Product Design

Appendix 1: Mathematical skills requirement

This appendix is taken from the document *Design and Technology GCE subject content* published by the Department for Education (DfE) in December 2015.

The mathematical skills listed will be assessed in the examination only. The minimum level of mathematics in the examinations will be equivalent to higher tier in a GCSE Qualification in Mathematics.   **✳✳**

These skills will be sampled in each examination and covered over the lifetime of the specification. Examples of mathematical questions are Q1(d), 4(c) and 4(d) in the *Sample Assessment Materials.*

Reference	Mathematical skills requirement	Potential applications
a	Confident use of number, percentages and percentiles	Calculation of quantities of materials, costs and sizes.
b	Use of ratios	Scaling drawings.
c	Calculation of surface areas and/or volumes	Determining quantities of materials.
d	Use of trigonometry	Calculation of sides and angles as part of product design.
e	Construction, use and/or analysis of graphs and charts	Representation of data used to inform decisions and evaluation of outcomes. Presentation of market data, user preferences, outcomes of market research.
f	Use of coordinates and geometry	Use of datum points and geometry when setting out design drawings.
g	Use of statistics and probability as a measure of likelihood	Interpret statistical analyses to determine user needs and preferences. Use data related to human scale and proportion to determine product scale and dimensions.

A minimum of 15% of the question in the exam paper will test your mathematical skills

