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. Solutions should arrive by January 20th 2019. Please give your School year, the name and address of your School or College, and the name of a teacher through whom the award will be made. Please print your own name clearly! The names of all successful solvers will be published in the March 2019 edition.

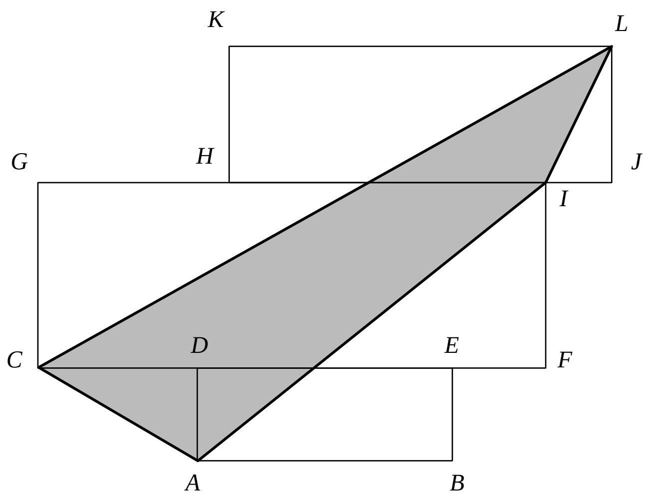
The MA and the *Gazette* comply fully with the provisions of the 2018 GDPR legislation. Submissions **must** be accompanied by the SPC permission form which is available on the Mathematical Association website

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 2018.5 (**Stan Dolan**)

The diagram shows three similar rectangles, *ABED*, *CFIG* and *HJLK*. Find, with proof, a trapezium with the same area as the shaded quadrilateral *AILC*.



Problem 2018.6 (**Paul Stephenson**)

Consider the two infinite series

$$1 + \frac{1}{3} + \frac{1}{6} + \ \dots \ + \frac{2}{n(n+1)} + \ \dots \qquad \text{(Reciprocals of the triangle numbers)}$$

$$1 + \frac{1}{2} + \frac{1}{4} + \ \dots \ + \frac{1}{2^{n-1}} + \ \dots \qquad \text{(Reciprocals of powers of 2)}$$

Precisely when is a sum of successive terms of the first series equal to the sum of successive terms of the second series?

An example of two such sums is

$$\frac{1}{3} + \frac{1}{6} + \frac{1}{10} + \frac{1}{15} + \frac{1}{21} + \frac{1}{28} = \frac{1}{2} + \frac{1}{4}.$$