A toolkit for contextualising post-16 GCSE Mathematics

The context grid and how to use it

MEI Mathematics Education Innovation

The context grid

This guide is part of a toolkit to support practitioners in developing contextualised resources to support post-16 GCSE Mathematics. A key component of the toolkit is a spreadsheet referred to as the 'context grid'. The purpose of the grid is to provide examples of applications of maths from the seven context areas that the toolkit focuses on.

The grid has seven tabs (i.e. worksheets), one for the title and one for each of the following maths strands:

> Number
> Algebra
> Ratio, proportion and rates of change
> Geometry and measure
> Probability
> Statistics
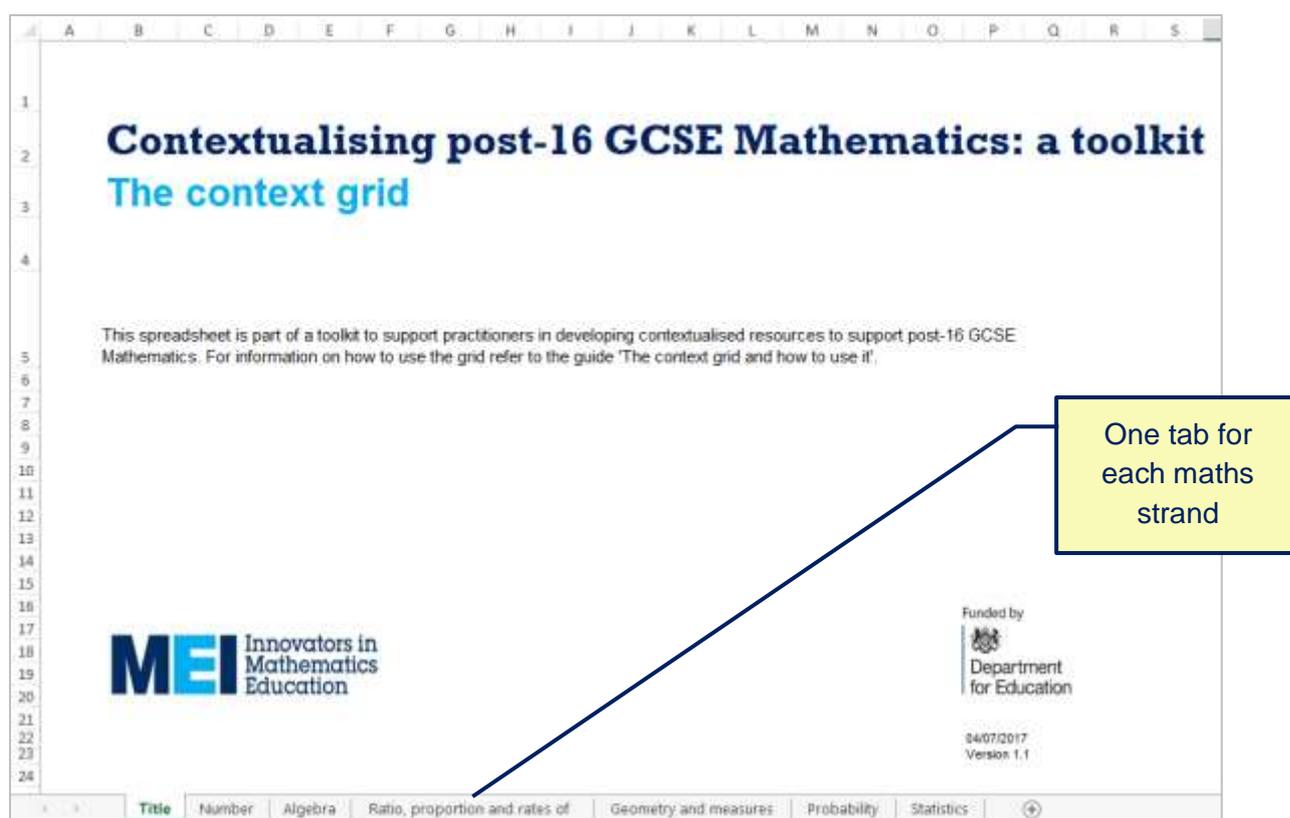
Down the left side of the grid, in the second column, are listed all of the Foundation tier GCSE Mathematics Assessment Objectives for the selected mathematical strand.

These Assessment Objectives are taken from the subject content used in all GCSE Mathematics specifications by all awarding organisations. In some cases an example and/or further explanation has been included for clarity. It may look like some topics are missing. For example A15 is not included in the grid. This is because A15 is a topic that is only covered in the Higher tier paper, and the grid only includes Foundation tier topics.

Strand	Ref	Content	Construction and the built environment	Health, social care and childcare	Business, administration entrepreneurship
Ratio, Proportion and rates of change	R1	Change freely between related standard units (e.g. Time, length, area, volume/capacity, mass) and compound units (e.g. speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts.	Changing between m and cm or mm for kitchen units. Changing between metric and imperial for renovation projects measured in imperial. Calculating price per metre, per tonne, etc.	Changing between ml and litres for making up milk, changing between cm, mm and m for measurements for a room; volume when making up water play areas, capacity and mass for sand play areas and soil for garden areas. Prices, e.g. cost per tonne of play sand.	Cost of hiring extra needed based on comparing hourly r International busin money, booking ho changing from km
	R2	Use scale factors, scale diagrams and maps.	Scale diagrams of floor plans for rooms, stairs - architects' drawings.	Scaling up recipes from 4 to 40 people. Scale diagrams of floor plans for play area.	Converting betwee currencies. Create floor of the building
	R3	Express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1.	Proportions of components for mortar and concrete can be written as fractions.	Ratio of staff to children or staff to patients can be written as fractions. Fraction of fluid intake required that has been consumed. ¾ of our residents are	Financial leverage Shareholders Equi members who are
	R4	Use ratio notation, including reduction to simplest form.	Proportions of mortar and concrete are written as ratios. Slenderness ratio - the height of a wall in relation to its thickness.	Ratio of staff to children or staff to patients.	Ratio of men to wo research. Risk of lo i.e. risk: reward rati
	R5	Divide a given quantity into two parts in a given part: part or part: whole ratio; express the division of a quantity into two parts as a ratio; apply ratio to real contexts and problems (such as those	Mixing paints or binary glues. Converting between m and cm for kitchen units. Scaling projects up or	Making up milk in bottles. Giving correct medicines.	Splitting a bonus ir employees. Choos items sold in differ Converting betwee currencies. A work

