



Oxford Cambridge and RSA

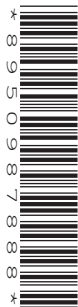
Friday 15 October 2021 – Morning

**A Level in Design and Technology:
Product Design**

H406/02 Problem Solving in Product Design

Resource Booklet

Time allowed: 1 hour 45 minutes



INSTRUCTIONS

- Use the Resource Booklet to answer all the questions.
- You should spend **35 minutes** reading this Resource Booklet.
- Do **not** send this Resource Booklet for marking. Keep it in the centre or recycle it.

INFORMATION

- This document has **8** pages.

ADVICE

- Read this Resource Booklet carefully before you start your answers.

The stimulus in this booklet relates to issues and opportunities encountered by business enterprises making and selling products for gardens.

Attracting wildlife into gardens

Gardens attract thousands of insects, many of which are helpful because they pollinate flowers and control pests. These insects support biodiversity and help to increase the productivity of the ecosystem.

Insect hotels, also known as bug houses, bug hotels and bug boxes, provide a safe place where insects can shelter in the garden.

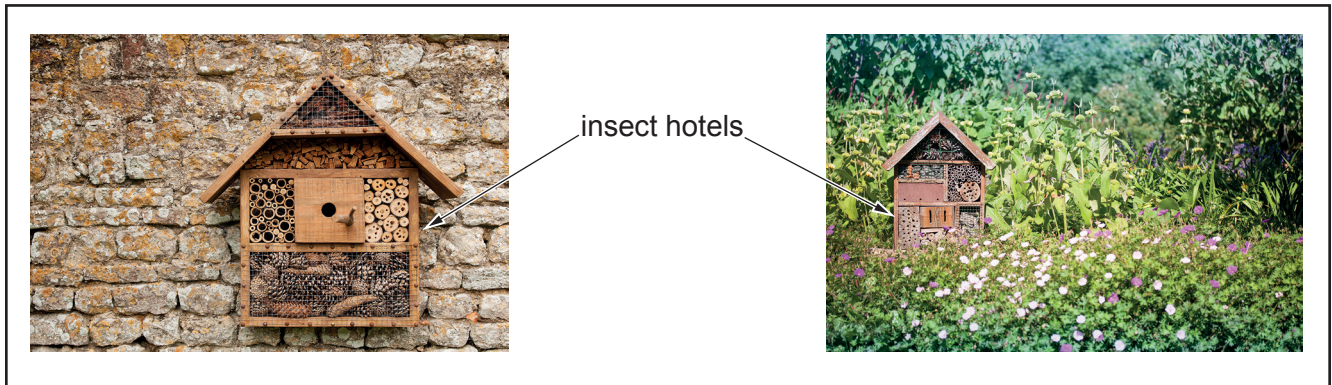


Fig. 1

Enterprise

The owner of a garden centre has identified a potential additional income stream. In keeping with the current trend of products made from upcycled materials, garden accessories such as bird boxes and insect hotels made from these materials can be sold.

A trial batch of 50 insect hotels are required to determine consumer interest.

The insect hotels will be based on the prototype shown in **Fig. 2**.



Fig. 2

Upcycling

The insect hotels will be made by the upcycling of materials such as those shown in **Fig. 3**.

