

Mathematical Modelling – Arithmetic Problems

1. 'Happy Baby' foods are sold in small tins of diameter 5cms and height 8cms. At present they are packaged in cartons 30cms long and 20cms wide.

The company is considering placing a new order for cardboard cartons.

- Calculate the amount of cardboard needed for the present carton.
- Find the average amount of cardboard used per tin.
- Consider two other possible packaging arrangements and calculate the amounts of cardboard that would be needed. (The cartons can hold up to 40 tins.)
- Would your plans represent a saving in cardboard per tin or not?
- Can you recommend a more economical package to the 'Happy Baby' Food Company?

2. Australia - you're standing in It!
But could all the people in the world stand in Australia?
And if so, how much space could each person have?

Attempt to answer this in the following way:

- Make a clear statement of the problem.
- List all the questions you want to ask.
- Supply your own information by making an assumption where appropriate or 'inventing' a suitable figure where needed.
- Use your figures to solve the problem.
- State your conclusion.

3. You have been assigned the task of marking out the school oval for athletics day. You decide to mark a track with semicircular ends that have a radius of 40m. The track must contain 8 lanes each 1 m wide. The length of a lane is measured 100 mm out from the inside line. Lines are 75mm wide.

- What must the length of the straight be?
- For a 400m race where must you mark the start lines for lanes 2 to 8 so that the finish line is to be at the end of one of the straights?
- In a 400m race, John runs in Lane 1, 90cm from the inside edge of his lane and Louise runs in Lane 2, 10 cm from the inside edge of her lane.
Who runs the shorter distance and what is the difference in distance covered?

Note: for each part... - sketch a diagram

- list all assumptions
- indicate all given data
- interpret your solutions, indicating how you will measure all distances involved.

4. A new restaurant has just opened, and the owner is trying to determine a reasonable cost for each meal. He has a set menu on each day.

One of the meals is roast beef with potatoes, peas and carrots and plum pudding.

The owner gathers the following information:

- 5kg cut of beef, to feed 12 people costs approx. \$30
- 25kg bag of frozen peas costs \$24 and would be sufficient for about 60 meals.
- sack 25kg of potatoes costs \$40 and would be sufficient for about 150 meals.
- box of carrots costs \$3 and would feed approximately 20 people.
- plum pudding costs \$6 to make and would serve 10 people.

He will need to employ one chef at \$320 p.w. and two waitresses at \$185 p.w. For each week he plans to be open six days and expects to sell, on average, 360 meals.

- (a) From the above data, estimate how much this meal costs the owner to prepare.
 - (b) List any other factors he might consider in deciding the price he should charge.
 - (c) Estimate what price you think he should charge for the meal. (State clearly your reasons for deciding on this price and any assumptions you have made.)
5. A supermarket buys cheese in the shape of a cylinder 20cm in diameter and 20cm long. Each cheese is to be cut into eight pieces by either slicing or by creating wedge shapes.
- (a) Find the better way to cut up the cheese if the amount of drying out is to be kept to a minimum.
 - (b) What other factors might the supermarket take into account when selecting a method for cutting up the cheese?