= 2 , n =
1 , and a = 0 . Ramanujan wrote his first formal paper for the Journal on the properties of Bernoulli numbers . One property he discovered was that the denominators (sequence A027642 in the OEIS) of the fractions of Bernoulli numbers were always divisible by six . He also devised a method of calculating Bn based on previous Bernoulli numbers . One of these methods follows :
It will be observed that if n is even but not equal to zero ,
(i) Bn is a fraction and the numerator of <formula> in its lowest terms is a prime number ,
(ii) the denominator of Bn contains each of the factors 2 and 3 once and only once ,
(iii) <formula> is an integer and <formula> consequently is an odd integer .
In his 17 @-@ page paper , " Some Properties of Bernoulli 's Numbers " , Ramanujan gave three proofs , two corollaries and three conjectures . Ramanujan 's writing initially had many flaws . As Journal editor M. T. Narayana Iyengar noted :
Mr. Ramanujan 's methods were so terse and novel and his presentation so lacking in clearness and precision , that the ordinary [mathematical reader] , unaccustomed to such intellectual gymnastics , could hardly follow him .
Ramanujan later wrote another paper and also continued to provide problems in the Journal . In early 1912 , he got a temporary job in the Madras Accountant General 's office , with a salary of 20 rupees per month . He lasted only a few weeks . Toward the end of that assignment , he applied for a position under the Chief Accountant of the Madras Port Trust .
In a letter dated 9 February 1912 , Ramanujan wrote :
Sir ,
I understand there is a clerkship vacant in your office , and I beg to apply for the same . I have passed the Matriculation Examination and studied up to the F.A. but was prevented from pursuing my studies further owing to several untoward circumstances . I have , however , been devoting all my time to Mathematics and developing the subject . I can say I am quite confident I can do justice to my work if I am appointed to the post . I therefore beg to request that you will be good enough to confer the appointment on me .
Attached to his application was a recommendation from E. W. Middlemast , a mathematics professor at the Presidency College , who wrote that Ramanujan was " a young man of quite exceptional capacity in Mathematics " . Three weeks after he had applied , on 1 March , Ramanujan learned that he had been accepted as a Class III , Grade IV accounting clerk , making 30 rupees per month . At his office , Ramanujan easily and quickly completed the work he was given , so he spent his spare time doing mathematical research . Ramanujan 's boss , Sir Francis Spring , and S. Narayana Iyer , a colleague who was also treasurer of the Indian Mathematical Society , encouraged Ramanujan in his mathematical pursuits .

= = = Contacting British mathematicians = = =

In the spring of 1913 , Narayana Iyer , Ramachandra Rao and E. W. Middlemast tried to present Ramanujan 's work to British mathematicians . M. J. M. Hill of University College London commented that Ramanujan 's papers were riddled with holes . He said that although Ramanujan had " a taste for mathematics , and some ability , " he lacked the educational background and foundation needed to be accepted by mathematicians . Although Hill did not offer to take Ramanujan on as a student , he did give thorough and serious professional advice on his work . With the help of friends , Ramanujan drafted letters to leading mathematicians at Cambridge University .
The first two professors , H. F. Baker and E. W. Hobson , returned Ramanujan 's papers without comment . On 16 January 1913 , Ramanujan wrote to G. H. Hardy . Coming from an unknown mathematician , the nine pages of mathematics made Hardy initially view Ramanujan 's manuscripts as a possible fraud . Hardy recognised some of Ramanujan 's formulae but others " seemed scarcely possible to believe " . One of the theorems Hardy found amazing was on the bottom of page three (valid for 0 < a < b + 1 / 2) :
<formula>

