MATHEMATICS Key Stage 3 Assessment

Mathematics has a vast set of inter-connected topics. In each topic there will always be the fundamental things that students must learn off by heart (facts, formulae, processes). They must be able to apply what they know accurately. A mathematician will be able to choose an appropriate or efficient way of linking together aspects of varying topics in order to solve a complex problem.

Assessments (at the end of each topic) are broken down into three sections which record scores for:

Knowledge   (*KNOWING…mathematical facts, formulae and strategies*)

Application   (*USING… facts, formulae and strategies to process or solve straightforward problems*)

Reasoning   (*CHOOSING… appropriate facts, formulae, strategies and processes to solve a complex problem*)

Note, there is an overall test score which is the mean average of these three sections.

In lessons, student understanding of a topic is developed through explanation, questions and questioning. Skills are practised, learned and consolidated through questions and tasks practised and undertaken in and outside of lessons. Consequently, knowledge and application of this knowledge is secured.

All students within this school are expected to reach this stage and be proficient in the skills required to apply their knowledge. What differentiates our most able mathematicians is their ability to take these skills (knowledge and application) and combine them with mathematics from possibly other topics in the solution of a more complex problem; this is mathematical reasoning.

Mathematical reasoning is something which, for most students, develops over time. It can be scaffolded and approaches can be suggested, but it absolutely cannot be taught with the same (if this then this) approach as learning a skill. When faced with these questions students often retort, "but you didn't teach me how to answer that question". In one sense this is correct, because what we are asking the student to do is:

- **think** about the problem,
- break it down into smaller components,
- assess which is the appropriate topic of mathematics and skill set they can bring to bear on the particular problem,
- identify and calculate an interim value they need or construct a mathematical model (equation or set of equations) and then solve it,
- link together the components they have identified in order to build a structured multi-step solution.

Often there a several approaches that could lead to a solution, some easy and others more complex.

Practising complex problems gives students an opportunity to develop their mathematical ability, but for students who only view this as "learning how to do this 'particular type' of question so that a similar one can be answered"; they are not really progressing beyond knowledge and application.

The mathematical reasoning section of the assessment is designed to coax students in to having a go at a complex problem. It is not designed to be a learn by rote test of knowledge and application. Marks are awarded quite simply in the following way:

1 mark   A genuine attempt at the questions, allow for misread values. A correct first step or correct attempt at finding an interim value, producing a relevant formula, building an equation or organising the information from the question into a relevant table or diagram.

          Or a correct solution unsupported by working

2 marks   Multiple relevant steps, mainly correct some part solution seen or full solution with a numerical slip.

          Or correct solutions with only partly correct interim solutions.

3 marks   Well-reasoned, clear steps of working shown and correct answer.

Every student should be capable of gaining at least 1 mark and what we are trying to encourage at Key Stage 3 is that they have a go rather than leave a blank space.

Sample Questions

KNOWING…mathematical facts, formulae and strategies

Q)   True or False. When fractions are multiplied or divided they **must** have a common denominator.

USING… facts, formulae and strategies to process or solve straightforward problems

Q)   Evaluate (find the value of) this sum, leaving your answer as a **mixed number** or a fraction in its simplest form.

$$\frac{5}{6} + \frac{7}{18}$$

CHOOSING… appropriate facts, formulae, strategies and processes to solve a complex problem.

   You must show full working to obtain full marks.

Q)   A pupil is saving up to buy a computer game. He has saved £20 out of the £42 he needs. His gran gives him one sixth of the price of the game for walking her dog. What percentage of the price of the game does he still need (answer to 1 decimal place)?