Write your name here

Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Design and Technology (Product Design)

Component 1

Sample assessment material for first teaching September 2017
Time: 2 hours 30 minutes

Paper Reference
9DT0/01

You must have:
a calculator and a ruler.

Total Marks

Instructions

- Use **black** ink or ball-point pen (HB pencil may be used for questions that require drawing or sketching).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- For questions requiring mathematics, you must **show all your working out**, with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Pearson

Answer ALL questions. Write your answers in the spaces provided.

1 Figure 1 shows a chessboard and some chess pieces that are to be manufactured from plywood.

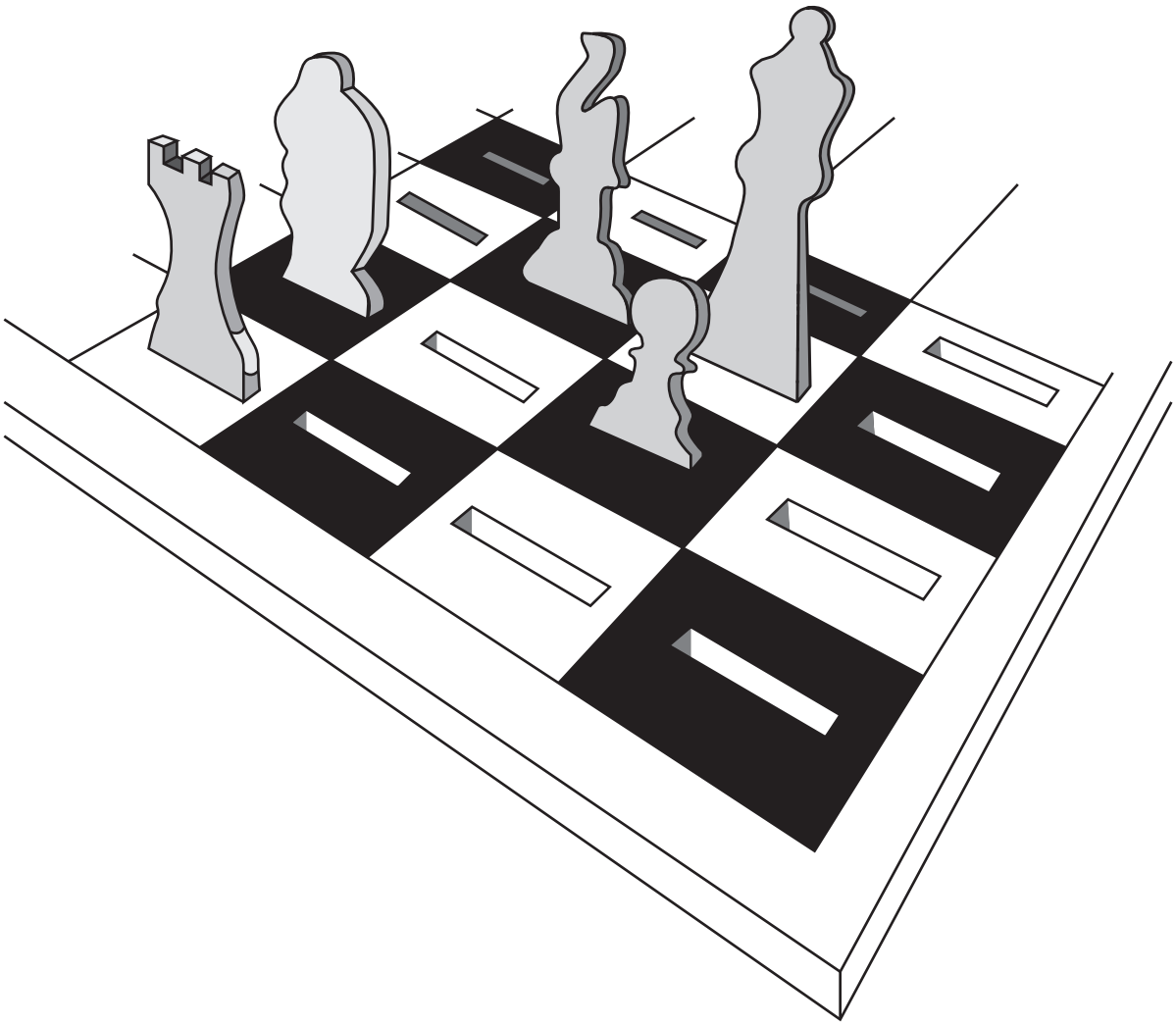

Figure 1

The chessboard will be made from a single piece of plywood and needs to have contrasting light and dark squares.

(a) Explain how a laser cutter could be used to achieve the contrasting squares.

(2)

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(b) Explain **two** benefits, other than cost, of using plywood rather than solid wood for manufacturing the chess pieces.

(4)

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The chess pieces could be made from acrylic.

(c) Explain **one** advantage of using acrylic rather than plywood for the chess pieces.

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(Total for Question 1 = 9 marks)

