create maths

Getting there: Ferries

Description

There are many problems in packaging where it is important to minimise the amount of wasted space. When a ferry is loaded, strategies to fit the most vehicles on for each journey will reduce waiting times and make best use of the resource.

Activity 1: Ferry filling

Activity 2: First fit and full bins

Organise the pupils in pairs for this topic. The ferry deck is divided into five rows of nine squares, giving 45 possible loading spaces. Each of the sets on **Ferry filling** has vehicles needing a total of 45 spaces but not all of them can be fitted on the deck. Encourage pupils to explain when all the vehicles can be accommodated on the deck and when not. Encourage them to experiment with their own sets of vehicles to find best and worst scenarios.

They might notice:

■ each row will need at least one vehicle which is an odd length

■ they need sets of vehicles whose lengths add up to nine.

Encourage them to alter the constraints and see how the patterns change. Suppose there were five rows of ten squares. Or what if there were three rows of ten squares and two of nine? Can they devise some rules that help find the optimum solution? Ask them to write down the various things they have found out about the problem.

First fit and full bins introduces the pupils to two of the algorithms used for working on problems like this. In this case, they are responding to a queue and so, with the *First fit* algorithm, have to make decisions based on incomplete information. They design a spinner to reflect the ratio of 120 vehicles arriving at the ferry as depicted on the **First fit and full bins data sheet** and use the two different algorithms to load the ferry.

Resources

All the ferries activities use the Ferry filling board and a set of vehicles from the Ferry filling cut out sheet. These need to be photocopied in colour onto card and laminated for re-use.

The First-Fit Algorithm Taking the vehicles one-by-one, place each in the first available lane that has sufficient room. Do not return to a lane.

Full bins algorithm Look for combinations of vehicles to fill the lanes.

Ask the pupils to compare the effectiveness of each algorithm. How many times do they need to conduct the experiment to decide which is best? Usually, *Full bins* gets more vehicles on the ferry but makes uneconomic use of time. Perhaps they can conduct a new set of experiments where they record the time taken. Can they think of any other approaches or any refinements of the given algorithms that will improve the efficiency of their response to the queue? Many pupils will be intrigued by the idea of unsolved problems in mathematics – it can help them see mathematics as unfinished and therefore worth working on.

The Mathematics

Ferries allows the opportunity to discuss the modelling function of mathematics. The tasks allow pupils to develop their own strategies and to consider the idea of an 'efficient' algorithm. In addition, **First fit and full bins** involves work on ratio and pie charts.