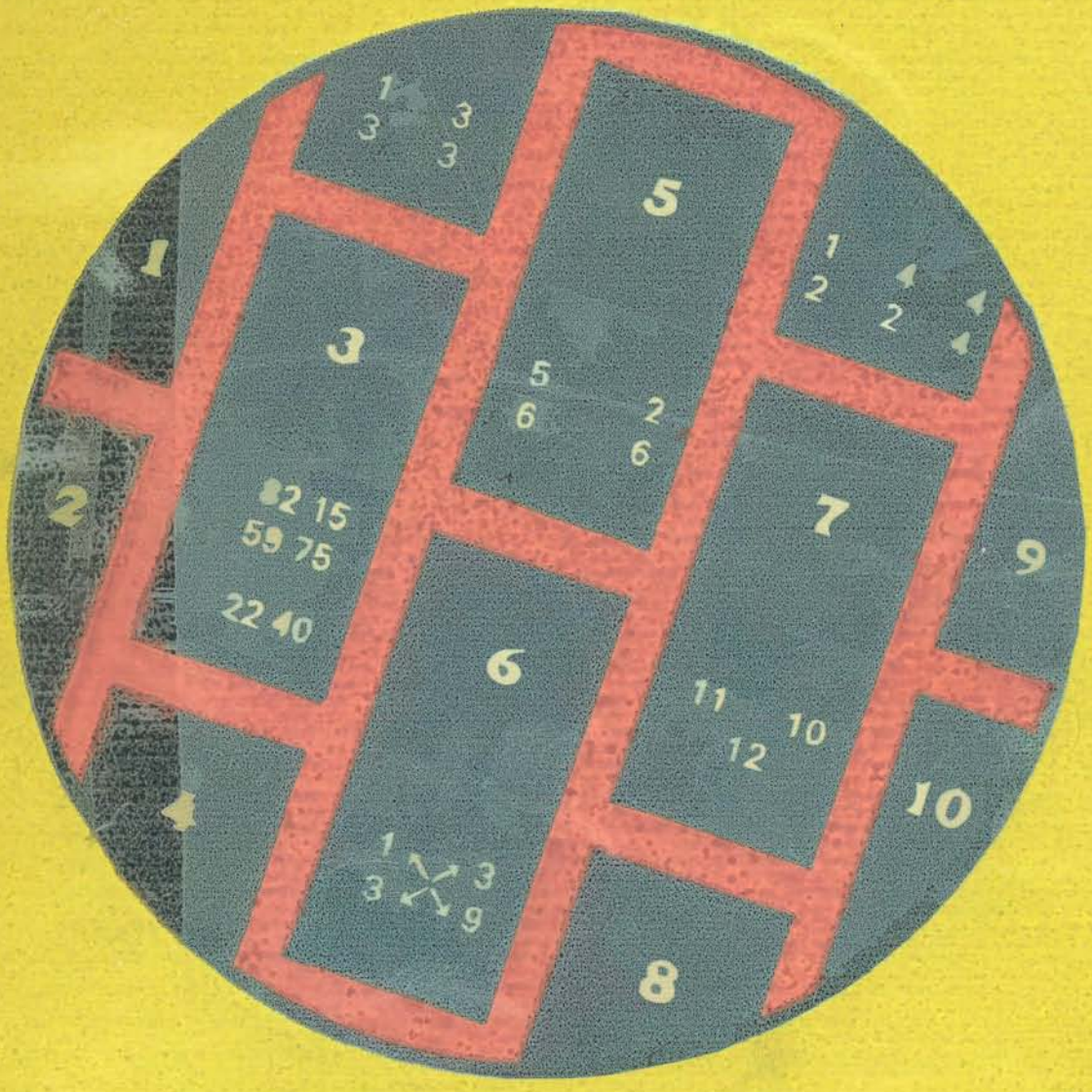
# STATUS OF WOMEN THROUGH TEACHING OF MATHEMATICS

*A TEACHERS HANDBOOK*



# STATUS OF WOMEN THROUGH TEACHING OF MATHEMATICS

*A Teacher's Handbook*

*Editor*

DR. SURJA KUMARI

एन सी ई आर टी
NCERT
राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
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# FOREWORD

Women, in the Indian set-up, share more than half of the life's burdens. In rural families, they not only look after the home but also equally share the work involved in various production processes. It is a common sight in farm areas to see women bending with sickle and scythe in hand and later with a large burden of odds and ends on their heads and backs returning to domestic chores after a day's hard toil. Nevertheless, the stereotype of women being weak and incapable of handling certain kinds of work, prevails in our communities. This stereotype has not, however, saved women from much of the back-breaking toil that they engage in day in and day out. One would also wish men to share some of the work that women do and which does not require any specialised qualification peculiar to women.