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

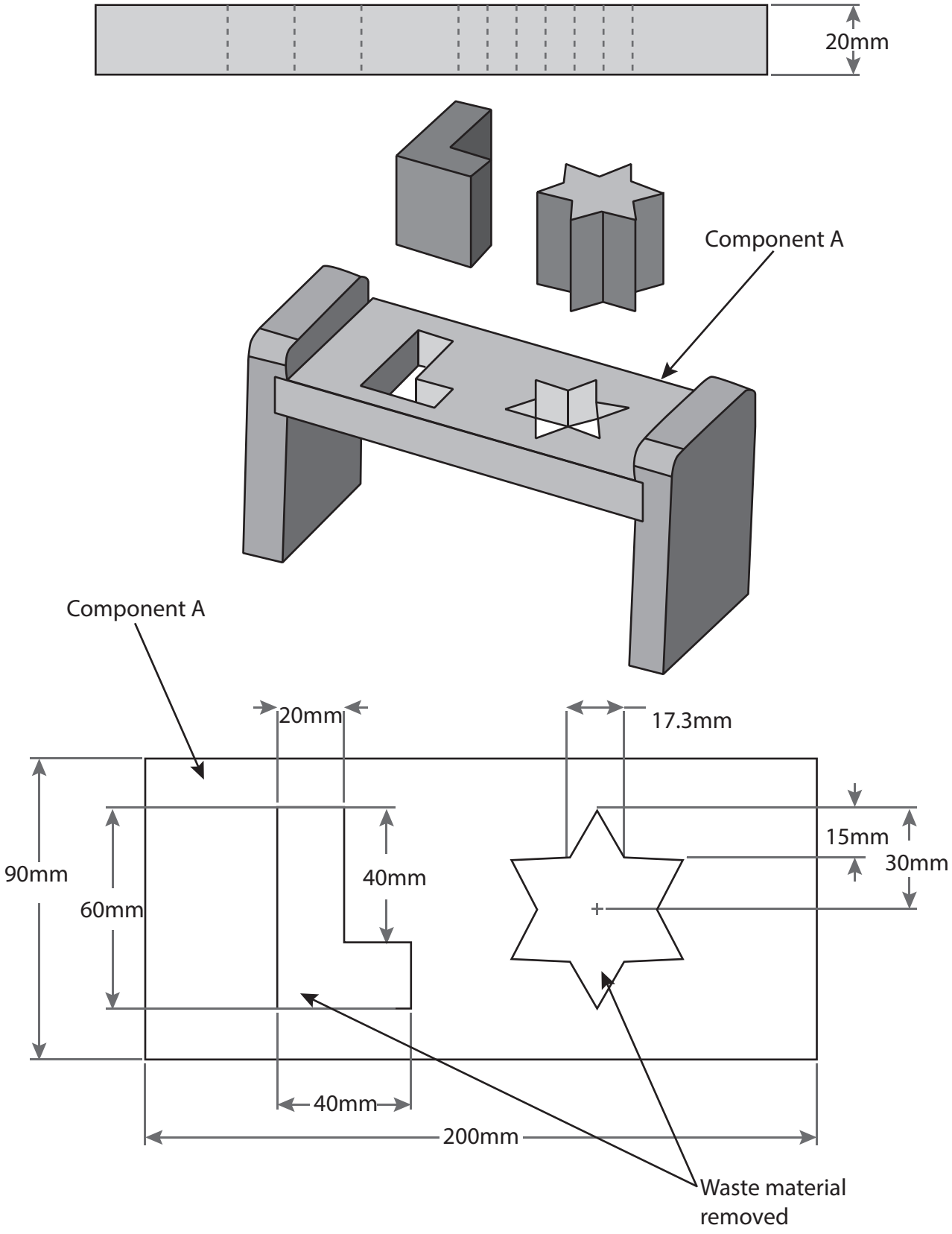

Figure 2

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.

(2)

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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.

(8)

Answer .....

(Total for Question 2 = 10 marks)

3 Die-casting is a common process used for making metal products.

(a) Explain **one** property of zinc that makes it a suitable material for die-casting.

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(b) Describe, using labelled sketches, the process of die-casting.

(4)

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Figure 3 shows a child's toy bus, which has been commercially die cast.

