

Extension & Challenge — Modelling with Number

Part A — Bar Models for Problem Solving

A **bar model** turns a word problem into a picture. Splitting a bar into equal parts, or drawing two bars side by side, makes it clear whether to multiply, divide, add or subtract.

Worked example. A bar of 240 is split into 4 equal parts. One part is $240 \div 4 = 60$. So three parts would be $3 \times 60 = 180$.

Bar model: 4 equal parts make 240



A bar model: four equal parts make a total of 240.

- 1 The bar above shows 4 equal parts making 240. What is the value of **one** part?

Answer: _____

- 2 Draw your own bar for this: 3 equal parts make 180. What is one part worth? What are two parts worth?

3 $\frac{2}{5}$ of a number is 30. Draw a bar split into fifths to find the **whole** number.

4 **Comparison bars.** Anna has \$40 more than Ben. Together they have \$150. Draw two bars and find how much each has.

5 A ribbon 240 cm long is cut into two pieces so that one piece is **three times** as long as the other. Use a bar model to find both lengths.

6 **Open challenge.** Invent a word problem that can be solved with a bar model and whose answer is exactly 60. Draw the bar and write the problem.

Part B — Working Through the Modelling Cycle

Real problems are messy. Mathematicians use a [modelling cycle](#): pose the problem, make sensible assumptions, do the mathematics, check whether the answer makes sense, then communicate it — looping back if it does not.



A circular diagram of the modelling cycle: pose the problem, make assumptions, do the maths, interpret and check, then communicate, looping back to the start.

The modelling cycle. Real modelling often loops back when the check fails.

Watch for answers that must be whole numbers. You cannot order 5.2 buses — you round *up* to 6 so everyone has a seat.

1 A school needs buses for 250 students. Each bus holds 48 students. Work through the cycle:

(a) **Assumptions:** what are you assuming? _____

(b) **Calculate:** how many buses? _____

(c) **Check:** would 5 buses be enough? Explain.

2 Estimation model. About how many students could stand in your classroom if there were no furniture? State your assumptions (e.g. floor area, space per student) and show your calculation.

3 A model says "a 12-year-old grows about 6 cm per year." List **two** assumptions this model makes, and one reason it might not be accurate for a real person.

4 Your own model. Choose one question below, then outline how you would model it: the steps, the assumptions, and the calculation you would do.

- A. How much water does our class drink in a week?
- B. How many pizzas to feed the whole year group?
- C. How long would it take to count to a million?
