# St Mungo's High School Numeracy Booklet



# **Introduction**

This booklet has been produced to help staff deliver a common approach with teaching and applying numeracy skills across the curriculum. Parents and carers may also find it useful when supporting pupils at home with numeracy skills.

# Numeracy and Literacy

When interpreting a numeracy problem it is helpful to consider the terminology involved to help to solve the problem.

#### Addition

- Sum of
- Add
- More than
- Total
- And
- Plus

#### Subtraction

- Less than
- Take away
- Minus
- Subtract
- Difference

#### **Multiplication**

- Product
- Times
- Multiply
- Of
- Lots (e.g. 3 lots of 7= 21)

#### Division

- Divide
- Share
- Split

- 1. Estimation and Rounding
- 2. Number and number processes
- 3. Fractions, decimal fractions and percentages
- 4. Ratio and Proportion
- 5. Calendar and Time
- 6. Measurement
- 7. Ideas of chance and uncertainty
- 8. Information Handling
- 9. Formulae
- 10. Measures of averages and spread

# Estimation and Rounding

# Rounding whole numbers

Rule:	If the number in t round the number	he next column in the place valu up.	ie is five or more, we
<u>Ex.1</u>	Round 138 to:	a) the nearest 10 b) the nearest 100	
<u>Solutio</u>	on		
a)	ΗΤυ	Since this number is greater	
		than 4, we round the number	
	1 3 (8)	up to 140.	Answer: 140
b)	нти	Since this number is smaller	
		than 4, we round the number	Answer: 100
		to 100.	

# Rounding decimals

If you are asked to round a number to *n* decimal places that means you want your answer to have *n* numbers after the decimal point.

Ex.1 Round 45.76 to 1 decimal place (1 number after the point)



# Estimating Calculations

We can use rounding to estimate a calculation. This allows us to check if our own answers makes sense.



# Rounding in a real life context

Some problems require pupils to round their answers to a specific degree of accuracy. For example any calculation involving money should be rounded to 2 decimal places.

£34.562 should be rounded to £34.56

The pupil is expected to show the previous answer and the rounded answer.

### Number and number processes

#### Addition and Subtraction

When completing addition and subtraction calculations, pupils must consider place value to align numbers correctly.

#### Addition





Ensure the numbers are written to the same number of decimal places.

i.e. 83 = 83.0



# Multiplication and Division

It is important that pupils can recall the time tables. Regular practice at home will help to develop and strengthen numeracy skills.

1	TI/	MES	TAB	LE
1	х	1	=	1
1	x	2	: # )	2
1	x	3	=	3
1	x	4	=	4
1	x	5	=	5
1	×	6	=	6
1	x	7	=	7
1	x	8	=	8
1	x	9	( <b>=</b> )/	9
1	x	10	=	10
1	x	11		11
1	х	12	=	12

5	TI/	MES	TAB	LE
5	x	1	=	5
5	×	2	=	10
5	x	3	=	15
5	x	4	=	20
5	x	5	( <b>=</b> )/	25
5	х	6	=	30
5	x	7	=	35
5	х	8		40
5	х	9	(1,2,2,2)	45
5	x	10	=	50
5	x	11	=	55
5	x	12	=	60

9	x	1	=	9
9	x	2	=	18
9	x	3	=	27
9	х	4		36
9	x	5	=	45
9	х	6	=	54
9	x	7	=	63
9	x	8	=	72
9	х	9	=	81
9	x	10	=	90
9	x	11	=	99
9	x	12	=	108

2	x	1	$\sim = 1$	2
2	x	2	2.E.	4
2	x	3	=	6
2	x	4	=	8
2	x	5	=	10
2	x	6	=	12
2	x	7	=	14
2	x	8	=	16
2	x	9	=	18
2	x	10	=	20
2	x	11	$c_{i}^{i} \neq c_{i}^{i}$	22
2	x	12	=	24

6	x	1	=	6
6	x	2	=	12
6	x	3	=	18
6	x	4	=	24
6	x	5	=	30
6	x	6	=	36
6	x	7	°.;≓∛	42
б	×	8	=	48
6	x	9	- <b>#</b> (	54
6	x	10	=	60
6	x	11	=	66
6	x	12	=	72

