

---

---

# CARS MATHS IN MOTION

---

---

## KS3 – ENGLAND - NUMBER AND ALGEBRA

### Using and applying number and algebra

explore connections in mathematics to develop flexible approaches to increasingly demanding problems; select appropriate strategies to use for numerical or algebraic problems

break down a complex calculation into simpler steps before attempting to solve it

use alternative approaches to overcome difficulties and evaluate the effectiveness of their strategies

make mental estimates of the answers to calculations; use checking procedures to monitor the accuracy of their results

### Communicating

develop correct and consistent use of notation, symbols and diagrams when solving problems

### Reasoning

show step-by-step deduction in solving a problem; explain and justify how they arrived at a conclusion

recognise the importance of assumptions when deducing results; recognise the limitations of any assumptions that are made and the effect that varying the assumptions may have on the solution to a problem.

### Calculator methods

## Numbers and the number system

### Decimals

use decimal notation and recognise that each terminating decimal is a fraction [for example,  $0.234 = 234$  one-thousandths]; order decimals

### Percentages

understand that 'percentage' means 'number of parts per 100' and use this to compare proportions; interpret percentage as the operator 'so many hundredths of'

## **Ratio and proportion**

use ratio notation, including reduction to its simplest form and its various links to fraction notation

recognise where fractions or percentages are needed to compare proportions; identify problems that call for proportional reasoning, and choose the correct numbers to take as 100%, or as a whole.

## **Calculations**

add, subtract, multiply and divide integers and then any number; multiply or divide any number by powers of 10, and any positive number by a number between 0 and 1; find the prime factor decomposition of positive integers

## **Written methods**

use standard column procedures for addition and subtraction of integers and decimals

use standard column procedures for multiplication of integers and decimals, understanding where to position the decimal point by considering what happens if they multiply equivalent fractions; solve a problem involving division by a decimal by transforming it to a problem involving division by an integer

solve simple percentage problems, including increase and decrease [for example, simple interest, VAT, discounts, pay rises, annual rate of inflation, income tax, discounts]

solve word problems about ratio and proportion, including using informal strategies and the unitary method of solution

## **Calculator methods**

use calculators effectively and efficiently: know how to enter complex calculations using brackets [for example, for negative numbers, or the division of more than one term], know how to enter a range of calculations, including those involving measures [for example, time calculations in which fractions of an hour need to be entered as fractions or decimals]

use the function keys for reciprocals, squares, square roots, powers, fractions (and how to enter a fraction as a decimal); use the constant key

understand the calculator display, interpreting it correctly [for example, in money calculations, and when the display has been rounded by the calculator], and knowing not to round during the intermediate steps of a calculation

## **Solving numerical problems**

draw on their knowledge of the operations and the relationships between them, and of simple integer powers and their corresponding roots, to solve problems involving ratio and proportion, a range of measures and compound measures, metric units, and conversion between metric and common imperial units, set in a variety of contexts

select appropriate operations, methods and strategies to solve number problems, including trial and improvement where a more efficient method to find the solution is not obvious

use a variety of checking procedures, including working the problem backwards, and considering whether a result is of the right order of magnitude

## **Simultaneous linear equations**

link a graphical representation of an equation to its algebraic solution; find an approximate solution of a pair of linear simultaneous equations by graphical methods, then find the exact solution by eliminating one variable; consider the graphs of cases that have no solution, or an infinite number of solutions

## **Numerical methods**

use systematic trial and improvement methods with ICT tools to find approximate solutions of equations where there is no simple analytical method

## **Breadth of study**

activities that ensure they become familiar with and confident using standard procedures for a range of problems, including ratio and proportion

solving familiar and unfamiliar problems, including multi-step problems, in a range of numerical, algebraic and graphical contexts and in open-ended and closed form

activities that develop short chains of deductive reasoning and concepts of proof in algebra and geometry

activities focused on geometrical definitions in which they do practical work with geometrical objects to develop their ability to visualise these objects and work with them mentally

practical work in which they draw inferences from data and consider how statistics are used in real life to make informed decisions

tasks focused on using appropriate ICT [for example, spreadsheets, databases, geometry or graphic packages], using calculators correctly and efficiently, and knowing when it is not appropriate to use a particular form of technology.

**Attainment Targets: Level 1, Level 2, Level 3, Level 4, Level 5, Level 6, Level 7**

## **SHAPE, SPACE AND MEASURES**

### **Using and applying shape, space and measures**

select problem-solving strategies and resources, including ICT, to use in geometrical work, and monitor their effectiveness

select and combine known facts and problem-solving strategies to solve complex problems

### **Reasoning**

distinguish between practical demonstration, proof, conventions, facts, definitions and derived properties

explain and justify inferences and deductions using mathematical reasoning

explore connections in geometry; pose conditional constraints of the type 'If ... then ...'; and ask questions 'What if ...?' or 'Why?'

