The Royal High School

Numeracy Across the Curriculum Booklet

A guide for S1 and S2 pupils, parents and staff
Introduction

What is the purpose of the booklet?

This booklet has been produced to give guidance to pupils and parents on how certain common Numeracy topics are taught in mathematics and throughout the school. Staff from all departments have been consulted during its production and will be issued with a copy of the booklet. It is hoped that using a consistent approach across all subjects will make it easier for pupils to progress.

How can it be used?

If you are helping your child with their homework, you can refer to the booklet to see what methods are being taught in school. Look up the relevant page for a step by step guide.

The booklet includes the Numeracy skills useful in subjects other than mathematics. For help with mathematics topics, pupils should refer to their mathematics textbook or ask their teacher for help.

Why do some topics include more than one method?

In some cases (e.g. percentages), the method used will be dependent on the level of difficulty of the question, and whether or not a calculator is permitted.

For mental calculations, pupils should be encouraged to develop a variety of strategies so that they can select the most appropriate method in any given situation.
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Addition

Mental strategies

There are a number of useful mental strategies for addition. Some examples are given below.

Example

Calculate 54 \(+ 27\)

Method 1 Add tens, then add units, then add together

\[
50 + 20 = 70 \quad 4 + 7 = 11 \quad 70 + 11 = 81
\]

Method 2 Split up number to be added into tens and units and add separately.

\[
54 + 20 = 74 \quad 74 + 7 = 81
\]

Method 3 Round up to nearest 10, then subtract

\[
54 + 30 = 84 \quad \text{but 30 is 3 too much so subtract 3;} \quad 84 - 3 = 81
\]

Written Method

When adding numbers, ensure that the numbers are lined up according to place value. Start at right hand side, write down units, carry tens.

Example

Add 3032 and 589

\[
\begin{array}{c}
3032 \\ +589 \\
\hline 1
\end{array} \quad \begin{array}{c}
3032 \\ +589 \\
\hline 21
\end{array} \quad \begin{array}{c}
3032 \\ +589 \\
\hline 621
\end{array} \quad \begin{array}{c}
3032 \\ +589 \\
\hline 3621
\end{array}
\]

\[
2 + 9 = \quad 3 + 8 + 1 = 1 \quad 0 + 5 + 1 = \quad 3 + 0 =
\]
**Subtraction**

We use decomposition as a written method for subtraction (see below). Alternative methods may be used for mental calculations.

**Mental Strategies**

**Example**  
Calculate 93 - 56

**Method 1** Count on

Count on from 56 until you reach 93. This can be done in several ways e.g.

\[
\begin{align*}
4 & \quad 30 & \quad 3 \\
56 & \quad 60 & \quad 70 & \quad 80 & \quad 90 & \quad 93 & = \ 37
\end{align*}
\]

**Method 2** Break up the number being subtracted

e.g. subtract 50, then subtract 6  
93 - 50 = 43  
43 - 6 = 37

\[
\begin{align*}
6 & \quad 50 \\
37 & \quad 43 & \quad 93 & \text{Start}
\end{align*}
\]

**Written Method**

**Example 1**  
4590 - 386

\[
\begin{align*}
4590 & \\
- \ 386 & \quad \underline{4204}
\end{align*}
\]

**Example 2**  
Subtract 692 from 14597

\[
\begin{align*}
14597 & \\
- \ 692 & \quad \underline{13905}
\end{align*}
\]

We do not "borrow and pay back".
Multiplication 1

It is essential that you know all of the multiplication tables from 1 to 10. These are shown in the tables square below.

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>100</td>
</tr>
</tbody>
</table>

Mental Strategies

Example Find $39 \times 6$

Method 1

$30 \times 6 = 180$

$9 \times 6 = 54$

$180 + 54 = 234$

Method 2

$40 \times 6 = 240$

40 is 1 too many so take away

$240 - 6 = 234$
Multiplication 2

Multiplying by multiples of 10 and 100

To multiply by 10 you move every digit one place to the left.
To multiply by 100 you move every digit two places to the left.

Example 1 (a) Multiply 354 by 10

\[
354 \times 10 = 3540
\]

(b) Multiply 50.6 by 100

\[
50.6 \times 100 = 5060
\]

(c) 35 x 30

\[
35 \times 3 = 105
105 \times 10 = 1050
\]

so 35 x 30 = 1050

(d) 436 x 600

\[
436 \times 6 = 2616
2616 \times 100 = 261600
\]

so 436 x 600 = 261600

We may also use these rules for multiplying decimal numbers.

