



**United Kingdom
Mathematics Trust**

Mentoring Scheme

Supported by **Ox**FORD
ASSET MANAGEMENT

Julia Robinson

Sample questions

These questions are taken from the first sheet and give a good indication of the level of difficulty and prerequisite knowledge required at the start of the programme.

1. A car made a journey of 144 miles, stopping for one hour along the way. Had it travelled at an average speed 4 mph faster and stopped for one and a half hours, it would have taken the same time.

What was its average speed?

The averages in this question should be taken only over the time at which the car is moving, not while it was stopped.

2. (a) Suppose that there are 1000 people in a room. Explain why two of them must share a birthday. What is the smallest number of people in the room to guarantee that two of them share a birthday?
(b) Suppose that S is a set of 10 integers. Prove that there are two integers in S which have a difference that is divisible by 9.
3. What is the area of a regular dodecagon (polygon with twelve sides) that has diameter 2?

The diameter is the diameter of the circle that passes through all of the vertices of the dodecagon.

Can you use this result to find a lower bound for the value of π ?