Dungannon Cookstown Area Learning Community

Best Practice in Numeracy Guidelines
1. **Topics for Best Practice Guidelines**  
   
2. **Consistency of Practice:**  
   Agreed strategies for  
   - Teachers of mathematics and  
   - Teachers of subjects other than mathematics.  

3. **Transfer of Skills**  
   With suggested examples and ideas of use in each subject area across the curriculum.
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Consistency of Practice

The Mathematical Association recommends that teachers of Mathematics and teachers of other subjects co-operate on agreed strategies.

In particular, that:

**Teachers of mathematics should:**

1. be aware of the mathematical techniques used in other subjects and provide assistance and advice to other departments, so that a correct and consistent approach is used in all subjects.

2. provide information to other subject teachers on appropriate expectations of students and difficulties likely to be experienced in various age and ability groups.

3. through liaison with other teachers, attempt to ensure that students have appropriate numeracy skills by the time they are needed for work in other subject areas.

4. seek opportunities to use topics and examination questions from other subjects in mathematics lessons

**Teachers of subjects other than mathematics should:**

1. ensure that they are familiar with correct mathematical language, notation, conventions and techniques, relating to their own subject, and encourage students to use these correctly.

2. be aware of appropriate expectations of students and difficulties that might be experienced with numeracy skills.

3. provide information for mathematics teachers on the stage at which specific numeracy skills will be required for particular groups.

4. provide resources for mathematics teachers to enable them to use examples of applications of numeracy relating to other subjects in mathematics lessons
Transfer of Skills

“It is vital that as the skills are taught, the applications are mentioned and as the applications are taught the skills are revisited.”

The transfer of skills is something that many pupils find difficult. It is essential to start from the basis that pupils realise it is the same skill that is being used; sometimes approaches in subjects differ so much that those basic connections are not made.

Subject areas are more aware of the underlying maths skills and approaches that go with the applications that they use. Some mathematical opportunities across the curriculum are listed below.