Stereotypes come to be formed in many ways. The process of socialisation through which a child acquires behaviour patterns leads to the formation of many attitudes which may have no scientific basis. What is worse, people tend to imbibe certain personality and behaviour characteristics which, society thinks, should be part of their mental make-up. Thus, girls themselves tend to accept the position assigned to them by the community. They also, in many cases, accept that they are weak and, therefore, incapable of doing many things that boys could naturally do.

Education as a powerful instrument of socialisation directly or indirectly perpetuates stereotypes and myths. Thus, till recently, girls were considered to be incapable of learning mathematics and, therefore, were asked to go in for softer option of domestic science. Similarly, textbooks and textual materials have tended to perpetuate certain stereotypes about women. Sexist bias in education has come now to be recognised.

The National Council of Educational Research and Training has been concerned with the need to give women a status in life commensurate with the contribution that they make to the society and social good. The curriculum frame work thatthe NCERT developed for the ten-year schooling, insisted upon undifferentiated curriculum for boys and girls. The assumption, underlying this framework, was that girls are as capable of learning various subjects and taking benefits from education as the boys are. The need to educate girls and boys in science and mathematics in particular, was stressed. Diversification of education was suggested in the two years of higher secondary stage. The diversified courses were to be offered by boys and girls on the basis of their potentiality.

The present document aims at developing "material in mathematics so as to achieve the sociological aim of raising the consciousness of pupils regarding status of women in society". It is expected that "problems and discussions on what boys and girls do at home and what their parents do at work as well as problems illustrating reversal of traditional stereotyped roles of boys and girls will widen children's horizon".

Dr. Surja Kumari, Lecturer in mathematics of the Women's Education Unit has been principally responsible for the preparation of this document. I would like to extend my appreciation for the effort that she has made in developing this document.

National Council of Educational Research and Training would welcome suggestions for improvement of the materials contained in this document.

P.L. MALHOTRA
*Director*
National Council of Educational
Research and Training

New Delhi
*26 October 1983*

# PREFACE

The classical statement that Mathematics is the rock on which all arts and sciences rest holds true in our perception, not only because it is the most precise discipline, but, more so, because it leads to precision in thinking through logical training. At the school level, it has been decided to train young mind with mathematics upto class X so that this faculty is nurtured in the interest of the individual and the society, and all in the ultimate interest of the development of the Nation.

For any biological organism there is only one essential activity—the goal-directed alteration of the environment. Although the anthropode transcends many of biology's dictates, his biological need to alter the environment to a suitable form is nonetheless fundamental. This is known as self expression, and human beings have two available means for self-expression. The first is above the spine-professional expression, and the second is below the spine-biological reproduction. It is obvious that the extent to which self is ultimately disseminated is the measure of biological success, both at the professional level and at the human family level.

This expressive potential is operating in the human family and human society, if we conceive them along with other natural systems like the atom, the cell and the human organism. Because of the fundamental biology of homo sapiens, the most primal philosophy which we can maintain is dictated to us. But it is equally clear that there is a control centre duality for all the systems and a balance in the control function only leads to normalcy, resulting into the totality of expressions in and out to environment, in general. For Atom, neutrons and protons; for cell, DNA and RNA; for human organism, right hemisphere and left hemisphere; for human family, woman and man and for human society, legislative branch and executive branch share this duality of control centre.

In this background it is necessary to consider the human family and see the principle of control function emphasised. The sound health of a given system depends critically upon the maintenance of an even balance between these two tendencies. Flexibility and stability are necessary for all systems and it is equally true for family as a system. Let us see the family. There are two stereotypes of human family, as prevalent—the Traditional Family and the Liberated Family. The traditional family is characterised by a full-time professional husband who labours in the environment to earn money, and a full-time wife and mother who labours in the home to bring up the children. Therefore, aside from the eternal problems of happi-

ness, self-realization, peace of mind and marital bliss, it is clear that the man in the traditional family structure has twice as many means to satisfy the mandates of biological existence as his wife. Margaret Mead has stated, "As matters now stand, and have stood through history, we have drawn on the gifts of men in both ways and on the gifts of women almost entirely in one way." This is a situation which no modern woman, seriously concerned with the socio-political world, will tolerate. To sit back and view ongoing world problems, awareness of which is now inevitable, and not to become a participant in determining one's resolution is not a fully human being.

Logical, obvious response to the traditional family structure is for the woman to find professional work. In such a case the problem of child rearing is left unsolved. With both parents professionally employed, the alternatives are; either not to have children at all, to give the children to agencies to care and upbringing or to give significant portions of time out of both parents' careers to bring up the child equally by both.