10	x	1	1	10
10	x	2	$\sim = 1$	20
10	x	3		30
10	x	4	=	40
10	x	5	$\sigma^{2}=0$	50
10	x	6	=	60
10	x	7	=	70
10	x	8	=	80
10	x	9	=	90
10	х	10	=	100
10	x	11	Ξ	110
10	х	12	1	120

3	TI	MES "	ГАВ	LE
3	x	1	=	3
3	x	2	=	6
3	x	3	=	9
3	x	4	=	12
3	x	5	=	15
3	x	6	=	18
3	x	7	=	21
3	x	8	=	24
3	x	9	=	27
3	x	10	=	30
3	х	11	=	33
3	x	12	=	36

4	х	1	=	4
4	x	2	=	8
4	x	3	=	12
4	x	4	=	16
4	х	5	=	20
4	x	6	=	24
4	x	7	=	28
4	x	8	1	32
4	x	9	=	36
4	x	10	=	40
4	x	11	=	44
4	x	12	=	48

**8 TIMES TABLE** 

1 х

5

6 х

7

8 х

9 х

10

=

=

=

=

=

=

=

8 16

24

32 40

48

56

64

72

80

8

8 x 2 =

8 x 3 =

8 х 4 =

8 x

8

8 ×

8

8

8

x

7	TI/	MES	TAB	LE
7	x	1	=	7
7	x	2	Ξ	14
7	x	3	=	21
7	x	4	=	28
7	x	5	=	35
7	x	6	=	42
7	x	7	=	49
7	x	8	=	56
7	x	9	=	63
7	x	10	=	70
7	x	11	=	77
7	x	12	=	84

7	x	12	=	84	8
1	1 TI	MES	TA	BLE	1
11	х	1	=	11	12
11	х	2	=	22	12
11	X	3	=	33	12
11	х	4	=	44	12
11	х	5	=	55	12
11	x	6	=	66	12
11	x	7	=	77	12
11	x	8	=	88	12
11	x	9	=	99	12
11	x	10	=	110	12
11	x	11	π	121	12
11	x	12	=	132	12

#### 8 88 11 х = 12 96 x = 2 TIMES TABLE 1 ×. x 12 х 2 = 24 х 3 = 36 x 4 = 48 х 5 = 60 6 = 72 х 7 = 84 x 8 = 96 x 108 x 9 = 10 120 х = 132 x 11 = 12 12 = 144 х

Remember it is never too late to learn!



#### Division

When completing division calculations we should no longer have remainders in our final answer. The answer should be written as a decimal if necessary.



#### Multiplying by 10, 100, 1000

Rule: When multiplying a number by 10, 100 or 1000 we move the decimal point to the right.

Multiply by 10 = move the decimal point 1 place to the right. Multiply by 100 = move the decimal point 2 places to the right. Multiply by 1000 = move the decimal point 3 places to the right.



#### Dividing by 10, 100, 1000

 Rule: When dividing a number by 10, 100 or 1000 we move the decimal point to the left.

 Divide by 10 = move the decimal point 1 place to the left.

 Divide by 100 = move the decimal point 2 places to the left.

 Divide by 1000 = move the decimal point 3 places to the left.

 Divide by 1000 = move the decimal point 3 places to the left.

 Ex.1

 132.76 ÷ 100

 = 1.3276

<u>Ex.2</u> 1.38 ÷ 10 = 0.138

Remember to put a zero  
before the decimal  
point.  
$$\div 10$$
  
**1.38** = **0.138**

# Multiplying by multiples of 10



# Dividing by multiples of 10



#### Negative numbers

Integers are positive and negative whole numbers. Negative numbers are numbers less than zero.