Percentage

2 Figure 2 shows a children's educational toy manufactured from mahogany.

20mm

Component A

Component A

20mm   17.3mm

90mm   60mm   40mm   15mm   30mm
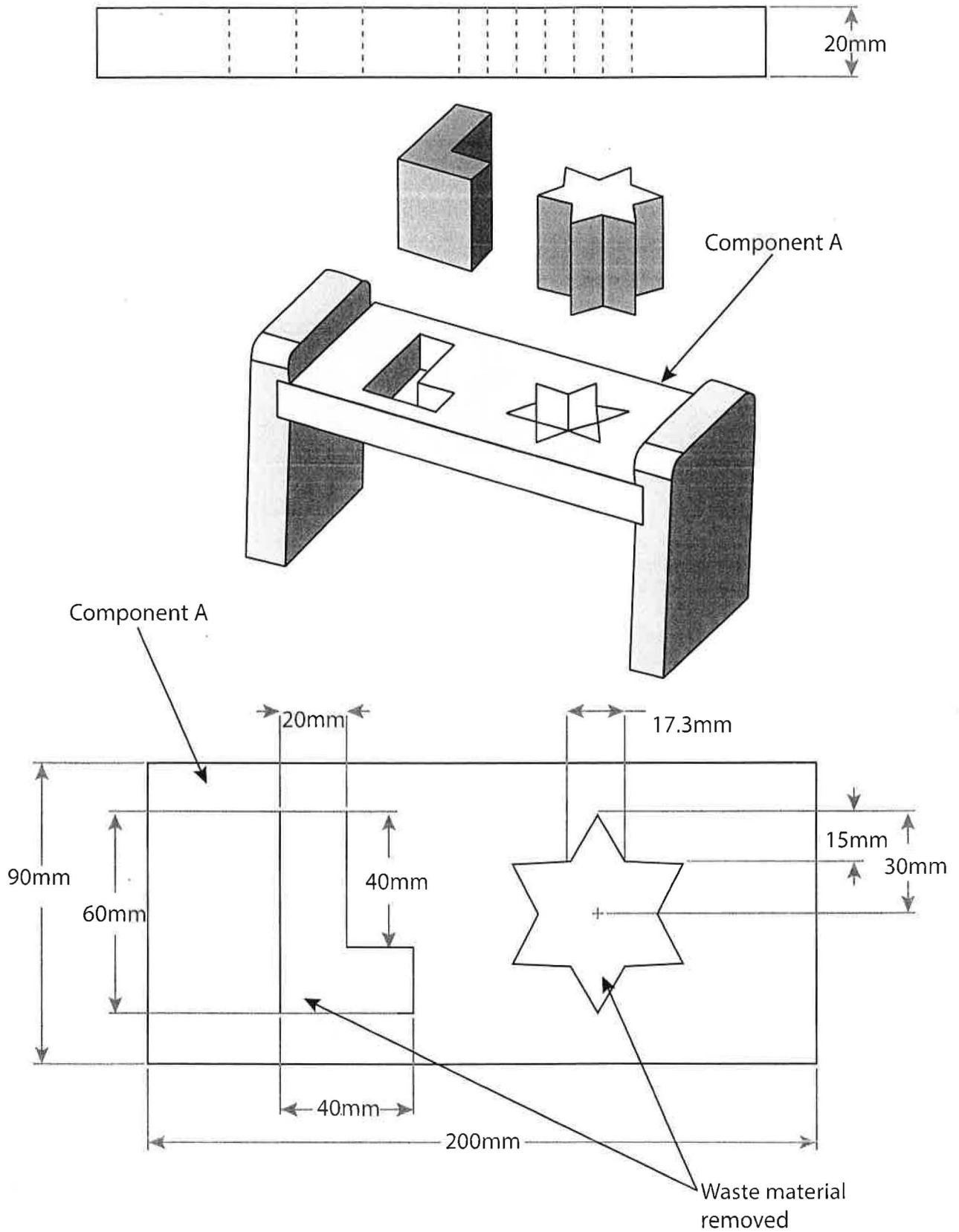
40mm

200mm

Waste material removed

Figure 2

A ruler and pencil are two of the tools used to mark out the 'L' shape to be removed.

(a) Give **two** additional marking-out tools that could be used for the 'L' shape.

1 ....

2 ....

Waste material is removed from Component A to make the toy, as shown in Figure 2.

(b) Calculate the percentage of the original piece of mahogany that is removed as waste material.

Give your answer correct to 1 decimal place.

Show all of your workings.

Answer ....

(Total for Question 2 = 10 marks)

Statistics

Figure 5 shows the initial sketch for a new hand drill that is being developed.

(Source: © Les Perysty/Shutterstock)

Figure 5

In order to design the drill ergonomically, the designer must consider anthropometric data.

Figure 6 presents anthropometric data showing the hand-grip sizes of a sample of people.
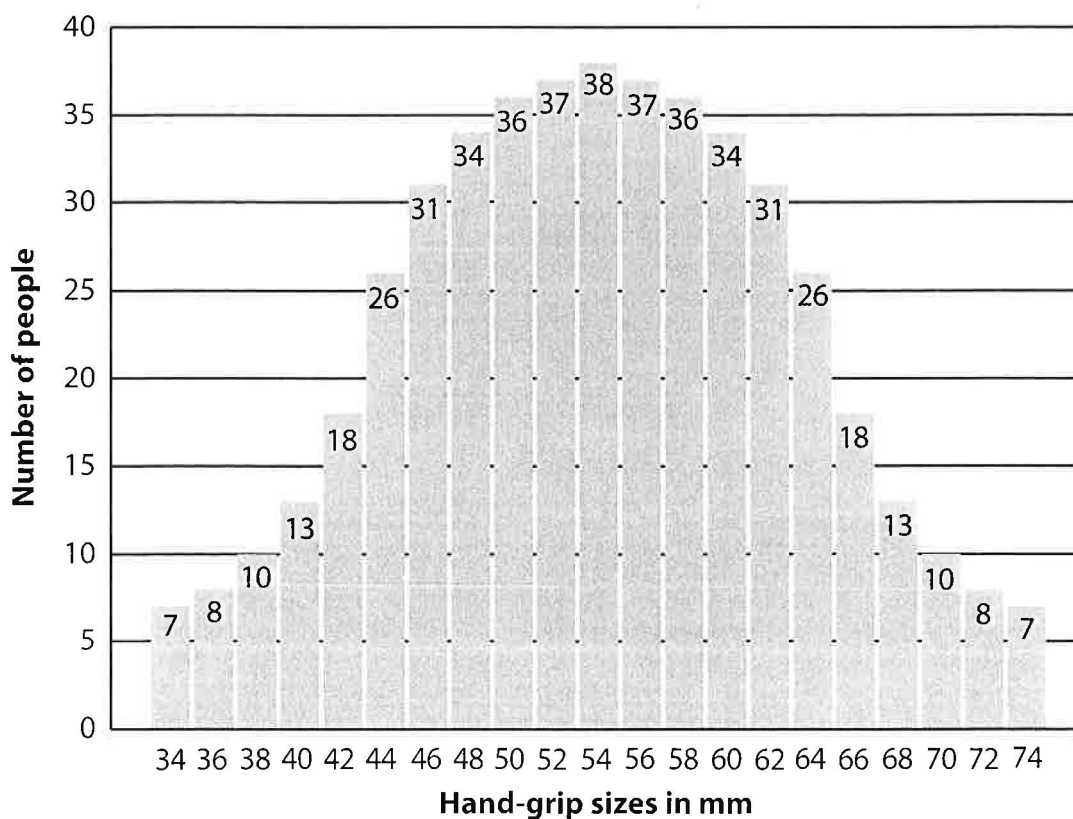

