frac{2}{7}$

These have the same denominators so we just add their numerators – we don't add or subtract the denominators

$$\frac{3}{7}+\frac{2}{7} = \frac{3+2}{7} = \frac{5}{7}$$

Example *Find* $\frac{6}{7}-\frac{3}{5}$

This time they have different denominators, so we need to find a common denominator and alter both fractions so they have this denominator.
The denominators are 7 and 5 so we need a number which is a multiple of both 7 and 5. The first number which fits this description is 35. So we change both fractions so they have a denominator of 35

$$\frac{6}{7} \overset{\times 5}{\underset{\times 5}{=}} \frac{30}{35} \qquad \frac{3}{5} \overset{\times 7}{\underset{\times 7}{=}} \frac{21}{35}$$

Now we can add or subtract the fractions like we did before…

$$\frac{6}{7}-\frac{3}{5} = \frac{30}{35}-\frac{21}{35} = \frac{30-21}{35} = \boldsymbol{\frac{9}{35}}$$

Multiplying fractions

Multiplying fractions is easy

- Multiply the numerators to get the new numerator
- Multiply the denominators to get the new denominator

Find $\frac{5}{8} \times \frac{3}{11}$

$$\frac{5}{8} \times \frac{3}{11} = \frac{5 \times 3}{8 \times 11} = \frac{15}{88}$$

Dividing fractions

There is another mnemonic to help you to divide fractions…

Keep the first fraction as it is

Flip the second fraction upside down

Change the ÷ sign to a x sign

Example $\frac{11}{12} \div \frac{3}{7}$

$$\frac{11}{12} \div \frac{3}{7} = \frac{11}{12} \times \frac{7}{3} = \frac{11 \times 7}{12 \times 3} = \frac{77}{36}$$

1) **K**eep the first fraction the same

2) **F**lip the 2nd fraction upside down

3) **C**hange the ÷ sign to a x sign

Percentages

Percentages are widely used across a variety of subjects in school but are also common in real life. A percentage is a fraction of one hundred (the word percent comes from the Latin meaning "by the hundred").

How to work out some common percentages mentally should be known in a way times tables are know – they can also be used in combination to work out more challenging percentages.

Percent	How to work it out
50%	Halve the quantity
25%	Quarter the quantity (halve then halve again)
10%	Tenth (divide by 10)
5%	Find 10% then halve it
1%	Hundredth (divide by 100)

You can use these basic percentages to find more complicated ones…

Example Find 37% of $250

37% can be broken down into 3 lots of 10%, 1 lot of 5% and 2 lots of 1%.

10% of $250 = $250 ÷ 10 = $25
5% of $250 = $25 ÷ 2 = $12.50
1% = $250 ÷ 100 = $2.50
37% = (3 x $25) + $12.50 + (2 x $2.50) **= $92.50**

Much of the percentage work we do in school however is done using a calculator. One thing to know is that **we <u>never ever</u> use the % button on the calculator.**
We reduce the percentage down to its decimal multiplier and then use this to calculate the various types of percentages.

To reduce a percentage to its decimal multiplier we simply divide it by 100.

Example Find 8.2% of $420

The decimal multiplier for 8.2% = 8.2% ÷ 100 = 0.082

8.2% of $420 = 0.082 x $420 **= $34.44**

To increase or decrease a quantity by a percentage we start with 100% which represents the original quantity (unchanged).

If we are increasing, we add the % increase to 100%
If we are decreasing, we subtract the % decrease from 100%
We then find the decimal multiplier of the result.

Example *Increase \$500 by 18.1%*

100% + 18.1% = 118.1%
Decimal multiplier = 118.1% ÷ 100 = 1.181

1.181 x \$500 = \$590.50

Decrease \$500 by 9.3%

100% - 9.3% = 90.7%
Decimal multiplier = 90.7%÷100 = 0.907

0.907 x \$500 = \$453.50

Students are also expected to work out one quantity as a percentage of another quantity and to find the percentage increase or decrease.

To do this we turn the question into a fraction first.
If we are working out A as a percentage of B our fraction would be $\frac{A}{B}$.
We then turn the fraction into a decimal (numerator ÷ denominator) and then into a percentage by multiplying by 100.

