EDEXCEL FUNCTIONAL SKILLS PILOT

TEACHER'S NOTES

Maths Level 2

Chapter 5

Shape and space

Maths Level 2

Su Nicholson

Chapter 5: Working with space and shape

Use these free pilot resources to help build your learners' skill base
We are delighted to continue to make available our free pilot learner resources and teacher notes, to help teach the skills learners need to pass Edexcel FS Mathematics, Level 2.

But use the accredited exam material and other resources to prepare them for the real assessment
We developed these materials for the pilot assessment and standards and have now matched them to the final specification in the table below. They'll be a useful interim measure to get you started but the assessment guidance should no longer be used and you should make sure you use the accredited assessments to prepare your learners for the actual assessment.

New resources available for further support
We're also making available new learner and teacher resources that are completely matched to the final specification and assessment – and also providing access to banks of the actual live papers as these become available. We recommend that you switch to using these as they become available.

Coverage of accredited specification and standards
The table below shows the match of the accredited specification to the unit of pilot resources. This table supersedes the pilot table within the teacher notes.

Coverage and Range	Exemplification	Learner Unit
Recognise and use 2-D representations of 3-D objects	• Sketch 3-D solids • Nets • Plans, elevations • Draw 3-D shapes on isometric grids	**H4** 2-D Representations of 3-D objects Wider coverage can be found in our new publishing (see below)
Find area, perimeter and volume of common shapes	• Perimeter and area of triangles and rectangles • Circumference and areas of circles • Volume of cuboids and cylinders • Formulae will be given • Composite shapes may be used	**H1** Perimeter **H2** Area **H3** Volume
		H5 Remember what you have learned

Where to find the final specification, assessment and resource material
Visit our website **www.edexcel.com/fs** then:
- **for the specification and assessments:** under **Subjects**, click on **Mathematics (Levels 1–2)**
- **for information about resources:** under **Support**, click on **Published resources**.

Published by Pearson Education, Edinburgh Gate, Harlow CM20 2JE. First published 2008.

5 Shape and space

(pages 75–83 in the learner materials)

Performance	Coverage and Range	Unit Objectives
Learners can:	**Learners can:**	
■ understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations ■ identify the situation or problem and the mathematical methods needed to tackle it ■ select and apply a range of mathematics to find solutions ■ use appropriate checking procedures and evaluate their effectiveness at each stage ■ interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations ■ draw conclusions and provide mathematical justifications	■ find area, perimeter and volume of common shapes ■ recognise and use 2-D representations of 3-D object	**H1** Perimeter **H2** Area **H3** Volume **H4** 2-D Representations of 3-D object
		H5 Remember what you have learned

Approach to learning

This section covers the skills necessary for learners to be able to work efficiently with shape and space. Each unit focuses on the delivery of one particular aspect of perimeter, area and volume and 2-D representations of 3-D objects. The questions set allow the learner to practise the full range of skills being taught. The table identifies the coverage and range from the functional skills standards: mathematics level 2 which are covered in this section.

H Working with perimeter, area, volume and nets

H1 *Perimeter*

The main idea is to familiarise the students with the perimeter of common shapes and problems that can be associated with them. Encourage students to look out for formulae where BIDMAS needs to be applied. Remind them that perimeters are lengths and so are one-dimensional. Emphasise that the test questions usually involve metric units, cm, m etc. and they should make sure they are familiar with them. Discuss the value of π and explain that it is an irrational number that cannot be expressed as a fraction. Ensure that they are familiar with the π key on their own calculator and discuss the number of decimal places given in the display.

Activities

Ask students to identify where they would come across different shapes in everyday life. They should produce a list under the headings of *triangle*, *quadrilateral* and *composite shapes*. The activity should be preceded by students identifying the names of the different types of quadrilateral.

Extension activity: Ask students to collect a range of round items, for example, can of cola, cake tin, tin of chocolates. Get them to measure the circumference and the diameter of each item and plot the pairs of points on a scatter graph, with the circumference on the vertical axis. They should then draw in a line of best fit. Ask them why this should pass through the point (0, 0). The gradient of the line of best fit is an estimate for π. Discuss why this should be so.