The third alternative comes closest to maintaining both professional expression and expression through child rearing; but here a problem arises concerning the feasibility of cultivating values commensurate with the newly emerging system where sharing of responsibilities at home are highlighted. The Teacher's Handbook on Status of Women through Mathematics has tried to pin point to this time budgeting and sharing of responsibilities as much as it tries to cultivate understanding of ancillary ideas of denigrating consumerism, dowry, bride price, and projecting national development through small savings, equal participation in all activities according to competencies and earning equal rights accruing therefrom. We hope that the teachers will be able to cull out information and feed it to the students.

This is an attempt to bring the rigid structures to an inbuilt device of flexibility through mathematics education and the Unit is grateful to Dr. Surja Kumari for her original creative endeavour.

SAROJINI BISARIA
*Head*
Women's Education Unit

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11. Shri Ajit Kumar Ghatak
    Sr. Mathematics Teacher
    Hindu School Calcutta
    I B, Bankim Chatterjee Street
    Calcutta
12. Shri O.P. Upadhya
    SIERT Udaipur
    Rajasthan
13. Miss Mukti Sen
    Lecturer
    Govt. Girls' Higher Secondary
    School Beohar Bad
    Beohar Bag
    Jabalpur
14. Shri T.K. Srinivasan
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Teacher
Pt. L.S. Jha Govt. Model
Higher Secondary School
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22. Shri H.C. Aggarwal
K.V.S. Head Qrs.
Nehru House
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23. Shri Lakshman Karma
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24. Shri R.K. Roy
Basic Training Institute
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25. Shri S.C. Das
Lecturer
State Institute of
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26. Shri Ramesh Bhomle
State Institute of
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Jabalpur

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Prof. and Dean
Faculty of Education
University of Saugar
Saugar

28. Dr. Shafruddin Ahmed
Lecturer
Deptt. of Mathematics
Aligarh Muslim University
Aligarh

29. Miss T. Nirmala
Superintendent
Govt. Maharani's Teachers'
Training Institution for Women
Mysore

30. Miss N.S. Seethadevi
Teacher Educator
Govt. Maharani's Teachers'
Training Institution for Women
Mysore

31. Dr. K.L. Arya
Lecturer in Mathematics
Regional College of Education
Ajmer

32. Shri K.C. Bansal
Principal
BTI
Pachmarhi

33. Shri Mahendra Shanker
DESM
NCERT
New Delhi

34. Dr. Surja Kumari
Lecturer
Women Education Unit
NCERT
New Delhi

# CONTENTS

# INTRODUCTION

In the present age of automation and computer, mathematics occupies the place of pride. Its dimensions and domains have tremendously expanded embracing almost all disciplines. This is the basis of common belief confirmed by teachers that the person good in mathematics is usually good in other fields as well. Thus, greater emphasis has been given on the quantum of mathematics taught at the school level. Appropriately the quality of its teaching should reflect the changing roles of men and women in shaping their common destiny.

For efficient and effective teaching of mathematics, it is wise to see the contact points where mathematics is attached to the living reality of the learner. The classroom where mathematics is taught does not float in empty space, but is an essential part of the training of socially conscious and useful citizens of tomorrow. This handbook entitled 'Status of Women through the Teaching of Mathematics' is an attempt to develop curriculum material in mathematics so as to achieve the sociological aim of raising the consciousness of pupils regarding status of women in society. The objective is to cultivate a healthy attitude towards the image of women in society by freeing the minds of pupils of the stereotyped biased image of women.

As a first step in this developmental exercise, a workshop was held at Mathematics Department, Jaipur University, in January 1980, to frame the objectives/values commensurate with Status of Women. These values are—highlighting the participatory role of women, dignity of labour, social evils, bride price, small family norms, evils of allurement for valuables, biographies of women mathematicians, etc. This Teacher's Handbook lists a set of representative problems for various mathematical concepts featuring these values. The handbook is divided into four broad sections—primary, middle, secondary and brief biographies of some women mathematicians.

In the primary section care has been taken to project such values which can be easily comprehended by pupils of age group 5 to 10. For class II stress has been given on the value—equal share of responsibilities by all family members since pupils at this age understand it better then the other values, viz. small family norms, bride price, etc. Problems and activities are posed so that pupils can infer that if at home the work is shared equally, the time so saved by the overloaded mother can be utilized for other socially useful work. It is a common practice that in a family a girl is supposed to work in the kitchen whereas a boy is free to do anything. This

segregation of children in the world of work from an early age affects their perception of roles. Thus problems and discussions on what boys and girls do at home and what their parents do at work, along with the problems illustrating reversal of traditional stereotyped roles of boys and girls will widen children's horizen.