Example 2 (a) 2.36 x 20

\[
2.36 \times 2 = 4.72
4.72 \times 10 = 47.2
\]

so 2.36 x 20 = 47.2

(b) 38.4 x 50

\[
38.4 \times 5 = 192.0
192.0 \times 10 = 1920
\]

so 38.4 x 50 = 1920
Division

You should be able to divide by a single digit or by a multiple of 10 or 100 without a calculator.

Written Method

Example 1  There are 192 pupils in first year, shared equally between 8 classes. How many pupils are in each class?

\[
\begin{array}{c}
24 \\
8 \overline{192}\end{array}
\]

There are 24 pupils in each class

Example 2  Divide 4.74 by 3

\[
\begin{array}{c}
1.58 \\
3 \overline{4.1724}\end{array}
\]

When dividing a decimal number by a whole number, the decimal points must stay in line.

Example 3  A jug contains 2.2 litres of juice. If it is poured evenly into 8 glasses, how much juice is in each glass?

\[
\begin{array}{c}
0.275 \\
8 \overline{2.26040}\end{array}
\]

Each glass contains 0.275 litres

If you have a remainder at the end of a calculation, add a zero onto the end of the decimal and continue with the calculation.
Order of Calculation (BODMAS)

Consider this: What is the answer to 2 + 5 x 8 ?

Is it 7 x 8 = 56 or 2 + 40 = 42 ?

The correct answer is 42.

Calculations which have more than one operation need to be done in a particular order. The order can be remembered by using the mnemonic BODMAS.

The BODMAS rule tells us which operations should be done first. BODMAS represents:

(B)rackets
(O)f
(D)ivide
(M)ultiply
(A)dd
(S)ubract

Scientific calculators use this rule, some basic calculators may not, so take care in their use.

Example 1 15 - 12 ÷ 6 BODMAS tells us to divide first
= 15 - 2
= 13

Example 2 (9 + 5) x 6 BODMAS tells us to work out the brackets first
= 14 x 6
= 84

Example 3 18 + 6 ÷ (5-2) Brackets first
= 18 + 6 ÷ 3 Then divide
= 18 + 2 Now add
= 20
Evaluating Formulae

Example 1

Use the formula $P = 2L + 2B$ to evaluate $P$ when $L = 12$ and $B = 7$.

- Step 1: write formula
- Step 2: substitute numbers for letters
- Step 3: start to evaluate (BODMAS)
- Step 4: write answer

\[ P = 2L + 2B \]
\[ P = 2 \times 12 + 2 \times 7 \]
\[ P = 24 + 14 \]
\[ P = 38 \]

Example 2

Use the formula $I = \frac{V}{R}$ to evaluate $I$ when $V = 240$ and $R = 40$

\[ I = \frac{V}{R} \]
\[ I = \frac{240}{40} \]
\[ I = 6 \]

Example 3

Use the formula $F = 32 + 1.8C$ to evaluate $F$ when $C = 20$

\[ F = 32 + 1.8C \]
\[ F = 32 + 1.8 \times 20 \]
\[ F = 32 + 36 \]
\[ F = 68 \]

To find the value of a variable in a formula, we must substitute all of the given values into the formula, then use BODMAS rules to work out the answer.
Numbers can be rounded to give an approximation.  

2652 rounded to the nearest 10 or to 3 significant figures is 2650.  
2652 rounded to the nearest 100 or to 2 significant figures is 2700.  

When rounding numbers which are exactly in the middle, convention is to **round up**.  
7865 rounded to the nearest 10 or to 3 significant figures is 7870.  

The same principle applies to rounding decimal numbers.  

In general, to round a number in terms of place value, we must first identify the place value to which we want to round. We must then look at the next digit to the right (the “check digit”) - if it is 5 or more round up.  

**Example 1** Round 1.57359 to 2 decimal places  

The second number after the decimal point is a 7 - the check digit (the third number after the decimal point) is a 3, so round down.  

\[1.57349\]  
\[= 1.57\] to 2 decimal places  

To round to significant figures we first identify the number of significant figures we want to round to. We must then look at the next digit to the right - if it is 5 or more round up.  