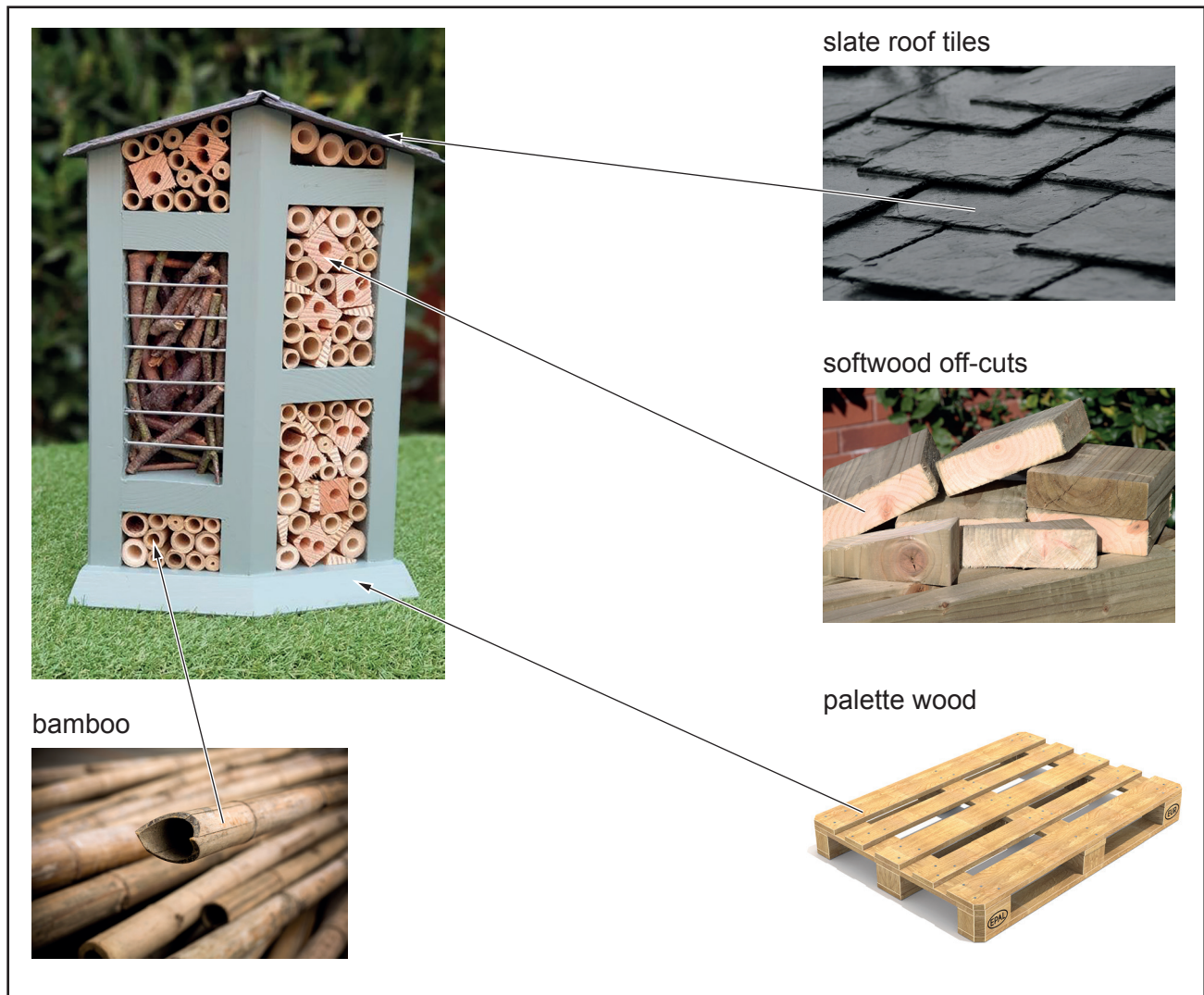


Fig. 3

Consumer feedback

After two weeks most of the insect hotels were sold to local customers and visitors.

Consumers liked the following aspects:

- aesthetics – pastel colours that complement the garden environment
- use of upcycled materials
- quality of finish
- ease of maintenance and cleaning.

The survey results indicated that there is a demand for the following:

- an increased range of products
- products in a selection of colours.

Additional survey comments indicate the market potential for garden accessories made from upcycled materials.

Range expansion

The garden centre owner develops a range of products branded 'Re-New', shown in **Fig. 4**, that includes a bird box, a robin nesting box, a hedgehog hotel and a bird feeder.



Fig. 4

Manufacturing

The Re-New range of products are made in-house by an existing employee who is responsible for general repairs and maintenance of the garden centre and associated products. This employee is a skilled craftsman that has been involved in developing the Re-New product range.

The products are made in the garden centre's small maintenance workshop using the following tools and equipment:

- work bench with bench vice
- tenon saw, bench hook
- chisels and mallet
- hand-held belt sander
- cordless orbital sander
- cordless drill driver.

Apple Blossom

Apple Blossom is a manufacturer of high-quality wooden garden furniture that supplies garden centres across the country. Examples of some of their products are shown in **Fig. 5**.