Hardy was also impressed by some of Ramanujan 's other work relating to infinite series :
<formula>
<formula>
The first result had already been determined by a mathematician named Bauer . The second was new to Hardy , and was derived from a class of functions called hypergeometric series , which had first been researched by Leonhard Euler and Carl Friedrich Gauss . Hardy found these results " much more intriguing " than Ramanujan 's work on integrals . After seeing Ramanujan 's theorems on continued fractions on the last page of the manuscripts , Hardy commented that " they [theorems] defeated me completely ; I had never seen anything in the least like them before " . He figured that Ramanujan 's theorems " must be true , because , if they were not true , no one would have the imagination to invent them " . Hardy asked a colleague , J. E. Littlewood , to take a look at the papers . Littlewood was amazed by Ramanujan 's genius . After discussing the papers with Littlewood , Hardy concluded that the letters were " certainly the most remarkable I have received " and said that Ramanujan was " a mathematician of the highest quality , a man of altogether exceptional originality and power " . One colleague , E. H. Neville , later remarked that " not one [theorem] could have been set in the most advanced mathematical examination in the world " .

On 8 February 1913 , Hardy wrote Ramanujan a letter expressing his interest in his work , adding that it was " essential that I should see proofs of some of your assertions " . Before his letter arrived in Madras during the third week of February , Hardy contacted the Indian Office to plan for Ramanujan 's trip to Cambridge . Secretary Arthur Davies of the Advisory Committee for Indian Students met with Ramanujan to discuss the overseas trip . In accordance with his Brahmin upbringing , Ramanujan refused to leave his country to " go to a foreign land " . Meanwhile , he sent Hardy a letter packed with theorems , writing , " I have found a friend in you who views my labour sympathetically . "

To supplement Hardy 's endorsement , Gilbert Walker , a former mathematical lecturer at Trinity College , Cambridge , looked at Ramanujan 's work and expressed amazement , urging the young man to spend time at Cambridge . As a result of Walker 's endorsement , B. Hanumantha Rao , a mathematics professor at an engineering college , invited Ramanujan 's colleague Narayana Iyer to a meeting of the Board of Studies in Mathematics to discuss " what we can do for S. Ramanujan " . The board agreed to grant Ramanujan a research scholarship of 75 rupees per month for the next two years at the University of Madras . While he was engaged as a research student , Ramanujan continued to submit papers to the Journal of the Indian Mathematical Society . In one instance , Narayana Iyer submitted some of Ramanujan 's theorems on summation of series to the journal , adding , " The following theorem is due to S. Ramanujan , the mathematics student of Madras University . " Later in November , British Professor Edward B. Ross of Madras Christian College , whom Ramanujan had met a few years before , stormed into his class one day with his eyes glowing , asking his students , " Does Ramanujan know Polish ? " The reason was that in one paper , Ramanujan had anticipated the work of a Polish mathematician whose paper had just arrived in the day 's mail . In his quarterly papers , Ramanujan drew up theorems to make definite integrals more easily solvable . Working off Giuliano Frullani 's 1821 integral theorem , Ramanujan formulated generalisations that could be made to evaluate formerly unyielding integrals .

Hardy 's correspondence with Ramanujan soured after Ramanujan refused to come to England . Hardy enlisted a colleague lecturing in Madras , E. H. Neville , to mentor and bring Ramanujan to England . Neville asked Ramanujan why he would not go to Cambridge . Ramanujan apparently had now accepted the proposal ; as Neville put it , " Ramanujan needed no converting and that his parents ' opposition had been withdrawn " . Apparently , Ramanujan 's mother had a vivid dream in which the family goddess , the deity of Namagiri , commanded her " to stand no longer between her son and the fulfilment of his life 's purpose " . Ramanujan voyaged to England by ship , leaving his wife to stay with his parents in India .