Similarly, for classes III, IV and V various problems corresponding to different values have been posed. Sometimes it is felt important to reverse the roles which will help boys and girls visualize themselves in non-traditional roles so that they have an open mind on the options in life. These days women are trying to enter in almost all fields whenever given the opportunity. These types of problems will leave some effect in their minds which will orient them to struggle and take up such areas of work.

People and the work they do afford many situations for narrative problems Famous people are featured in quantitative situations because birthdays or anniversaries afford opportunities for arithmetical computations. Many women have made contributions towards development of mathematics, but they have been less publisised. Such examples or narrative problems featuring birthdays, participatory role of women in all walks of life, social evils etc. are given in middle and secondary sections.

In the last section biographies of some famous women mathematicians* are given. It is unfortunate to note that some had to publish their research papers under fictitious names because of their sex. They were intellectually undervalued and any creative work done by them was looked at with doubts. This image of women is still continuing. The whole educational system is taught and written in masculine gender. The contribution made by women for the betterment of mankind is casually mentioned. The woman has been always depicted as a weaker sex and protected by man like his personal property. Her appearance is shown like a degraded person who has no capability and courage to work, albiet two third of total work in the world is done by women. Mathematics, being part of our culture, can help us in imparting correct image of women in the society as human beings and not as plastic toys of men.

The implications of this handbook forecast a heavy responsibility for educators in general and for classroom teachers in particular. If the societal goals of equal educational opportunity are to be realised, materials in the textbooks ought not favour one sex over the other. In the selection of examples, and problems to promote learning of concepts, the teacher should not pose the problems which feature men doing important work and women in supportive roles, so as not to stifle the aspirations of girls. In developing countries like ours, if the budding aspirations of girls are not fulfilled it not only means waste of human potential, but also results in dissatisfied individuals.

*Note : The main purpose was to highlight biographies of Indian women mathematicians of antiquity. Unfortunately no authentic reference material was available, the search is still going on.

School personnel at the state and central level responsible for selection of text-books and instructional materials need to consider selections that offer a balance in the presentation of the sex roles. Teachers and curriculum specialists ought to consider materials from the standpoint of fair and equal treatment of the sexes.

Beyond these general awareness measures, classroom teachers can do much on an hour-by-hour basis in the regular arithmetic period by using some or all of the suggested problems when teaching mathematics to children. The teacher can display photos of famous women mathematicians and discuss their contributions. Women who are in male-oriented professions can be invited to talk to pupils so as to widen their horizons and illustrate concretely the fact that only with equal rights and opportunities comes the freedom to function as individuals according to one's abilities and not according to roles assigned by cultural practice.

A slide-cum-tape programme entitled 'Status of Women through Teaching of Mathematics' has been prepared. This gives a visual feeling of participatory role of women in all walks of life. This is available from Women's Education Unit, NCERT, New Delhi.

Lastly, I would say that the main responsibility lies on the creative teacher for inculcating positive values regarding role of women in society, since the children are fairly malleable and an educational artist can mould them.

SURJA KUMARI
Women's Education Unit

# Objectives/Values of Mathematics Commensurate with the Status of Women

(Framed at Jaipur Workshop)

1. Work at the domestic level is equally productive and should be projected as a responsibility to be shared by all members of the family.
2. Dignity of work in all walks of life should be reflected through exercises projecting computation of time, labour and energy consumed at each job.
3. Growing participatory role of women in all walks of life must be re-inforced and failure in participation must reflect on loss of labour force.
4. Indications of social, economic and cultural changes to be knit in mathematical exercises so as to imprint change indicators for raising aspiration level.
5. Mathematics teaching must emphasize logical thinking so as to discover evils of dowry system and bride price, and bring out the importance of small family norm from the point of view of family welfare.
6. Decision making competence in both boys and girls should be equally developed through mathematics teaching.
7. In the context of equality of opportunities, to highlight through mathematical data, that women can shoulder responsibilities, equally.
8. To help in the eradication of social evils such as dowry, death ceremonies, etc., by highlighting their arithmetical aspects.
9. To minimise the allurement for gold, silver and valuables, and to cultivate our attitude of increasing the National resources by depositing the savings in banks.
10. The biographies of women mathematicians and their contributions should be highlighted.