The toy bus measures 70 mm long, 40 mm high and 2 mm wide.

(Source: © Soundsnaps/Shutterstock)

Figure 3

(c) Explain **two** advantages of using die-casting over sand casting to manufacture the body of the toy bus.

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(Total for Question 3 = 12 marks)

4 Figure 4 shows a selection of screwdriver bits that have been hardened and tempered.

(Source: © Yegor Larin/Shutterstock)

Figure 4

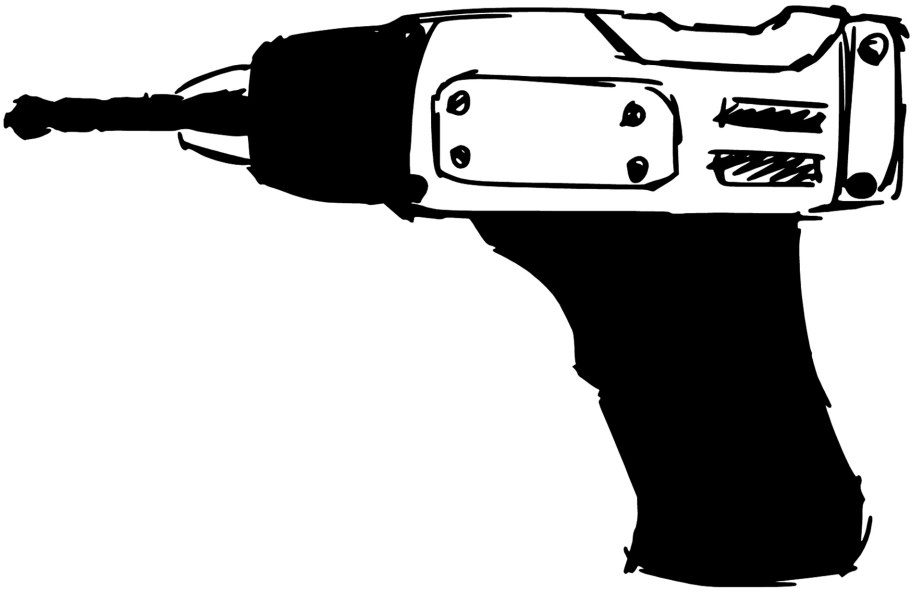
(a) (i) Describe the process used to harden the screwdriver bits.

(2)

(ii) Explain **one** reason why the screwdriver bits are tempered once they have been hardened.