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<td>• Use standard measures to find length</td>
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<td>• Form repeating patterns (tessellations), making use of reflection, rotation and translation.</td>
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<td></td>
<td>• Use of paint mixing as a ratio context.</td>
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<td></td>
<td>• Many patterns and constructions in our own and other cultures are based on spatial ideas and properties of shapes, including symmetry.</td>
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<td>• Calculating the golden ratio in pictures/drawings (Mona Lisa)</td>
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<td>• Drawing in 3 dimensions</td>
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<td><strong>Business Studies</strong></td>
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<td></td>
<td>• Use of mathematical vocabulary e.g. sum, profit</td>
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<td>• Sketching graphs to show change over time</td>
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<td>• Accurate graph drawing including labelling axes</td>
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<td>• Sampling and surveying in market research</td>
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<td>• Awareness of sensible answers - approximate calculation including percentages, fractions, multiplication, division etc.</td>
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<td>Subject</td>
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| Design Technology     | • Use standard measures (metric and imperial) to find length, mass, time, force, temperature area or capacity.  
                        | • Use mathematical symbols and notation, construct and interpret graphs and charts.  
                        | • Use scale and ratio to produce drawings.  
                        | • Using ruler, compass, protractor correctly  
                        | • Converting between units  
                        | • Drawing in 2 dimension or 3 dimensions, including plans and elevations | [http://motivate.maths.org/content/node/110](http://motivate.maths.org/content/node/110) |
| Home Economics        | • Using recipes in a ratio/proportion context  
                        | • Estimation of quantities or of results of calculations  
                        | • Sampling and surveying  
                        | • Reading scales on equipment  
                        | • Converting between units  
                        | • Time planning including Gantt charts, timelines etc.  
                        | • Pricing the cost of a meal/product  
                        | • Temperature |                                      |
| English               | • Comparison of 2 data sets on word and sentence length.  
                        | • Graph sketching eg, tension throughout an act of a play  
                        | • Use of fractions and percentages in persuasive writing including misleading graphs  
                        | • Reading and writing numbers, identifying centuries  
                        | • Coding, secret codes  
                        | • Grouping/categorising ideas/words |                                      |
| Geography             | • Use mathematical symbols and notation, construct and interpret graphs and charts.  
                        | • Use grids to identify position (links to co-ordinates and grid references).  
                        | • Use negative numbers to interpret below sea level.  
                        | • Use standard measures (metric and imperial) to find length, mass, time, force, temperature area or capacity, especially distance and area.  
                        | • Discussing evidence in history or geography may involve measurement, estimation and approximation skills, and making inferences.  
                        | • Pupils will make statistical enquiries, for example, in analysing population data to explore and compare lifestyles; they will also use a wide range of measurements and rates of change.  
<pre><code>                    | • The study of maps includes the use of coordinates and ideas of angle, direction, position, scale and ratio. | [http://motivate.maths.org/content/node/110](http://motivate.maths.org/content/node/110) |
</code></pre>
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<tr>
<th>Subject</th>
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| Citizenship PD   | • Use mathematical symbols and notation, construct and interpret graphs and charts.  
• Use standard measures (metric and imperial) to find length, mass, time, force, temperature area or capacity.  
• Use timelines and interpret negative numbers.  
• Consider infinity and the meaning of this conceptually  
• Reflect on logic and the process of constructing a sound argument  
• Belief and likelihood in religious education, or risk assessment in PSHE, relate well to work in mathematics. The discussion of moral and social issues is likely to lead to the use of primary and secondary data and the interpretation of graphs, charts and tables, helping pupils to make reasoned and informed decisions and to recognise biased data and misleading representations. By applying mathematics to problems set in financial and other real-life contexts, pupils will develop their financial capability and awareness of the applications of mathematics in the workplace. | http://motivate.maths.org/content/resources/maths-history                  |
| LLW              |                                                                                                                                                                                                                                                                                                                                                                                             |
| History & R.E.   | • Use timelines and interpret negative numbers. (AD and BC)  
• Use fractions and percentages to express and compare proportions  
• Use scale to interpret maps and diagrams  
• Use mathematical symbols and notation, construct and interpret graphs and charts.                                                                                     | http://motivate.maths.org/content/resources/maths-history                  |
| ICT              | • Use mathematical symbols and notation (sigma for sum), construct and interpret graphs and charts.  
• Use formulae to calculate and to interpret data in spreadsheets.                                                                                                           | http://motivate.maths.org/content/resources/maths-ICT                     |
<p>|                  | • In ICT lessons, pupils will collect and classify data, enter them into data-handling software, produce graphs and tables, and interpret and explain their results. Their work in control will include the measurement of distance and angle.                                                                                                         |
|                  | • Spreadsheet skills, used in modelling and simulations, rely on the numeric, algebraic and graphical skills involved in constructing formulae and generating sequences, functions and graphs.                                                                                                                   |                                                                         |</p>
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<tr>
<th>Subject</th>
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| **Languages** | • Use dates, sequences and counting in other languages;  
• Use basic graphs and surveys to practise language vocabulary and reinforce interpretation of data.  
• Use of and calculation with money  
• Conversion/exchange rates  
• Directions |  
| **Music** | • Use addition of fractions in bar music  
• Use counting for beats  
• Use sound waves, frequency and oscillations  
• Use graph sketching to demonstrate change over time e.g. in dynamics over a piece of music | [http://motivate.maths.org/content/node/130](http://motivate.maths.org/content/node/130) |
| **PE** | • Use time, height and distance in measurements.  
• Telling the time, timekeeping  
• Reading from scales using measuring equipment  
• Calculation of speed, acceleration, deceleration and graphing of these over time during an action/event  
• Use fractions to identify time.  
• Design data collection sheets.  
• Collect and record real data, find the averages, compare and draw conclusions.  
• Sequencing results (decimals, lengths etc)  
• Scoring  
• Athletic activities use measurement of height, distance and time, and data-logging devices to quantify, explore, and improve performance.  
• Ideas of counting, time, symmetry, movement, position and direction are used extensively in music, dance, gymnastics, athletics and competitive games. E.g. angles, rotation, planes, axes | [http://motivate.maths.org/content/node/131](http://motivate.maths.org/content/node/131) |
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<td>• Use formulae to calculate work, power, mass, density</td>
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<td></td>
<td>• Rearrange formulae</td>
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<td></td>
<td>• Use graphs to represent data, interpretation of graphs</td>
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<td></td>
<td>• Estimating quantities or results of calculations</td>
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<td></td>
<td>• Use standard measures to find length, mass, time, force, temperature, area or capacity:</td>
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<td></td>
<td>• Hypothesise before an experiment, consider limitations to findings afterwards</td>
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<td>• Manipulate numerical data from their experiments and do calculations including averages;</td>
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<td>• Record results in tables – choose appropriate form and design data collection sheets</td>
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<td>• Use mathematical symbols and notation, construct and interpret graphs and charts.</td>
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<td>• Constructing graphs, extrapolating, recognising patterns</td>
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<td>• Take readings from scales</td>
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Multiplication

**Multiplication Tips:**

- X 10 – Add a 0 to a whole number or otherwise move the digits one place to the left
- x 100 – Add 00 to a whole number or otherwise move the digits two places to the left
- x 1000 – Add 000 to a whole number or otherwise move the digits three places to the left

**Remember, for a whole number the decimal point is to the right of the units digit.**

- Use knowledge of facts
- Eg. 7 x 8 = 56
  - 70 x 8 = 560
  - 7 x 80 = 560 etc.