**Example 2** Round 1.57349 to 2 significant figures  

The second significant digit is 5 the check digit to the right is 7, so round up.  

\[1.57359\]  
\[= 1.6\] to 2 significant figures
**Estimation : Calculation**

We can use rounded numbers to give us an approximate answer to a calculation. This allows us to check that our answer is sensible.

---

**Example 1**
Tickets for a concert were sold over 4 days. The number of tickets sold each day was recorded in the table below. How many tickets were sold in total?

<table>
<thead>
<tr>
<th></th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>486</td>
<td>205</td>
<td>197</td>
<td>321</td>
</tr>
</tbody>
</table>

Estimate = 500 + 200 + 200 + 300 = 1200

Calculate:  
486
205
197
+321
1209  
Answer = 1209 tickets

---

**Example 2**
A bar of chocolate weighs 42g. There are 48 bars of chocolate in a box. What is the total weight of chocolate in the box?

Estimate = 50 x 40 = 2000g

Calculate:  
42
x48
336
1680
2016  
Answer = 2016g
12-hour clock
Time can be displayed on a clock face, or digital clock.

When writing times in 12 hour clock, we need to add a.m. or p.m. after the time.
a.m. is used for times between midnight and 12 noon (morning)
p.m. is used for times between 12 noon and midnight (afternoon / evening).

24-hour clock
In 24 hour clock, the hours are written as numbers between 00 and 24. Midnight is expressed as 00 00, or 24 00. After 12 noon, the hours are numbered 13, 14, 15 … etc.

Examples
9.55 am → 09 55 hours
3.35 pm → 15 35 hours
12.20 am → 00 20 hours
02 16 hours → 2.16 am
20 45 hours → 8.45 pm
Time Facts
In 1 year, there are: 365 days (366 in a leap year)
52 weeks
12 months

The number of days in each month can be remembered using the rhyme:

“30 days hath September,
April, June and November,
All the rest have 31,
Except February alone,
Which has 28 days clear,
And 29 in each leap year.”
Time 3

In maths we look at distance, speed and time. In science we also take the direction into account, so we look at displacement, velocity and time.

Distance, Speed and Time
For any given journey, the distance travelled depends on the speed and the time taken. If speed is constant, then the following formulae apply:

\[
\text{Distance} = \text{Speed} \times \text{Time} \quad \text{or} \quad D = S \times T
\]

\[
\text{Speed} = \frac{\text{Distance}}{\text{Time}} \quad \text{or} \quad S = \frac{D}{T}
\]

\[
\text{Time} = \frac{\text{Distance}}{\text{Speed}} \quad \text{or} \quad T = \frac{D}{S}
\]

Example

Calculate the speed of a train which travelled 450 km in 5 hours

\[
S = \frac{D}{T}
\]

\[
S = \frac{450}{5}
\]

\[
S = 90 \text{ km/h}
\]

The speed of an object does not require a direction to be considered, it simply has a value and a unit e.g. 35 m/s (written as ms\(^{-1}\) in science)

In science the direction is also taken into account and so the speed is called velocity e.g. 35 ms\(^{-1}\) to the left. The basic calculations are the same.

\[
\text{Velocity} = \frac{\text{Displacement}}{\text{Time}} \quad \text{or} \quad V = \frac{D}{T}
\]
Fractions 1

Addition, subtraction, multiplication and division of fractions are studied in mathematics. However, the examples below may be helpful in all subjects.

Understanding Fractions

**Example**
A necklace is made from black and white beads.

What fraction of the beads are black?

There are 3 black beads out of a total of 7, so $\frac{3}{7}$ of the beads are black.

Equivalent Fractions

**Example**
What fraction of the flag is shaded?

6 out of 12 squares are shaded. So $\frac{6}{12}$ of the flag is shaded.

It could also be said that $\frac{1}{2}$ of the flag is shaded.

$\frac{6}{12}$ and $\frac{1}{2}$ are equivalent fractions.
Fractions 2

Simplifying Fractions

The top of a fraction is called the **numerator**, the bottom is called the **denominator**.
To simplify a fraction, divide the **numerator** and **denominator** of the fraction by the same number.

**Example 1**

(a) \[
\frac{20}{25} \div 5 = \frac{4}{5}
\]
(b) \[
\frac{16}{24} \div 8 = \frac{2}{3}
\]

This can be done repeatedly until the numerator and denominator are the smallest possible numbers - the fraction is then said to be in it's **simplest form**.