(3)

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.

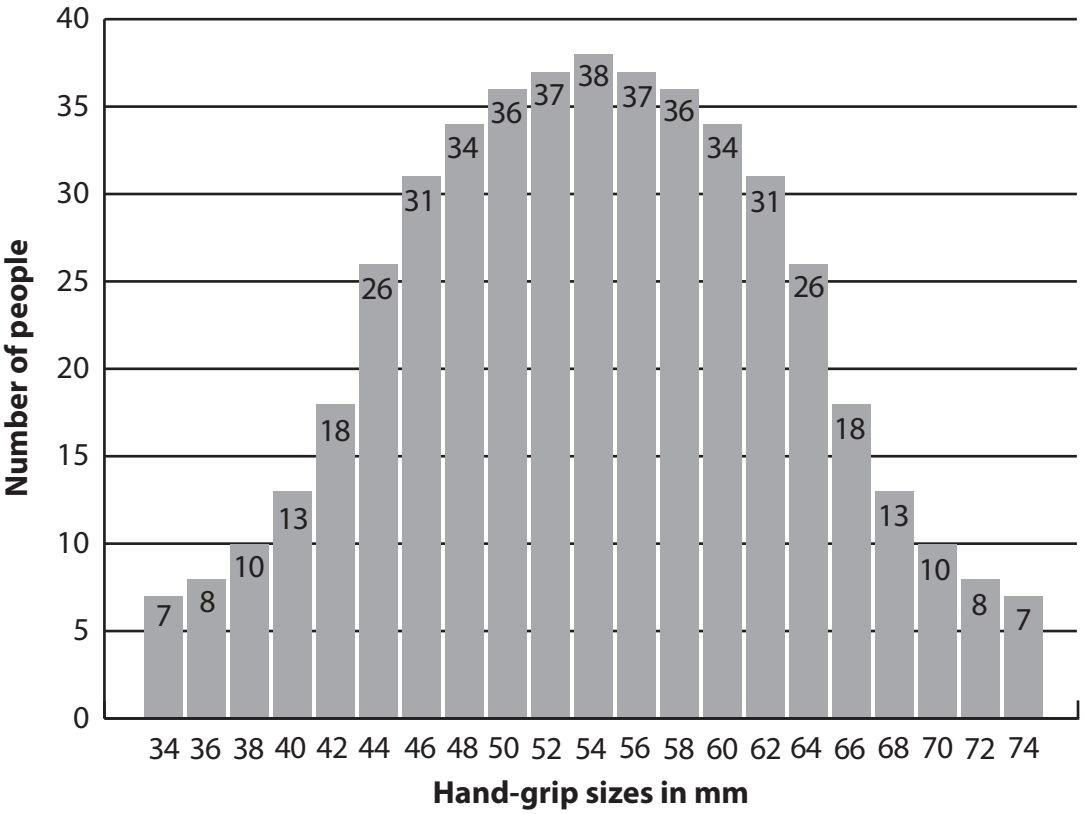


Figure 6

(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.

(2)

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.

(3)

Answer .....

The design for the drill has been finalised.

(c) Explain **one** benefit to the designer of taking out a patent on the new drill design.

(2)

Figure 7 shows a parts drawing for both halves of the drill body.