Misconceptions

Students sometimes have difficulty identifying the necessary lengths around the perimeter of a composite shape. For example, in question 2 on page 76, two of the lengths are not labelled. Emphasise the properties of parallel lines so that they can visualise that the missing horizontal length comes from taking 4.5 m from 7 m. Encourage learners to write in the missing lengths on the question paper to ensure they include all the necessary lengths which comprise the perimeter.

H2 *Area*

The main idea is to familiarise the students with the areas of common shapes and problems that can be associated with them. Encourage students to look out for formulae where BIDMAS needs to be applied, in particular working out r^2, which relates to the I of BIDMAS. Remind students that areas are two-dimensional and are measured in square units, usually metric, cm^2, m^2 etc. Emphasise that problems involving area may mix units and that they must make sure all the units they work with are the same. Discuss the different methods of finding the area of a composite shape, for example, an L-shaped room can be split into two rectangles or considered as a large rectangle with a piece cut out.

Activities

Investigation: Give students the dimensions of a room, for example 4 m by 3.5 m and 2.5 m high. The walls need to be painted with two coats of paint. There are two doors measuring 0.9 m by 2 m and one window measuring 2 m by 1 m. The paint is sold in 5-litre tins costing £15.99 each. Each litre of paint covers 8 m^2. Work out the total area of wall to be painted and the total cost of painting the walls.

Misconceptions

Difficulties arise when questions mix units. For example, in question 1b on page 78 of the Skills Book the worktop has dimensions in metres and is covered with tiles with dimensions in cm. Students will often attempt to convert the units but will do so incorrectly, for example writing 3 m as 30 cm. They should be encouraged to learn the connections between the units. The stages of working out this practical problem need to be gone through carefully, for example, by making use of a grid to help students visualise the task. Emphasise that if the dimensions don't divide exactly they need to round up.

The main idea is to familiarise the students with the volumes of common shapes and problems that can be associated with them. Encourage students to look out for formulae where BIDMAS needs to be applied, in particular working out r^2 which relates to the I of BIDMAS. Remind students that volumes are three-dimensional and are measured in cubic units, usually metric, cm^3, m^3 etc.

Emphasise that packaging problems in three dimensions need to be tackled in a systematic way, by comparing the three edges in turn. Discuss the relationship between volume and capacity and the associated units.

H3 *Volume*

Misconceptions

Three-dimensional packaging problems can cause difficulty. The questions are usually set up so that the dimensions can be compared in order. For example, in question 2 on page 80 a common mistake is to add the values instead of multiplying to give 20 + 40 + 60 instead of 20 × 40 × 60. Visual aids can help illustrate why this is incorrect, using connect cubes or some other kinaesthetic tool.

H4 *2-D Representstions of 3-D objects*

The main idea is to ensure the learners are familiar with the common three dimensional shapes and that they understand the associated terminology of faces, edges and vertices, (corners). Discuss the definitions: flat surfaces of 3-D shapes are called faces, the line where two faces meet is called an edge and the point where three edges meet is called a vertex. It is helpful to ensure the learners have access to three dimensional shapes whilst covering this section, so that they can adopt a kinaesthetic approach to the activities. They should also know that a net is a 2-D shape which can be folded into a 3-D shape, and be aware of the different 2-D shapes that form the faces of 3-D shapes. The learners should be familiar with the phrases 'plan view' and 'front elevation', insofar as they apply to practical problems such as outlined in the 'Apply the Skills' section of the Teacher Notes.

Activities

Discuss the different nets the learners draw for the cube with sides of length 4 cm in question 3 under 'Try the skill'. How many different nets can they find? (There should be 11.) In pairs, ask the learners to cut out examples of the 11 different nets and check they can be folded up to make a cube. (They should use either graph or squared paper.)

The opposite faces of dice add up to 7. Ask the learners to show possible nets for cubic dice.

Ask the learners to draw nets with given lengths for other 3-D shapes and then make them up into a 3-D model. Discuss the fact that 'flaps' will be needed on ***some*** of the edges if the models are to hold together and ask them to identify the minimum number of flaps in each case.