**Partitioning**

- Eg. 13 x 4 = (10 + 3) x 4
  - = 10 x 4 + 3 x 4
  - = 40 + 12
  - = 52
Division

Divisibility tests

- Divisible by 2 if the number ends in an even number or 0
  eg 124 is divisible by 2 because 4 is an even number
- Divisible by 3 if the sum of the digits is divisible by 3
  eg 123 is divisible by 3 because the sum = 6 and 6 is divisible by 3
- Divisible by 4 if the last 2 digits are divisible by 4
  eg 248 is divisible by 4 because 48 is divisible by 4
- Divisible by 5 if the number ends in a 5 or a 0
  eg 255 is divisible by 5 because it ends in 5
- Divisible by 6 if the number is divisible by 2 and 3
  eg 126 is divisible by 6 because it follows the rules for divisibility for 2 and 3
- Divisible by 9 if the sum of the digits is divisible by 9
  eg 81 is divisible by 9 because 8 + 1 = 9 and 9 is divisible by 9
- Divisible by 10 if the number ends in a 0
  eg 2580 is divisible by 10 because it ends in a 0.

Divide by 10 – If the number ends in 0 remove it, otherwise move the digits one place to the right
Divide by 100 – If the number ends in 00 remove them, otherwise move the digits two places to the right
Divide by 1000 – If the number ends in 000 remove them, otherwise move the digits three places to the right

**Remember, for a whole number the decimal point is to the right of the units digit.**

Know simple facts

- $x$ by 5 is the same as $x$ 10 and dividing by 2
- $x$ 25 is the same as $x$ 100 and dividing by 4
- $x$ 50 is the same as $x$ 100 and dividing by 2
- Dividing by 5 is the same as dividing by 10 and $x$ 2
- Dividing by 25 is the same as dividing by 100 and $x$ 4
- Dividing by 50 is the same as dividing by 100 and $x$ 2

Doubling and halving technique

- 24 x 6 (half the 24 and double the 6)
- 12 x 12
- = 144
- Partitioning
- 92 divided by 4 = (80 + 12) divided by 4
  = 20 + 3
  = 23
- (Could also divide by 2 and then divide by 2 again instead of dividing by 4)
Directed Numbers: The Number Line

Rules for adding, subtracting, multiplying and dividing negative numbers

Two signs
When adding or subtracting negative numbers, remember that when two signs appear next to each other and are different, then you subtract. When two signs are next to each other and they are the same, you add:

Eg. \( 2 + (-2) \) or \(-4 - (-6)\)

\[
\begin{align*}
\text{Eg.} & \quad 2 + (-2) \quad \text{or} \quad -4 - (-6) \\
& \quad = 2 - 2 \quad \quad \quad = -4 + 6 \\
& \quad = 0 \quad \quad \quad \quad \quad = 2
\end{align*}
\]

Multiplying and dividing
The rules for multiplying and dividing are:

- When the signs are different the answer is negative.
- When the signs are the same the answer is positive.

Eg. \(-2 \times 3 = -6\)

or \(-12 \div -2 = 6\)
PATTERN SPOTTING

Pattern Spotting:
The most common patterns are odd, even, prime, square, cube and triangular.

In a number sequence, the same difference between successive terms can occur, for eg., 3, 5, 7, 9, 11….. (a common difference of 2).

Additionally, an increased difference by one each time between terms of the sequence can occur, for eg. 2, 3, 5, 8, 12… (difference of 1, then 2, then 3 etc.)

Fibonacci sequences are also common where the next term is found by adding the two previous terms, for example, 1, 1, 2, 3, 5, 8……

Within sequences and diagrams it is important to understand the rule to move to the next term of the sequence (in the diagram below 2 is added each time).

ESTIMATION (height, weight, etc.)

Estimation of Length:
Example: The average person is 1.6m tall, estimate how many men would it take to equate to the length of, for example, a football pitch or the height of a building (tall objects)?

For small objects, for example, estimate how many feet would be equivalent to the height of a door (1 foot is approximately the same length as a 30 cm ruler)?