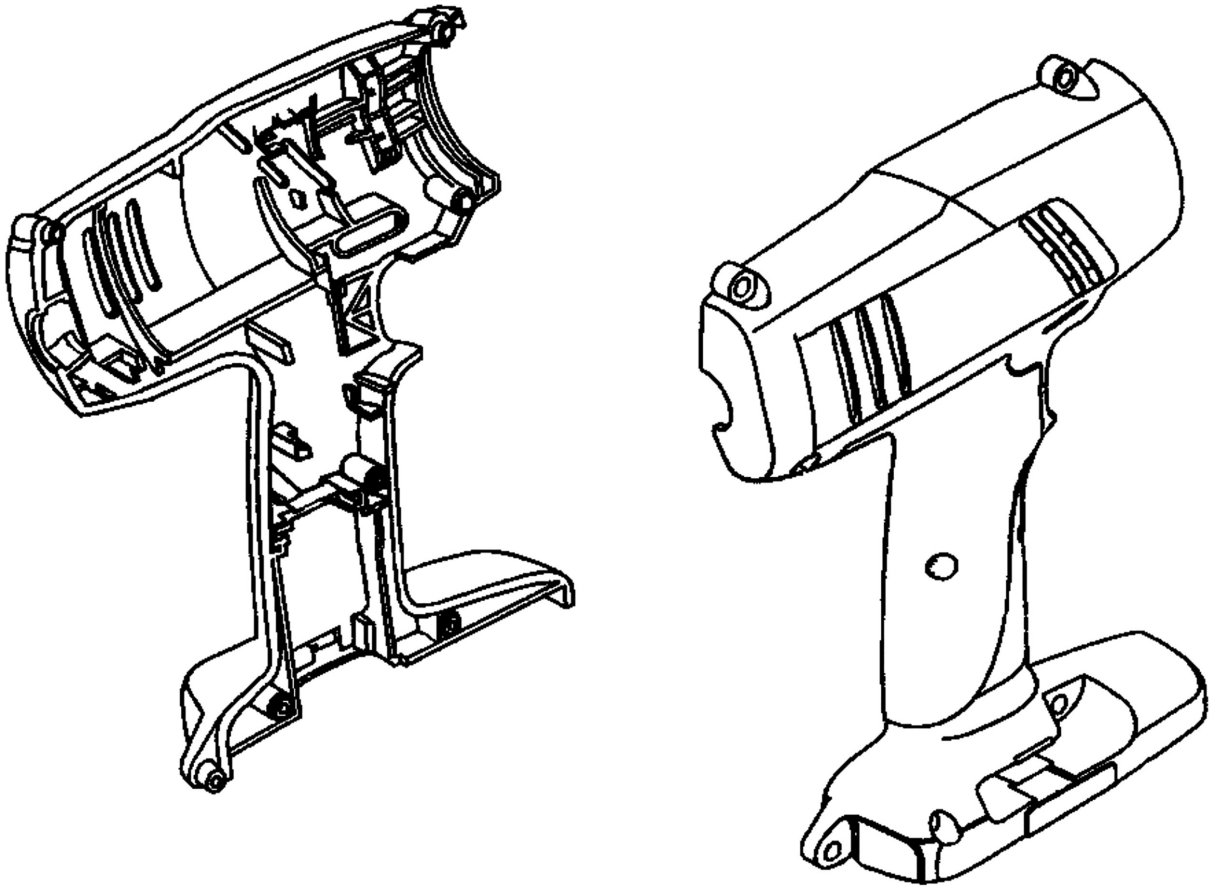


Figure 7

The design for the drill body has now been finalised and patented. It has been designed to be mass produced using injection moulding.

(d) Evaluate the decision to use injection moulding to create the drill body.

(9)

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The manufacturer would like the drill on the market as soon as possible and they have decided to use a critical path analysis project management strategy to achieve this.

(e) Outline the process of critical path analysis.

(4)

(Total for Question 4 = 25 marks)

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5 Figure 8 shows a scooter.

Figure 8

The manufacturer of the scooter has ensured that it meets the requirements of the Consumer Rights Act 2015.

(a) State **two** requirements of the Consumer Rights Act 2015 that relate to the purchase or use of the scooter.

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The scooter features rubber tyres.

(b) (i) Explain **two** performance characteristics of rubber that makes it a suitable material for the tyres of the scooter.

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The manufacturer is considering two design options for the scooter wheels:

– Solid wheels, which would need to be replaced when damaged.
– Pneumatic (air filled) wheels, which could be repaired when they get punctured.