#### Adding negative numbers

Consider the calculations below

5 + 2 = 7	You can see that when we
5 + 1 = 6	add a negative number it is
	the same as subtracting
5 + 0 = 5	that number.
5 + (-1) = 4	5 - 1 = 4
5 + (-2) = 3	- 5 - 2 = 3

<u>Ex.1</u>

25 + (-7)	<u>Ex.2</u> -3 + (-4)	
= 25 - 7	= -3 - 4	
= 18	= -7	

# Subtracting negative numbers

Consider the calculations below

<b>5</b> 2 - 2	
5 - 2 = 3	You can see that when we
5 - 1 = 4	subtract a negative
	number it is the same as
5 - 0 = 5	adding that number.
5 - (-1) =	6 <del>→</del> 5 + 1 = 6
5 - (-2) =	7
<u>Ex.1</u> 12 - (-5) = 12 + 5 - 17	<u>Ex.2</u> -50 - (-20) = -50 + 20
- 17	= -30
<u>Multiplying intege</u>	<u>ers</u>
Rules:	sitive x negative = negative
ne	gative x negative = postive
<u>Ex.1</u> positive 8 x (-4 = -40	$\frac{E \times .2}{-3 \times (-20)}$
<u>Dividing integers</u>	
Rules:	tive ÷ negative = negative
neg	ative ÷ negative = postive
<u>Ex.1</u> positive 12 ÷ (- = -6	$\frac{Ex.2}{-35 \div (-7)}$ = 5

# Order of operations

To make sure we get the correct answers, we need to perform calculations in the correct order. To help us we can use the acronym:



# Fractions, Decimals and Percentages

#### Fractions

A fraction is defined as part of a whole. The top part of a fraction is called the numerator and the bottom part is called the denominator.

#### Simplifying fractions

It can be useful to simplify a fraction to help make calculations easier.

To simplify a fraction, we recall our times tables facts to identify a number which we can divide the numerator and denominator by.



#### Equivalent fractions

An equivalent fraction is a fraction which is equal to but not the same fraction.

When we simplify fractions the result is an equivalent fraction.

We can produce equivalent fractions by either multiplying or dividing the numerator and denominator by the same number.



<u>Common fractions, decimal fractions and percentages</u>

Fraction	Decimal	Percentage
1 10	0.1	10%
1 5	0.2	20%
$\frac{1}{4}$	0.25	25%
<u>1</u> 3	0.33	33 <u>1</u> %
1/2	0.5	50%
2	0.66	$66\frac{2}{3}\%$
<u>3</u> 4	0.75	75%

Converting between fractions, decimal fractions and percentages



Ex.1 Write 34% as a fraction and a decimal fraction

$$34\% = \frac{34}{100} = \frac{17}{50}$$

$$34\% = 34 \div 100$$

$$= 0.34$$

<u>Ex.2</u> I scored 18 out of 25 in my French test. What was my score as a percentage?



# Fraction of a quantity



# Mixed number and Improper fractions

If the numerator of a fraction is larger than the denominator then we can write this fraction as a mixed number or an improper (top-heavy fraction).

Ex.1 Write the improper fraction 
$$\frac{7}{5}$$
 as a mixed number.  
Divide the numerator by the denominator  
 $1 r 2$   
 $5 7$   
Whole number  $1\frac{2}{5}$   
denominator

# <u>Ex.2</u> Write the number $3\frac{4}{7}$ as an improper fraction.



#### Adding and Subtracting Fractions

When adding or subtracting fractions we must find a common denominator.

 $\frac{\text{Ex.1}}{\text{Find}} \quad \frac{2}{3} + \frac{1}{5}$   $\frac{\text{Add the}}{\text{numerators}} = \frac{10}{15} + \frac{3}{15}$   $= \frac{13}{15}$ 

and the 5 times table.	
is the first number which appears	in both the 3
The lowest common denominator is	15 since 15

Set	up eq	uivalent fr	actions		
2	x5	10	1	x5	= 3
3	×5	15	5	x5	15

#### Multiplying fractions

Rules: • multiply the numerators together • multiply the denominators together • simplify the fraction

$$\frac{4}{7} \times \frac{3}{20}$$

Solution

Applying the rules above

#### **Dividing fractions**

Rule:

- invert the second fraction
- change the division sign to a multiplication sign
- multiply the fractions together





<u>Method 2</u> Split 45% into common percentages using the table to help.

10% = £800 ÷ 10 = £80	45% of £800
5% = £80 ÷ 2 = £40	- 640 - 6320
10040 20000 0 200000 -	= 140 + 1320
40% = £80 × 4 = £320	= £360

= 8 × 45 = £360

### Ratio and Proportion

Ratios are used to compare two or more quantities.