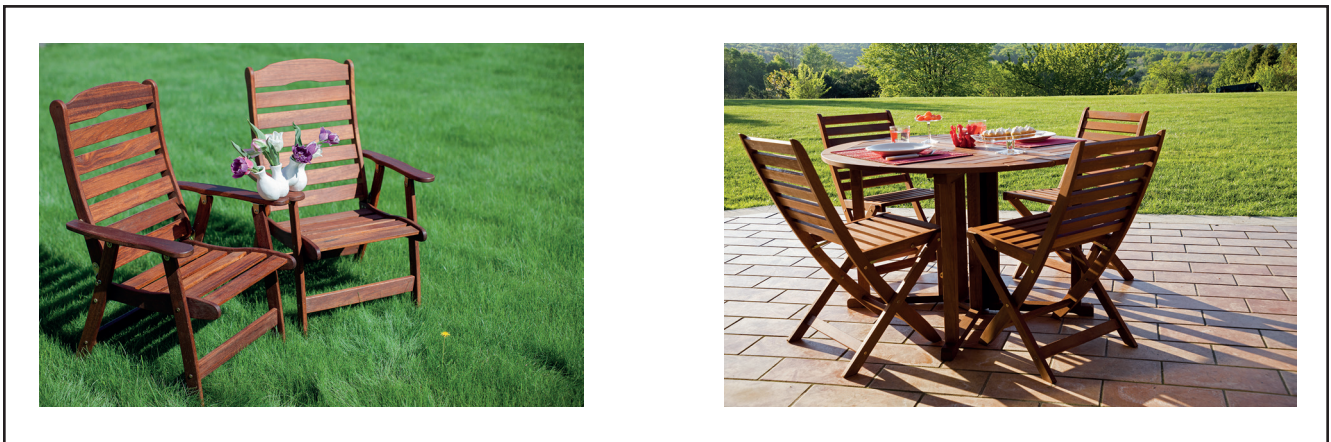


Fig. 5

The availability of low cost imported online garden furniture has had a negative impact on sales and the owners need to consider an overhaul of their product range and manufacturing methods in order to remain competitive.

Designers have been given the brief to develop designs for product ranges that will provide new sales opportunities.

Modern material

One designer has identified a new material that would be suitable for the manufacture of garden furniture – ‘Meditate Tricoya Extreme’ (MTX) shown in **Fig. 6**.

MTX:

- launched in early 2019
- suitable for construction, landscaping and exterior applications
- guaranteed for 50 years above ground
- resistant to water and fungus growth
- sheet dimensions 1210 mm × 2420 mm
- sheet thicknesses of 6, 9, 12, 15, 18 mm.

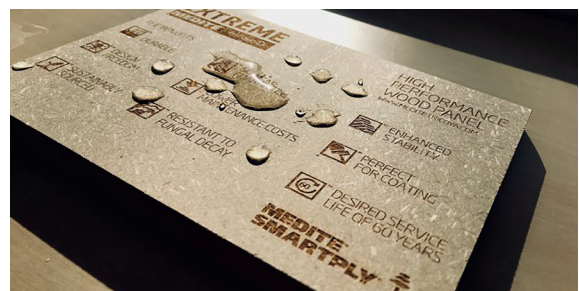


Fig. 6

Digital design and manufacture

Designers have developed a range of concepts, branded ‘Kwik slot’, to be made of manufactured boards such as MTX.

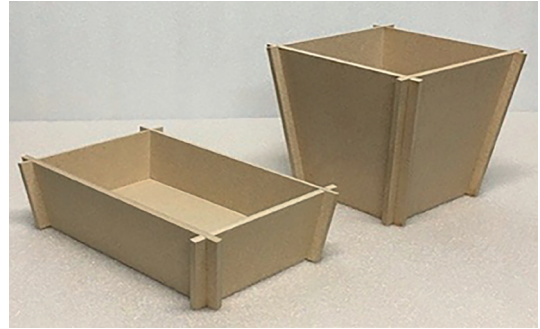
The use of manufactured boards presents another opportunity to modernise Apple Blossom’s factory operations and increase profits. The use of CNC machinery, such as CNC laser cutters and CNC routers, would reduce labour and increase output.

