# Packaging Design
## Lesson 1: The Design Task

### Australian Curriculum: Mathematics (Year 8)

ACMMG195: Choose appropriate units of measurement for area and volume and convert from one unit to another.
ACMMG197: Investigate the relationship between features of circles such as circumference, area, radius and diameter. Use formulas to solve problems involving circumference and area.

### Lesson abstract

Students think their way into the role of being a designer by considering the factors that would be important in designing packaging. They consider the priorities of the manufacturer (e.g. easily manufactured and transported), the retailer (e.g. easy to display on shelves) and the perspectives of customers (e.g. attractive). They begin to design a container to hold five essentially cylindrical products, that will come in various sizes.

### Mathematical purpose (for students)

Designers use mathematical ideas to meet the varying needs of manufacturers, retailers and customers.

### Mathematical purpose (for teachers)

This lesson sets up the design task, by helping students build a thorough understanding of the context within which the packaging task is situated. They think about criteria, such as efficiency of packaging, that they will later mathematise. For example, later they may mathematise two efficiency criteria as the percentage of area of card going to waste in cutting, and as percentage of wasted space in a carton packing 100 products. Some students may begin to use mathematical ideas when they start their design, but this is not a priority at this early stage.

Ideally, students beginning this unit will have some knowledge of the mathematical modelling cycle (from Unit 1 of on Mathematical Modelling). If this is not possible, do the 'QuickStart' lesson supplied in this package. It is not really needed in this first lesson but should definitely be done before Lesson **2.**

Lesson Length 50 minutes approximately

Vocabulary Encountered

- design
- design cycle

Lesson Materials

- Samples of packages, preferably brought by students
- Slide show: ST7_Packaging_1a.pptx
- Student Sheet 1 - Packaging Designer (one per student)
- Videos (optional) http://www.youtube.com/watch?v=8i3riKvCYkM (How cardboard boxes are made, 5 mins) and https://www.youtube.com/watch?v=AwrTWciEfZ0 (Amazing box designs you should see, 2 mins)

We value your feedback after these lessons via https://www.surveymonkey.com/r/J8GPD7Z

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## Lesson Structure

- Whole-class and group discussion: What makes good packaging? (10-15 minutes).
- Whole-class explanation and clarifying questions: Introducing the design cycle (5 minutes).
- Whole-class explanation and clarifying questions: Introducing the design brief (5-10 minutes).
- Collaborative small-group work: Developing initial ideas and sketches (30 - 35 minutes).

# What makes good packaging?

Explain that students are going to be designing packaging.

**Before this lesson, ask students to bring in some packages, some functional and some with an aesthetic priority**. Also bring in some of your own so that there is good variety.

Display the packages and allow students to comment on them. Encourage them to say what they like and what they don't like about the different designs.

Show the slide Packaging designer

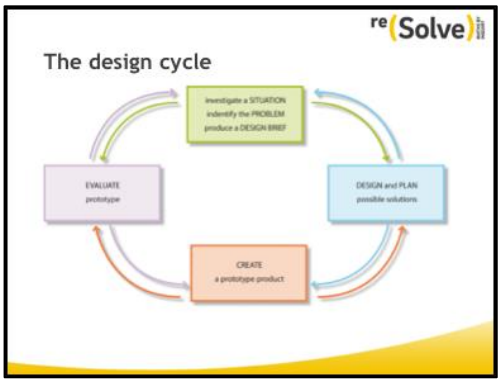
Ask students what factors they should take into account when designing packaging. During whole-class discussion, emphasise that designers must take account of very practical considerations such as how to stack packages and also aesthetic considerations.

You may wish to introduce the context with the video "How its made: cardboard boxes" https://www.youtube.com/watch?v=HL2yvqSk8Ww (5 mins). The video situates the task in the real world and the brief discussion raises students' awareness of the need to take into account different perspectives.

The video (2 mins) Amazing Box Design You Should See shows presents a variety of novel and attractive box designs (https://www.youtube.com/watch?v=AwrTWciEfZ0).

# The Design Cycle

This whole-class discussion aims to introduce the students to the idea that design is an iterative process and that they are expected to adopt the role of a designer when working on this unit.




Show the slide The design cycle.

Tell students that this design cycle is often used by designers.
Ask students what they think the boxes and the arrows indicate.

### Expected student responses

- The boxes explain what you need to do to design something.
- You can travel either one way around the cycle or the other
- There is a need to move backwards and forwards between the different phases of the design.

Emphasise that much like the mathematical modelling cycle, the design process is not one-way. Earlier phases may need to be reviewed, and future phases need to be considered.

Tell students that in the next few lessons they will engage in the different phases of design activity, and in each phase they will refer back to previous phases and keep in mind future phases.

## Customers, Retailers and Manufacturers

Show the slide Packaging designer.

Hand out Student Sheet 1 - Packaging Designer.

Organize students to work in groups of four in two pairs as far as possible. One pair will take the role of a manufacturer and retailer and the other pair the role of customer.

- A new product needs packaging. Students discuss features of the design are important to the manufacturer and retailer.
- The customer wants to select, buy and use the product. Students discuss what features of the packaging are important to the customer.

The group of four comes together and students summarise their discussion on their Student Sheet 1 - Packaging Designer and provide some examples from packaging they have seen.

