SPC March 2020

Student Problems

Students up to the age of 19 are invited to send solutions to either or both of the following problems to Stan Dolan, 126A Harpenden Road, St Albans, Herts., AL3 6BZ.

Two prizes will be awarded − a first prize of £25, and a second prize of £20 − to the senders of the most impressive solutions for either problem. It is not necessary to submit solutions to both. Entries should arrive by 20th May 2020 and solutions will be published in the July 2020 edition.

The Mathematical Association and the *Gazette* comply fully with the provisions of the 2018 GDPR legislation. Submissions **must** be accompanied by the SPC permission form which is available on the MA website

https://www.m-a.org.uk/the-mathematical-gazette

Note that if permission is not given, a pupil ***may still participate and will be eligible for a prize in the same way as others***.

Problem 2020.1 (**Paul Stephenson**)

Show analytically that

$$e^{\frac{1}{e}} > \sqrt{2}.$$

Problem 2020.2 (**Paul Stephenson**)

For a polygon with vertices on a grid of points with integer coordinates, Pick's theorem says that the area of the polygon is

$$i + \frac{b}{2} - 1.$$

Where i is the number of points in the interior and b is the number of points on the boundary. Find the analogous expression for the volume of a cuboid in a three-dimensional lattice with i interior grid points, f grid points lying in a face, e grid points lying on an edge and $v\,(=8)$ grid points at vertices.