Kwik slot garden planters

One of the design concepts is a range of slot together garden planters shown in **Fig. 7**. The panels are designed to be made from MTX using an industrial CNC laser cutter.

The garden planters would be delivered to garden centres and other retailers in flat-packed form for self-assembly. The end-user slots the panels together before adding compost and plants.

Examples of prototype Kwik slot garden planters



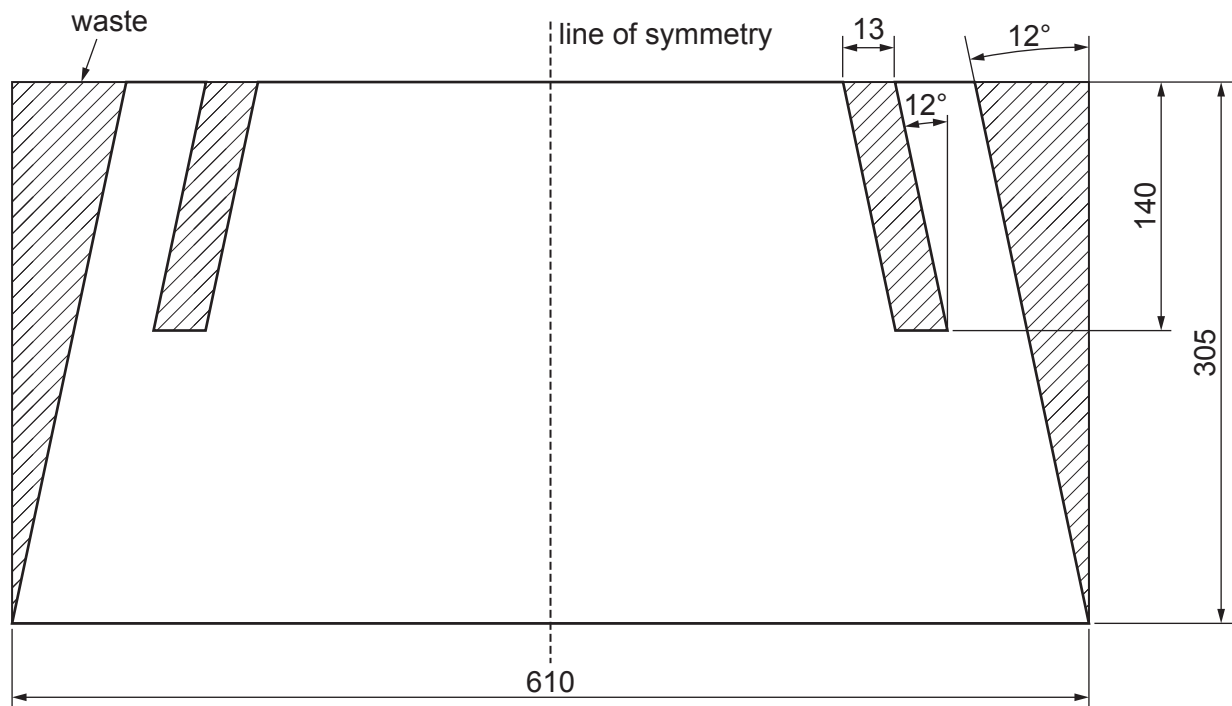
Example industrial CNC laser cutter

Oculus 1325:

- suitable for the cutting and engraving of acrylic, MDF and plywood
- bed dimensions 1300 mm × 2500 mm
- accuracy of ± 0.01 mm
- cuts MDF up to 20 mm in thickness
- cutting speed up to 36 000 mm/min.