(ii) Discuss the factors that need to be considered before deciding which option to produce.

(6)

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

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

(2)

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

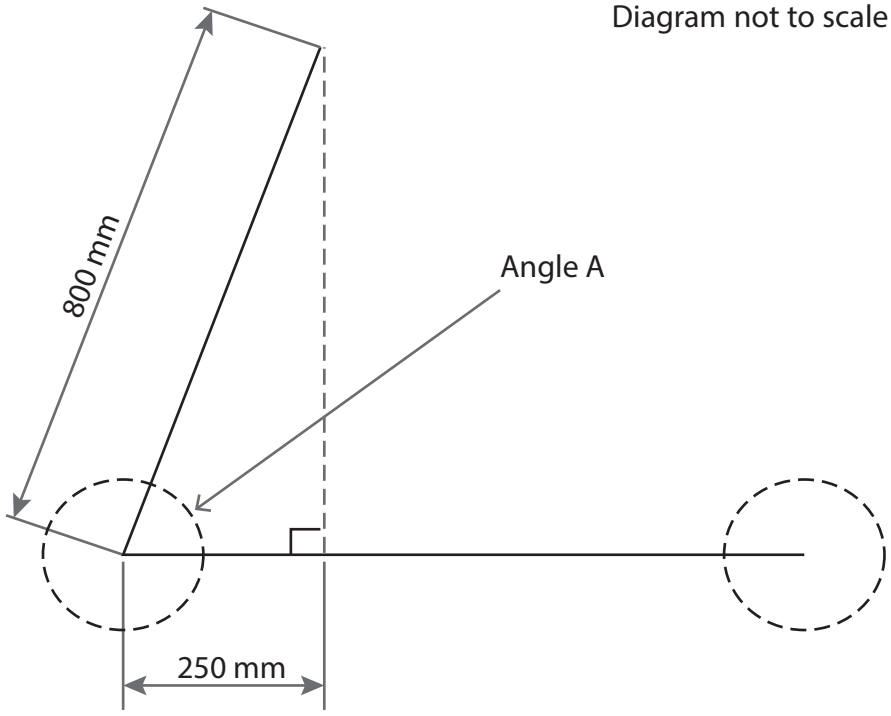

Figure 9

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

Give your answer to 2 significant figures.

(3)

Answer .....