Estimation of Weight:
Typical Questions:
Is this lighter or heavier than a 1 kg bag of sugar?
How many bags of sugar?
For lighter objects use a 25g bag of crisps.

Estimation of Capacity: Here is a 2lt milk container. How many could you use to fill typical objects? For smaller capacity, use a can of Coke 330 ml.
Fractions

- Basic fractions

- Pupils should be aware that fractions, decimals and percentages are different ways of representing part of a whole and know the simple equivalents.
Calculating a fraction or percentage of a number

- Where percentages have simple fraction equivalents, fractions of the amount can be calculated.

eg.  i) To find 50% of an amount, halve the amount.
   
   ii) To find 75% of an amount, find a quarter by dividing by four and then multiply it by three.

- Most other percentages can be found by finding 10%, by dividing by 10, and then finding multiples or fractions of that amount.

eg.  To find 30% of an amount first find 10% by dividing the amount by 10 and then multiply this by three.
   
   30% = 3x10%

Similarly: 5% = half of 10% and 15% = 10% + 5%

- Most other percentages can be calculated in this way.
Proper, Improper fractions and mixed numbers

Proper fraction = the numerator is smaller than the denominator
  e.g. $\frac{2}{5}$

Improper fraction = the numerator is greater than the denominator
  e.g. $\frac{7}{4}$

Mixed number = a whole number and a proper fraction together
  e.g. $1\frac{3}{4}$ where this means 1 whole and $\frac{3}{4}$ of a whole.
  This can also be written as an improper fraction, $\frac{7}{4}$
RATIO AND PROPORTION

Ratios are one way of comparing amounts of things. Ratios can tell us how much bigger, or smaller, one thing is than another. In other words, ratios show how much of one thing we have in relation to another thing.

Example of ratio
In the example below we are trying to get purple paint by mixing cans of red and blue paint.

4 parts blue paint

3 parts red paint

The ratio of blue to red paint is 4:3

Writing a ratio in the form 1:n or n:1
To write a ratio in its simplest form we divide both sides by their highest common factor (just as we divide the top and bottom of a fraction).

For example, 12:15 becomes 4:5, and 4:8 becomes 1:2.

When a ratio is in its simplest form, all the numbers are whole numbers.

However, it is sometimes useful to write a ratio in the form 1:n or n:1 (where n is any number, possibly a fraction or decimal). This means we will not necessarily be dealing with whole numbers.

For example, if we are asked to write the ratio 2:5 in the form 1:n, we need to make the left-hand side of the ratio equal to 1. We do this by dividing both sides of the ratio by 2.

\[ 2:5 = \frac{2}{2} : \frac{5}{2} \]

\[ = 1 : 2.5 \]

If we were asked to write 2:5 in the form n:1, we would need to make the right-hand side equal to 1. So we would divide both sides by 5:

\[ 2:5 = \frac{2}{5} : \frac{5}{5} = 0.4 : 1 \]
Reading and interpreting scales on axes

It is important that pupils can read and interpret scales on axes accurately. Pupils will need to work out what each division represents. This is done by dividing the difference between the two values by the number of divisions between them.

For example
The horizontal axis is going up in 10s and there are 5 divisions between the values. So each small division = 10 ÷ 5 = 2

The vertical axis is going up in 20s and there are 5 divisions between the values. So each small division = 20 ÷ 5 = 4
Reading and interpreting scales on axes

For this set of axes the horizontal axis is going up in 5s and there are 2 divisions between the values.
So each small division = $5 \div 2 = 2.5$ minutes

The vertical axis is going up in 1s and there are 5 divisions between the values.
So each small division = $1 \div 5 = 0.2$ km
Co-ordinates

When drawing a diagram on which co-ordinates have to be plotted, pupils should write the numbers on the lines and not in the spaces. The co-ordinate plotted on the grid below is (5,2). The first number is the x co-ordinate. The second number is the y co-ordinate.

Plotting co-ordinates in the four quadrants

The point (-3, 5) means move 3 to the left of 0 along the x axis and then 5 up in the direction of the y axis (as plotted in the diagram).
Bar Charts

Bar charts should be drawn on squared or graph paper. The way in which the graph is drawn depends on the type of data being represented.

Graphs should be drawn with **gaps between the bars** if the data categories are not numerical (colours, makes of car, etc). There should also be gaps if the data is numeric but can only take a particular value – **DISCRETE DATA** (number of children in a class, shoe size, KS3 level, etc).

Graphs should be drawn with **no gaps between the bars** if the data comes from measuring and can take any value – **CONTINUOUS DATA** (height, weight, temperature, etc).