# PRIMARY SECTION

## CLASS II

**Units: Addition, Subtraction, Multiplication and Division**
**Value: Areas of home management should be projected as joint responsibility of all the members.**

| *Questions* | *Activities* |
|---|---|
| Aruna works 8 hours in the office and spends 3 hours in the house for cooking. How many hours does she work in a day? | Teacher should explain how a person is over-worked if all the family members do not share the responsibilities. |
| Arvind's parents spend one hour and forty five minutes in household chores besides their eight hours office work in a day? How many hours do they work in a day? | To share the household chores equally saves the time and energy which can be utilized in other productive work. |
| The total income of Abida and her husband last year was Rs 20,000. If they spend Rs 750 per month on rent then how much is left? | Sharing responsibilities increase the resources. |
| Rashida wants to buy a sewing machine worth Rs 550. She has Rs 435. How much more does she need to buy the machine? | -do- |
| On Sunday Ramprakash and Rohini took two ours and 40 minutes to clean their house. How many minutes does each work? | -do- |
| By cutting on domestic extravagance Raman's mother saved Rs 75 per month. How much did she save in 9 months? | -do- |
| Karim and his sister planted 35 tomato plants in 7 rows in the kitchen garden. If the number of plants in each row is the same, how many plants are there in one row? | -do- |
| Draw a table showing the type of work and number of hours each member of your family does in a day. Find who does more work and how many hours. | -do- |
| Make up two problems relating to your daily help in household jobs in the home in which you have to subtract in order to find the answer. | |

## CLASS III

**Units: Addition, Subtraction, Multiplication, Division and Metric Measures.**
**Value: To develop the idea of growing participatory role of women in all walks of life.**

| *Questions* | *Activities* |
|---|---|
| Sushma helped her father in selling things as his partner on Monday and total sale was Rs 982. Ramesh, Sushma's brother helped his father on Tuesday and the total sale was Rs 879. What was the total sale on these two days? | The teacher should discuss the growing participatory role of women in different walks of life. |
| In an innings of a test match, the runs scored by the 11 players of Women's cricket team are as follows: 105, 84, 53, 22, 7, 93, 9, 29, 67, 0. What is the total score of the team in the innings? | -do- |
| In a factory there are 2425 men workers and 1985 women workers. How many workers are there in all? | -do- |
| After retirement Lakshman gave equal amount of Rs 12,575 to his son Gopal and daughter Rashmi from his bank account. He kept Rs 18,976 for himself. What was the total amount of his bank account? | The teacher should discuss that girls and boys have equal right in the property irrespective of the girls marriage. |
| Sarojini purchased 9,500 bricks. She used 6,375 brickes in constructing a room. How many bricks were left with her? | The teacher should pose the problems on interchangibility of the roles of women, e.g. a woman can also take responsibility of constructing a house. |
| In a Co-educational school girls collected Rs 7,864 and boys collected Rs 6,956 as donation for constructing a reading room in the school. How much more the boys have to collect to equalise the girls contribution? | -do- |
| "In Sanchayika Yojana" in a school, the boys deposited Rs 2,559 and girls deposited Rs 2,784 by curtailing their pocket expenses. How much less amount did the boys deposit as compared to girls? | The teacher should highlight the participation of girls in all spheres of life. |
| There are 45 beads in a chain. Karim and his sister wanted to prepare 85 such chains for their shop? How many beads will they need? | Equal participation, sharing of responsibility and contribution of each member of the family towards family prosperity can be framed. |
| Rajindra and Rani each help their mother in household activities for 3 hours daily. How many hours per month do they help jointly, if the month is of 30 days? | -do- |

| 1 | 2 |
|---|---|
| A stainless steel tea-set costs Rs 246. Mohsina wants to purchase three sets to present among her two sons and one daughter. How much amount does she need to purchase them? | -do- |
| Mahesh got Rs 9,600 in a lottery and he gave equal share to his two sons and one daughter. Find how much will each get? | Problems on saving, sharing, distribution, etc. may be framed. |
| There are 23 girls and 24 boys in a class. The teacher wants to form Kabaddi teams of nine players each. How many teams can be formed. How many students will be left out? | -do- |
| Amrita bought 3 pieces of ribbon, one 30 centimetres long, second 35 centimetres and the third 25 centimetres long. What is the total length of the ribbon she bought? | Many examples from day-to-day life and from different sphere of activities, when men and women have equal participation, may be taken into account. |

