November 2016

YBMA News

Vol. 26 No. 2

The Newsletter of the Yorkshire Branch of the Mathematical Association

Our next meeting

Thursday, 1 December 2016,
7pm for 7:30pm

MALL 1, School of Mathematics

University of Leeds

Christmas Quiz and Buffet

Our famous Christmas Quiz in which everyone wins prizes!

A sociable evening of brain-frazzling questions, quirky mathematical prizes with seasonal food and drink. Cajole your colleagues to come and enjoy themselves.

A mathematician who was born on Christmas Day, 1937.

Can you name him?

Coming soon …

Wednesday, 8 February 2017
7pm for 7:30pm, MALL 1, School of Mathematics, University of Leeds

Learning from Young Mathematicians

Dr Jennie Golding, President of the Mathematical Association.

"One of the great joys of teaching mathematics is what we can learn from those we "teach". Join me in exploring some wacky lessons from my own students."

Saturday, 11 March 2017, 2pm
Problem Solving – so what is new?
A study session led by Colin Prestwich, Yorkshire Ridings Maths Hub.

A date for your new diary:

Wednesday, 29 March 2017, 2:30pm

W P Milne Lecture for Sixthformers
Dr Vicky Neale, University of Oxford
How to Solve Equations

see overleaf for Mathematics in the Classroom.

Non-members are welcome at these meetings. Please bring them to the attention of your colleagues and friends and encourage them to come along. Our meetings are very friendly and include refreshments.

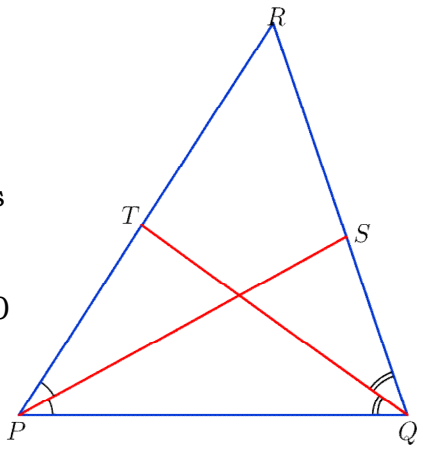
Anyone who would like to be added to our email list should send their name and email address to a.slomson@leeds.ac.uk

For more information about the Yorkshire Branch of the Mathematical Association, please go to our website http://ybma.org.uk.

Mathematics in the Classroom

Lehmus's Angle Bisector Problem

In the triangle *PQR*, the line bisecting the angle *QPR* meets *RQ* at *S*, and the line bisecting the angle *RQP* meets *RP* at *T*, as shown in the diagram.



Can you prove that if *PS* has the same length as *QT*, then the triangle is isosceles with *RP* = *RQ*?

This question was sent by C. L. Lehmus in 1840 to Charles Sturm.

Several proofs are now known, but finding a proof is rather harder than you might expect.

Can you find a proof?

Divisibility Tests

In the last Newsletter we asked why the following test for divisibility by 29 works.

We use the following notation. Given a number *m*, we let *u* be its units digit, and we let *n* be the number we obtain by deleting this digit from *m*.

The divisibility test is as follows. We replace *m* by $n+3u$ .Then *m* is divisible by 29 if, and only if, $n + 3u$ is divisible by 29. This process is continued until we reach a two-digit number. For example, starting with 40252, we have:

$$40252 \to 4025 + 3 \times 2 = 4031 \to 403 + 3 \times 1 = 406 \to 40 + 3 \times 6 = 58$$

Because 58 is divisible by 29, we can deduce that 40252 is divisible by 29.

This test works because *m*, *n* and *u* are related by the equation $m = 10n + u$. It follows that $m = 10(n + 3u) - 29u$. Therefore, if $n + 3u$ is divisible by 29, then so also is m . Conversely, if *m* is divisible by 29, then so also is $10(n + 3u)$. Hence, as 10 and 29 are coprime, it follows that $n + 3u$ is divisible by 29.

Note that we have shown that *m* is divisible by 29 if, and only if, $n + 3u$ is divisible by 29. However, it is not true that, in general, *m* and $n + 3u$ have the same remainder when divided by 29, as you may easily check by, for example, taking $m = 291$.

We also asked you to find similar tests for divisibility by 7, 13, 17, 19 and 23. We leave it to you to check, that, using the same notation as above, the following tests work.

d	replace *m* by
7	$n - 2u$
13	$n + 4u$
17	$n - 5u$
19	$n + 2u$
23	$n + 7u$

In each case, *m* is divisible by *d*, if, and only, if the number it is replaced by is also divisible by *d*.