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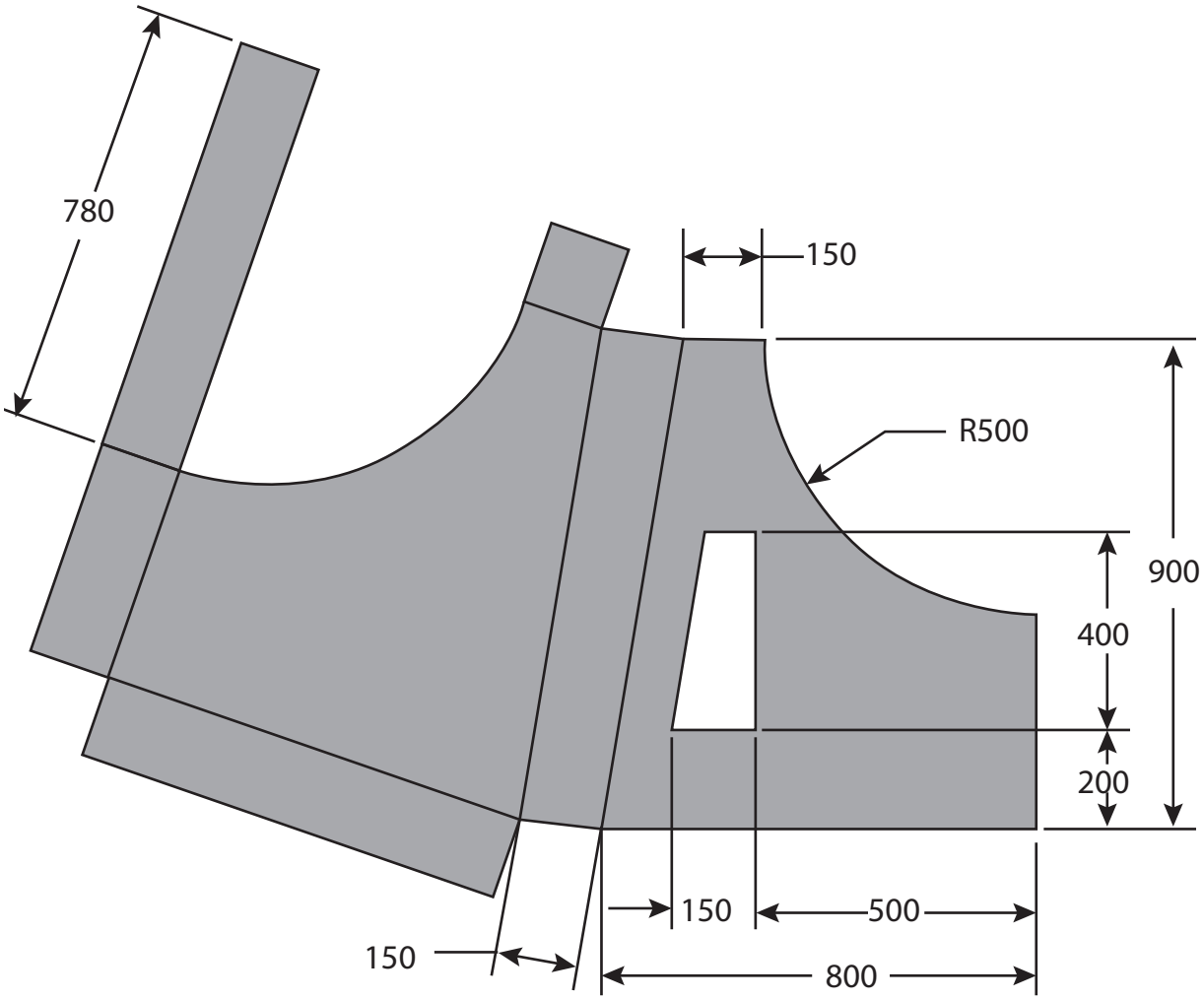
A child-sized version of the scooter has been developed and is being marketed with a unique packaging design. Figure 10 shows the net (development) for the scooter packaging. The construction tabs have been omitted for clarity.