All bars should be drawn the same width. Pupils should give the bar chart a title and label the axes.
Bar Charts for Discrete Data

When there are gaps in the graph, the horizontal axis will be labelled beneath the bars. The labels on the vertical axis should be across from the lines.

Notice the scale. The numbers are written across from the lines and need to go in equal steps.
Bar Charts for Continuous Data

When there are no gaps in the graph, scale the horizontal axis so that the numbers go from the smallest to the largest values required. The numbers should be written below the lines and not in the centre of the squares. When the values do not start at zero, this can be shown on the graph by a broken axis. Your scale should go in equal steps. The labels on the vertical axis should be across from the lines.

Notice the scale. The numbers are written across from the lines and need to go in equal steps.

This symbol indicates that a section of the axis has been cut out.

Notice the values are written below the lines and are spaced out equally.
Line Graphs

A line graph is useful for displaying information gathered over a period of time. The horizontal axis should represent time and should be scaled in equal steps with the values written below the lines and not in the centre of the squares. The labels on the vertical axis should be across from the lines. The points are then plotted and joined with straight lines. The trend can then be seen over this period of time. Pupils should give the line graph a title and label the axes.

The line graph shows the growth of a plant over an 8 week period.
Scatter Graphs

A scatter graph is a way of displaying two sets of data to see if there is a relationship between them. The relationship between the two sets of data is called the correlation.

Scatter graphs should be drawn on squared or graph paper.

The horizontal axis is used for one set of data and should be scaled in equal steps with the values written below the lines. The vertical axis is used for the other set of data and should be scaled in equal steps with the values written across from the lines.

The points are then plotted using Xs in the same way as co-ordinates are plotted. These points should not be joined.

Pupils should give the scatter graph a title and label the axes.
Scatter Graphs

The marks of seven students in a History test and a Geography test are given in the table. The scatter graph below illustrates this data.

<table>
<thead>
<tr>
<th>History mark</th>
<th>34</th>
<th>52</th>
<th>64</th>
<th>22</th>
<th>48</th>
<th>38</th>
<th>61</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geography mark</td>
<td>47</td>
<td>61</td>
<td>79</td>
<td>31</td>
<td>64</td>
<td>48</td>
<td>77</td>
</tr>
</tbody>
</table>

![Scatter Graph Image]
Correlation and Line of best fit

There are three types of correlation:

- Positive correlation – this is when as one data set increases so does the other.
- Negative correlation – this is when as one data set increases the other decreases.
- No correlation – this is when there is no relationship between the points.

The line of best fit should be drawn using a ruler and should show the general direction in which the points are lying. There should roughly be the same number of data points on either side of the line. The line of best fit should only be drawn if there is a positive or negative correlation. The gradient (slope) of the line of best fit shows the type of correlation. A positive gradient (slopes up) shows there is a positive correlation. A negative gradient (slopes down) shows there is a negative correlation.
Pie Charts

Pie charts - representing data in 360°

30 people were asked which newspapers they read regularly.

<table>
<thead>
<tr>
<th>Newspaper</th>
<th>Number of people</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Guardian</td>
<td>8</td>
</tr>
<tr>
<td>Daily Mirror</td>
<td>7</td>
</tr>
<tr>
<td>The Times</td>
<td>3</td>
</tr>
<tr>
<td>The Sun</td>
<td>6</td>
</tr>
<tr>
<td>Daily Express</td>
<td>6</td>
</tr>
</tbody>
</table>

There are 30 people in the survey and 360° in a full pie chart.

The number of degrees in a circle: \( 360° / 30 = 12° \)

This means each person in the list is represented by 12°.

So we can now calculate the angle for each category.

<table>
<thead>
<tr>
<th>Newspaper</th>
<th>No of people</th>
<th>Working (No of people x 12)</th>
<th>Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Guardian</td>
<td>8</td>
<td>8 x 12</td>
<td>96°</td>
</tr>
<tr>
<td>Daily Mirror</td>
<td>7</td>
<td>7 x 12</td>
<td>84°</td>
</tr>
<tr>
<td>The Times</td>
<td>3</td>
<td>3 x 12</td>
<td>36°</td>
</tr>
<tr>
<td>The Sun</td>
<td>6</td>
<td>6 x 12</td>
<td>72°</td>
</tr>
<tr>
<td>Daily Express</td>
<td>6</td>
<td>6 x 12</td>
<td>72°</td>
</tr>
</tbody>
</table>

Total: 30, 360°

---

Drawing pie charts

- Once the angles have been calculated you can draw the pie chart.
- If not already given, start by drawing a circle using a compass.
- Draw a radius. (Sometimes this is already given)
- Measure the first angle (96°) from the radius using a protractor and label the sector.
- Measure the next angle (84°) from the last line you drew and label the sector.
- Repeat for each sector until the pie chart is complete.
Compound Measures

- A **compound measure** is made up of two or more other **measurements**.
- One example of a **compound measure** is speed.
  - Speed is a **compound measure** because it is calculated from distance and time.
  - Look at the triangles below to see the relationship between speed, distance, and time.