| *Values (What)* | *Unit (When)* | *Questions (How)* |
|---|---|---|
| To highlight the role of women participation in family management and ability to solve day-to-day problems. | Indian Currency | Sharmila purchased a mathematics textbook for Rs 3.75 for herself, a woolen cap for Rs 15.50 for her father, a chappal for Rs 9.75 for her mother and a toy for Rs 1.80 for her brother. How much in all did she spend on these? |
| ,, | | Meenakshi deposited Rs 9.50, Rs 5.50 and Rs 7.50 respectively as tuition fee for her three children, find the total amount deposited as tuition fee? |
| ,, | | Deepika had Rs 19.75 in her pocket. She purchased toys for Rs 11.85 for her younger brother and sister. How much money was left with her? |
| ,, | | Salma went to a nearby city market for purchasing some clothes for Rs 100. If she purchased clothes worth Rs 79.80 and gave Rs 1.30 as bus fare, how much money was left with her? |
| To impart the idea of leadership of women in socially useful ventures. | Metric measure | Rajani purchased 2 Kg 500g of ghee at the beginning of a month. At the end of the month she was left with 750g of ghee. How much ghee did she use during the month? |
| | | Ranjita purchased 2 Kg 150g wool. She used 400g to prepare a pull over for her husband, 200g for her daughter's midi and 175g for her son's sweater. She also used 350g for her own midi. How much wool did she use? How much wool is still left with her? |
| | | In a 'Sharamadan Camp' one group lead by Zahira built 36 m by 75 cm of link road, while the other group headed by Kumar built 32 m by 75 cm. Find the total length of the road built by the two groups. Which group did built more and by how much? |
| To give an idea of literacy rate of women in the country | Whole Numbers | According to the 1971 census the total female population of India was 26,41,10,376 in which only 4,93,71,551 were found to be literate. Find the number of illiterate women. |
| | | The total female population of India, according to 1981 census, was 318,244,919 in which only 78,942,913 were literate. Find the number of illiterate women. |

| 1 | 2 | 3 |
|---|---|---|
| Ability to solve day-to-day problems | Fractional numbers | If Rashmi devotes, $1\frac{1}{4}$ hours for doing home work in the evening and $\frac{3}{4}$ hours in the morning, how much time does she devote to complete her home work? |
| | | The school is at a distance of $2\frac{1}{2}$ km from Khalida's home, while the distance of Sarita's home is $1\frac{3}{4}$ km from the school and they go on foot. Who covers more distance and by how much to reach the school? |
| | Subtraction | Naseema's school is 3.5 km from her home. She walks 0.8 km to get the school bus. How much distance does she travel by bus? |
| | Multiplication | In the class picnic there were 13 girls and 12 boys and each was served with 250g of sweats. What was the total quantity of sweets served? |

| *Values* (*What*) | *Unit* (*When*) | *Questions* (*How*) |
|---|---|---|
| To develop the consciousness for women literacy in the country. | Number and Numeration System. | The following table gives the number of literate males and females of age-group (15-24 years) in India in the year 1961 and 1971. |

| Area | *1961* | | *1971* | |
|---|---|---|---|---|
| | *Number of Literates* | | *Number of literates* | |
| | Male | Female | Male | Female |
| Rural | 1,25,15,727 | 41,42,795 | 1,94,92,761 | 83,16,906 |
| Urban | 62,21,799 | 34,51,150 | 95,85,889 | 62,55,373 |
| Total | | | | |

(i) Find the total literates of males in 1961.

(ii) Find the total literates of females in 1961.

(iii) Find the total literates of males in 1971.

(iv) Find the total literates of females in 1971.

(v) Find the total literates of India in 1961.

(vi) Find the total literates of India in 1971.

(vii) How many more rural literates were there in 1971 than in 1961?

(viii) How many more urban literates were there in 1971 tha nin 1961?

(ix) How many more literate men than women in 1961?

(x) How many more literate men than women in 1971?

(xi) How many more literate men and women were there in 1971 than there were in 1961?

| 1 | 2 | 3 |
|---|---|---|
| To inculcate in the students habit of saving through "earn while learn scheme" thus be self dependent. | Fractional numbers | Dolly receives Rs 50/- per month from the school under "earn while learn scheme" and saves 2/5th of the total amount. How much will she save in one year ? |
| To highlight participatory role of women in all walks of life. | Per cents | Reshma's father and mother earn Rs 1,550 and Rs 950 per month respectively. The expenditure on different items is as follows :<br>1. Education 10%<br>2. Clothing 15%<br>3. Food 30%<br>4. House rent 12%<br>5. Miscellaneous 16%<br>(i) Find what per cent of the earning of the family is saved per month.<br>(ii) How much amount is spent on each item ? How much is saved ? |
| To inculcate the habit of saving regularly to safe-guard the future of the family. | | Sushma wishes to purchase a sewing machine costing Rs 750. Her monthly earning is Rs 500 p.m. She decides to purchase the machine after 10 months. What per cent of her earning will she have to save per month ? |
| To develop proper attitude for socially useful productive work. | | Sunita purchased 4 kg of wool for Rs 320 and knitted 20 sweaters. She sells each sweater for Rs 28. Find the percentage of profit she gets. |
| To highlight the participation of women in different spheres. | | Sarika borrowed Rs 50,000 from a bank in order to set up a factory. Compute the annual interest at 9% per annum. What amount will she pay, if the loan is to be repayed after 5 years ? |
| To develop ability to solve day-to-day problem. | Decimal | On sports day each girl needed a ribbon of 0.75 metre. How many metres of ribbon will be required for 45 girls ? |
| To inculcate the habit of saving. | | In sanchayika yojna each student deposits Rs 3.50 per month. If there are 45 students in the class, what amount will be deposited by the class in 8 months ? |
| To minimise the domestic extravagance to keep the expenditure within means. | | The monthly consumption of mustard oil in Seeta's family was 5 kg when the rate was Rs 12.48 per kg. How much consumption of oil should she curtail when the rate becomes Rs 15.60 per kg. |
| To highlight the growing participation of women in | L.C.M. | Chandani, Satish and Mahima are three medical representatives. They take 18, 24 and 36 |