Show the learners the table of 3-D shapes with the number of faces, edges and vertices identified, ***leaving out the cylinder***. Ask them if they can find a rule that links the number of faces, edges and vertices for each

3-D shape. They are looking for Euler's rule, $F + V = E + 2$, where F is the number of faces, V the number of vertices and E the number of edges. A cylinder can be explained to fit the rule if you consider it to be a tin can with a seam down the curved surface. This seam forms an edge with the ends creating vertices on the top and bottom circular faces. The number of faces is then 3, the number of edges is 3 and the number of vertices is 2, which satisfies Euler's rule.

Misconceptions

Learners, particularly female learners, often have difficulty in visualising the process of converting from a 3-D shape to a 2-D representation as a net. The kinaesthetic activity of practising drawing nets and making them up into 3-D shapes can help them overcome this difficulty.

Apply the skills

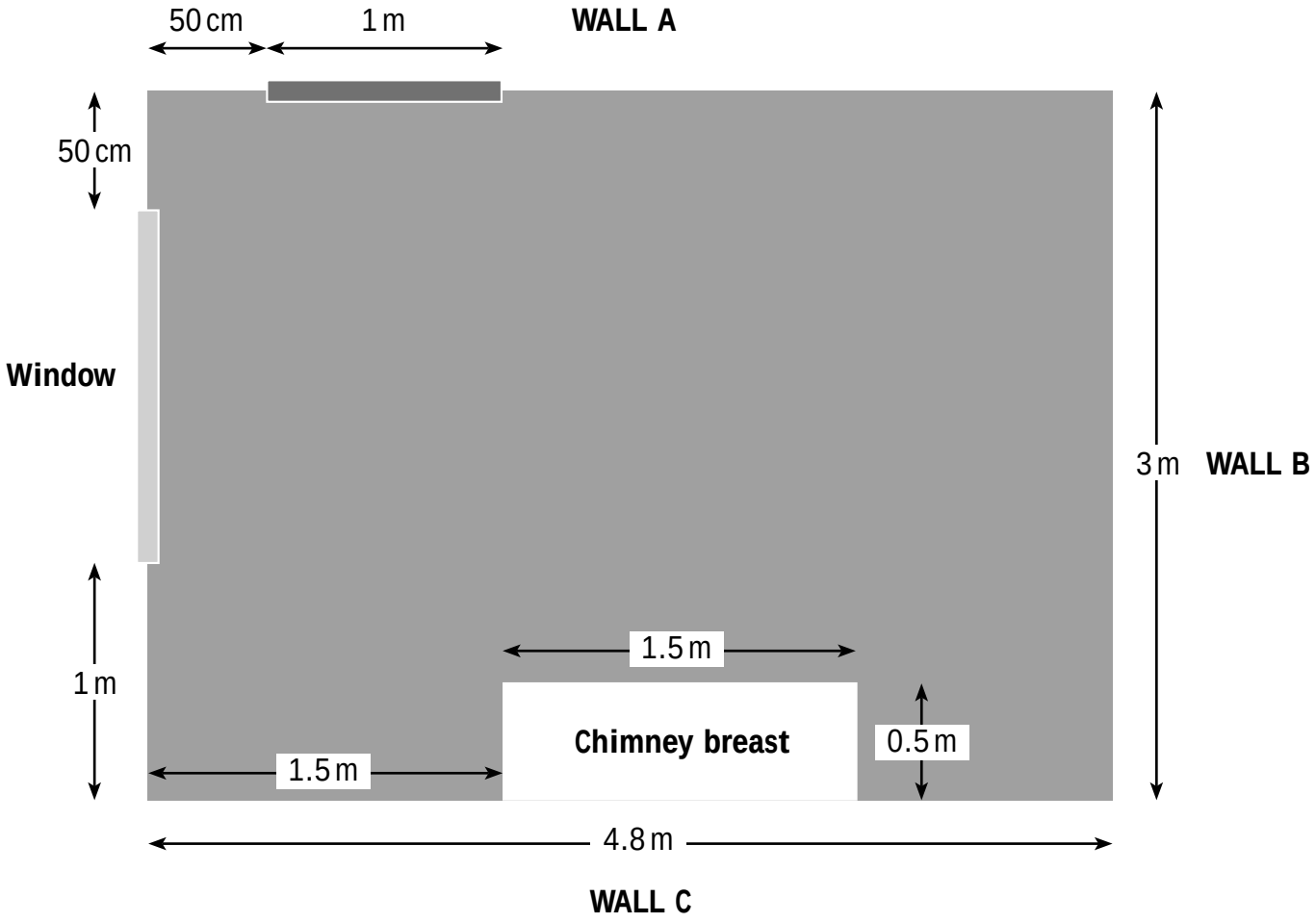
The learners need to develop their Process Skills, which are:

Representing	Analysing	Interpreting
Making sense of situations and representing them	Processing and using the mathematics	Interpreting and communicating the results of the analysis

At Level 2 learners must decide on the methods used and identify the information they need for themselves. A suitable activity to practise their skills in shape and space would be to investigate furnishing and/or decorating a room. The task below involves a make-over for a lounge and incorporates measures of perimeter, area and volume as well as problem solving in two and three dimensions.

Lounge make-over

The diagram shows the aerial view of a lounge which is to be decorated, carpeted and furnished (not drawn to scale).



Potential tasks:

Picture rail:

- A picture rail is going to be fitted all round the walls of the room. What is the total length of picture rail required? (Remember to leave gaps for the door, window and chimney breast)
- The picture rail is sold in 3600 mm lengths. How many lengths of picture rail are needed?
- The picture rail costs £3.68 per length. What is the total cost of the picture rail?
- What percentage of the picture rail bought is wasted?

Carpeting:

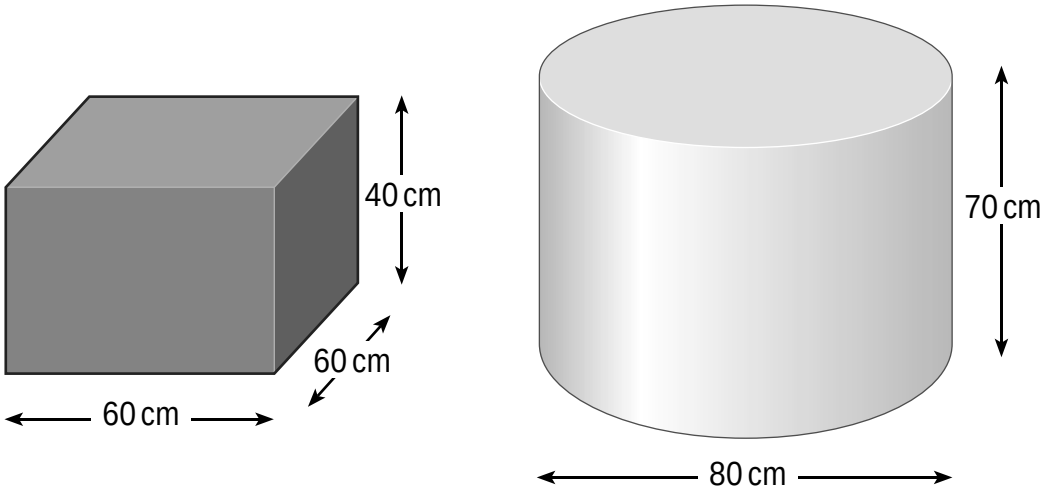
- Calculate the area of the lounge floor.
- The floor is to be carpeted with carpet tiles measuring 50 cm by 50 cm. How many carpet tiles are needed?
- The carpet tiles are sold in packs of 5. How many packs of carpet tiles are needed?
- The carpet tiles cost £12.35 a pack. What is the total cost of the carpet tiles?

Wall papering:

- Wall A is to be wallpapered below the picture rail. The height of the room is 2.3 m and the picture rail is positioned 50 cm below the ceiling. The door is 2 m high. Use this information to draw a front elevation of wall A and work out the total area of wall that needs to be wallpapered.
- One strip of wall paper is 53 cm wide. How many strips of wall paper are needed for wall A?
- A roll of wallpaper is 10 m long. How many rolls of wallpaper are needed for wall A?

Furnishing:

- A footstool in the shape of a cuboid is covered in material as shown in the diagram, (not drawn to scale). Draw a net of the cuboid and use it to work out the total surface area of the footstool that is covered with material. (The bottom of the footstool does not need to be covered.)
- A fish tank in the shape of a cylinder is bought for the lounge. The diameter of the fish tank is 80 cm and the height is 70 cm as shown in the diagram, (not drawn to scale). What is the maximum amount of water that the fish tank can hold to the nearest litre?



Try a similar activity on a plan of your own lounge.