A side panel for a large Kwik slot garden planter



Dimensions in mm

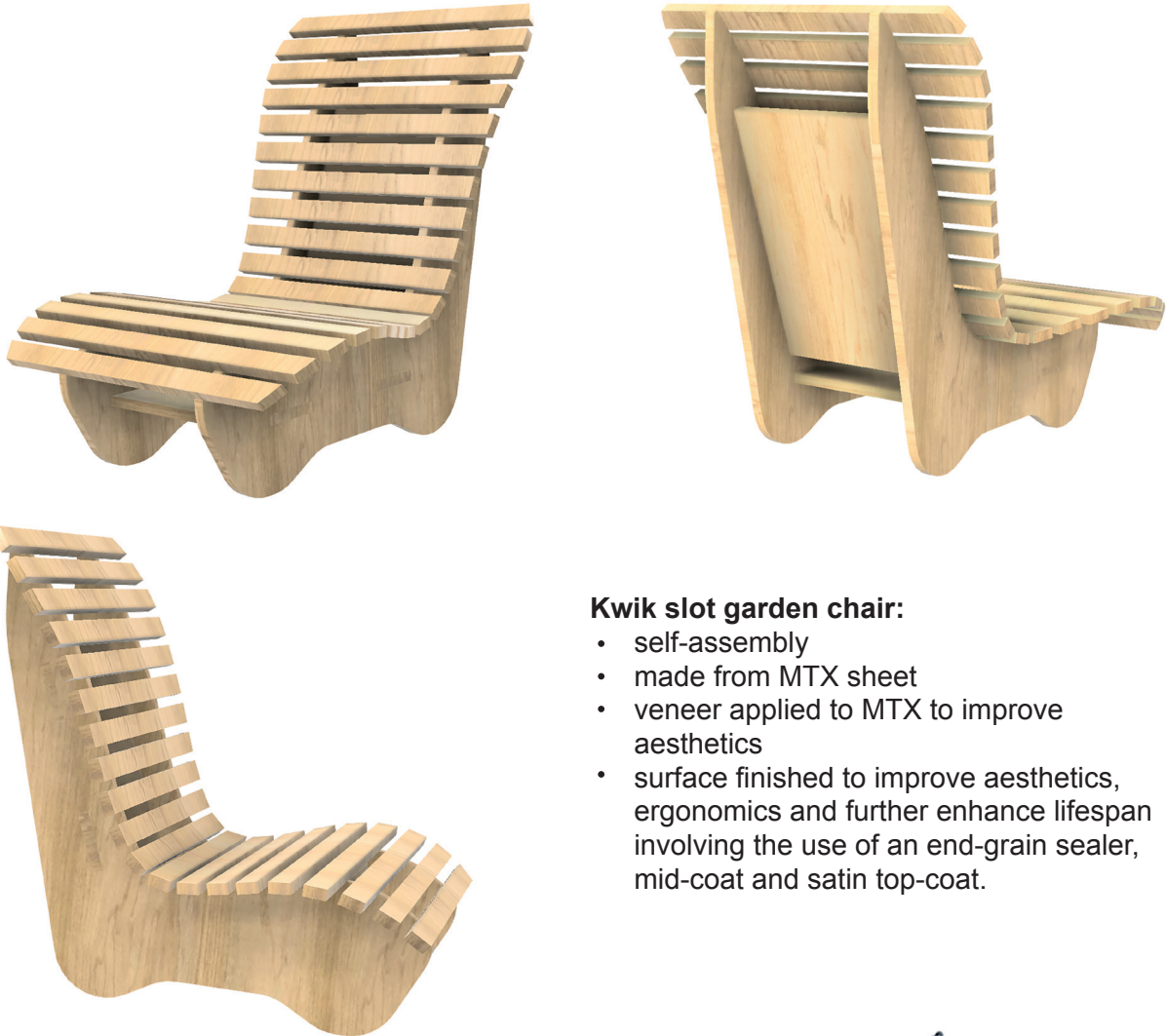
Fig. 7
(not to scale)

Kwik slot furniture

Designs have also been developed for a range of slot together outdoor garden furniture.

The chair concept shown in **Fig. 8** is part of the range of slot together furniture. It is designed to be manufactured out of MTX using an industrial CNC router.

The chair would be flat-packed in cardboard boxes for the end-user to assemble.



Kwik slot garden chair:

- self-assembly
- made from MTX sheet
- veneer applied to MTX to improve aesthetics
- surface finished to improve aesthetics, ergonomics and further enhance lifespan involving the use of an end-grain sealer, mid-coat and satin top-coat.

