UNIT 12: C.P. SNOW: "RAMANUJAN"

UNIT STRUCTURE

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12.1 LEARNING OBJECTIVES

After going through this unit, you will be able to:

- recognise Hardy's association with Ramanujan
- state the steps taken by Hardy to bring Ramanujan to England
- analyse the strengths and weaknesses of Ramanujan as a mathematician
- appreciate the prose piece
- describe the style of C.P. Snow

12.2 INTRODUCTION

In this unit, we propose to introduce you to a great mathematician whose full name was Srinivas Ramanujan Ayyengar but whom the world of Mathematics know as Ramanujan. The unit is based on an extract from the *Foreword* by C.P. Snow to a famous book on Ramanujan by G.H. Hardy titled *A Mathematician's Apology*, Canto edition of the Cambridge University Press book of 1992, reprinted in 1996, pages 30 to 38.

The extract which forms the unit on Ramanujan for the prescribed course is a very well-written, interesting account of the association of G.H.

Hardy with Ramanujan. The account is an exciting story of the great mathematical achievements of Ramanujan and the way in which, from obscure beginning, he rose to world fame.

The unit begins with G.H. Hardy receiving "a large untidy envelope decorated with Indian Stamps" which contained a manuscript and a letter "written in halting English" addressed to him. The letter is not part of the unit; but it may interest you to know what he actually wrote to Hardy. The following is an extract from the letter to Hardy dated 16-1-'13.

> . . . I have no University education but I have undergone the ordinary school course. After learning school, I have been employing the spare time at my disposal to work at Mathematics.
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> . . . I have made a special investigation of divergent series .... Being poor, if you are convinced that there is anything of value, I would like to have my theorems published. I have not given the actual investigations nor the expressions that I get; but I have indicated the lines on which I proceed. Being inexperienced, I would very highly value the advice you give me...

We shall find out in the unit what Hardy did after he had received this letter.

12.3 C.P. SNOW: LIFE AND WORKS

Charles Percy Snow, Baron Snow of Leicester (1905-1980) born in Leicester, rose from a humble home through local grammar school and university college to a Cambridge fellowship. He joined the Civil Service and the Ministry of Technology in Harold Wilson's first Labour administration. This was followed by a life peerage as Lord Snow.

A scientist, he set himself the task of breaking through the barriers between science and literature, a barrier he lamented in 1959 in a public lecture "Two Cultures and the Scientific Revolution". His major novel, *Strangers and Brothers* (1940), later re-titled *George Passent*, is set in an unnamed Leicaster. His other novels include *The Masters* (1951), *The New*

Men (1954) and *Corridars of Power* (1964). Earlier he had tried his hand in a detective novel *Death under Sail* (1952).

The *Foreword* to G.H. Hardy's book *A Mathematician's Apology* (1967) gives sympathetic and witty insights into Hardy's life, with its rich store of anecdotes concerning his collaboration with Ramanujan, his wise sayings and his passion for cricket.

12.4 G.H. HARDY: THE MATHEMATICIAN BEHIND RAMANUJAN

Godfrey Harold Hardy was born on 7th February 1877 at a small town named Cranleigh in the south of England. His father Issac Hardy was a Bursar and art master at Cranleighschool and his mother Sophia was a teacher at Lincoln Teachers' Training School. After his schooling at Cranleigh, he won a scholarship to Winchester College and in 1896 won an open scholarship to Trinity College, Cambridge. He was elected a fellow of Trinity in 1900.

During his stay at Cambridge, Hardy began his collaboration with J.E. Littlewood which was to last thiry-five years. Then in 1913, he received Ramanujan's first letter from India which became the starting point for his association with this self-taught Indian mathematical genius. He could recognise Ramanujan's mathematical genius and brought him to Cambridge.

Hardy has been regarded as one of the 20th century's finest mathematical thinkers. He was known among his contemporaries as "a real mathematician... the purest of the pure." He was also, as C.P. Snow recounts in his *Foreword*, "unorthodox, eccentric, radical, ready to talk about anything."

Hardy lived on for some 27 years after Ramanujan's death on 20th April 1920, to the ripe old age of 70. In one of his interviews, Hardy recalled that his discovery of Ramanujan and their collaboration has been the one romantic incident of his life.



CHECK YOUR PROGRESS

Q 1: Name the book on Ramunujan written by G.H. Hardy?

Q 2: What does the ''Foreword'' to Hardy's book *A Mathematician's Apology* contain?

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12.5 MAJOR THEMES

C.P. Snow's attempt in the essay is to give a pen-picture of Ramanujan as a mathematical genius and how the great mathematician from Cambridge G.H. Hardy, had discovered his mathematical genius. The incident associated with this discovery took place one morning early in 1913 when Hardy received a manuscript and a letter from Ramanujan seeking his opinion on the mathematical discoveries contained in the manuscript.