  ![Speed Triangle](image)

  So this will be written as **distance per time**. The most common units used to measure speed are mph (miles per hour) or km/h (kilometres per hour).

- This equation triangle can be used to help rearrange equations

  ![Distance and Time Triangle](image)

Other examples of Compound Measures

**Density**

- Mass = Density × Volume
- Density = Mass ÷ Volume
- Volume = Mass ÷ Density

**Question**

Work out the density of a 4 kg lump of metal with a volume of 1.25 m³.

**Solution**

Density = Mass ÷ Volume, so: 4 ÷ 1.25 = 3.2 kg per m³.

**Force**

- Force = Pressure × Area
- Pressure = Force ÷ Area
- Area = Force ÷ Pressure

**Question**

Find the pressure exerted by a force of 900 Newtons on an area of 60 cm².

**Solution**

Pressure = Force ÷ Area
900 ÷ 60 = 15 N/cm²
Averages

**MEAN**

Is also known as the “average”

1. Add up all the values to get the total
2. Then divide the total by the number of values you added together

\[
\frac{3 + 4 + 8 + 7 + 5 + 3}{6} = 5
\]

The average for these values is 5

**MEDIAN**

The “middle” number in a set of values

1. First put all the values in order
2. Find the middle number in the set of data
3. If there are two values in the middle, find the mean of these two.

\[
1, 2, 4, 5, 6, 8, 9
\]

The median is 5.
**MODE**

The number which occurs the most

1. Count how many of each value appears
2. The mode is the value which appears the most
3. There can be more than 1 mode

\[ 1, 2, 2, 5, 6, 6, 9 \]

2 and 6 are the mode for these values

**RANGE**

The range is the difference between the highest and lowest value

1. Find the highest and lowest values
2. Subtract the lowest value from the highest value.

\[ 1, 2, 2, 5, 6, 6, 9 \]

\[ 9 - 1 = 8 \]

The range is 8
Approximations

Rounding Rules!
Find the number.
Look RIGHT next door.
5 or more?
Raise the Score!
4 or less?
Let it Rest!

Estimation & Rounding

Rounding helps estimate answers to calculations and shorten answers that have too many decimal places.
Money should always be rounded to two decimal places.

Rules for Rounding
If the number that follows the digit that is being rounded is five or greater, we round UP.
Otherwise, the digit that is being rounded stays the same.

Example
328·045 → 300 to the nearest 100
330 to the nearest 10
328 to the nearest whole number
328·0 to 1 decimal place
328·05 to 2 decimal places
How to round to significant figures

<table>
<thead>
<tr>
<th>Number</th>
<th>... to 1 significant figure</th>
<th>... to 2 significant figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>3875</td>
<td>4000</td>
<td>3900</td>
</tr>
<tr>
<td>6.254</td>
<td>6</td>
<td>6.3</td>
</tr>
<tr>
<td>0.07109</td>
<td>0.07</td>
<td>0.071</td>
</tr>
</tbody>
</table>

Significant Figures:

The most significant, or most important, digit in a number has the highest place value. The first significant figure is the first non-zero digit in a number.

3510 4780060 0.29 0.00052

Approximation

To give an approximate answer, or an estimate, we need to make each number very easy to use. This means rounding each number to 1 significant figure before any calculations are performed.

\[
\begin{align*}
37 \times 0.074 &= 2.678 \\
40 \times 500 &= 20000 \\
36000 &= 1200
\end{align*}
\]

YOU MUST show each rounded number that you use.

\[
\begin{align*}
15.8 \times 42.06 &= 660.1272 \\
0.175 &= 0.2 \\
800 &= 4000
\end{align*}
\]
Compass Points

Turning

Turning and Angles
Shapes

It is important to use correct names of shapes. 2D and 3D shapes and their properties are below.

2D Shapes

A polygon is a 2D shape consisting of 3 or more straight sides. A regular polygon has all sides and angles the same size. Specific names of polygons are shown below in the table.