**Example 2**

Simplify \[
\frac{72}{84}
\]
\[
\frac{72}{84} = \frac{36}{42} = \frac{18}{21} = \frac{6}{7}
\] (simplest form)

Calculating Fractions of a Quantity

To find the fraction of a quantity, divide by the denominator.
To find \(\frac{1}{2}\) divide by 2, to find \(\frac{1}{3}\) divide by 3, to find \(\frac{1}{7}\) divide by 7 etc.

**Example 1**

Find \(\frac{1}{5}\) of £150

\[
\frac{1}{5} \text{ of £150} = \frac{150}{5} = £30
\]

**Example 2**

Find \(\frac{3}{4}\) of 48

\[
\frac{1}{4} \text{ of 48} = \frac{48}{4} = 12
\]
so \[
\frac{3}{4} \text{ of 48} = 3 \times 12 = 36
\]

To find \(\frac{3}{4}\) of a quantity, start by finding \(\frac{1}{4}\)
Percentages 1

Percent means out of 100. A percentage can be converted to an equivalent fraction or decimal.

36% means $\frac{36}{100}$

36% is therefore equivalent to $\frac{9}{25}$ and 0.36

Common Percentages

Some percentages are used very frequently. It is useful to know these as fractions and decimals.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Fraction</th>
<th>Decimal</th>
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</thead>
<tbody>
<tr>
<td>1%</td>
<td>$\frac{1}{100}$</td>
<td>0.01</td>
</tr>
<tr>
<td>10%</td>
<td>$\frac{1}{10}$</td>
<td>0.1</td>
</tr>
<tr>
<td>20%</td>
<td>$\frac{1}{5}$</td>
<td>0.2</td>
</tr>
<tr>
<td>25%</td>
<td>$\frac{1}{4}$</td>
<td>0.25</td>
</tr>
<tr>
<td>33$\frac{1}{3}$%</td>
<td>$\frac{1}{3}$</td>
<td>0.333…</td>
</tr>
<tr>
<td>50%</td>
<td>$\frac{1}{2}$</td>
<td>0.5</td>
</tr>
<tr>
<td>66$\frac{2}{3}$%</td>
<td>$\frac{2}{3}$</td>
<td>0.666…</td>
</tr>
<tr>
<td>75%</td>
<td>$\frac{3}{4}$</td>
<td>0.75</td>
</tr>
</tbody>
</table>
Percentages 2

Non-Calculator Methods

Method 1 Using Equivalent Fractions

Example Find 25% of £640

\[
25\% \text{ of } £640 = \frac{1}{4} \text{ of } £640 = £640 ÷ 4 = £160
\]

Method 2 Using 1%

In this method, first find 1% of the quantity (by dividing by 100), then multiply to give the required value.

Example Find 9% of 200g

\[
1\% \text{ of } 200g = \frac{1}{100} \text{ of } 200g = 200g ÷ 100 = 2g
\]

so 9% of 200g = 9 × 2g = 18g

Method 3 Using 10%

This method is similar to the one above. First find 10% (by dividing by 10), then multiply to give the required value.

Example Find 70% of £35

\[
10\% \text{ of } £35 = \frac{1}{10} \text{ of } £35 = £35 ÷ 10 = £3.50
\]

so 70% of £35 = 7 × £3.50 = £24.50

There are many ways to calculate percentages of a quantity. Some of the common ways are shown below.
Percentages 3

Non- Calculator Methods (continued)

The previous 2 methods can be combined so as to calculate any percentage.

Example  Find 23% of £15000

\[
\begin{align*}
10\% \text{ of } £15000 &= £1500 \quad \text{so } 20\% &= £1500 \times 2 = £3000 \\
1\% \text{ of } £15000 &= £150 \quad \text{so } 3\% &= £150 \times 3 = £450 \\
23\% \text{ of } £15000 &= £3000 + £450 = £3450
\end{align*}
\]

Finding VAT (without a calculator)

Value Added Tax (VAT) = 15%
To find VAT, firstly find 10%

Example  Calculate the total price of a computer which costs £650 excluding VAT

\[
\begin{align*}
10\% \text{ of } £650 &= £65 \quad \text{(divide by 10)} \\
5\% \text{ of } £650 &= £32.50 \quad \text{(divide previous answer by 2)}
\end{align*}
\]

so 15% of £650 = £65 + £32.50 = £97.50

Total price = £650 + £97.50 = £747.50
Percentages 4

**Calculator Method**

To find the percentage of a quantity using a calculator, change the percentage to a decimal, then multiply.

