

## Student Problems

Students up to the age of 19 are invited to send solutions to either or both of the following problems to Tuya Sa, SCH.1.17, Schofield Building, Loughborough University, Loughborough, LE11 3TU. 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 20th May 2023 and will be published in the July 2023 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 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 2023.1 (Christopher Starr)**

A shot-putter releases a shot with speed  $V$  from a height  $h$  at an angle  $A$  to the horizontal. Find an expression for the value of the angle that gives the greatest possible horizontal distance.

### **Problem 2023.2 (Geoffrey Strickland)**

Given that  $a$  and  $b$  are strictly positive integers such that  $a^3 - 3b^2 = 1$  and  $x = 2a - 3b$ ,  $y = 2b - a$ , prove that  $x^2 - 3y^2 = 1$ ,  $0 < x < a$  and  $0 \leq y < b$ .