= = Life in England = =

Ramanujan departed from Madras aboard the S.S. Nevasa on 17 March 1914 . When he

disembarked in London on 14 April , Neville was waiting for him with a car . Four days later , Neville took him to his house on Chesterton Road in Cambridge . Ramanujan immediately began his work with Littlewood and Hardy . After six weeks , Ramanujan moved out of Neville 's house and took up residence on Whewell 's Court , a five @-@ minute walk from Hardy 's room . Hardy and Littlewood began to look at Ramanujan 's notebooks . Hardy had already received 120 theorems from Ramanujan in the first two letters , but there were many more results and theorems in the notebooks . Hardy saw that some were wrong , others had already been discovered , and the rest were new breakthroughs . Ramanujan left a deep impression on Hardy and Littlewood . Littlewood commented , " I can believe that he 's at least a Jacobi " , while Hardy said he " can compare him only with [Leonhard] Euler or Jacobi . "

Ramanujan spent nearly five years in Cambridge collaborating with Hardy and Littlewood , and published part of his findings there . Hardy and Ramanujan had highly contrasting personalities . Their collaboration was a clash of different cultures , beliefs , and working styles . Hardy was an atheist and an apostle of proof and mathematical rigour , whereas Ramanujan was a deeply religious man who relied very strongly on his intuition . While in England , Hardy tried his best to fill the gaps in Ramanujan 's education without interrupting his inspiration .

Ramanujan was awarded a Bachelor of Science degree by research (this degree was later renamed PhD) in March 1916 for his work on highly composite numbers , the first part of which was published as a paper in the Proceedings of the London Mathematical Society . The paper was more than 50 pages and proved various properties of such numbers . Hardy remarked that it was one of the most unusual papers seen in mathematical research at that time and that Ramanujan showed extraordinary ingenuity in handling it . On 6 December 1917 , he was elected to the London Mathematical Society . In 1918 he was elected a Fellow of the Royal Society , the second Indian to be , following Ardaseer Cursetjee in 1841 . At age 31 Ramanujan was one of the youngest Fellows in the history of the Royal Society . He was elected " for his investigation in Elliptic functions and the Theory of Numbers . " On 13 October 1918 , he was the first Indian to be elected a Fellow of Trinity College , Cambridge .

= = = Illness and death = = =

Throughout his life , Ramanujan was plagued by health problems . His health worsened in England . He was diagnosed with tuberculosis and a severe vitamin deficiency , and was confined to a sanatorium . In 1919 he returned to Kumbakonam , Madras Presidency , and soon thereafter , in 1920 , died at the age of 32 . His widow , S. Janaki Ammal , moved to Bombay ; in 1950 she returned to Chennai (formerly Madras) , where she lived until her death in 1994 at age 95 .

A 1994 analysis of Ramanujan 's medical records and symptoms by Dr. D. A. B. Young concluded that it was much more likely he had hepatic amoebiasis , an illness then widespread in Madras , rather than TB . He had two episodes of dysentery before he left India . When not properly treated , dysentery can lie dormant for years and lead to hepatic amoebiasis . Amoebiasis was a treatable and often curable disease at the time .

= = = Personality and spiritual life = = =

Ramanujan has been described as a person of a somewhat shy and quiet disposition , a dignified man with pleasant manners . He lived a rather spartan life at Cambridge . Ramanujan 's first Indian biographers describe him as a rigorously orthodox Hindu . He credited his acumen to his family goddess , Mahalakshmi of Namakkal . He looked to her for inspiration in his work and claimed to dream of blood drops that symbolised her male consort , Narasimha . Afterward he would receive visions of scrolls of complex mathematical content unfolding before his eyes . He often said , " An equation for me has no meaning unless it represents a thought of God . "

Hardy cites Ramanujan as remarking that all religions seemed equally true to him . Hardy further argued that Ramanujan 's religious belief had been romanticised by Westerners and overstated ? in reference to his belief , not practice ? by Indian biographers . At the same time , he remarked on

Ramanujan 's strict vegetarianism .

= = Mathematical achievements = =

In mathematics , there is a distinction between having an insight and having a proof . Ramanujan proposed a plethora of formulae that could be investigated later in depth . G. H. Hardy said that Ramanujan 's discoveries are unusually rich and that there is often more to them than initially meets the eye . As a byproduct of his work , new directions of research were opened up . Examples of the most interesting of these formulae include the intriguing infinite series for ? , one of which is given below :

<formula>

This result is based on the negative fundamental discriminant d

= ? 4 × 58 =