<table>
<thead>
<tr>
<th>Number of sides</th>
<th>Name of polygon</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Triangle</td>
</tr>
<tr>
<td>4</td>
<td>Quadrilateral</td>
</tr>
<tr>
<td>5</td>
<td>Pentagon</td>
</tr>
<tr>
<td>6</td>
<td>Hexagon</td>
</tr>
<tr>
<td>7</td>
<td>Heptagon</td>
</tr>
<tr>
<td>8</td>
<td>Octagon</td>
</tr>
<tr>
<td>9</td>
<td>Nonagon</td>
</tr>
<tr>
<td>10</td>
<td>Decagon</td>
</tr>
</tbody>
</table>

Some triangles have special names:

**Equilateral triangle**
All sides and angles are equal.

**Isosceles triangle**
Two sides and two angles are equal.

**Scalene triangle**
All sides and angles are different.

**Right-angled triangle**
One angle is a right angle (90°)
Some quadrilaterals have special names:

**Square**
- All sides are the same length and all angles are 90°

**Rectangle**
- Opposite sides are the same length and all angles are 90°

**Parallelogram**
- Opposite sides are parallel and the same length.
- Opposite angles are the same.

**Trapezium**
- One pair of opposite sides are parallel.

**Kite**
- Two pairs of adjacent sides are equal.
- One pair of opposite angles are equal.

**Rhombus (NOT diamond)**
- All sides are the same length.
- Opposite angles are equal.

A **circle** has a radius which goes from the centre to the rim (circumference). The diameter, which is twice the length of the radius, goes from a point on the circumference to a point opposite, passing through the centre.

**3D shapes**

The flat surfaces of a 3D shape are called faces. The lines where two faces meet are called edges. The point (corner) at which edges meet is called a vertex. The plural of vertex is vertices. Some 3D shapes and their properties are below.

**Cube**
- 6 faces, 12 edges and 8 vertices.

**Cuboid**
- 6 faces, 12 edges and 8 vertices.

**Cylinder**
- 3 faces, 2 edges and no vertices.
Area

Area of Squares and Rectangles
\[ = \text{base} \times \text{height} \]

Area of Triangles
\[ = \frac{1}{2} \times \text{base} \times \text{height} \]

Area of Parallelograms
\[ = \text{base} \times \text{height} \]

Area of Circle
\[ \text{Area} = \pi r^2 \]

Area of Trapeziums
\[ = \frac{1}{2} \times (a + b) \times \text{height} \]

Surface Area
Surface area is the area of the surface of a 3D shape. To calculate the surface area, calculate the area of every face of the shape, then add those areas together.
Choosing the Correct Units of Measurements

Below is a list of key words

<table>
<thead>
<tr>
<th>Distance</th>
<th>Mass</th>
<th>Volume/Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilometres (km)</td>
<td>Kilograms (kg)</td>
<td>Litres (L)</td>
</tr>
<tr>
<td>Metres (m)</td>
<td>Grams (g)</td>
<td>Millilitres (ml)</td>
</tr>
<tr>
<td>Centimetres (cm)</td>
<td>Milligrams (mg)</td>
<td>Gallons</td>
</tr>
<tr>
<td>Millimetres (mm)</td>
<td>Stone</td>
<td>Pints</td>
</tr>
<tr>
<td>Miles</td>
<td>Pounds</td>
<td></td>
</tr>
<tr>
<td>Yards</td>
<td>Ounces</td>
<td></td>
</tr>
<tr>
<td>Feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inches</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The units in bold are all METRIC units (more modern), while the remaining units are IMPERIAL units (older).

Examples

<table>
<thead>
<tr>
<th></th>
<th>Metric</th>
<th>Imperial</th>
</tr>
</thead>
<tbody>
<tr>
<td>The weight of a man</td>
<td>Kilograms</td>
<td>Pounds</td>
</tr>
<tr>
<td>The volume of water in a bath</td>
<td>Litres</td>
<td>Gallons</td>
</tr>
<tr>
<td>The length of an arm</td>
<td>Centimetres</td>
<td>Inches</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Metric</th>
<th>Imperial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of a football</td>
<td>Centimetres</td>
<td>Inches</td>
</tr>
<tr>
<td>Amount of fuel in a car fuel tank</td>
<td>Litres</td>
<td>Gallons</td>
</tr>
</tbody>
</table>
You NEED to learn the ones in red, these are requirements for GCSE Maths. They are NOT given in the exam.