At first Hardy was rather bored when he glanced through the manuscript. He was irritated too. He wondered if the author of the manuscript was a fraud. He noted that the manuscript consisted of wild and fantastic looking theorems. One or two of these were already well-known. But they were laid out as though they were original. There was no proof of any kind. He kept the manuscript aside and went on with his day's work.

But at the back of his mind, the manuscript kept disturbing him all the time. He began to ask himself whether Ramanujan was really a fraud or a genius. To seek an answer to this question, he discussed the manuscript with his colleague, Littlewood. It did not take them long to discover that the author of the manuscript was a genius of the class of Gauss and Euler except for the defects of his education and because he had come on the scene too late to make a similar contribution.

Hardy was not the first person to whom Ramanujan had sent the manuscript. There were two before him, both English, of the highest professional standards. But they returned the manuscript without comment.

Hardy, unlike them, understood the genius of the author and made immediate plans to bring him to England. With financial support from Trinity and blessings from the goddess of Namakkal who visited Ramanujan's mother in a dream, Ramanujan arrived in England in 1914. He was put up in Trinity College where there began his historic association with G.H. Hardy.

Coming into contact with Ramanujan, Hardy discovered the inadequate educational background of this mathematical genius. He found that Ramanujan knew nothing of the modern rigour. In a sense, he did not know what a proof was. In fact Hardy was obliged to teach him some formal mathematics as though Ramanujan were a scholarship candidate at Winchester. For Hardy, this association was the most singular experience of his life: what did modern mathematics look like to someone who had the deepest insight but who had literally never heard of most of it.

Hardy and Ramanujan produced together five papers of the highest class. Ramanujan received due honours from England as was possible. The Royal Society elected him a Fellow at the age of thirty. Trinity also elected him a Fellow in the same year. He was the first Indian to be given either of these distinctions. He was amiably grateful. But he soon became ill. Hardy used to visit him as he lay dying at hospital in Putney. It was in one of his visits that there happened the incident of the taxi-cab number 1729.

Ramanujan died of tuberculosis, back in Madras, two years after the war. According to Hardy, there was hardly anyone above 50 years who could initiate a major mathematical advance. Indeed, Hardy's discovery of Ramanujan constitute the major theme of the essay.

Now let us look at the significant issues highlighted in the essay.

Ramanujan's Strengths & Weaknesses :

C.P. Snow relates how after receiving the manuscript from Ramanujan, Hardy and Littlewood discussed the theorems contained in Ramanujan's manuscript. Hardy could discover that Ramanujan was a curious blend of strengths and weaknesses.

Ramanujan's strength as a mathematician was that he was a natural mathematical genius. He belonged to the class of Johann Karl Fredrich

Gauss (1777-1855), the eminent German mathematician and physical scientist. Hardy also placed him in the class of Leonhard Euler (1707-1783), the noted Swiss mathematician.

At the same time Hardy noted that because of the defects in his education Ramanujan could not expect such a level. Besides he had come on the scene too late in the line of mathematical history, to make a contribution on the same scale. His defect in his education was that he had never been exposed to formal education; he was self taught. He knew nothing of the modern rigour. In a sense, he did not know what a proof was. He could not enter Madras University because of the defects in his education.



CHECK YOUR PROGRESS

Q 3: As a natural mathematical genius, Ramanujan is compared to two other mathematicians. Who are they?

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Q 4: Why, according to Snow, Ramanujan cannot come to the level of Gauss and Euler?

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Hardy's Help in Overcoming Ramanujan's Weaknesses :

Being aware of Ramanujan's strength as a genius in mathematics and at the same time a defect in his education, Hardy decided to help Ramanujan in overcoming the defects of his education. First, he made arrangements to bring Ramanujan to England so as to introduce him to modern mathematics. Money was not a major problem. He approached Trinity College for financial support knowing that the college supported unorthodox talent. It was due to Hardy's efforts that Ramanujan could be brought to England.

Moreover, in order to overcome Ramanujan's defects in his education, Hardy was obliged to teach him some formal mathematics as though he were a scholarship candidate at Winchester. Indeed, Hardy's

greatest help to Ramanujan was to expose him to modern mathematics. Hardy noted that Ramanujan had the deepest insight into mathematics but had literally never heard of the modern concepts of mathematics.