**Example 1**  Find 23% of £15000

\[23\% = 0.23 \text{ so } 23\% \text{ of } £15000 = 0.23 \times £15000 = £3450\]

**Example 2**  House prices increased by 19% over a one year period. What is the new value of a house which was valued at £236000 at the start of the year?

\[19\% = 0.19 \text{ so } \text{Increase} = 0.19 \times £236000 = £44840\]

\[\text{Value at end of year} = \text{original value} + \text{increase}\]
\[= £236000 + £44840 = £280840\]

The new value of the house is £280840

We do not use the % button on calculators. The methods taught in the mathematics department are all based on converting percentages to decimals.
Percentages 5

Finding the percentage

To find a percentage of a total, first make a fraction, then convert to a decimal by dividing the top by the bottom. This can then be expressed as a percentage.

Example 1

There are 30 pupils in Class 3A3. 18 are girls. What percentage of Class 3A3 are girls?

\[
\frac{18}{30} = \frac{18}{30} \div 0.6 = 60% 
\]

60% of 3A3 are girls

Example 2

James scored 36 out of 44 his biology test. What is his percentage mark?

Score = \[
\frac{36}{44} = 36 \div 44 = 0.81818... 
\]

= 81.818...% = 82% (rounded)

Example 3

In class 1X1, 14 pupils had brown hair, 6 pupils had blonde hair, 3 had black hair and 2 had red hair. What percentage of the pupils were blonde?

Total number of pupils = 14 + 6 + 3 + 2 = 25
6 out of 25 were blonde, so,
\[
\frac{6}{25} = 6 \div 25 = 0.24 = 24% 
\]

24% were blonde.
Ratio 1

When quantities are to be mixed together, the ratio, or proportion of each quantity is often given. The ratio can be used to calculate the amount of each quantity, or to share a total into parts.

Writing Ratios

Example 1

To make a fruit drink, 4 parts water is mixed with 1 part of cordial.

The ratio of water to cordial is 4:1 (said "4 to 1")

The ratio of cordial to water is 1:4.

Order is important when writing ratios.

Example 2

In a bag of balloons, there are 5 red, 7 blue and 8 green balloons.

The ratio of red : blue : green is 5 : 7 : 8

Simplifying Ratios

Ratios can be simplified in much the same way as fractions.

Example 1

Purple paint can be made by mixing 10 tins of blue paint with 6 tins of red. The ratio of blue to red can be written as 10 : 6

It can also be written as 5 : 3, as it is possible to split up the tins into 2 groups, each containing 5 tins of blue and 3 tins of red.

Blue : Red = 10 : 6
= 5 : 3

To simplify a ratio, divide each figure in the ratio by a common factor.
Simplifying Ratios (continued)

Example 2
Simplify each ratio:

(a) 4:6
(b) 24:36
(c) 6:3:12

(a) 4:6 \[= 2:3\]
(b) 24:36 \[= 2:3\]
(c) 6:3:12 \[= 2:1:4\]

Example 3
Concrete is made by mixing 20 kg of sand with 4 kg cement. Write the ratio of sand : cement in its simplest form

\[
\text{Sand : Cement} = 20 : 4 = 5 : 1
\]

Using ratios
The ratio of fruit to nuts in a chocolate bar is 3 : 2. If a bar contains 15g of fruit, what weight of nuts will it contain?

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Nuts</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2\times 5</td>
</tr>
<tr>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>

So the chocolate bar will contain 10g of nuts.
Sharing in a given ratio

Example

Lauren and Sean earn money by washing cars. By the end of the day they have made £90. As Lauren did more of the work, they decide to share the profits in the ratio 3:2. How much money did each receive?

Step 1  Add up the numbers to find the total number of parts

\[3 + 2 = 5\]

Step 2  Divide the total by this number to find the value of each part

\[90 ÷ 5 = £18\]

Step 3  Multiply each figure by the value of each part

\[3 \times £18 = £54\]
\[2 \times £18 = £36\]

Step 4  Check that the total is correct

\[£54 + £36 = £90 \quad \checkmark\]

Lauren received £54 and Sean received £36
Proportion

Two quantities are said to be in direct proportion if when one doubles the other doubles. We can use proportion to solve problems.