### Converting Metric to Imperial

- **1 kg = 2.2 pounds**
- **1 foot = 30 cm**
- **1 mile = 1.6 km**
- **1 inch = 2.5 cm**
- **1 litre = 1.75 pints**
- **1 gallon = 4.5 litres**

You NEED to learn the ones in red, these are requirements for GCSE Maths. They are NOT given in the exam.
**Substituting into formulae**

It is essential that pupils write out what the formula means in “long hand”, before replacing the letters with numbers. Stressing the importance of method is essential to obtaining the correct answer. It is expected that pupils show all of the following working out exactly as detailed below, the equal signs all underneath each other.

**Example:** \( v = u + at \) means ‘\( v = u + a \times t \)’ (remembering to multiply first!)

So given \( u = 4, a = -5, t = 10, v = ? \)

We now *literally* replace the letters with the numbers and perform the calculation in the normal way, not forgetting to multiply first!

\[
\begin{align*}
v &= u + at \\
v &= 4 + (-5) \times 10 \\
v &= 4 + (-50) \\
v &= 4 - 50 \\
v &= -46
\end{align*}
\]

**Note**

Problems will occur if you provide the pupils with values for \( v, u \) and \( a \) and ask them to find the value of \( t \). This is quite a difficult concept for pupils who will need to be reminded of the method for changing the subject of a formula.

**Example:** The formula to change temperatures measured in degrees Celsius (°C) into degrees Fahrenheit (°F) is given by:

\[
F = \frac{9}{5}C + 32
\]

Change 35°C into °F.

\[
F = \frac{9}{5}C + 32 \quad \text{means} \quad F = 9 \times C + 5 + 32 \quad \text{or} \quad F = \frac{9}{5} \times C + 32
\]

\[
F = \frac{9}{5} \times 35 + 32
\]

\[
F = 9 \times 7 + 32
\]

\[
F = 63 + 32 \quad \rightarrow \quad F = 95 \, ^\circ F
\]
Example: \( s = ut + \frac{1}{2} at^2 \) means ‘\( s = ut + \frac{1}{2} \times a \times t^2 \)’ (remembering only \( t \) is squared!)\\

Find \( s \) given \( u = 2, \ a = -6, \ t = 3. \)

\[
\begin{align*}
\text{\( s = ut + \frac{1}{2} at^2 \)}
\end{align*}
\]
\[
\begin{align*}
\text{\( s = 2 \times 3 + \frac{1}{2} \times (-6) \times 3^2 \)}
\end{align*}
\]
\[
\begin{align*}
\text{\( s = \quad 6 + (-3) \times 9 \) (only multiply by \( \frac{1}{2} \) once)}
\end{align*}
\]
\[
\begin{align*}
\text{\( s = \quad 6 + (-27) \)}
\end{align*}
\]
\[
\begin{align*}
\text{\( s = \quad 6 - 27 \)}
\end{align*}
\]
\[
\begin{align*}
\text{\( s = \quad -21 \)}
\end{align*}
\]
Order of Operations

It is important that pupils follow the correct order of operations for arithmetic calculations. Most will be familiar with the mnemonic: BIDMAS (otherwise known as BODMAS).

Brackets, Indices, Division, Multiplication, Addition, Subtraction

Note: Indices is another word for powers. It includes squares, cubes, roots, and other higher, fractional and negative powers.

This shows the order in which calculations should be completed. eg

\[ 5 + 3 \times 4 \quad \text{NOT} \quad 5 + 3 \times 4 \]

means

\[ 5 + 12 \]

\[ = 17 \quad \checkmark \]

\[ = 32 \quad \times \]

The important facts to remember are that the Brackets are done first, then the Indices, Multiplication and Division and finally, Addition and Subtraction.

eg (i) \((5 + 3) \times 4\)

\[ = 8 \times 4 \]

\[ = 32 \]

eg (ii) \(5 + 6^2 \div 3 - 4\)

Indices first

\[ = 5 + 36 \div 3 - 4 \]

Division

\[ = 5 + 12 - 4 \]

\[ = 17 - 4 \]

\[ = 13 \]

Care must be taken with Subtraction.

eg \(5 - 12 + 4\)

\[ = -7 + 4 \]

\[ = -3 \quad \checkmark \]

\[ = -11 \quad \times \]

but \(5 - 12 + 4\)

\[ = 5 - 16 \]

For this to be correct it would have to be written: \(5 - (12 + 4)\) so that the bracket is worked out first.

eg. \(10 - 2 + 3\)

\[ = 8 + 3 \]

\[ = 11 \quad \checkmark \]

\[ = 5 \quad \times \]