### Expected student responses

- From the manufacturer's and retailer's point of view the packaging:
  - should be cheap and easy to make
  - should be easy to pack for transport and easy to display
  - should be eye-catching so it sells well.
- From the customer's point of view the packaging:
  - should be aesthetically pleasing and easy to identify on a shelf;
  - should give good information about the product;
  - should be easy to carry, durable (depending on the product)
  - should be easy to dispose of when not needed.

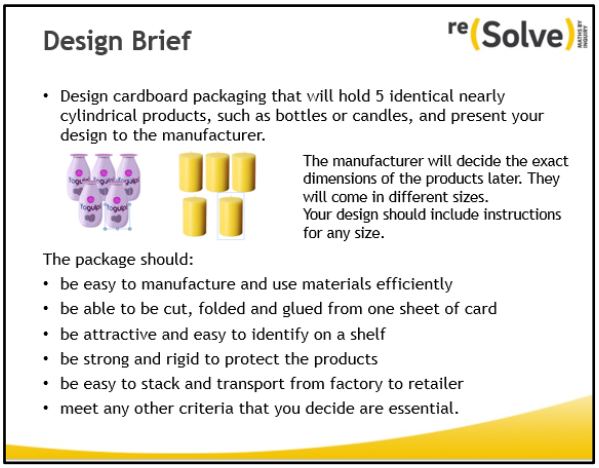
Draw together all the ideas, possibly making a class display.

Students should have developed an appreciation that customers, retailers and manufacturers might have some demands that are the same (for example, keeping costs down, minimizing environmental impact) but others that are different (for example, ease of manufacturing and transporting packages).

At this stage mathematical issues will have a low profile. Acknowledge this.

# The Design Brief

Now introduce students to the design brief, specifying the required final outcome.




Show the slide Design brief

The task is

- to design packaging that will hold five identical nearly cylindrical products such as candles or probiotic drink bottles (students can choose the product themselves)
- to write a design report for the manufacturer and
- to present the design to the class (oral, poster etc as decided by teacher)

Explain that

- students do not need to make the packaging, but develop a design on paper (although it is good to make a prototype)
- the design will only be used for five identical near cylindrical products

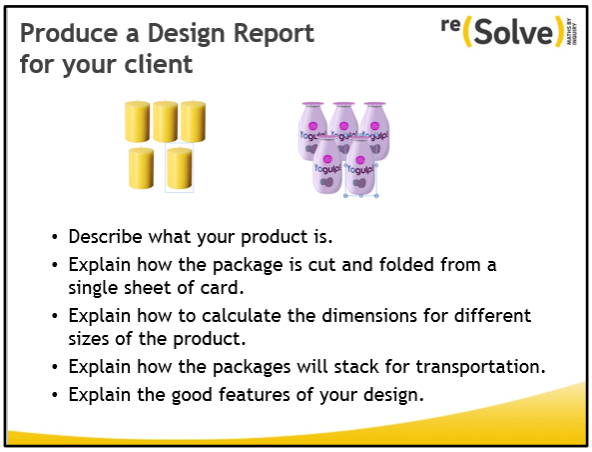
- the manufacturer has not yet decided on the dimensions of the products and indeed several sizes will be produced so the manufacturer will need to be told how to adapt the design for different dimensions
- students should primarily design only the shape of the packaging – not the decoration
- students can choose any product they like. The products do not have to exactly be cylinders, but this is the main shape. Examples of variation are:
    - product may be candles or bottles, tapering at the top or bottom.
    - radius may be smaller or larger in the middle of the product, like some drink bottles.
    - cross-section might be a multi-sided polygon instead of a circle.
    - product might be tall and thin, or short and fat.
    - product may need to 'stand up' or 'lie down'.

Students should now select the product for which they will design a package (e.g. candles of a particular shape).

## Design Report

Show the slide Design report.

Discuss with students the sort of things that their design report for their package should contain. Explain how they will present their report to the class (e.g. as an oral presentation, possibly with a poster). A handout with the report criteria is distributed in the next lesson.




The report will be evaluated by thinking about:

- **Does the packaging meet the design brief?**
- **Are there good instructions for making the design for products of various sizes?**
- **Does the report explain how and why design decisions were made?**

Students should continue to work in groups of two sets of pairs.

# First Design Ideas

During the remainder of the lesson, each pair should decide on their produce and begin to sketch their first ideas for a package and ask the other pair to comment, as critical friends, on their ideas. They should use the design brief to help guide their discussions. Here they only begin their initial sketches. In later lessons students have time to develop their final design report and presentation (e.g. an oral presentation or a poster).

### Enabling Prompts

- Some students will need to experiment with arrangements of 5 circles. They can use coins or other circular objects for this.
- Most students will need to use concrete measurements to get started. At this stage they may select a convenient radius and height and consider the variation of dimensions later.

### Extending Prompts

- Encourage some students who are already thinking about a general design to name their varying dimensions algebraically.
- Some students will be able to begin to create and calculate measures of criteria for good packaging, such as how much card is wasted, how much space is wasted in a carton holding 100 packages (for example). This can be done with arithmetic or algebra.

# Packaging Designer

Name: _____

- Have you ever come across really bad packaging? Describe it. What didn't you like?

- Have you ever come across really good packaging? Describe it. What did you like?

- What are the priorities for packaging of a product?
  - For manufacturers
  - For retailers
  - For customers

- How would a manufacturer find out what is important to customers?

- Make a list of everything you think a packaging designer should take into account.

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