| 1 | 2 | 3 |
|---|---|---|
| all walks of life. | | days respectively to cover their respective territories. If they start from their head office on a given day, after how many working days will the three simultaneously return to the head office ? |
| | -do- Ratio | Monthly earning of each member of a family is given below :<br>(a) Father Rs 750<br>(b) Mother Rs 875<br>(c) Daughter Rs 600<br>(d) Son Rs 555<br>Find the following ratio :<br>(a) Father's earning to mother's earning.<br>(b) Son's earning to daughter's earning. |
| To highlight that both the sexes have equal right in the family property and pin point the advantage of small family. | Measurement | Rampal has two daughters and one son. He has a rectangular farm whose length and breadth are 450 m and 260 m respectively. He distributes the farm in three equal parts among his children. Calculate the area of the farm each will get. Had the farmer have only one daughter and one son what area would each have got ? |
| To develop the capacity to solve day-to-day problems. | | Jyotisna has 96 cm by 48 cm cloth and she wants to prepare handkerchieves of 16 cm by 12 cm each. How many handkerchieves can she prepare out of the cloth ? |
| To highlight the decision making and home management problems to the girls. | Unitory Method | Subhashini purchased wheat for her family consisting of four members for 30 days. If two guests joined them, how many days will the wheat be sufficient for them ? |
| To highlight the importance of Sharamdan and to inculcate the values of dignity of labour. | | The principal wants to develop a lawn in the school. If he engages 24 school girls for 3 hours daily, the work is finished within 16 days. How many days will be required if they are engaged for two hours daily ? |

# MIDDLE SECTION

CLASS VI

| *Values* (*What*) | *Unit* (*When*) | *Questions* (*How*) |
|---|---|---|
| To inculcate the habit of savings regularly from their income to safeguard the future of the family and also to highlight the growing participatory role of women in all walks of life. | Ratio, Percentage and their applications. | Margarette works in a factory and earns Rs 855 per month. She saves Rs 185 per month from her earnings. Find the ratio of her savings to her income. |
| To highlight the equal participation of both the sexes in all types of activities. | | In a school the ratio of girls to boys participating in sports is 6 : 5. If 210 girls take part in sports, find the number of boys participating in the sports. |
| To highlight the growing participation of women in all walks of life. | | In a medical college, the ratio of male to female students is 4 : 5. If the total number of female students in the college is 100, find the number of male students. |
| | -do- | Nazima runs a grocery shop in a market. The ratio of the sale of eggs on Sunday to that of the whole week was 2 : 9. If the total sale of eggs in the same week was Rs 360, find the sale of eggs on Sunday. |
| | -do- | Kavia' monthly income is Rs 1000. She spends Rs 452 on food, Rs 150 on cloths, Rs 100 on the education of her children. Express her expenditure in percentage. What per cent of the income does she save every month ? |
| | -do- | In a watch factory 15 women can assemble 150 watches in 22 days. In how many days will 22 women assemble the same number of watches ? |
| To encourage girls to face the modern hazards of travel and transport and also to highlight that activity-wise or otherwise women is not the weaker sex. | | Monika drives a car with an average speed of 40 km/hour and takes 5 hours to reach Ambala Cantt. Find her speed if she takes 4 hours to reach Ambala Cantt. |
| To encourage girls to participate in physical activities which till recent past were dominated by boys and also to highlight the growing participatory role of women in all walks of life. | | In a school, there are four hockey teams of girls each having 12 players. If the total number of girls in the school is 288 find the percentage of girls participating in hockey. |

