ESW Maths curriculum reasoning

Principles:

1. **Common teaching objectives for all abilities up to the end of year 9.**

   We have high expectations of our students and are ambitious for them so we aim to teach them all content that will allow them to excel on the higher tier GCSE. We know that setting is not exact, learning is not a linear process and students mature at different rates. Pre-requisite learning that is not secure can be taught in context or if the teacher considers it necessary can be given lesson time. Differentiation of objectives if needed is done by the teacher.

2. **Common assessment for all abilities up to the end of year 9.**

   Setting is not exact and we do not want any student to be held back by their group. Year 7, 8 and 9 students have the opportunities to show how they directly compare with their peers. Teachers will be able to more directly compare their impact and learn from each other.

3. **Do now and homework designed to assist recall.**

   Do now activities contain a circulating selection of previously learnt topics. This enables the teacher to assess recall and plan further learning. Sparx homework contains a strong element of recall and consolidation work.

4. **Time allowed for teaching each topic will allow teachers to use the mastery cycle and do their repair as part of their first teaching.**

   Most people need a bit of time to get things the first time – we should recognise and allow for this.

5. **Opportunities for interleaving will be clearly identified and resourced.**

   We should make it easy for teachers to combine topics and use the opportunity for extending the ability of students to use their learning in different contexts (aka problem solving)

6. **Supporting Sparx classroom**

   The Sparx classroom product is an extremely powerful teaching tool and our teaching resources support its use.

Weak students, the same teaching objectives for all and the overlap with key stage 2

Students come to secondary having had years of teaching on things like written methods, place value etc. This sort of KS2 pre-requisite knowledge will be identified on the scheme (but not as teaching objectives) so the teacher is aware of it. If the teacher considers that the class has an area of weakness they will do the following:

- In the first instance, the teacher will attempt to repair/develop the KS2 knowledge in the context of the topic being taught (this can be done on an individual/small group or whole class basis depending on the need).

- If there is a serious lack of understanding then the teacher will devote teaching time for the whole class before resuming the main topic objectives. This is where professional judgement will be required.

Cognitive load, notation and calculators

The teaching guidance should make it clear where teachers should be aware of inadvertently making a challenging topic unnecessarily more difficult. An example of this might be teaching expanding brackets with a group that struggles with their times tables. The scheme should encourage teachers to use calculators where appropriate to reduce cognitive load and then deliberately introduce non calculator work as an additional complication when students understand the main concept.

Similarly, where possible students should be introduced to ideas before notation is added. Examples of this would include

Pythagoras - where $a^2+b^2=c^2$ often adds an algebraic layer of confusion over the idea that Pythagoras is all about the sum of areas of squares. Initially, students should be taught that solving Pythagoras consists of 1)squaring the sides, 2)deciding whether to add or subtract and 3)finding the side length of a square by square rooting the answer.

The parallel line angle facts – where students should understand that the two sets of angles on each parallel line are identical (and that there is no proof or reason for this – the parallel postulate is axiomatic) before the idea is complicated by the naming conventions for alternate, corresponding, allied, co-interior, z and f angles etc.

Mastery

From the national curriculum document (italics mine):

Decisions about progression should be based on the security of pupils' understanding and their readiness to progress to the next stage*[objective].* Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent should consolidate their understanding, including through additional practice, before moving on.

In practice, the teacher will be constrained by the time allowed on the scheme.

Fitting everything in

Leaving aside students who have a lot of sickness or join the school after year 7, we should be able to be certain which topics students have been taught. It is unfair to leave the decision of whether or not to teach something to a given student down to the class teacher and where possible this decision should be made by the scheme of work.

Time allocations should allow enough time for the average teacher to teach the average class the given objectives. The objective lists should be given in difficulty order so that teachers of the weakest groups know which objectives (if any) they can leave off. More able groups should be stretched by being given more complex teaching material around the given objectives (possibly material that involves other areas of maths that have already been taught).

