

Pricing for Profit

Lesson 4: Reflecting on Modelling

Australian Curriculum: Mathematics (Years 7 - 9)

ACMNA174: Investigate and calculate 'best buys', with and without digital technologies (Year 7)

ACMNA194: Solve linear equations using algebraic and graphical techniques. Verify solutions by substitution (Year 7)

ACMNA189: Solve problems involving profit and loss, with and without digital technologies (Year 8)

ACMNA296: Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations (Year 9)

Lesson abstract

Students choose the model they think is best, and work in pairs to write report, critique the report of another pair and revise their reports in the light of their peers' critique. They reflect on the process of modelling and consider the wider applicability of the model they have developed.

Mathematical purpose (for students)

It is important to communicate a mathematical model clearly to its users.

Mathematical purpose (for teachers)

This lesson rounds off the unit by having students clearly communicate their modelling and the mathematics they have done. Importantly they consider their work in terms of the practice of mathematical modelling so that they develop a more sophisticated understanding of this. The step by step improvement of the model has been a key feature, as has been the way that a model can be implemented using a spreadsheet. There are opportunities for substantial communication of mathematical ideas, including by using algebra. Students can also link verbal descriptions, spreadsheet formulas and algebraic formulas.

Lesson Length 50 minutes approximately

Vocabulary Encountered

- validation
- evaluation

Lesson Materials

- Slide show: ST7_Pricing_4a.pptx
- [Student Sheet 1 - Critiquing Reports](#) (especially for groups who finish quickly)
- Spreadsheet access (all groups)

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



Evaluating the Model

Start by showing the slide [Mathematical modelling](#) to remind students of the purpose of learning about mathematical modelling.

Stimulate whole-class discussion of the process by asking students where, in developing their models for pricing of toy animals and biscuits, students were in each of the phases. If Lesson 5 on formulation skills has already been done, also ask students where they were involved in the modelling sub-skills of **formulating** a model by **identifying variables** and **mathematising the relationships between them**.

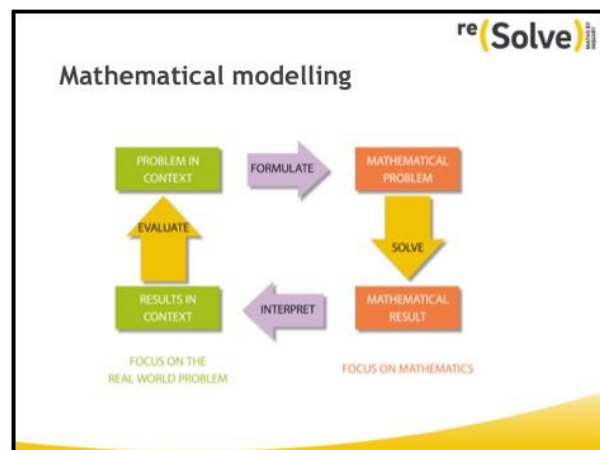
Briefly draw attention to **validating** a solution. Explain that we need to examine the model and solution to see if it provides an acceptable resolution to the problem.

If not, either the model will have to be improved or the solution will have to be corrected.

Useful ways to validate a solution are

- To ask yourself if you really believe the answer obtained.
- To make some predictions using the model and test them.

Here, you can draw attention to how students' first simple models were unrealistic - they didn't take account of the cost of materials to produce the items for sale. The evaluation phases led to more trips around the modelling cycle.



Writing a Report

Now consider the writing of a report of their work. Start by showing the slide [The school fair](#) to remind them of the problem to answer.

The school fair

Jack and Megan plan to raise money at the school fair:

- They plan to sell wooden toys and Anzac biscuits
- The money they raise will go to charity

Images of a wooden dinosaur toy, a pack of Anzac biscuits, and another wooden dinosaur toy.

How much money should they charge for each animal and pack of biscuits to make the biggest profit?

Show the slide [A report](#) and explain that they now need to

- select the model that they think is best and
- produce a report about this model for Jack and Megan.

This needs to explain how their best model is constructed, what the outputs of the model are and what they mean, and how Jack and Megan should use it to develop their pricing strategy.

Encourage presentation of a spreadsheet implementing the model.

A report

Report on your preferred model to Jack and Megan.

Explain how the model is constructed.

Tell them what the outputs of the model are and what they mean.


Advise them on how to use the model to develop their pricing strategy.

Images of a blue folder labeled 'REPORT' and a person writing on a notepad.

For substantial part of this lesson students should work in pairs and small groups developing their report.


During this time, show the slide [A detailed report](#) to remind students of what they need to do when developing their report.

As students finish their reports, ask them to swap reports with another pair. Hand out [Student Sheet 1 - Critiquing Each Other's Reports](#) as students move into this phase, to guide them to help each other improve their reports.



A detailed report will include:

- How is the model constructed?
- What assumptions have been made?
- How should the model be used?
- What can be varied?
- How should the graphs and tables be interpreted?
- What are the implications for pricing for profit?
- Give examples throughout.



Reflecting on Modelling and the Models

Show the slide [Mathematical modelling](#).

Ask students to spend a few moments to reflect on the modelling cycle and how their work in this unit has improved their understanding of the process.

Students should recognise that they have:

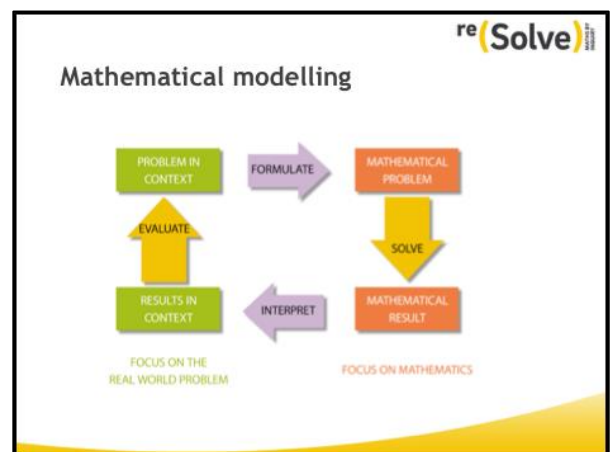
- considered carefully the real world situation of pricing products for profit,
- started with a very simple model of the situation,
- iteratively worked towards a more sophisticated model that better describes the real-world situation,
- implemented it with a spreadsheet.

Emphasise how, when making assumptions, we must compromise between reality and the how we can work mathematically. Consequently, in these lessons we assumed that a relationship is linear when the actuality is probably more complex than this.

Ask students to explain what effect making such compromises might have on the modelling of a situation. The aim is that the model will be 'good enough' to give helpful answers to practical questions.

Emphasize that is why we must evaluate the model. In this case, market survey data on the Sales v Price function might be included. However, this would extend considerably the work required, and so in a commercial work situation this should be only undertaken if it is likely to bring a benefit. The question is whether a model is 'good enough' for the original purpose.

In real life, the criteria for 'good enough' are often very well specified and models are often extensively tested to see if they meet the criteria. For example, the mathematical models used for weather prediction are constantly tested and continuously improved by teams of scientists around the world. After there is a bad prediction, such as a serious unpredicted storm, scientists may work for months to find out what went wrong. In our artificial exercise, we have no real criteria to meet.



- Exchange reports with another pair and then check that you can clearly understand
 - how the other pair built their model,
 - exactly what each of the variables is,
 - exactly what the relationships between the variables are.
- Provide a verbal or written critique for the other pair from the point of view of Jack and Megan.
- Explain how their model is different to yours.
- Discuss with the other pair what improvements could be made to the two reports.
- Improve your own report.