Figure 6

(b) (i) Calculate the number of sampled people capable of using the hand drill if it is designed to be suitable for 90 per cent of the sample.

Give your answer correct to the nearest whole number.

Show all of your workings.

Answer ....

The drill is being designed to be ergonomically suitable for hand-grip sizes that fall within the 5th to 95th percentile of the sample.

(ii) Calculate the minimum and maximum hand-grip sizes that the designer must consider.

Show all of your workings.

Answer ....

The nuts and bolts used to assemble the scooter are standard parts.

(c) Give **two** benefits, other than cost, of using standardised parts.

....

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....

....

A jig is required to hold the main upright at the correct angle while it is welded in place.

Figure 9 shows a schematic drawing to be used to calculate the correct angle of the jig.
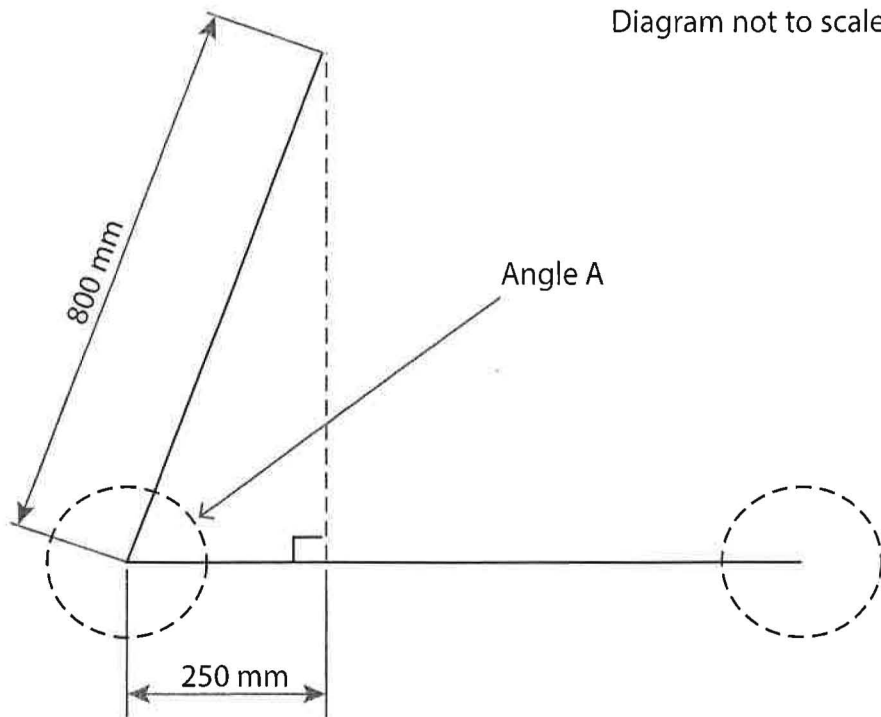
Diagram not to scale

Angle A

800 mm

250 mm

Figure 9

(d) Using the information in Figure 9, calculate Angle A in degrees.

Give your answer to 2 significant figures.

Answer ....

