Activity description

This activity is about using graphical methods to solve maximum and minimum problems which can occur in industry and in working life. The problems included in the activity are intended to be solved using a spreadsheet or graphic calculator

Suitability

Level 3 (Advanced)

Time

1–3 hours

Resources

Student information sheet
Optional: slideshow

Equipment

Graphic calculators, Excel spreadsheets
Optional: internet access

Key mathematical language

Maximum, minimum, capacity, volume, surface area, variable.

Notes on the activity

The first two slides of the presentation can be used to introduce the activity. The method for solving the example is shown on slides 3 to 5.

If you have an active board you could also demonstrate how the formulae are entered and the graph is drawn on a spreadsheet. Alternatively students could work through the example themselves using the information sheet and a spreadsheet or graphic calculator before trying the other problems in the Try these section.

The final slide is to help students reflect on their work at the end of the session. The same questions are given at the end of the student sheets.

During the activity

Students can work either individually or in pairs using graphic calculators, spreadsheets, or a combination of both so comparisons can be made and discussed with the whole group.

Points for discussion

Discuss with students which formulae they need to use in order to work out the solution to the first example.

You could also discuss what difference it would make to the surface area if an alternative shape was used to hold the 330 ml of drink. Is a cylinder the best shape to use?

Discuss with students the types of equations which lead to maximising problems and those which lead to minimising problems. They should be encouraged to link the equations with the shape of the graph.

Extensions

For extra practice, use similar problems in textbooks and websites which employ calculus methods to find solutions. Students also studying calculus could compare the graphical method with the use of differentiation.

Answers (to 3sf)

1a Minimum surface area = 349 cm^2
when the radius is 4.30 cm and the height is 8.60 cm
b Minimum surface area = 554 cm^2
when the radius is 5.42 cm and the height is 10.8 cm

2b Maximum possible area = 1300 m^2 when x = 25.5 (m)

3b Maximum possible volume = 18 000 cm^3 when x = 10 (cm)

4a ii Minimum surface area = 326 cm^2 when x = 7.37 (cm)
b ii Minimum surface area = 259 cm^2 when x = 9.28 (cm)

5a $C = 40\,000 - 40x + 50\sqrt{x^2 + 360\,000}$
b Minimum cost occurs when x = 800 (m)
c Minimum cost = £58 000