BL Solution

BL also[1] reduced the problem to

$$(a^2 + ab + b^2)/(a - b)^2 = 73/3$$

Only he expanded the denominator and cross multiplied to get

$$3(a^2 + ab + b^2) = 70(a^2 - 2ab + b^2)$$

From this point on I can see he must construct the quadratic equation

$$70a^2 - 149ab + 70b^2 = 0.$$

Again taking $r = a/b$, we have the quadratic equation

$$70r^2 - 149r + 70 = 0$$

Solving for r (with the use of a calculator), we get

$$r = a/b = 10/7 \text{ or } 7/20$$

But since $a > b$, $a/b = 10/7$. That means $a = 10k$, and $b = 7k$ for some integer k. But since a and b are relatively prime, $k = 1$. So $a = 10$, $b = 7$, and $a - b = 3$.

[1] https://medium.com/bellas-weekly-math-games/an-algebra-challenge-c4dec24375ee