Example *There are 14 boys and 18 girls in a class. What percentage of the class are girls?*

We are finding the girls as a percentage of all those in the class, so 18 out of 32 are girls, which as a fraction is $\frac{18}{32}$

$$\frac{18}{32} = 18 \div 32 \times 100 = \mathbf{56.25}\%$$

Turn fraction to a decimal

Turn decimal to a %

% of the class who are girls

To find the percentage increase or decrease our fraction is $\frac{\text{Quantity after change}}{\text{Original Quantity}}$.
We then compare the final % to 100 to work out the % increase or decrease

Example *In 2016 the population of a town was 14,000. In 2017 it had grown to 15,140. Find the % increase.*

Population after the increase

Original population

$$\frac{15140}{14000} = 15140 \div 14000 \times 100 = 108\%$$

This is 8% more than 100% so it has increased by 8%

Example *A car was bought for \$8000. It was sold for \$5200. Work out the % loss in value.*

Sale price

Original price

$$\frac{5200}{8000} = 5200 \div 8000 \times 100 = 65\%$$

This is 35% less than 100% so there was a loss of 35%

Proportion and Ratio

Proportion and ratio is a key area of mathematics. Many other mathematical topics use a good understanding of proportion and ratio and it is one of the area of mathematics we use in real life.

Proportion questions can usually be answered using the unitary method. This is a method where one part of the proportion is reduced to one (a unit) which can then be transformed into another quantity very easily. Both steps are easy (particularly if you have a calculator).

Example 5 miles is approximately 8km.
(a) Convert 17 miles into km.
(b) Convert 19km into miles.

(a) Start with the original proportion

It is the miles we are converting so this needs to be reduced to 1 so divide by itself (5)

Now we know how many km 1 mile is, it is easy to convert 1 mile into 17 miles by x by 17

5 miles = 8 km

÷ 5

1 mile = 1.6km

x 17

17 miles = 27.2km

(b) Start with the original proportion

5 miles = 8 km

÷ 8

0.625 mile = 1km

x 19

11.875 miles = 27.2km

This time it is the km we are converting so this needs to be reduced to 1 so divide by itself (8)

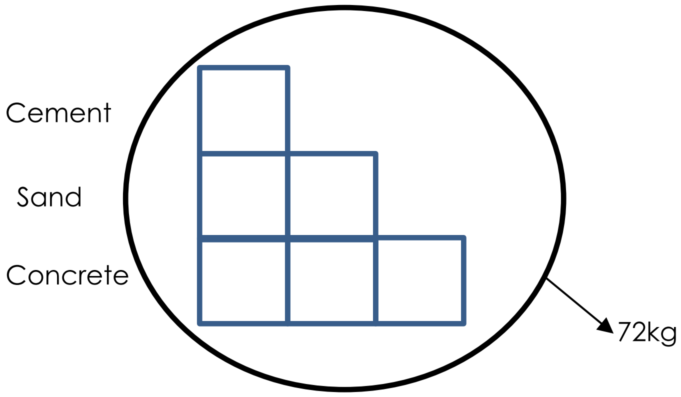
Now we know how many miles 1km is, it is easy to convert 1 km into 19 miles by x by 19

Ratios are closely related to fractions but are often mistaken for fractions.
How you read a ratio is how you write it, so if we say there are 3 red counters to every 5 blue counters we write this as a ratio 3 : 5 – the red comes first in the sentence so it comes first in the ratio.

This is where the commonest misconception between ratios and fractions occurs.
A ratio of 3 : 5 is often incorrectly written as a fraction $^3/_5$. If you think about it there are 3 red for every 5 blue counters so in every 8 counters there are 3 red and 5 blue so the fraction of red counters is $^3/_8$ and the fraction of blue counters is $^5/_8$.

When performing calculations with ratios, we often use a bar-model method to illustrate the ratio – this often makes the ratio much easier to understand. Consider these examples which show the two different kinds of ratio questions we usually encounter.

Example The ratio of concrete is 1 part cement to 2 parts sand and 3 parts gravel. How much of each element will be needed for 72kg of concrete?

