

## Problem set 2

### 1 *Estimation*

- a) Estimate how thick a layer of rubber is deposited on the road by a car tyre. Comment on your result.
- b) Estimate how much mechanical power you can generate.
- c) Estimate the world-record speed for cycling.

### 2 *Mathematical exploration*

Into how many regions can  $N$  planes divide space? Find the maximum number (what conditions on the planes ensure that the number is a maximum?). For example, one plane divides space into two regions; two planes divide space into at most four regions (but only three if you are unlucky, and only two if you are really unlucky). Hint: Play with simpler versions of this problem.

### 3 *Bouncing ball*

You drop a steel ball from a height of one or two metres. It lands on a scale and bounces up to nearly the original height. (Neglect air resistance.) Draw free-body diagrams for the ball at four times: (1) while you are holding it, (2) while it is falling, (3) when it is motionless on the scale (namely, just as it starts its upwards journey), and (4) while it is rising. Indicate qualitatively the relative magnitudes of the forces. Sketch qualitatively the scale reading as a function of time, while the ball is on the scale.

### 4 *Standard problem*

Problem 7 from the Examples sheet.

### 5 *Your turn*

Invent an estimation question (but don't solve it, unless you really want to – we'll try them in supervision).