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## My friendship with Ramanujan in England

P. C. Mahalanobis

*Prof. P. C. Mahalanobis, the eminent statistician, recalls the days of his friendship with Ramanujan in England.*

### Berry's class

I joined King's College, Cambridge, in October 1913. I was attending some mathematical courses at that time including one by Professor Hardy. A little later, we heard that S. Ramanujan, the mathematical prodigy, would come to Cambridge. I used to do my tutorial work with Mr Arthur Berry, Tutor in Mathematics of King's College. One day I was waiting in his room for my tutorial when he came in after having taken a class in elliptic integrals. He asked me: 'Have you met your wonderful countryman, Ramanujan?'. I told him that I had heard that he had arrived but I had not met him so far. Mr Berry said: 'He came to my elliptic integrals class this morning.' (This was some time after the full term had begun, and I knew Mr Berry had already given a few lectures on that subject.) I asked, 'What happened? Did he follow your lecture?'. Mr Berry said, 'I was working out some formulae on the black board. I was looking at Ramanujan from time to time to see whether he was following what I was doing. At one stage, Ramanujan's face was beaming and he appeared to be excited. I asked him whether he was following the lecture and Ramanujan nodded his head. I then enquired whether he would like to say anything. He then got up from his seat, went to the black board and wrote some of the results which I had not yet

proved'. I remember Mr Berry was greatly impressed. He said that Ramanujan must have reached those results by pure intuition as Professor Hardy had advised Ramanujan to attend the lectures on elliptic integrals because Ramanujan had not studied that subject before.

I was fortunate in becoming good friends with Ramanujan very soon. It came about in a somewhat strange way. Within a few days of his arrival I had managed to get acquainted with him and was meeting him from time to time. One day I went to see Ramanujan in his room in Trinity College. It had turned quite cold. Ramanujan was sitting very near the fire. I asked him whether he was quite warm at night. He said he was feeling the cold; he was sleeping with his overcoat on and was also wrapping himself up in a shawl. I went to his bedroom to see whether he had enough blankets. I found that his bed had a number of blankets but all tucked in tightly, with a bed cover spread over them. He did not know that he should turn back the blankets and get into the bed. The bed cover was loose; he was sleeping under it, with his overcoat and shawl. I showed him how to get under the blankets. He was extremely touched. I believe this was the reason why he was so kind to me.

In my second year, I got rooms in King's College; one term I had rooms in the staircase overlooking Queen's (just below where J. M. Keynes, at that time, a brilliant young fellow of King's, had

his rooms). On Sunday mornings Ramanujan and I often went out for long walks. One Sunday it had been arranged that we would both have our breakfast in my room and then go out for a walk. It was a cold morning with some snowfall. I was a bit late in getting up and was shaving in my bedroom when he arrived. I asked him to wait in the sitting room. When I came out I found that he was reading Loney's *Dynamics of a Particle* with great interest. Seeing me, he put back the book on the table and said it was very interesting. Evidently he had never studied dynamics but had got interested in what he was reading.

### A problem from *Strand Magazine*

On another occasion, I went to his room to have lunch with him. The First World War had started some time ago. I had in my hand a copy of the monthly *Strand Magazine* which at that time used to publish a number of puzzles to be solved by the readers. Ramanujan was stirring something in a pan over the fire for our lunch. I was sitting near the table, turning over the pages of the *Strand Magazine*. I got interested in a problem involving a relation between two numbers. I have forgotten the details but I remember the type of the problem. Two British officers had been billeted in Paris in two different houses in a long street; the two numbers of these houses were related in a special way; the problem was to find out the two numbers. It was not at all difficult; I got the solution in a few minutes by trial and error. In a joking way, I told Ramanujan, 'Now here is a problem for you'. He said, 'What problem, tell me', and went on stirring the pan. I read out the question from the *Strand Magazine*. He promptly answered 'Please take down the solution' and dictated a continued fraction. The first term was the solution which I had obtained. Each successive term represented successive solutions for the same type of relation between two numbers, as the number of houses in the street would increase indefinitely. I was amazed and I asked him how he got the solution in a flash. He said, 'Immediately I heard the problem it was clear that the solution should obviously be a continued fraction; I then thought, which continued



P. C. Mahalanobis, Nirmalakumari (Rani) and Rabindranath Tagore

fraction? And the answer came to my mind. It was just as simple as this.'

### His theory of reality

I have mentioned that Ramanujan and I often used to go out for long walks on Sunday mornings. During these walks our discussions ranged over a wide variety of subjects. He had some progressive ideas about life and society but no reformist views. Left to himself, he would often speak of certain philosophical questions. He was eager to work out a theory of reality which would be based on the fundamental concepts of 'zero', 'infinity', and the set of finite numbers. I used to follow in a general way but I never clearly understood what he had in his mind. He

sometimes spoke of 'zero' as the symbol of the Absolute (*Nirguna Brahman*) of the extreme monistic school of Hindu Philosophy, that is, the reality to which no qualities can be attributed, which cannot be defined or described by words and is completely beyond the reach of the human mind; according to Ramanujan, the appropriate symbol was the number 'zero', which is the absolute negation of all attributes. He looked on the number 'infinity' as the totality of all possibilities which was capable of becoming manifest in reality and which was inexhaustible. According to Ramanujan, the product of infinity and zero would supply the whole set of finite numbers. Each act of creation, as far as I could understand, could be symbolized as a particular product of infinity and zero, and from each such product would

emerge a particular individual of which the appropriate symbol was a particular finite number. I have put down what I remember of his views. I do not know the exact implications.

Ramanujan's facility in the theory of numbers was in a large measure intuitive. He made numerous conjectures, like other pure mathematicians. Many of the results apparently came to his mind without any effort. He was, however, aware that a good deal of intellectual effort would be required to establish his philosophical theories. This probably was the reason why he seemed to have been perhaps emotionally more interested in his philosophical ideas than in his mathematical work. He spoke with such enthusiasm about the philosophical questions that sometimes I felt he would have been better pleased to have succeeded in establishing his philosophical theories than in supplying rigorous proofs of his mathematical conjectures.

### Ramanujan — the man

Ramanujan had a somewhat shy and quiet disposition, a dignified bearing and pleasant manners. He would listen carefully to what other people were saying, but would usually remain silent. If he was asked any question, or on rare occasions, if he joined in any general conversation, he would speak in a frank and open way, but briefly. In speaking to a friend or in very small groups, he would, however, expound his own ideas with great enthusiasm, not only on philosophical questions but occasionally also on other subjects in which he was seriously interested. Although I could not follow his mathematics, he left a lasting impression on my mind. His bright eyes and gentle face with a friendly smile are still vivid in my mind.