Market Hall

_TEACHERS NOTES

RIBA KS3 | **Mathematics Activity**

INTRODUCTION + ACTIVITY /

The session is introduced with the power point presentation featuring Towncaster architects Sophie and Tomas and the Mayor of Greater Towncaster. The Mayor sets the scene and what she thinks the city needs. Sophie and Tomas narrate their approach to these needs and make a design solution for which they enlist the help of your students and their mathematical skills. In this activity pupils work in groups of 4 or 5. Each student is provided with an activity sheet and materials (listed on the activity sheet) to build a model of Sophie and Tomas's design for a Market Hall for Towncaster.

The Market is an important part of the economy and community so it needs to be planned well in terms of function, costs and aesthetics. Making a scale model is important way in which architects can explore space planning, cost planning materials.

KS2 / Learning Aims

- **Numbers**
- **Units**
- **Decimals**
- **Operations**

Students will carry out addition, multiplication and division calculations involving decimal places. These can be done long hand or with a calculator where recommended.

- **Measurement**
- **Formulae**
- **Currency**
- **Geometry (Position + direction)**
- **Geometry (Properties and Shapes)**
- **Proportion**

Students will have the opportunity to use different currencies in this activity using the current exchange rate between Euros and Pound Stirling. They will be introduced to, and work with, very large numbers through which they can begin to understand the cost outcomes of the design they are working with.

ARCHITECTURE + DESIGN / Learning Aims

The scale model which students are being asked to make in this lesson is a sophisticated design using principles of space, light and function employed by leading architects. It is a challenging task but achievable using simple craft materials if students work carefully and accurately.

By making a scale model students will gain an insight into architectural space planning, structures and materials. Through this they can begin to understand how real buildings that they experience in the built environment need careful design which brings together beauty, materials, space and economics.

NOTES/

Working in groups of 4 and 5 students will make a sophisticated model but actually the activity is relatively easy as each element of the model involves a simple repetitive task. It is recommended that within each group individual students are assigned to the making of one of the model elements: Marking out the Baseboard; Making Columns; Making Stalls and Making Roof Leaves. To achieve a good result, each element needs to be made carefully, and importantly, they need to be done consistently.

COLUMNS/

The column element needs a little dexterity and clear 3D thinking to make. The design allows for the over lapping straws to be connected by simply wrapping a piece of sticky tape to make a strong rigid item due to the triangles in the shape. It is recommended that you gain some proficiency in making this element prior to the session so you can support students who might find this difficult.

The columns are then carefully inserted into the holes in the baseboard and secured underneath with sticky tape. Again consistency is important here and students should aim to get an even height of columns. They should all face the same direction.

Once the columns have been inserted, they are joined together with craft sticks, again using sticky tape. Alternatively, barque skewers can be used but these have a sharp point at one end. The structure will now be quite strong and rigid.

Due to time lost when students try to find the end of the tape, it's recommended that sticky tape should be provided on dispensers. Alternatively, you can provide a supply of ready cut lengths.

EXCHANGE RATE/

It would be interesting to use the current exchange rate in converting from Euros to Pounds Sterling. It is recommended that students are permitted to use calculators for this calculation.

'LET'S DO SOME MATHS!'

BASEBOARD/

The corrugated cardboard should be as thick as possible e.g. 6mm. Depending on the skills of your students you can decide how they can cut the corrugated cardboard (and make holes in it) such as with scissors or a craft knife (with a metal straight edge on a cutting mat with supervision) if deemed appropriate. Alternatively, you can provide the cardboard baseboard ready cut or use a different material such as foamboard which is available from craft shops. The important thing is that it is stiff and flat and holes can easily be made in it.

STALLS/

The stall design suggested can be replaced by another design. The design suggested is very simple to make as the height of a stand construction block is similar to the height of a counter at 1:100 scale. It is recommended that blue tack or similar is used to stick the block to the card so that the block can be recovered undamaged when disassembling the models.

Students should be encouraged to experiment with different layouts. In doing this they should consider: the number of stalls they can fit in; the space left to circulate between the stalls; does the pattern match the pattern of columns; can someone visiting the market easily find their way around.

ROOF/

This is an opportunity for some creativity and different groups can be encouraged to try different shapes and materials (including transparent) to create a variety of different aesthetic outcomes. A roof leaf can be of any shape or size but should match the pattern formed by the roof structure. Again consistency is important and roof leaves should be made to just one design for each model. Alternatively, if transparent material is being used a great result could be achieved by using opaque and transparent roof leaves on the same model.