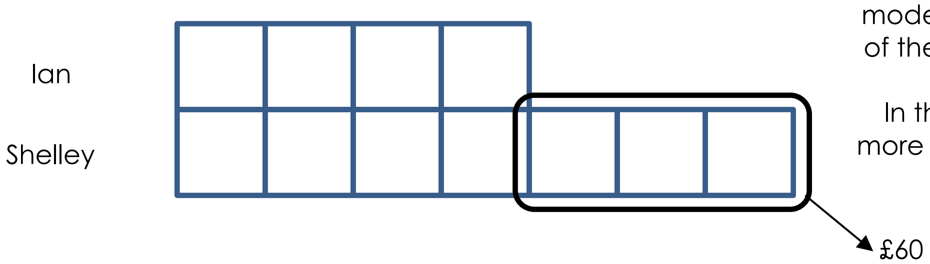


Each row of the bar model represents one element of the ratio. Each box represents 1 part of the ratio. In this case we want 72kg of concrete so the whole diagram represents 72kg.

So 72kg needs to be shared equally amongst 6 parts (6 boxes)
1 part = 72 ÷ 6 = 12kg.
So each box represents 12kg.
Cement = 1 box = 12kg
Sand = 2 boxes = 2 x 12 = 24kg
Concrete = 3 boxes = 3 x 12 = 36kg.

Example Ian and Shelley share money in the ratio 4 : 7.
Shelley gets $60 more than Ian.
How much do they each get?

This time the quantity isn't representative of the whole ratio…



Again, each row of the bar model represents one element of the ratio and each box one part. In this case Shelley gets £60 more so the extra boxes Shelley has equate to £60

So 3 parts = $60
1 part = $20
Ian = 4 parts = 4 x $20 = $80
Shelley = 7 parts = 7 x $20 = $140

Algebra

Algebra is the one area of mathematics that seems to evoke the most 'fear'. This is often because of the use of letters to represent numbers. The letters represent unknown quantities and obviously the letter x is commonly used to represent this unknown quantity (but it could be any letter).

Just a word about some of the terms used in algebra…

Variable	this is something which can vary. This is the quantity that is represented by a letter in algebra
Constant	This is something that does not vary
Coefficient	A number attached to a variable – for example in $9x$, 9 is the coefficient and x is the variable
Expression	This is a collection of constants and variable – but no = sign. $5x + 7$ is an example of an expression
Equation	This is an expression with an = sign – this allows us to solve the equation (find the value of the unknown). For example $3x + 6 = 12$
Formula	This looks like an equation but shows how one variable is related to another variable – it will have at least two variable in it. For example $y = 3x + 5$
Identity	This has an ≡ rather than an = sign. This means the left hand side is ALWAYS the same as the right hand side irrespective of the value of the variable. For example $5(2x + 3) \equiv 10x + 15$
Expand	This is when we get rid of (expand) brackets
Factorise	This is the opposite of expanding – we put brackets back into an expression.

Solving equations – to solve an equation we use the inverse operation method. This means if you want to eliminate something, you do its opposite (the inverse of adding is subtracting and vice versa and the inverse of multiplying is dividing and vice versa).