**<u>Ex.1</u>** There are 12 girls and 18 boys in a class. State the ratio of boys to girls.

<u>Solution</u>

boys : girls

18 : 12

We divide both numbers by the highest common factor



<u>Ex.2</u> The ratio of cows to chickens in a field is 2 : 5. If there are 15 chicken in a field how many cows are in the field?



There are 6 cows in the field.

<u>Ex.3</u> Jack and Jill want to split £51 between them in the ratio 2 : 1. How much will they each receive?

There are 3 parts so we divide 51 by 3. Jack will

receive 2 parts of the money

and Jill will receive 1 part of the money.

#### <u>Solution</u>

51 ÷ 3 = £17

 $\pm 17 \times 2 = \pm 34$ 

 $£17 \times 1 = £17$ 

Jack will receive £34 and Jill will receive £17.

#### **Proportion**

Two quantities are said to be in direct proportion if one quantity increases and the other quantity increases.

**Direct Proportion** 

Ex. 1 Find the cost of 3 apples if 8 apples cost  $\pounds$ 1.86





Two quantities are said to be in indirect (inverse) proportion if one quantity increases and the other quantity decreases.

#### **Indirect Proportion**

<u>Ex. 1</u> It takes 4 people 12 hours to build a wall. How long would it take to build the wall if there were 6 people?



# Calendar and Time

60	minutes in an hour	
24	hours in a day	
7	days in a week	
365	days in a year	
4	weeks in a month	
52	weeks in a year	
12	months in a year	



30 days have September, April, June and November All the rest have 31, Except for February alone Which has 28 days clear And 29 in a leap year.





Telling the time is very important. You must be able to tell the time from an analogue clock and a digital clock.

We can use 12 hour and 24 hour time to record the time.

12 hour time is written with 'am' or 'pm' and 24 hour time contains four digits but no 'am' or 'pm'.

The 3 clocks above show the same time displayed in three different ways.



<u>Ex.1</u> What date is it 24 days after Thursday 16th November?



# Speed, Distance and Time



## Distance

Calculate the distance covered by a car travelling at an average speed of 75km/h for 5 hours.

Check for consistency with the units

Distance = Speed x Time

Distance =  $75 \times 5$ 

Distance = 375km



# Speed

Calculate the average speed of a bus driving 220 miles in 4 hours.



Encod - Dictorico	$\mathcal{N}$		
Time	Use the units in the		
Speed = 220	question to determine		
4	the units in the		
Speed = 55mph	answer.		

### Time

Calculate the time taken for an athlete to complete a 10K race, running at an average speed of 8km per hour.



#### **Measurement**

Units of length	Units of area	Units of volume
mm	mm <sup>2</sup>	mm <sup>3</sup>
1cm = 10mm	cm <sup>2</sup>	1cm <sup>3</sup> = 1ml
1m = 100cm	m <sup>2</sup>	m <sup>3</sup>
1km = 1000m		1 litre = 1000ml
Inches		
Feet		
Yards		
Miles		

# Perimeter

Perimeter is the distance around a shape.



To calculate the perimeter of a shape, we add up the length of all its sides.

Perimeter = 25 + 12 + 25 + 12

= 74m

# Area of a rectangle

The area of a shape is the amount of space inside the shape.



# Composite shapes

Can you calculate perimeter and area of the shape below?



Perimeter = 8 + 5 + 4 + 7 + 4 + 12 = 40m

Area



12m

Area A = length x breadth	
Area A = 5 x 8	
Area A = 40m <sup>2</sup>	
Area B = length x breadth	
Area B = 7 x 4	
Area B = 28m²	
Total area = 40m² + 28m²	٦

 $= 68m^2$ 



Ex.1 Calculate the area of the triangle





### Ideas of chance and uncertainty

Probability

The probability of an event happening is the fraction of times it would happen "in the long run".

Probability is represented as a fraction and can range from 0 to 1.

Probability = <u>Number of favourable outcomes</u> Total number of outcomes

<u>Ex.</u> There are 12 girls and 18 boys in a classroom. The teacher asks the pupils a question and picks a pupil at random to answer. What is the probability that the teacher picks a girl?