A child-sized version of the scooter has been developed and is being marketed with a unique packaging design. Figure 10 shows the net (development) for the scooter packaging. The construction tabs have been omitted for clarity.

780

150

R500

900

400

200

150

500

150

150

800
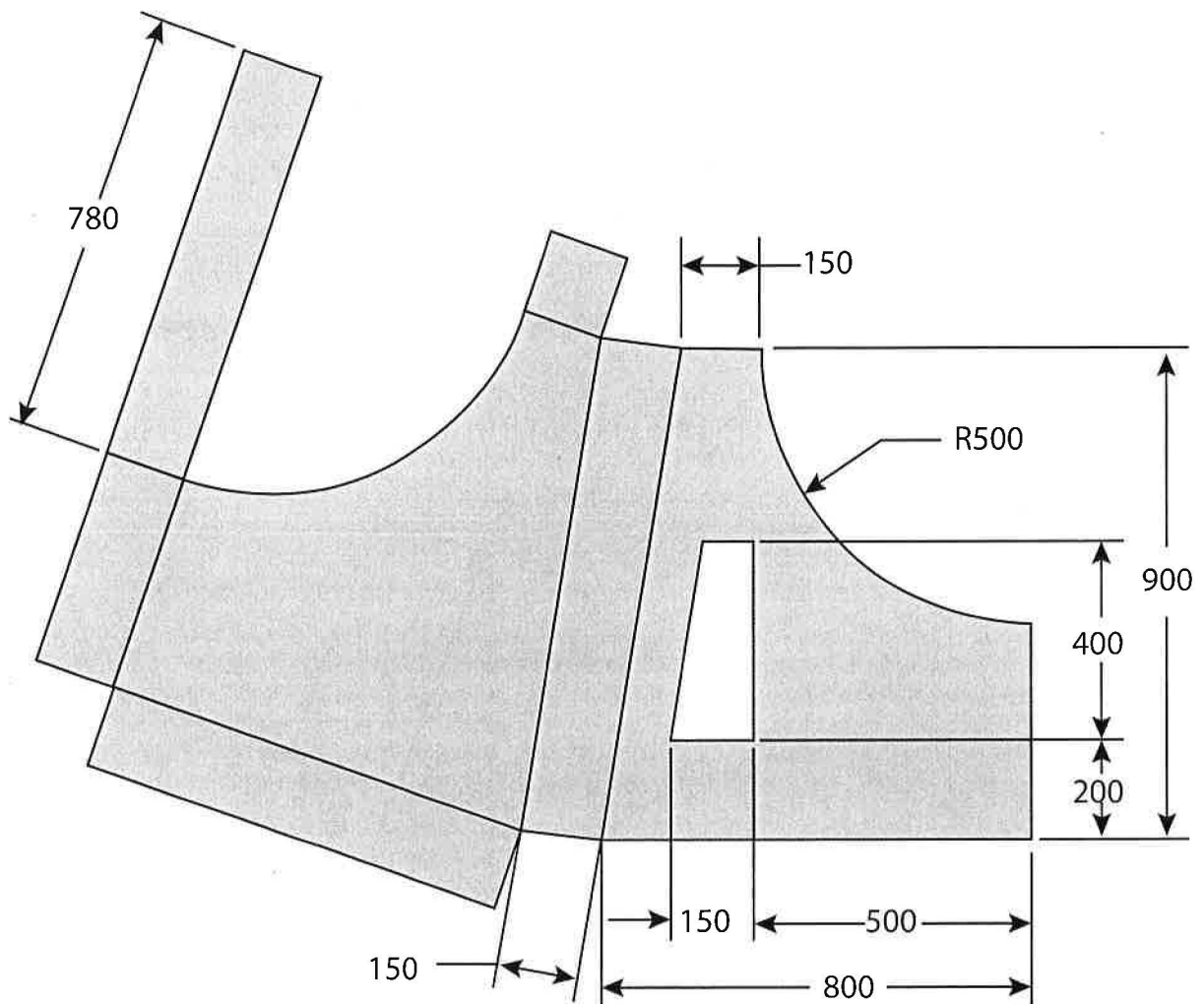
All dimensions are in mm

Figure 10

(e) Draw an accurate isometric view of the assembled box, to a scale of 1:10, on the grid provided.
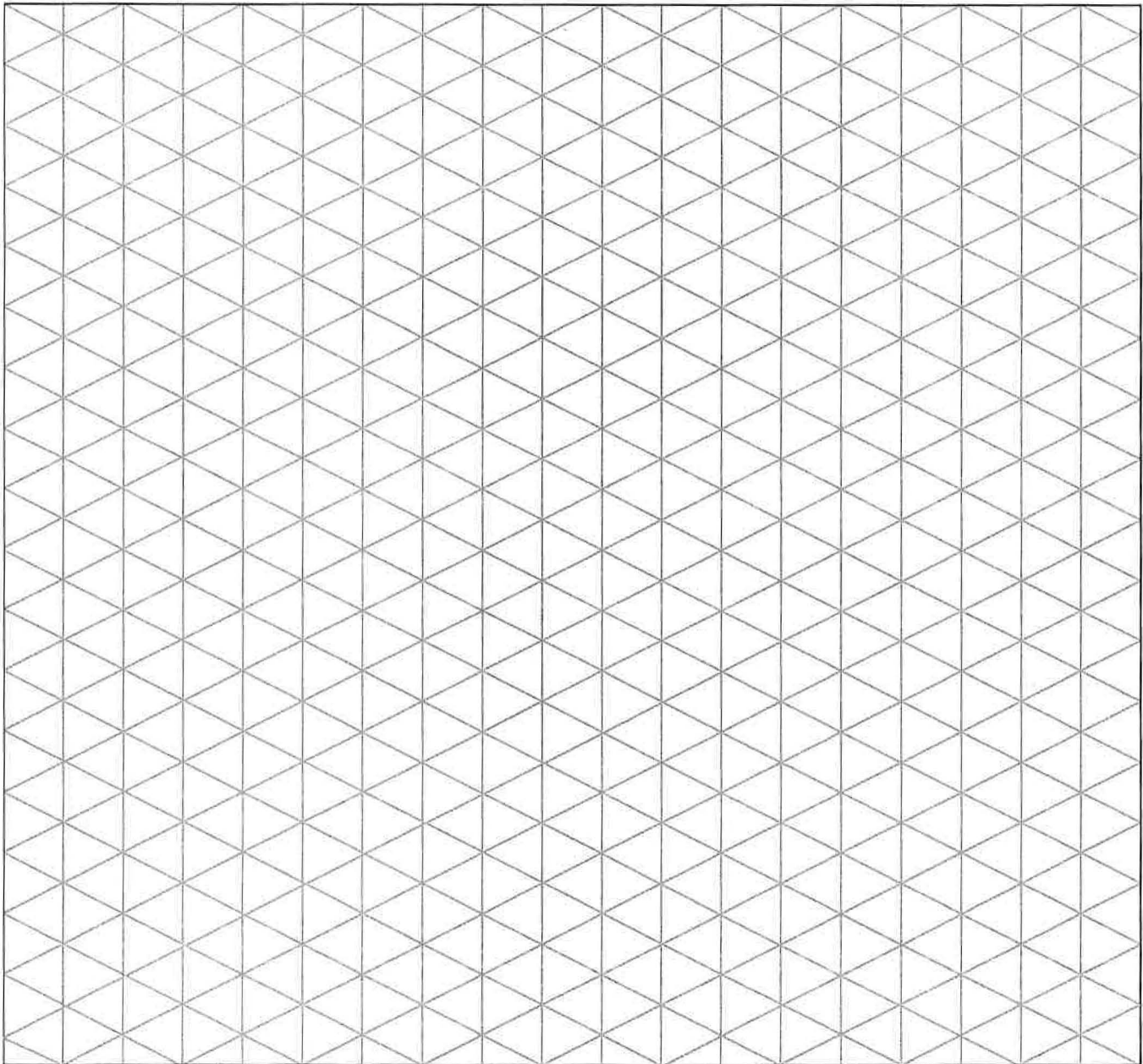
10 mm isometric grid

(Total for Question 5 = 25 marks)