Hardy's Gain from His Association :

This is indeed a tricky issue raised in the text. You will note that Hardy was not the first person to whom Ramanujan had sent the manuscript. There were two eminent British mathematicians before him to whom Ramanujan had sent the manuscript seeking an opinion on the theorems. But they didn't even make a single comment and returned it to its author. But Hardy did not do that. What did he gain by doing what he did for him?

Hardy had himself stated that from his association with Ramanujan, he had gained the most singular experience of his life. This association was mutually rewarding to both Hardy and Ramanujan. Together, they produced five papers of the highest class.

Moreover, Hardy gained the singular credit of discovering Ramanujan. It was because of him that we know Ramanujan today. While gaining this credit, he had shown himself to be an honest and selfless person. Snow had rightly called Hardy "the most honest of men".

12.6 STYLE AND LANGUAGE

As a novelist, C.P. Snow has a flair for handling language. Even while writing a 'Foreword' to a book about eminent mathematicians and their theorems, his narrative skill becomes apparent. The opening sentence with the prepositional phrase placed at the beginning of the sentence is primarily to focus upon the thematic concern of the piece of text - the discovery of Ramanujan. The 'it' in the sentence that follows used twice has a cross reference or an anaphoric reference to 'discovery' in the first sentence. The 'discovery' refers forward to the context of the arrival of "a large untidy envelope decorated with Indian stamps".

The entire text is free from the jargon that one is likely to expect in a piece of text written by a scientist about mathematicians of the calibre of G.H. Hardy and Ramanujan. The language of the text is simple, easy and

natural conveying exactly the impression on Hardy and Ramanujan as one would find impressed in one of C.P. Snow's works of fiction. There is no trace of affectation in his style. The references to how Hardy spends a normal day in Cambridge or Ramanujan in his pyjamas, cooking vegetables rather miserably in a frying pan in his own room, add a touch of warmth to the sober and quiet prose that characterize the text.

There are many short sentences placed between longer sentences in the paragraphs. But there is no jerkiness in the style. It flows easily and quietly with touches of the colloquial - just touches - without spoiling the beauty of elegant prose. The anecdotes especially the one on the taxicab number make the style of the text more absorbing to the reader.



CHECK YOUR PROGRESS

Q 5: What arrangement did Hardy make for Ramanujan's coming to England?

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Q 6: What was Hardy's greatest help to Ramanujan?

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Q 7: Write a note on C. P. Snow's use of language.

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12.7 LET US SUM UP

In this unit, we have learnt how G.H. Hardy came into contact with Ramanujan and what Hardy did after receiving the manuscript form Ramanujan containing some of his theorems. We have also learnt about the decision that Hardy had taken after examining with his colleague Littlewood the manuscript from Ramanujan. With Hardy's initiative, a Fellowship at Trinity was arranged and Ramanujan arrived in England, where

began the very mutually rewarding association between Hardy and Ramanujan.

This essay also reflects Ramanujan's strengths and weaknesses as a mathematician and discusses how he was able to overcome the weaknesses through his association with Hardy. We also learnt how Ramanujan became a famous mathematician of his time. Through this essay we also became acquainted with the style and language of C.P. Snow whose writings show 'a flair for handling language'.



12.8 FURTHER READING

1. Berndt, Bruce C et al. (eds.) *Ramanujan: Essays and Surveys.*
2. Hardy, G. H. (1940). *Ramanujan*. Cambridge University Press.
3. Snow, C. P. (1967). Foreword to *A Mathematician's Apology* by G.H. Hardy. London: Cambridge University Press.



12.9 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q No 1: *A Mathematician's Apology.*

Ans to Q No 2: The *Foreword* to G.H. Hardy's book *A Mathematician's Apology* (1967) gives sympathetic and witty insights into Hardy's life, with its rich store of anecdotes concerning his collaboration with Ramanujan, his wise sayings and his passion for cricket.

Ans to Q No 3: Johann Karl Fredrich Gauss and Leonhard Euler.

Ans to Q No 4: Hardy noted that because of the defects in his education Ramanujan could not expect such a level.

Ans to Q No 5: He made arrangements to bring Ramanujan to England so as to introduce him to modern mathematics. Money was not a major problem. He approached Trinity College for financial support knowing that the college supported unorthodox talent.

Ans to Q No 6: Hardy's greatest help to Ramanujan was to expose him to modern mathematics.

Ans to Q No 7: Refer to Section 12.6



12.10 MODEL QUESTIONS

Q1: Give a pen-picture of Ramanujan touching upon his association with Hardy.

Q2: Discuss the strengths and weaknesses of Ramanujan as a mathematician.

Q3: Relate how G.H. Hardy overcame the defects of Ramanujan's education.

Q4: Relate what Hardy had gained from his association with Ramanujan.

Q 5: Briefly discuss the style of the essay.

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