#### **Information Handling**

We can analyse and represent data using data using various statistical diagrams.

#### Stem and Leaf charts

The weights of 20 newborn kittens (to the nearest gram) are given below.

73 48	55	50	41	65	47	52
64 71	50	89	63	54	49	65

Draw a STEM-AND-LEAF diagram to illustrate this data. (Remember to state a <u>KEY</u>)

#### Weights of kittens



#### Back to back Stem and Leaf chart

If we want to compare two sets of data, we can display the results in a back to back stem and leaf chart.

Weights of kittens at 2 weeks

n = 20

#### Weights of kittens at birth

# Bar Graphs

Bar graphs are used to display information. The categories should be displayed along the x-axis and the frequency should be displayed up the y-axis.



# Line Graphs

A line graph is often used to **show a trend** over a number of days or hours. It is plotted as a series of points, which are then joined with straight lines. The ends of the line graph do not have to join to the axes.



#### Pie Charts

Pie charts represents data using different sized sectors. These sectors are usually represented as angles or percentages.



### Drawing Pie Charts

We can use a protractor to measure and draw the angles used to produce a pie chart.

# Drawing Pie charts

<u>Ex.1</u> The table shows the different crisp flavours chosen by a group of S3 pupils during a school trip. Display the information using a pie chart.

Crisp flavour	Number of pupils
Salt and Vinegar	120
Ready Salted	15
Cheese and Onion	45
Prawn Cocktail	90

Step 1: Write each number as a fraction of the total amount

Step 2: Multiply the fraction by 360° to	covert	to an	angle
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Crisp flavour	Number of pupils	Fraction	Angle
Salt and Vinegar	120	120 270	$\frac{120}{270} \times 360 = 160^{\circ}$
Ready Salted	15	<u>15</u> 270	15 270× 360 = 20∘
Cheese and Onion	45	<u>45</u> 270	<u>45</u> × 360 = 60°
Prawn Cocktail	90	<u>90</u> 270	<u>90</u> 270 × 360 = 120°
Total	270	1	360°

#### Step 3: Display this information in a pie chart

Step 4: Label the pie chart



#### Scatter graphs

We can use a scatter graph to compare two quantities. Each quantity is plotted along an axis. A scatter graph allows you to see if there is a connection (correlation) between the two quantities.



 $E \times 1$  The height of a plant measured over five days is shown below.



#### Formulae

# Formulae

To find the variable in a formula we substitute the numbers into the formula and apply BODMAS rules to find the answer.

Ex.1 Use the formula 
$$R = \frac{F}{A}$$
 to evaluate R when F = 2250 and A = 50.

Solution
$$R = \frac{F}{A}$$
Step 1: Write out the formula $R = \frac{2250}{50}$ Step 2: Substitute the numbers into the formula $R = 45$ 

# <u>Ex.2</u>

The volume of a cylinder can be found using the formula  $V = \pi r^2 h$ . Use the formula to evaluate the volume of a cylinder with r = 8 cm, h = 10 cm and  $\pi = 3.14$ .

Solution  $V = \pi r^2 h$   $V = 3.14 \times 8^2 \times 10$   $V = 3.14 \times 64 \times 10$  $V = 2009.6 cm^3$ 

Remember to apply the rules of BODMAS!

#### Measures of averages and spread

We can use statistics to help us compare data. Mean, median and mode are all measures of averages and can be used to represent the numbers in a data set as a whole. The range is a measure of how spread out a data set is.

#### Median

The Median is the middle number in an ordered list.

#### Mean

To find the mean, we add all the numbers in the data set and divide by the total amount of numbers.

#### Mode

The Mode is the most common number in a data set.

#### Range

The Range is the difference between the highest value and the lowest value.

Ex. Find the median, mode, mean and range of:

13, 16, 19, 22, 25, 25, 30, 31

#### Solution

13, 16, 19, 22, 25, 25, 30, 31

position of the median

The median is half way between 22 and 25.

```
median = 23.5
```

mode = 25

mean = 
$$\frac{13 + 16 + 19 + 22 + 25 + 25 + 30 + 31}{8}$$
  
=  $\frac{181}{8}$   
= 22.6 (to 1 decimal place)