Example Solve the equations

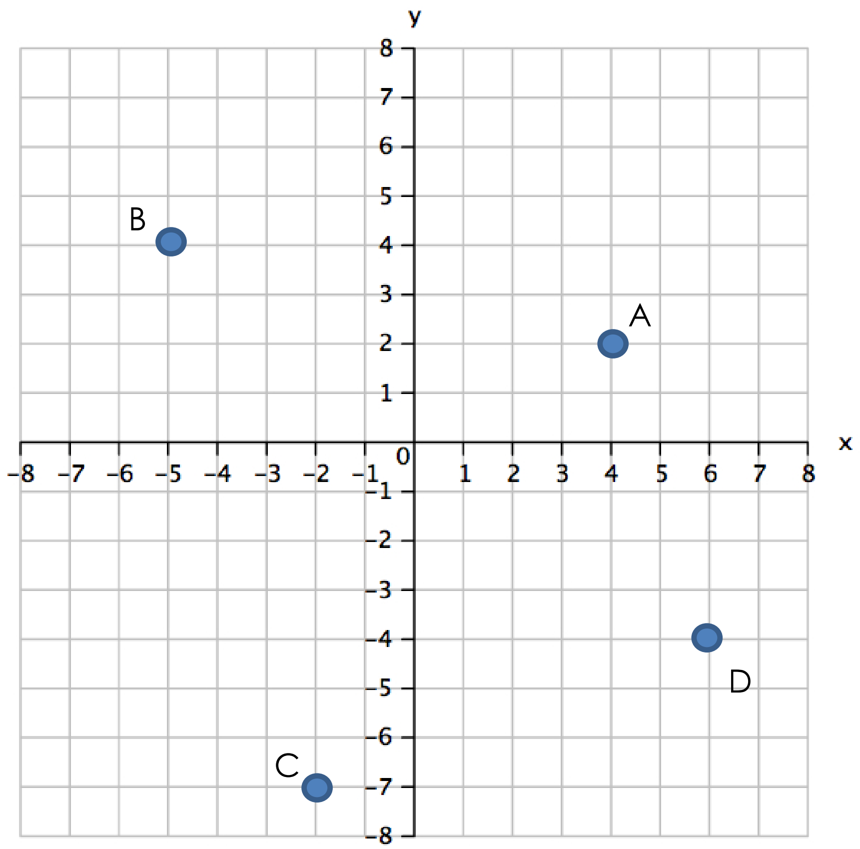
5x + 9 = 24
We need to get rid of the +9
So -9 from both sides
5x = 15
Now we need to get rid of the x5
So ÷5 on both sides
x = 3

6x – 5 = 2x + 23
We have unknowns on both sides
Get rid of the smalles (-2x from both sides)
4x – 5 = 23
Now we need to get rid of the -5
So +5 on both sides
4x = 28
Now we need to get rid of the x4
So ÷4 on both sides
x = 7

Graphs and Coordinates

A coordinate is a location. In school we usually work with 2-dimensional coordinates. They are written in brackets such as (4, 2).
The first number is the x-coordinate and tells you have far horizontally from the origin (the coordinate (0, 0)) you need to go and the second number is the y-coordinate and tells you the vertical distance to go from the origin. So (4, 2) means 4 right and 2 up. If the signs were negative this would indicate the opposite direction, so (-4, -2) would mean 4 left and 2 down.
One way of remembering the order is *Along the corridor and up the stairs*.

When plotting coordinates use the grid lines rather than the squares…



In the diagram A has coordinate (4, 2), B is (-5, 4), C is (-2, -7) and D is (6, -4)

When plotting a graph you will usually substitute the x-coordinates into a formula which generates the y-coordinate which then creates a set of coordinates you can plot. So for y = 3x + 5 the following table could be created (the x-values are called the independent variables as you can choose these, the y-values are the dependent variables as they depend on the x-variable.)

x	-2	-1	0	1	2	3	4	5
y	-1	2	5	8	11	14	17	20

You will be told or will be free to choose the x-values. The y-values are found by substituting the x-value into the formula being plotted so for x = 4, we get y = (3x4) + 5 = 12 + 5 = 17

This creates a set of coordinates (-2, -1), (-1, 2), (0, 5), (1, 8), (2, 11), (3, 14), (4, 17) and (5, 20) which can be plotted on a set of axes.

Statistics

Statistics is the mathematics behind collecting, representing and analysing data.

The most common charts used in early secondary school are bar charts, pictograms, line graphs and pie-charts to represent data. Bar Charts, pictograms and line graphs are fairly straight-forward – remember that axes should be drawn with a ruler and labelled.

Pie-Charts often cause problems.
The draw a pie-chart a pair of compasses, ruler and protractor is needed.

Example The favourite football teams of 30 Year 7 students was surveyed
Draw a pie chart to illustrate this.

Team	Frequency
Arsenal	3
Liverpool	4
Manchester United	5
Sheffield United	10
Sheffield Wednesday	8

To find the size of each slice
we add the frequencies.
This is shared amongst 360°
So 1 person = $360^\circ \div 30 = 12^\circ$

$3 \times 12 = 36^\circ$
$4 \times 12 = 48^\circ$
$5 \times 12 = 60^\circ$
$10 \times 12 = 120^\circ$
$8 \times 12 = 96^\circ$

The main measures we use for average and spread are mode, median, mean and range.

