

Lesson 2: Merchandise mayhem

Narrative

With the fields cleared of rainwater and sewage, and the sun breaking through the clouds, the festival is now ready for the 100 000 music fans straining at the gates. The gates are opened and the crowds swoop in past the food stalls and merchandise stands. Del and Cassy, rival stallholders, give each other dirty looks as they each set up stalls by the main entrance, ready to sell band T-shirts and colourful accessories to the festival revellers. But they are worried. Have they made enough T-shirts to sell? Will enough people buy their merchandise? What should they charge? And have they made the right decisions about the amount of each product they have brought to the festival to maximise profits?

Problems

Main challenge

Each team becomes a market stall vendor, with a van with a back 330 cm long, 175 cm wide and 190 cm high. They set up a stall not far from Del and Cassy and are keen to make money from selling T-shirts, hats and Glow sticks. Over the four days of the festival, the teams can sell only what they have brought in the van. Given the sizes of the boxes, and the cost price and selling price of the goods, which team will make the most money if they bring only one type of item and everything is sold? But what if nobody likes this item – maybe it would make better commercial sense to bring at least two different items, even if the potential profit is not as great?

Further problems or homework

- 1 At 2:00 pm on the third day Del realises that sales are good and he will need more T-shirts to sell. He phones his assistants and asks them to make 1350 more T-shirts by 7:00 pm. But he knows they will get tired so he assumes that each hour they will make 60 fewer T-shirts than the hour before. How many T-shirts will be made in each hour to 7:00 pm? If his assistants carry on making 60 fewer T-shirts each hour after 7:00 pm, what is the maximum number of T-shirts they could make and by what time?
- 2 A small T-shirt can be made from a rectangular piece of jersey fabric 1 metre long and half a metre wide. Jersey fabric is 1 metre wide. The team has a length of jersey fabric. They investigate the number of different ways that they can cut out the rectangles to make T-shirts.

Skills required

In this lesson pupils will need to:

- work out how many smaller cuboids of given dimensions can be fitted into a larger cuboid
 - use a calculator effectively and efficiently to carry out more difficult calculations, interpreting the display in different contexts, including money
- and, for the further problems or homework,
- use algebraic methods to solve problems.



Torbury resources

- 2.1** Video clip: (01'46") The festival gates open and crowds stream through. The video introduces the characters of the two vendors standing by their stalls. They banter about which of them will make more money at the festival. Cassy argues that the cheaper something is, the more people are likely to buy it. Del argues that the best idea is to charge a lot so there is no need to sell as many items.
- 2.2** Resource sheet of the main challenge for pupils (print one per pair).
- 2.3** Resource sheet of further problems or homework (if you are using either problem for homework, print one sheet per pupil, otherwise print several copies to use in class as needed).
- 2.4** Video clip: (36") A group of festival-goers is screaming and running across a field as fast as they can, looking back over their shoulders. There are tents, bin-bags and drinks cans flying everywhere. Is something chasing them?

Other resources

Calculators

Main activity

Play **Resource 2.1**, a video clip (01'46") showing the gates opening and the crowds flooding in, and giving the background of the main challenge. Del and Cassy, the two vendors, argue about which of them will make more money.

Give out **Resource 2.2**, one copy per pair. Explain the problem and set the teams to work.

Differentiation

Some pupils may find it hard to visualise the problem, as it is not a question of simply dividing the volume of the back of the van by the volume of a box, but of working out how many boxes of a given shape can fit along the length, width and height of the van. If necessary, ask the teams to pause and feed in the suggestion: 'Would it help to draw a diagram?' Encourage them to visualise the plan, side and front views of the van.

In the second part of the problem the teams must consider how to make the most profit by considering how to pack the van with combinations of boxes.

Two shorter problems can be found on **Resource 2.3**.

Review

Bring the class together to discuss and compare solutions and justify decisions. Invite one or two teams to sketch diagrams on the board to help explain their solutions to the class.

To finish, play **Resource 2.4**, a video clip (36"). Screaming revellers are racing across a field, looking over their shoulders. Is something chasing them?

Optional homework

If you are setting homework, ask pupils to do a remaining problem from **Resource 2.3** (or a remaining problem from Lesson 1).



Solutions for Lesson 2

Main challenge (Resource 2.2)

a

Dimensions (cm)	length (cm)	height (cm)	width (cm)
Van	330	190	170
T-shirt box	60	40	40
Hat box	40	40	40
Glow sticks box	15	15	15

	along length of van	along width of van	along height of van	Maximum no. of boxes	No. of items	Cost	Revenue if all items are sold	Maximum possible profit
T-shirt box upright	5	4	4	80	2 400	£4800	£12 000	£7200
T-shirt box on side	8	3	4	96	2 880	£5760	£14 400	£8640
Hat box	8	4	4	128	2560	£3840	£10 240	£6400
Glow sticks box	22	12	11	2904	101 640	£5082	£12 705	£7623

If the T-shirt boxes are stacked upright, then $5 \times 4 \times 4 = 80$ boxes can be fitted in but if the boxes are laid on their sides the maximum number that could be fitted in is $8 \times 3 \times 4 = 96$, at a cost of £5760. If all the T-shirts are sold over the week of the festival, the revenue from sales would be £14 400, giving a maximum possible profit of £8640. Teams should consider whether it is realistic that a stall holder would sell nearly 3000 T-shirts in the course of a 4 day festival.

b

Teams are likely to come up with different ways of packing the van with two or more items, and different amounts of profit. The team with the greatest profit wins. Here are a couple of examples.

Maximum number				Total	Cost	Revenue	Profit
T-shirt box	3	4	4	48	£2880	£7200	£4320
Hat box	3	4	4	48	£1440	£3840	£2400
				TOTAL	£4320	£11 040	£6720

Maximum number				Total	Cost	Revenue	Profit
Hat box	8	4	4	128	£3840	£10 240	£6400
Glow sticks at top	22	2	11	484	£847	£2117.50	£1270.50
				TOTAL	£4711.20	£12 357.50	£7670.50

Further problems or homework (Resource 2.3)

- 1 a Del's assistants should make $390 + 330 + 270 + 210 + 150 = 1350$ T-shirts per hour
- b If they carried on making 60 less T-shirts per hour they could make another $90 + 30 = 120$ T-shirts, a total of 1470 T-shirts, which they could make by 9:00 pm.
- 2 Fabric is 1 metre wide. Rectangle to make T-shirt is 1 m by 0.5 m.

Length of fabric	0.5 m	1 m	1.5 m	2 m	2.5 m	3 m	3.5 m
No. of ways to cut out rectangles	1	2	3	5	8	13	21

For example, there are five different ways to cut out 1 m by 0.5 m rectangles from a length of fabric 2 m long and 1 m wide.



In general, each number of ways of cutting out the rectangles is the sum of the two previous ways.

