

Chapter 6 Drawing and measuring

Specification

FS coverage and range Construct geometric diagrams, models and shapes

FS exemplification Measure angles in 2D shapes
Measure lengths
Draw 2D shapes using a ruler and protractor

GCSE

GCSE specification **GM t** Measure and draw lines and angles
GM u Draw triangles and other 2-D shapes using ruler and protractor

Edexcel GCSE course **Specification A:**
Foundation 2.5, 2.6, 6.4, 7.9
Higher 12.6
Specification B:
Foundation Unit 1: 2.2, 2.3; **Unit 2:** 14.5, 14.6; **Unit 3:** 7.5, 7.7
Higher Unit 1: Chapter 3; **Unit 3:** 14.7

Resources

General resources Cut-out triangles
Maps
String
Rulers, protractors
Centimetre squared paper
Card
Scissors
Details of furniture sizes

Resource sheets 6.1, 6.2, 6.3, 6.4

Links <http://www.ordnancesurvey.co.uk/oswebsite/getamap/>

ActiveTeach resources Video
ResultsPlus Knowledge Check
ResultsPlus Problem Solving
Question Audio
Animations

Lesson 1

Objectives

- Choose the best instrument to measure with
- Choose the best units to measure in
- Measure accurately
- Write answers unambiguously
- Measure angles

Starter

- Give students a number of cut-out triangles. Ask them to estimate the size of each angle and the length of each side. Ask: *How could you do a rough check to see if your answers for the angles are possible?* (Add up the angles to see if they total about 180° .) Emphasise the fact that estimation is an important skill and will help ensure that protractors are used properly.

Main teaching and learning

- Divide students into pairs and give each student a copy of a map. This could be a simple representation of a map with towns marked on it and a simple scale of 1 cm:10 km or, for more confident learners, an Ordnance Survey map. Give each pair two places on the map. Ask them to measure the direct distance from one place to another. Ask: *How would you measure the distance using roads to get from one place to another?* Discuss strategies that could be used and have some string available.
- Ask students to complete *Have a go* Q1–4 (p66).
- Ask students to measure accurately the angles of the triangles used in the Starter activity. Encourage students to use their estimates to check that they are using the correct scale on their protractor.
- Relate this activity to *Take a look*: Measuring angles.
- Ask students to complete *Have a go* Q5 and Q6.

Issues and misconceptions

- Using a protractor incorrectly by using the wrong scale is a common error. Encourage students to first estimate the size of an angle before measuring.

Support

- Provide plenty of practice at measuring angles.

Extension

- Tell students that a museum wants to commission a set of large arrows to stick on the floor or wall to guide children round an exhibition. Ask students to design a suitable arrow and mark on it all the measurements needed to make it.

Plenary

- Mark numerical answers to Q1–6. Discuss what level of accuracy is acceptable.

Formative assessment

- Divide students into pairs and ask each student to draw five angles for their partner to measure. Pairs should then swap work and mark each other's measurements.

Homework

- Ask students to list all the different units that they know for measuring length. You could also ask them to investigate what a 'hand' and a 'fathom' are used to measure and how long each is.

Lesson 2

Objectives

- Interpret information from a scale drawing
- Choose the correct measuring equipment
- Communicate results using the correct units

Starter

- Ask students to look at the diagram in *Take a look*: Scale drawing (pp67–8). They should measure the ladder in the diagram and the angle, and then compare their answers with those given in the worked solution.

Main teaching and learning

- Explain that the size of a television set or a computer screen is given by the length of its diagonal. Ask students to work in pairs to find the size of a television screen that is in the shape of a rectangle of length 75 cm and width 40 cm. Provide centimetre squared paper to make it easier for students to draw the screen to scale. They should use the scale 1 cm:10 cm. They could also use their diagrams to find the angle between the diagonal and the length of the rectangle.
- Discuss the different strategies used. What scale did students use? Ask: *Would using a different scale give you a more or less accurate answer?* Now tell students to try solving the problem again but this time using a scale that gives a bigger diagram. Discuss these results and then give students the cards from Resource sheet 6.2. These show a number of different screen sizes, ranging from a small laptop to a very large television, to encourage them to use different scales in their work.
- Ask students to complete *Have a go* Q7 and Q8.

Issues and misconceptions

- Emphasise that the size of angles remains the same in scale drawings; only measurements of length are affected by an enlargement.
- Encourage students to think about their answer and check that answers are 'sensible'.

Support

- In the television screen activity, discuss the use of scales and ensure that students use a sensible, easy-to-use scale.

Extension

- In the television screen activity, give students cards from Resource sheet 6.3. These give the height and the diagonal dimensions of the screen; ask students to work out the width. Note that some of the screen sizes are in inches and some are in centimetres.

Plenary

- Discuss the accuracy of drawings produced during the formative assessment activity (below). Ask:
 - *Did everyone get the same answer for each triangle? If not, why not?*
 - *How could the accuracy of answers be improved?*

Formative assessment

- Give students some diagrams of triangles to draw to scale. Two sides and an angle should be given; students should use their diagram to determine the length of the third side. Ask students to check each other's work.

Homework

- Ask students to measure the height and width of a television in their house. They should then draw a scale drawing and use it to find the length of the diagonal. Finally, they should check their answer by measuring the diagonal of the television.

Lesson 3

Objectives

- Represent 3D objects as a 2D plan
- Use a scale drawing to position items
- Communicate results

Starter

- Give students some centimetre squared paper. Ask them to draw a rectangle using a scale of 1 cm:1 m to represent a room of size 6 metres × 8 metres. Then ask them to draw a plan of the same room using a scale of 2 cm:1 m. Discuss which is the better scale and why.

Main teaching and learning

- Give students a copy of Resource sheet 6.1 and direct them to *Have a go* Q10 (p70). Divide students into pairs and provide each pair with some card, scissors and a ruler. Ask them to design Jill's bedroom/study. Once they have chosen a design, they should draw this on the Resource sheet.
- Discuss the strategies students used. Ask:
 - *Was it useful to cut out objects and be able to move them around?*
 - *Will Jill be able to open her wardrobe and drawers?*
- Relate this to *Take a look*: The office.
- Students could now be given some centimetre squared paper and details of furniture sizes (or they could research sizes for themselves using the internet) and design their ideal bedroom. Their final plan should show the position of all the furniture within the room.
- Ask students to complete *Have a go* Q9, Q11 and Q12.

Issues and misconceptions

- Emphasise the need to check what the scale is and to use it correctly.

Support

- Help students to accurately draw the furniture to be placed in the bedroom in Q10. Assist them in working out the scale used on the Resource sheet.

Extension

- Students could work in pairs to produce either a plan of the classroom or of the maths department.

Plenary

- Divide students into pairs and ask them to look at each other's answers to Q9. They should check that their partner's solution satisfies the conditions given. Solutions could be shared with the rest of the class.

Formative assessment

- Give students the pre-drawn plans and scale drawings of objects from Resource sheet 6.4. They should calculate the 'real-life' dimensions of these. Ask:
 - *Are your 'real-life' dimensions sensible?*
 - *Are the units that you have given the answers in appropriate?*
 - *Would a different unit be more appropriate?*

Homework

- Ask students to draw a plan of a room in their house.