Across the top of the grid, in the top row, are listed the seven context areas that the toolkit focuses on:

> Construction and the built environment
> Health, social care and childcare
> Business, administration and entrepreneurship
> Leisure and tourism
> Hair and beauty
> Hospitality and catering
> General life and personal interests

The cells in the intersections provide examples of applications of a specific maths topic within a specific context area. For example, within the 'Ratio, Proportion and rates of change' tab, an application of R2 'Use scale factors, scale diagrams and maps' in 'Construction and the built environment' is: 'Scale diagrams of floor plans for rooms, stairs - architects' drawings.'

There are several empty cells for which a realistic application of maths has not been identified. For example, there is no entry for a realistic application of 'Describe translations as 2D vector' for 'Health, Social Care and Childcare'.

How to use it

The grid provides a source of contextualised examples that can be used use to enrich teaching and learning in various ways.

Explaining uses of maths

The examples might help you to explain the usefulness of a particular topic of maths, for example, to answer learners' questions such as "When will I ever use this stuff?". If you are going to use it in this way you might find it helpful to check the grid for examples when preparing to deliver the lesson.

Finding existing contextualised resources

There are lots of teaching and learning materials that others have created and uploaded to the internet, including videos of people using maths in their work. If you want to search the internet for these, you can use the examples in the grid to suggest key words to search on. For example, if you were looking for resources to support teaching algebra to construction learners. You could look at the grid, which suggests an example relating to the rise in stairs. Searching the internet with the words, "formula rise stair", results in several websites with diagrams and videos that could be used in lessons.

Developing your own contextualised resources

A key use of the grid is to provide you with examples of applications of maths to help you to generate ideas for developing your own contextualised resources. The contextualisation toolkit includes a guide that offers further help on using the grid in this way.

Embedding maths in vocational subjects

Vocational teaching practitioners may find the grid a useful resource for identifying ways in which they can embed maths learning within vocational learning. It might also serve as a reminder of how maths is used in the vocational subject and encourage vocational practitioners to highlight and reinforce relevant maths when covering a vocational topic.

Further examples

You may find it helpful to make a copy of the grid and update it with additional examples of applications of maths that you have discovered yourself. For example, you could add new columns for other context areas, such as Land-based or Automotive. If you plan to do this, here are a few things that you might find it helpful to consider:

Realistic contexts

The most useful examples are those that learners might actually use as part of their vocational studies, in their future work in the vocational sector, or in their future life and work in general. Learners will be better able to relate to such examples.

Where possible, avoid examples that at first sight look as though they refer to real-life; however on closer examination it is clear that learners are unlikely to use maths in that way. These kinds of examples can be off-putting for some learners. For example, a sports scientist might use a quadratic equation to model the path of a football; however most learners with an interest in football are unlikely to use maths to analyse the game to that extent.

This may not be a straightforward decision; if you are in doubt consider:
- Are there are better alternatives?
- In your experience, is the example likely to engage and motivate learners?
- Does the example have the potential to be developed into an interesting and meaningful contextualised resource?

Where it is difficult to find a realistic example for a maths topic, it might nevertheless in some circumstances be helpful to use an unrealistic one to help learners to make sense of an abstract maths topic. For example, continuing the football example above. It is unlikely that a learner following a hospitality course would use quadratic equations as part of his/her course or work experience; however they may find it easier to understand the concept of quadratic equations if it is explained as a way of modelling the path of a football as it flies through the air. If you record such examples in your copy of the grid you may find it helpful to add note to the cell to remind you that it is unrealistic.

The use of this kind of 'unrealistic' examples can be made more palatable to learners if it is explained that, although it may not be realistic to their situation, it may help them to understand the maths. Furthermore, it can be helpful to practice this type of question because similar questions may be included in a maths examination.

Work experience

You may be able to exploit your learners' work experience placements to help you to identify new and particularly relevant contextualised examples of maths. Further ideas to help with this are available in MEI's Maths at Work Guides.

Vocationally-specific language

Each of the toolkit's focus vocational areas, and even 'General life and personal interests', may have specialist vocabulary and usage. These authentic terms should be used with learners, even if you need to explain what they mean. For example, refer to the 'pitch' of a roof, when you mean its angle with the horizontal.

Sources of reference

The toolkit's grid does not include links to web pages (e.g. videos), as they may change over time; however you may it useful to include them in your own copy of the grid. Similarly you may find it helpful to refer to printed sources that can support the contextualisation of maths, such as a roofing ready reckoner, which learners studying and gaining work experience in carpentry may be familiar with.

MEI intends to enhance and extend the grid in future to include further examples, and new context areas, so please let us know if you have any examples that could contribute to this.

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