It is often useful to make a table when solving problems involving proportion.

**Example 1**

A car factory produces 1500 cars in 30 days. How many cars would they produce in 90 days?

<table>
<thead>
<tr>
<th>Days</th>
<th>Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>1500</td>
</tr>
<tr>
<td>90</td>
<td>4500</td>
</tr>
</tbody>
</table>

The factory would produce 4500 cars in 90 days.

**Example 2**

5 adult tickets for the cinema cost £27.50. How much would 8 tickets cost?

<table>
<thead>
<tr>
<th>Tickets</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>£27.50</td>
</tr>
<tr>
<td>1</td>
<td>£5.50</td>
</tr>
<tr>
<td>8</td>
<td>£44.00</td>
</tr>
</tbody>
</table>

Find the cost of 1 ticket:

\[
\frac{5 \times £27.50}{5 \times £5.50} = \frac{£44.00}{£44.00}
\]

The cost of 8 tickets is £44.
Information Handling : Tables

Example 1  The table below shows the average maximum temperatures (in degrees Celsius) in Barcelona and Edinburgh.

<table>
<thead>
<tr>
<th></th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
<th>J</th>
<th>A</th>
<th>S</th>
<th>O</th>
<th>N</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barcelona</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>17</td>
<td>20</td>
<td>24</td>
<td>27</td>
<td>27</td>
<td>25</td>
<td>21</td>
<td>16</td>
</tr>
<tr>
<td>Edinburgh</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>11</td>
<td>14</td>
<td>17</td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>13</td>
<td>8</td>
</tr>
</tbody>
</table>

The average temperature in June in Barcelona is 24°C

Frequency Tables are used to present information. Often data is grouped in intervals.

Example 2  Homework marks for Class 4B

27 30 23 24 22 35 24 33 38 43 18 29 28 28 27 33 36 30 43 50 30 25 26 37 35 20 22 24 31 48

<table>
<thead>
<tr>
<th>Mark</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 - 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 - 25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 - 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 - 35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36 - 40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41 - 45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46 - 50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each mark is recorded in the table by a tally mark. Tally marks are grouped in 5’s to make them easier to read and count.
Information Handling: Bar Graphs

Bar graphs are often used to display data. The horizontal axis should show the categories or class intervals, and the vertical axis the frequency. All graphs should have a title, and each axis must be labelled.

Example 1 The graph below shows the homework marks for Class 4B.

Example 2 How do pupils travel to school?

When the horizontal axis shows categories, rather than grouped intervals, it is common practice to leave gaps between the bars.
Information Handling : Line Graphs

Line graphs consist of a series of points which are plotted, then joined by a line. All graphs should have a title, and each axis must be labelled. The trend of a graph is a general description of it. Line graphs are used when one variable (y-axis) is known to be dependent on the other (x-axis).

Example 1 The graph below shows Heather’s weight over 14 weeks as she follows an exercise programme.

The trend of the graph is that her weight is decreasing.

Example 2 Graph of temperatures in Edinburgh and Barcelona.
A scatter diagram is similar to a line graph. Here the data is used to determine if there is a relationship between two variables. If a pattern appears on the graph it is called a correlation.

**Example**

The table below shows the height and arm span of a group of first year boys. This is then plotted as a series of points on the graph below.

<table>
<thead>
<tr>
<th>Arm Span (cm)</th>
<th>150</th>
<th>157</th>
<th>155</th>
<th>142</th>
<th>153</th>
<th>143</th>
<th>140</th>
<th>145</th>
<th>144</th>
<th>150</th>
<th>148</th>
<th>160</th>
<th>150</th>
<th>156</th>
<th>136</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>153</td>
<td>155</td>
<td>157</td>
<td>145</td>
<td>152</td>
<td>141</td>
<td>138</td>
<td>145</td>
<td>148</td>
<td>151</td>
<td>145</td>
<td>165</td>
<td>152</td>
<td>154</td>
<td>137</td>
</tr>
</tbody>
</table>

The graph shows a general trend, that as the arm span increases, so does the height. This graph shows a positive correlation.

The line drawn is called the line of best fit. This line can be used to provide estimates. For example, a boy of arm span 150cm would be expected to have a height of around 151cm.

Note that in some subjects, it is a requirement that the axes start from zero.
Information Handling: Pie Charts

A pie chart can be used to display information. Each sector (slice) of the chart represents a different category. The size of each category can be worked out as a fraction of the total using the number of divisions or by measuring angles.