### **Geometrical reasoning**

distinguish between acute, obtuse, reflex and right angles; estimate the size of an angle in degrees

### **Properties of triangles and other rectilinear shapes**

understand, recall and use Pythagoras' theorem

### **Measures and construction**

interpret scales on a range of measuring instruments, including those for time and mass; know that measurements using real numbers depend on the choice of unit; recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction; convert measurements from one unit to another; know rough metric equivalents of pounds, feet, miles, pints and gallons; make sensible estimates of a range of measures in everyday settings

understand angle measure, using the associated language [for example, use bearings to specify direction]

understand and use compound measures, including speed and density

### **Construction**

measure and draw lines to the nearest millimetre, and angles to the nearest degree; draw triangles and other 2-D shapes using a ruler and protractor, given information about their side lengths and angles; understand, from their experience of constructing them, that triangles satisfying SSS, SAS, ASA and RHS are unique, but SSA triangles are not; construct cubes, regular tetrahedra, square-based pyramids and other 3-D shapes from given information

### **Breadth of study**

activities that ensure they become familiar with and confident using standard procedures for a range of problems, including ratio and proportion

solving familiar and unfamiliar problems, including multi-step problems, in a range of numerical, algebraic and graphical contexts and in open-ended and closed form

practical work in which they draw inferences from data and consider how statistics are used in real life to make informed decisions

a sequence of activities that address increasingly demanding statistical problems

tasks focused on using appropriate ICT [for example, spreadsheets, databases, geometry or graphic packages], using calculators correctly and efficiently, and knowing when it is not appropriate to use a particular form of technology.

**Attainment Targets: Level 1, Level 2, Level 4, Level 5, Level 7, Level 8**

## **KS4 – ENGLAND – HANDLING DATA**

### **Using and applying handling data**

carry out each of the four aspects of the handling data cycle to solve problems:

specify the problem and plan: formulate questions in terms of the data needed, and consider what inferences can be drawn from the data; decide what data to collect (including sample size and data format) and what statistical analysis is needed

collect data from a variety of suitable sources, including experiments and surveys, and primary and secondary sources

process and represent the data: turn the raw data into usable information that gives insight into the problem

interpret and discuss: answer the initial question by drawing conclusions from the data

select and organise the appropriate mathematics and resources to use for a task

review progress while working; check and evaluate solutions

### **Communicating**

communicate mathematically, including using ICT, making use of diagrams and related explanatory text

examine critically, and justify, their choices of mathematical presentation of problems involving data

### **Reasoning**

apply mathematical reasoning, explaining and justifying inferences and deductions

explore connections in mathematics and look for cause and effect when analysing data

recognise the limitations of any assumptions and the effects that varying the assumptions could have on conclusions drawn from the data analysis.

### **Specifying the problem and planning**

see that random processes are unpredictable

discuss how data relate to a problem; identify possible sources of bias and plan to minimise it

### **Collecting data**

gather data from secondary sources, including printed tables and lists from ICT-based sources

### **Processing and representing data**

draw and produce, using paper and ICT, pie charts for categorical data, and diagrams for continuous data, including line graphs for time series, scatter graphs, frequency diagrams and stem-and-leaf diagrams

calculate mean, range and median of small data sets with discrete then continuous data; identify the modal class for grouped data

understand and use estimates or measures of probability from theoretical models (including equally likely outcomes), or from relative frequency

find the median for large data sets and calculate an estimate of the mean for large data sets with grouped data

### **Interpreting and discussing results**

interpret a wide range of graphs and diagrams and draw conclusions

consider and check results and modify their approach if necessary

use the vocabulary of probability to interpret results involving uncertainty and prediction

understand that if they repeat an experiment, they may - and usually will - get different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics

discuss implications of findings in the context of the problem

### **Breadth of study**

extending mental and written calculation strategies and using efficient procedures confidently to calculate with integers, fractions, decimals, percentages, ratio and proportion

solving a range of familiar and unfamiliar problems, including those drawn from real-life contexts and other areas of the curriculum

activities that provide frequent opportunities to discuss their work, to develop reasoning and understanding and to explain their reasoning and strategies

activities focused on developing short chains of deductive reasoning and correct use of the '=' sign

activities in which they do practical work with geometrical objects, visualise them and work with them mentally

practical work in which they draw inferences from data, consider how statistics are used in real life to make informed decisions, and recognise the difference between meaningful and misleading representations of data

activities focused on the major ideas of statistics, including using appropriate populations and representative samples, using different measurement scales, using probability as a measure of uncertainty, using randomness and variability, reducing bias in sampling and measuring, and using inference to make decisions

substantial use of tasks focused on using appropriate ICT [for example, spreadsheets, databases, geometry or graphic packages], using calculators correctly and efficiently, and knowing when not to use a calculator.

**Attainment Targets: Level 1, Level 2, Level 3, Level 4, Level 8**