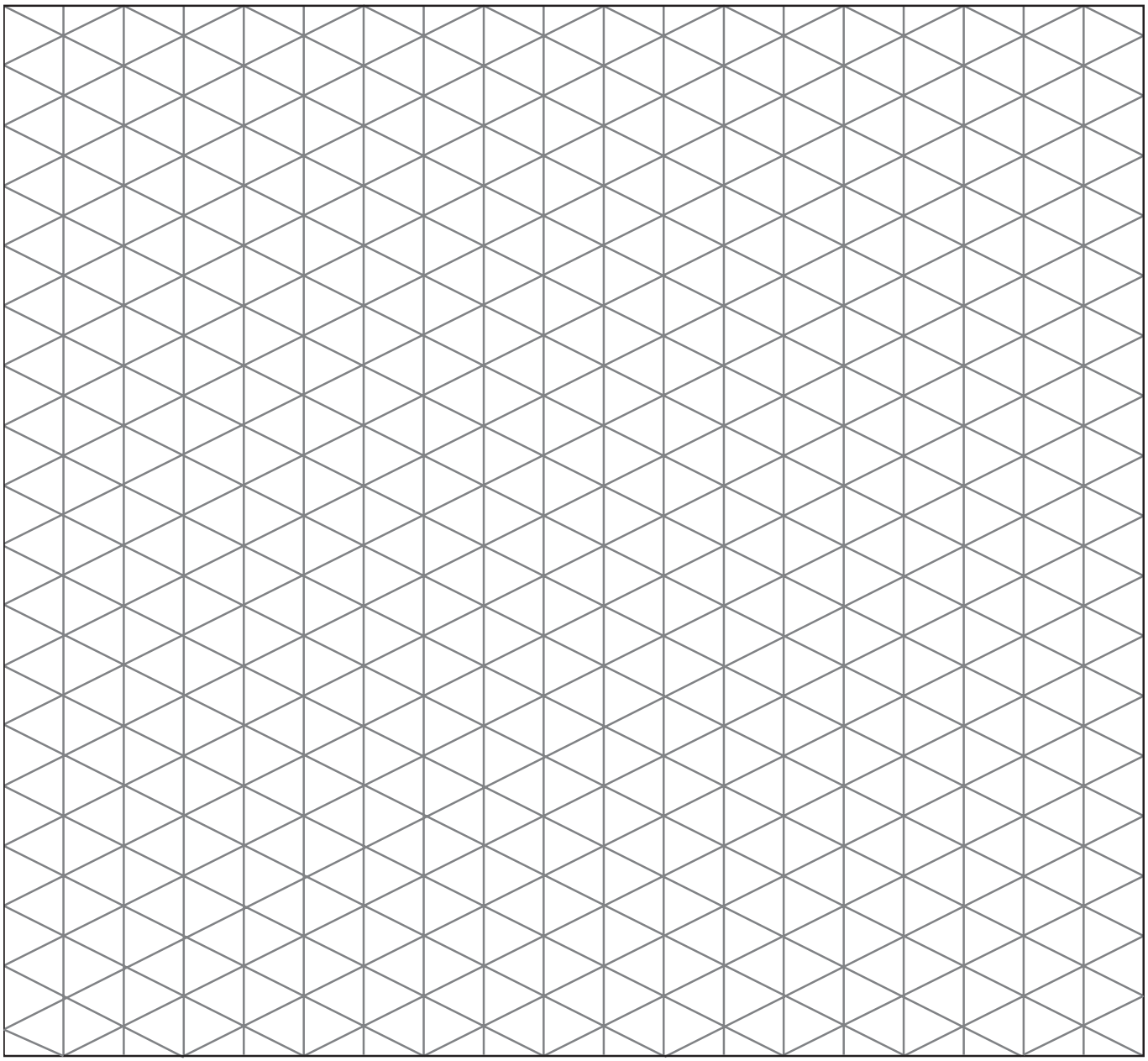


All dimensions are in mm

Figure 10

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

(6)



10 mm isometric grid

(Total for Question 5 = 25 marks)

6 Figure 11 shows a chair produced during the Bauhaus Modernist period.

(Source: https://www.1stdibs.com/furniture/seating/chairs/mr-20-bauhaus-chair-ludwig-mies-van-der-rohe/id-f_2581042/)

Figure 11

Discuss how the design of the chair in Figure 11 was influenced by Bauhaus Modernist philosophies and the manufacturing technology available during the period.

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(Total for Question 6 = 9 marks)

7 Figure 12 shows a smartphone.

Mobile phone design 2015

(Source: © Krystian Nawrocki/Istock)

Figure 12

(a) Explain **three** features in the design of the smartphone shown in Figure 12 that have been impacted by smart materials and the miniaturisation of components.

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(b) Explain **three** ways in which built-in obsolescence of smartphones has a positive or negative impact on society.

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(Total for Question 7 = 18 marks)

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8 Figure 13 shows a vacuum cleaner.

(Source: © Ralf Juergen Kraft/Shutterstock)

Figure 13

The vacuum cleaner has been designed with a transparent collection tube.

Evaluate this design decision with reference to aesthetics and functionality.

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(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 120 MARKS

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