Example

30 pupils were asked the colour of their eyes. The results are shown in the pie chart below.

How many pupils had brown eyes?

The pie chart is divided up into ten parts, so pupils with brown eyes represent \(\frac{2}{10}\) of the total.

\[\frac{2}{10} \text{ of 30} = 6\]

so 6 pupils had brown eyes.

If no divisions are marked, we can work out the fraction by measuring the angle of each sector.

The angle in the brown sector is 72°.

so the number of pupils with brown eyes

\[= \frac{72}{360} \times 30 = 6\]

If finding all of the values, you can check your answers - the total should be 30 pupils.
### Drawing Pie Charts

On a pie chart, the size of the angle for each sector is calculated as a fraction of 360°.

**Example:** In a survey about television programmes, a group of people were asked what was their favourite soap. Their answers are given in the table below. Draw a pie chart to illustrate the information.

<table>
<thead>
<tr>
<th>Soap</th>
<th>Number of people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastenders</td>
<td>28</td>
</tr>
<tr>
<td>Coronation Street</td>
<td>24</td>
</tr>
<tr>
<td>Emmerdale</td>
<td>10</td>
</tr>
<tr>
<td>Hollyoaks</td>
<td>12</td>
</tr>
<tr>
<td>None</td>
<td>6</td>
</tr>
</tbody>
</table>

Total number of people = 80

Eastenders = \( \frac{28}{80} \times 360° = 126° \)

Coronation Street = \( \frac{24}{80} \times 360° = 108° \)

Emmerdale = \( \frac{10}{80} \times 360° = 45° \)

Hollyoaks = \( \frac{12}{80} \times 360° = 54° \)

None = \( \frac{6}{80} \times 360° = 27° \)

Check that the total = 360°

---

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<tr>
<td>Hollyoaks</td>
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<tr>
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</tbody>
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Emmerdale = \( \frac{10}{80} \times 360° = 45° \)

Hollyoaks = \( \frac{12}{80} \times 360° = 54° \)

None = \( \frac{6}{80} \times 360° = 27° \)

Check that the total = 360°
Information Handling : Averages

To provide information about a set of data, the average value may be given. There are 3 ways of finding the average value - the mean, the median and the mode.

**Mean**
The mean is found by adding all the data together and dividing by the number of values.

**Median**
The median is the middle value when all the data is written in numerical order (if there are two middle values, the median is half-way between these values).

**Mode**
The mode is the value that occurs most often.

**Range**
The range of a set of data is a measure of spread.
Range = Highest value - Lowest value

**Example**  Class 1A4 scored the following marks for their homework assignment. Find the mean, median, mode and range of the results.

7, 9, 7, 5, 6, 7, 10, 9, 8, 4, 8, 5, 7, 10

Mean = \[\frac{7 + 9 + 7 + 5 + 6 + 7 + 10 + 9 + 8 + 4 + 8 + 5 + 7 + 10}{14}\]
= \[\frac{102}{14}\] = 7.285...
Mean = 7.3 to 1 decimal place

Ordered values: 4, 5, 5, 6, 7, 7, 7, 8, 8, 9, 9, 10, 10

Median = 7

7 is the most frequent mark, so Mode = 7

Range = 10 - 4 = 6
### Mathematical Dictionary (Key words):