Example industrial CNC router

Olympus 1325:

- suitable for the cutting and routing of manufactured boards including MDF, plywood, laminates, as well as hard and soft wood
- bed dimensions 1300 mm × 2500 mm
- accuracy of ± 0.01 mm
- spindle speed 24 000 rpm
- vacuum bed.



Fig. 8
(not to scale)

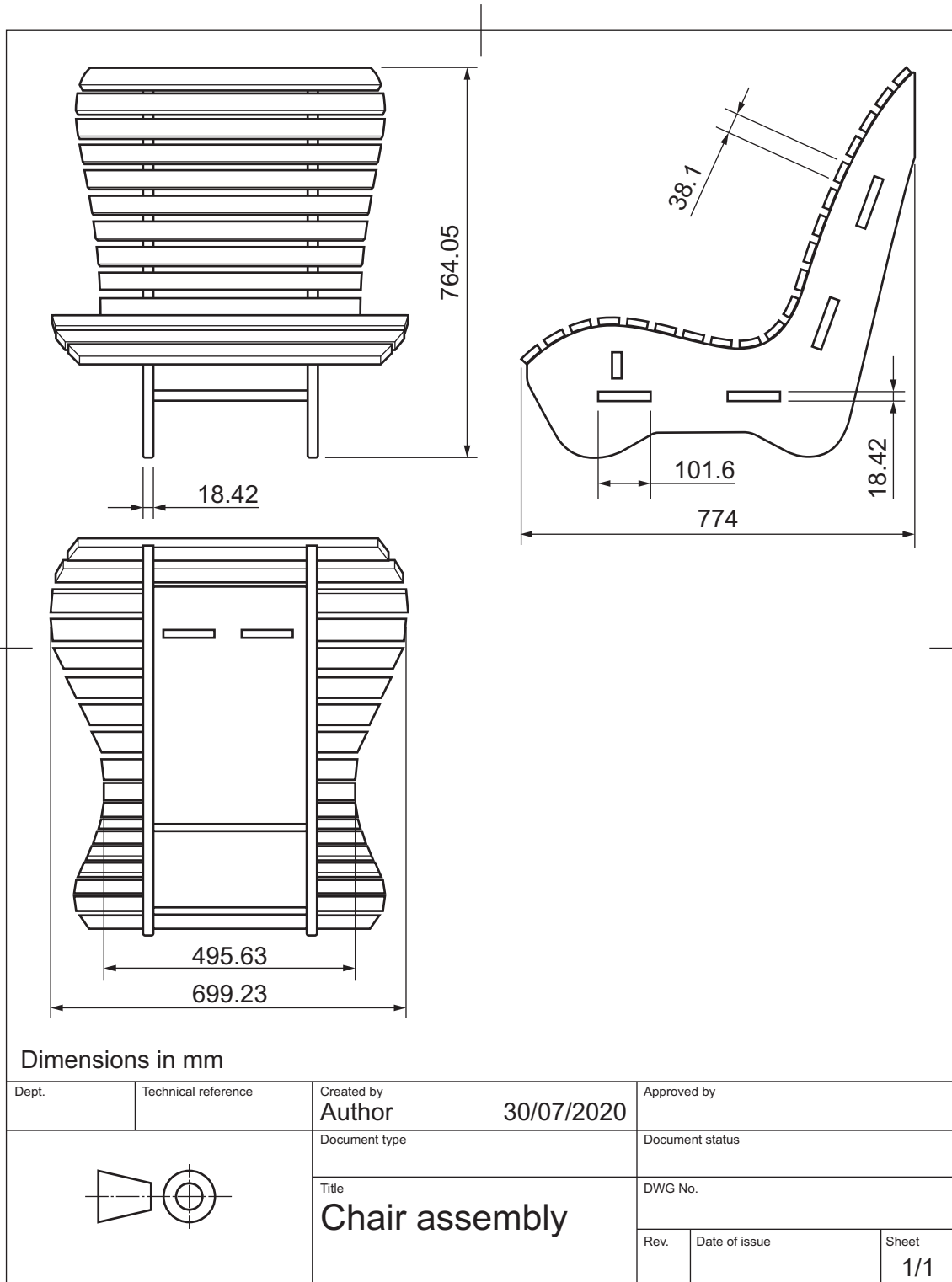


Fig. 9
(not to scale)

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