Y11 should be the time when the teacher is required to use assessment evidence to prioritise which topics to repair and develop for the final GCSE exams.

KS2 knowledge areas that are not identified in explicit teaching objectives. The scheme will contain opportunities for teachers to look for understanding of these things (diagnostic activities and low stakes quizzes) so they can do repair work if necessary. Do Now tasks will also contain questions covering the overlap between KS2 and KS3.

- Written methods for multiplication, division, addition and subtraction of integers and decimals. Students should continue to practice and improve this area of KS2 learning but we should only apply non calculator methods to a topic after it has been learnt, as a strategy to reduce cognitive load.
- Equivalent fractions (introduced in year 3) – this should be checked as part of the fractions of an amount and adding/subtracting fractions section.
- FDP(Year 4/5) – should be taught as part of the percentage multiplier work.
- Money and time calculations (all through KS2).
- Rounding to whole numbers and powers of 10 (years 4&5) – we should be teaching rounding as a generalised skill and getting students to see the general process for rounding to any degree of accuracy.
- Knowledge of unit conversions (metric) and the ability to convert between units (a year 5 objective). This should be covered as part of area and perimeter.
- Bar charts and pictograms – students will have first met these in year 3
- Names of triangles and quadrilaterals (and their properties) – this comes from the year 4 programme of study. Students should be reminded of these alongside the teaching of area.
- Basic angle facts (from year 5) – around a point, on a line and in a triangle. These are naturally covered in the study of harder angle facts.
- Factors, multiples and primes (year 5) – these should be taught alongside prime decomposition, fractions and referred to where appropriate (eg/ when factorising).

Pre-A level topics that don't really get developed further at GCSE. These are split into two groups, difficult topics that should be fully taught to high ability students who have mastered the rest of the curriculum and topics that are an easy way for mid-ability students to get extra marks

Hard

- Fractional indices – very little benefit to GCSE algebra. Extremely important at A level. Some opportunity to enjoy interesting numbers and practice roots and powers. Do at end.
- Transformations of graphs and common graph shapes. – Transformations mainly useful as prep for A level. Common graph shapes is a memory issue.
- Geometric sequences – a pre- A level topic with very limited application at GCSE.
- Functions and function notation – pre A level

Easy

- Recurring decimals to fractions – a curiosity at GCSE. Useful for students going on to A level as it provides a first view of a strategy for dealing with infinite sequences.

- Combinations – another pre-a level idea. Not complex at GCSE.

Random topics with low long term impact. Things that do not develop general mathematical skills such as algebraic or proportional reasoning. These should generally be taught closer to the exam as there are likely to be fewer opportunities to develop them in the context of other topics.

- Stem and leaf – rarely used outside of GCSE. Useful only for the exam. Easy to teach and understand.
- Iteration – unusual notation that is only used in this topic.
- Vector proof – useful as it reinforces ratio and fractions in its harder form but not a big idea.
- Compass constructions – develops students dexterity and supports understanding of angles but not a basis for much else at GCSE.
- Loci – confusing for many and a topic that doesn't really support the development of other mathematical ideas.

Topics to do after the higher/foundation split

These are topics that only appear on the higher tier and represent the end of the GCSE progression and the start of pre-A level work.

- Bounds
- Surds
- Quadratics/linear simultaneous equations
- Equation of a tangent to a circle
- Geometric sequences
- Gradient of curves
- Proof (the harder stuff)
- Cosine and sine rule
- 2D inequalities

Topics that provide level 6/7 students with practice of key skills while extending level 8/9 students.

- Quadratics/linear simultaneous equations. With scaffolding these provide a lot of practice simplifying and solving quadratics.
- Equation of a tangent to a circle. If scaffolded, this provides great practice of most of the straight line coordinate geometry at GCSE.
- 2D inequalities – lots of straight line drawing practice for weaker students.
- Some algebraic proof – lots of practice expanding double brackets and simplifying.