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Add; Addition (+)</strong></td>
<td>To combine 2 or more numbers to get one number (called the sum or the total)</td>
</tr>
<tr>
<td>Example: 12+76 = 88</td>
<td></td>
</tr>
<tr>
<td><strong>a.m.</strong></td>
<td>(ante meridiem) Any time in the morning (between midnight and 12 noon).</td>
</tr>
<tr>
<td><strong>Approximate</strong></td>
<td>An estimated answer, often obtained by rounding to nearest 10, 100 or decimal place.</td>
</tr>
<tr>
<td><strong>Calculate</strong></td>
<td>Find the answer to a problem. It doesn’t mean that you must use a calculator!</td>
</tr>
<tr>
<td><strong>Data</strong></td>
<td>A collection of information (may include facts, numbers or measurements).</td>
</tr>
<tr>
<td><strong>Denominator</strong></td>
<td>The bottom number in a fraction (the number of parts into which the whole is split).</td>
</tr>
<tr>
<td><strong>Difference (-)</strong></td>
<td>The amount between two numbers (subtraction).</td>
</tr>
<tr>
<td>Example: The difference between 50 and 36 is 14 50 - 36 = 14</td>
<td></td>
</tr>
<tr>
<td><strong>Division (÷)</strong></td>
<td>Sharing a number into equal parts.</td>
</tr>
<tr>
<td>Example: 24 ÷ 6 = 4</td>
<td></td>
</tr>
<tr>
<td><strong>Double</strong></td>
<td>Multiply by 2.</td>
</tr>
<tr>
<td><strong>Equals (=)</strong></td>
<td>Makes or has the same amount as.</td>
</tr>
<tr>
<td><strong>Equivalent fractions</strong></td>
<td>Fractions which have the same value.</td>
</tr>
<tr>
<td>Example: (\frac{6}{12}) and (\frac{1}{2}) are equivalent fractions</td>
<td></td>
</tr>
<tr>
<td><strong>Estimate</strong></td>
<td>To make an approximate or rough answer, often by rounding.</td>
</tr>
<tr>
<td><strong>Evaluate</strong></td>
<td>To work out the answer.</td>
</tr>
<tr>
<td><strong>Even</strong></td>
<td>A number that is divisible by 2.</td>
</tr>
<tr>
<td>Even numbers end with 0, 2, 4, 6 or 8.</td>
<td></td>
</tr>
<tr>
<td><strong>Factor</strong></td>
<td>A number which divides exactly into another number, leaving no remainder.</td>
</tr>
<tr>
<td>Example: The factors of 15 are 1, 3, 5, 15.</td>
<td></td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>How often something happens. In a set of data, the number of times a number or category occurs.</td>
</tr>
<tr>
<td><strong>Greater than (&gt;)</strong></td>
<td>Is bigger or more than.</td>
</tr>
<tr>
<td>Example: 10 is greater than 6.</td>
<td>10 &gt; 6</td>
</tr>
<tr>
<td><strong>Least</strong></td>
<td>The lowest number in a group (minimum).</td>
</tr>
<tr>
<td><strong>Less than (&lt;)</strong></td>
<td>Is smaller or lower than.</td>
</tr>
<tr>
<td>Example: 15 is less than 21.</td>
<td>15 &lt; 21</td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>The largest or highest number in a group.</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>The arithmetic average of a set of numbers (see p32)</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>Another type of average - the middle number of an ordered set of data (see p32)</td>
</tr>
<tr>
<td><strong>Minimum</strong></td>
<td>The smallest or lowest number in a group.</td>
</tr>
<tr>
<td><strong>Minus (−)</strong></td>
<td>To subtract.</td>
</tr>
<tr>
<td><strong>Mode</strong></td>
<td>Another type of average - the most frequent number or category (see p32)</td>
</tr>
<tr>
<td><strong>Most</strong></td>
<td>The largest or highest number in a group (maximum).</td>
</tr>
</tbody>
</table>
| **Multiple**         | A number which can be divided by a particular number, leaving no remainder.  
Example: Some of the multiples of 4 are 8, 16, 48, 72 |
| **Multiply (x)**     | To combine an amount a particular number of times.  
Example: 6 x 4 = 24 |
| **Negative Number**  | A number less than zero. Shown by a minus sign.  
Example: -5 is a negative number. |
| **Numerator**        | The top number in a fraction. |
| **Odd Number**       | A number which is not divisible by 2.  
Odd numbers end in 1, 3, 5, 7 or 9. |
| **Operations**       | The four basic operations are addition, subtraction, multiplication and division. |
| **Order of operations** | The order in which operations should be done.  
BODMAS (see p9) |
| **Place value**      | The value of a digit dependent on its place in the number.  
Example: in the number 1573.4, the 5 has a place value of 100. |
| **p.m.**             | (post meridiem) Any time in the afternoon or evening (between 12 noon and midnight). |
| **Prime Number**     | A number that has exactly 2 factors (can only be divided by itself and 1). Note that 1 is not a prime number as it only has 1 factor. |
| **Product**          | The answer when two numbers are multiplied together.  
Example: The product of 5 and 4 is 20. |
| **Remainder**        | The amount left over when dividing a number. |
| **Share**            | To divide into equal groups. |
| **Sum**              | The total of a group of numbers (found by adding). |
| **Total**            | The sum of a group of numbers (found by adding). |