Mode: The is the MOST popular piece of data. This is the only average that doesn't have to be a number. If more than one piece of data is equally the most popular there can be more than one mode. However if each different piece of data appears the same number of times there is no mode.

Median: This is the middle value AFTER the data has been put in order. If there is an odd number of pieces of data there will be one middle number which will be the median. If there is an even number of pieces of data there will be two middle numbers – the median will be half-way between these two values.

Mean: This is when the sum of all the data is found and divided by the number of pieces of data there were.

These are measures of average.

The main measure of spread we use in early secondary school is range.
This is simply the difference between the highest and lowest piece of data.

Example Find the mode, median, mean and range for the set of data

11, 5, 9, 5, 8, 9, 10, 12, 2, 4

Mode: 5 and 9 appear twice, all the other pieces of data appear once.
The mode is 5 and 9.

Median: Put the numbers in order first…

2, 4, 5, 5, 8, 9, 9, 10, 11, 12

There are two middle numbers – 8 and 9 – so the median is halfway between these so the median is 8.5.

Mean: Add the numbers together first

$$11 + 5 + 9 + 5 + 8 + 9 + 10 + 12 + 2 + 4 = 75$$

There are 10 pieces of data so divide by 10

$$\text{Mean} = 75 \div 10 = 7.5$$

Range: The largest piece of data is 12, the smallest is 2

$$\text{Range} = 12 - 2 = 10$$

Metric and Imperial Conversions

Metric conversions should be learned. Here are some of the most common…

LENGTH

Metric
1 centimetre (cm) = 10 millimetres (mm)
1 metre (m) = 100 cm
1 kilometre = 1000m

Imperial
1 foot = 12 inches
1 yard = 3 feet
1 mile = 1760 yards

Metric/Imperial
1 inch ≈ 2.54cm
5 miles ≈ 8 km

MASS

Metric
1 gram (g) = 1000 milligrams (mg)
1 kilograms (kg) = 1000g
1 tonne = 1000 kilograms

Imperial
1 pound (lb) = 16 ounces (oz)
1 stone = 14 lb
1 ton = 2240 lb

Metric/Imperial
1kg ≈ 2.2 lb

CAPACITY

Metric
1 litre = 1000 millilitre (ml)
1 litre = 100 centilitres (cl)
1 centilitre = 10 millilitres

Imperial
1 gallon = 4.5 pints

Metric/Imperial
1 litre = 1.75 pints

Key Mathematical Vocabulary

This is a list of mathematical terms that we would expect students to know…

Multiple	A number in another numbers times table. For example the multiples of 4 are the numbers in the 4 times table.
Factor	A number which can be divided exactly into another number without a remainder. For example the factors of 12 are 1, 2, 3, 4, 6 and 12 because these numbers divide exactly into 12.
Lowest Common Multiple (LCM)	The smallest multiple that is a multiple of more than one number. For example, the LCM of 5 and 7 is 35 because this is the smallest number which is a multiple of 5 and 7.
Highest Common Factor (HCF)	The highest number which is a factor of two or more numbers. For example the HCF of 12 and 20 is 4 because this is the largest number which is a factor of 12 and 20.
Prime Number	A number which has exactly 2 factors. These are the building blocks of all numbers. The first 10 prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, 23 and 29. 1 is NOT a prime number because it only has 1 factor (1).
Sum	The sum of two numbers is when two numbers are added together
Difference	The difference is when one number is subtracted from another
Product	This is when two or more numbers are multiplied
Quotient	The result of a division. In $24 \div 4 = 6$, 24 is the dividend, 4 is the divisor and 6 is the quotient.
Square Number	When one number is multiplied by itself. The first 5 square numbers are 1, 4, 9, 16 and 25 because they are the results of 1x1, 2x2, 3x3, 4x4, 5x5.
Cube Number	When one number is multiplied by itself and by itself again. The first 5 cube numbers are 1, 8, 27, 64 and 125 because they are the results of 1x1x1, 2x2x2, 3x3x3, 4x4x4 and 5x5x5.
Integer	A whole number
Even Number	A number which can be divided exactly by 2. An even number ends with a 0, 2, 4, 6 or 8.
Odd Number	A number which ends in a 1, 3, 5, 7 or 9. Odd numbers cannot be divided exactly by 2.