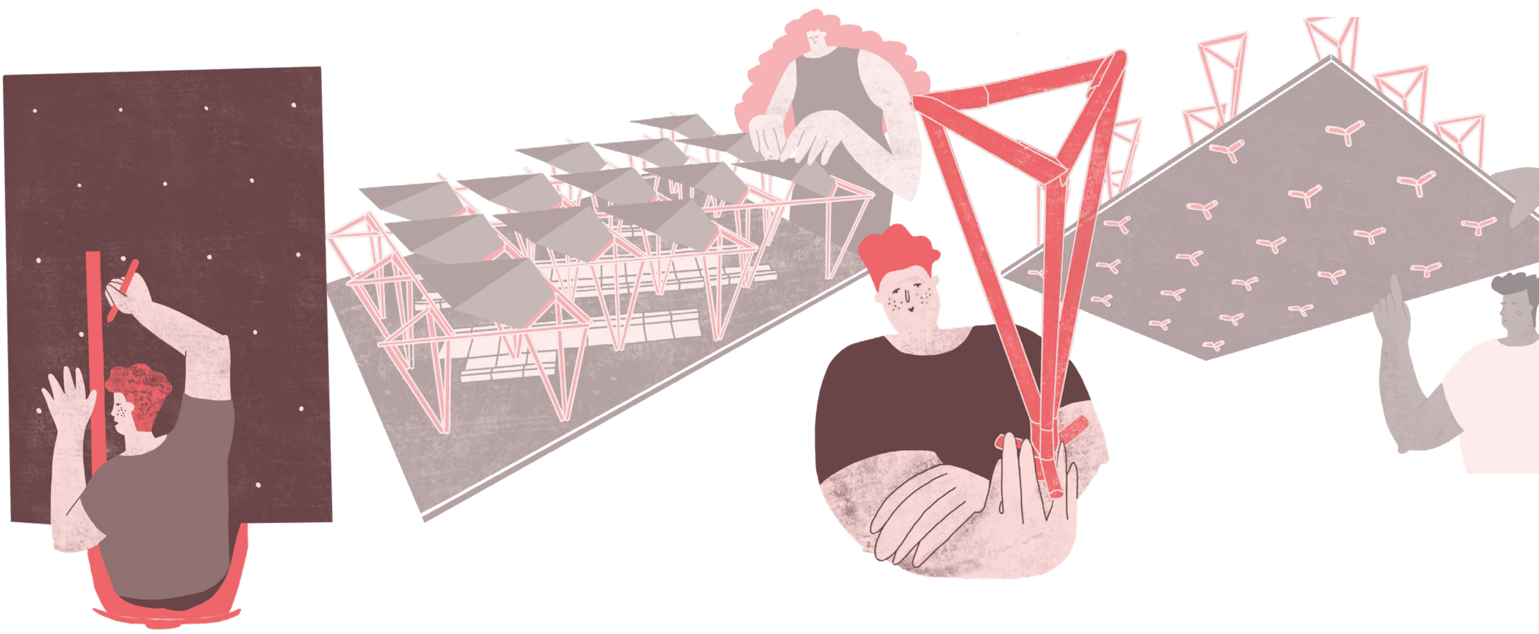
AREA CONVERSION/

The scale of the model is 1:00 which makes it easy to covert the area of the model roof into the area of the real roof. i.e. the area of the model roof in square centimetres (cm^2) is numerically the same as the area of the roof in square metres (m^2). The area of one leaf can be found easily by drawing a 1cm square grid on a leaf and counting up the squares; partly filled squares can be approximated to halves and quarters. If the leaves are identical then this can be multiplied up to find the total area.

CALCULATIONS/

It is recommended that a sheet of paper is provided for each group to set out their calculations. Alternatively, if your students are computer-proficient, calculations could be set out on a spread sheet. Each calculation is based on costing issues that may arise on a real project. If the calculations are done correctly there is a good chance that the total cost of the project will come within the budget of £5,000,000. If too many stalls are installed or the roof leaves are too big then the project may go over budget.

At the end of the session it will be a learning point to compare the different layout and roof designs for each group and see how this has affected the resulting total costs.



‘LET’S DO SOME MATHS!’

ALGEBRA /

- **substitute numerical values into formulae** and expressions, including scientific formulae
- **model situations or procedures** by translating them into algebraic expressions or formulae and by using graphs
- recognise, sketch and produce **graphs of linear and quadratic functions** of one variable with appropriate scaling, using equations in x and y and the Cartesian plane
- **interpret mathematical relationships** both algebraically and graphically

RATIO, PROPORTION + RATES OF CHANGE /

- **change freely between related standard units** [for example time, length, area, volume/capacity, mass]

GEOMETRY + MEASURES /

- **derive and apply formulae to calculate and solve problems** involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders)
- **describe, sketch and draw using conventional terms and notations**: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric
- **use the properties of faces, surfaces, edges and vertices** of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D
- **interpret mathematical relationships both algebraically and geometrically**