a good time is had by all. We do *not* officially study the history of Mathematics. In recent years a number of good biographies suitable for children have appeared, e.g. Andrade's, "Sir Isaac Newton." Lewis's "Brief Lives. Leonardo the Inventor." Cottler's "Man with Wings." Kendal's "Life of Faraday."

In conclusion let me admit freely that I have devised nothing new or original—I have picked other people's brains for ideas and shall continue to do so. I should welcome suggestions for my next course from readers who have doubtless experimented in other directions more successfully. Can I assess the value of my own course? No. Did I achieve any of my aims? I do not know. My pupils are very polite. Of one thing only can I be quite certain. I personally enjoyed the teaching.

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CORRESPONDENCE

THIS TYRANNY OF DEGREES

To the Editor of the *Mathematical Gazette*

Dear Sir, $(\pi/2)^2 = (90°)^2 = 8100$. Yes, this is what we have come to now. It was written by a Sixth Form boy in an A & S Level paper. He had evaluated a definite integral without many mistakes, and having arrived at the rather too high-brow-looking result $(\pi/2)^2$, decided to express it in plain numbers that any schoolboy can understand. So $(\pi/2)^2 = (90°)^2 = 8100$. Answer.

Why? Because $\pi/2$ is nothing but a faddy schoolmaster's name for 90°: so let's be practical.

For fifty years I have been watching with growing dismay the ever-increasing tendency of boys (yes, and some older folk too) to think of angles exclusively in terms of degrees. The result on their minds has been disastrous. Ask some boys, if you dare, what an angle is, and note how many answer "Degrees". By now I am afraid to ask a boy the meaning of a right angle: I would be too likely to burst a blood-vessel when he inevitably answers "90 degrees". He evidently thinks that in the beginning God created degrees, and men came along afterwards and build up right angles out of them. The truth is the exact opposite of this: what God has done for you is to put you into a world full of right angles, and you were familiar with the look of them before you had learnt to suck a bottle. The Babylonians, Adolf Hitler and others have devised various ways (and not very good ones) of dividing the right angle, and boys have enthroned these divisions as divinely appointed units.

Here are some concrete instances for you: you can test them for yourself. Question in an exam paper: "How many right angles do the angles of a triangle make? Give a short reason." The most frequent answer. "Two, because that makes 180°". "Two angles of a triangle are 5/11 and 7/11 of a right angle. What fraction of a right angle is the other?" Nearly every boy who tried it reduced the angles to degrees, and back again to a fraction of a right angle after the subtraction, though of course most of them did it wrong.

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Can stupidity go further? But was it really stupidity, or just corruption of the mind by vicious teaching? Is this perhaps the natural way for a boy who has never heard of a right angle except by the name of "90°", or worse still just "90"?

Writing last March in one of our most respectable papers, a celebrated sportsman attributed the excellence of the Oxford crew, then hot favourites, to their application of the maximum effort when the oars were at ninety degrees to the boat. After that Cambridge won.

Nobody wants to abolish degrees: in their right place they are harmless enough, though 60ths of a right angle would have been a better unit to choose but for astronomical and theological complications in ancient Babylon. But this monstrous supremacy of the degree over Nature's right angles and radians must be broken if sanity is to survive. It begins with the masters, who are more to blame that the boys, sloppily calling a right angle "90"; and it reaches its climax in "$(\pi/2)^2 = (90°)^2 = 8100$". Who will join in a firm stand against the usurper?

Yours etc., W. Hope-Jones

To the Editor of the *Mathematical Gazette*

Dear Sir,—Prof. Watson has very kindly drawn my attention to a geometrical proof by J. W. L. Glaisher of the identity

$$\sum_1^N n^3 = \left(\sum_1^N n\right)^2,$$

which is the subject of the first part of my note on sums of powers of the natural numbers ("Mathematical Gazette", October 1957, p. 187). Glaisher's proof may be familiar to many readers of the "Gazette", but was new to me; it is given in "Messenger of Mathematics", III (1874), p. 5. It is equivalent to mine, though it looks different because it is expressed in geometrical language.

Suppose we take two axes at right angles, intresecting at O. Given the sequences a_n, b_n, we mark off in succession lengths $OX_1 = a_1$, $X_1X_2 = a_2, \ldots,$ $X_{n-1}X_n = a_n$, .. on the first axis, and $OY_1 = b_1, \ldots, Y_{n-1}Y_n = b_n$, .. on the second. We then complete the rectangle R_n with OX_n, OY_n as sides; the lengths of these are A_n, B_n, where $A_n = a_1 + a_2 + \ldots + a_n$, $B_n = b_1 + b_2 + \ldots + b_n$, and so the area of the L-shaped region between R_n and R_{n-1} is $a_nB_n + b_nA_{n-1}$. From this point of view, the process of partial summation used in my note simply expresses the fact that the area of R_N is the sum of the areas of such regions for $n \leqslant N$ (taking R_0 as having zero area). Glaisher's proof consists in applying this geometrical idea to the special case $a_n = b_n = n$ (the areas being evaluated geometrically by induction). He also points out that the same idea can be used to demonstrate the formula for $\sum_1^N n$, and his version of this, using rectangles of sides n, $n + 1$, is a little neater than mine. Thus, apart from certain differences of detail, my proof may be regarded as a translation of Glaisher's into the language of analysis.

Yours, etc., S. M. Edmonds

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