Useful Websites

You can download a kitchen planner from the Ikea website
http://www.ikea.com/ms/en_GB/rooms_ideas/splashplanners.html

Prices can be found on the B&Q website
http://www.diy.com/diy/jsp/index.jsp?linktype=topnav_Home&ts=1203895833954

Answers

Section H Working with perimeter, area and volume

H1 Perimeter

1. 63 cm

2. 22.2 m

3. 4.1 metres

4. 52.6 metres

H2 Area

1. a 3.04 m^2
b 1900

2. 3156.3 m^2

3. 8.2 m^2

4. 15

5. 2375 m^2

H3 Volume

1. 512 cm^3

2. 48 000 cm^3

3. 7854 cm^3

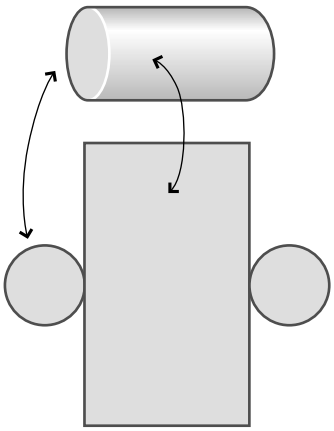
4. 769.7 cubic feet

5. 27

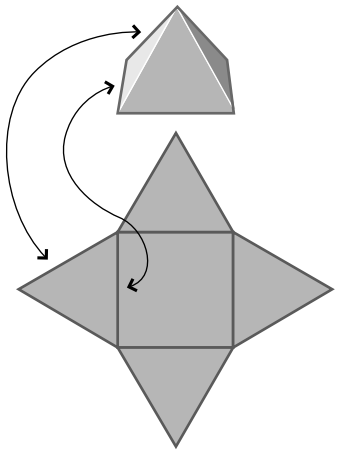
6. Internal measurements 9 cm by 9 cm by 3.6 cm high

H4 2-D Representations of 3-D objects

1.

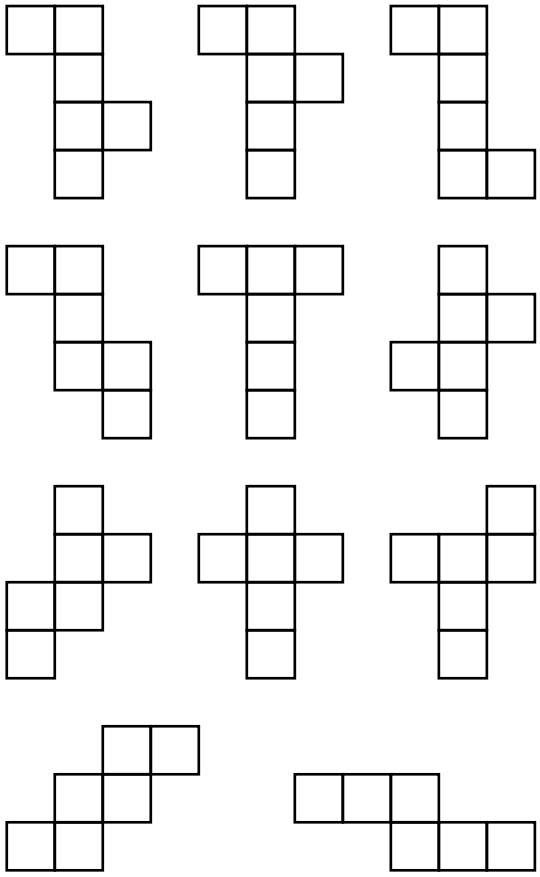


2.



2(a) faces = 4, edges = 6, vertices = 4

3. one of 11 possible nets



3(a) 96 cm^2 3(b) 48 cm

4.

3-D Shape	Shape of Faces
Cube	square
Cuboid	rectangle and possibly square
Cylinder	circle and rectangle
Square based pyramid	square and triangle
Triangular prism	triangle and rectangle

H5 Remember what you have learned

1. B

2. C

3. C

4. C

5. D

6. A

Apply the skills

Picture rail	Carpeting	Wallpapering	Furnishing
11.6	15.65 m^2	Front elevation	Net and 13 200 m^2
4 lengths	57	8 strips	352 litres
£14.72	12	2 rolls	
19.4%	£148.20		