| 1 | 2 | 3 |
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| To make the girls conscious of their civic rights including the right to vote. | | There are 4500 voters in a town. Out of these 2500 are women voters. In an election, 2000 women and 1500 men cast their votes. Find the percentage of men and women voters who cast their votes. |
| To highlight the need and importance of small ize family norm from the point of view of family welfare. | | Nisha has 4 children and Hamida has 6 children. Their monthly incomes are Rs 900 and Rs 1200 respectively. They spend 20% of their income on the education of their children. Who is spending more per head on education and by how much ? |
| To highlight the growing participatory role of women in all walks of life including owing a factory, etc. | | Sarika borrowed Rs 50,000 from a bank to set up a factory. Calculate the annual interest at the rate of 9% per annum. Find the amount to be repaid after the period of 5 years to clear the loan, the interest being simple. |
| To highlight the importance of proper age difference between children for a small family. | Equations | Sarla has two daughters, Anjali and Babita. Anjali is 4 years older than Babita. If the sum of the ages of Anjali and Babita is 16, find their age. |
| To highlight that planning and well being are interrelated. | | Sheela decided to purchase a rectangular plot for constructing a house after retirement. Length of the plot is 10 m more than its breadth. The perimeter of the plot is 52 m. Find the length and breadth of the plot. |
| To highlight the merits of a small family. | | Hema's present age is 29 years more than her daughter Asha. Her son Ashok is five years older than Asha. If 3 years ago Asha was four years of age, find their present ages. |
| To highlight the growing participatory role of women in all walks of life. | | Pakeeza and Rashid were two candidates for the Presidential election of a cooperative society. Pakeeza won the election by 80 votes. If Rashid got 240, find the total number of votes. |
| To emphasise among the girls the importance of relief programmes. | | A women club arranges a charity show for the flood relief. The tickets of the show were sold at Rs 2, Rs 3 and Rs 5 each. The number of tickets sold at Rs 2 was 20 more than the number of tickets sold at Rs 3. The number of tickets at Rs 5 was 15 more than the number of tickets sold at Rs 3. Find the number of tickets sold of each type if the total sale is of Rs 1315. |

| 1 | 2 | 3 |
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| To inculcate among girls the habit of saving and taking part in different saving schemes of the country. | | In the school Sanchayikayojna, Amita and Ashok deposited money by curtailing their pocket expenses and Amita's savings is Rs 8 more than Ashok's savings. If the sum of their savings is Rs 16, find Ashok's savings. |

## CLASS VII

| *Values* (*What*) | *Unit* (*When*) | *Questions* (*How*) |
|---|---|---|
| To highlight selfreliance and decision-making competence among women. | Equations in one variable | Sunita receives some bonus from her factory. She deposits 3/5th of it in a bank and spends the rest in minor repairs of her house. If the difference of the amounts deposited and spent is Rs 108, find the bonus received by Sunita. |
| To highlight women have equal rights in the family property. | | Shobha is the head of the family. She distributed 4/5th of her property between her son and daughter equally. If she is left with the property worth Rs 5000, find the value of Sobha's property before distribution. |
| To highlight that women are shouldering equally the responsibilities of the family. | Rational numbers | Zohra spends 2/5th of her monthly income on food, 1/10th on education for her two children and 1/4th on rent. What part of her income does she spend ? |
| To inculcate the habit of saving regularly among girls. | | Reeta used to spend Rs 1.25 per day as pocket money. On the advice of her mother she opened a bank account and started depositing the pocket money therein. Find her savings at the end of one week, one month and one year. (Assume one month—30 days, one year—365 days). |
| To highlight that women are taking active parts in all walks of activities such as sports, etc. | | In a 2 km relay race, 4 girl athletes ran 1/2 km each and covered the distance in 98.8 seconds respectively. If the race record be 6 minutes 2.5 seconds, by how many seconds did they fail to match the record ? |
| To highlight that women are competing well in the field of education. | | In the annual examination, Ram secured 475 marks out of 600 and her sister 584 marks out of 700. Whose performance was better and by what per cent ? |
| To minimise allurment for gold etc., among women and also to highlight the growing participatory role of women in all walks of life including business. | | Mumtaz sold her ornaments and opened a stationery shop. Her daily sale for one week is as under :<br>Sunday Rs 889.55<br>Monday Rs 625.00<br>Tuesday Rs 570.25<br>Wednesday Rs 680.00<br>Thursday Rs 636.75<br>Friday Rs 580.00<br>Saturday Rs 756.90<br>On what day of the week is her sale (i) the maximum (ii) the minimum ? Find her average daily sale. |

| 1 | 2 | 3 |
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| To highlight that women can shoulder responsibility boldly in difficult days. | | On the untimely death of her husband Shiela opened a general store with the provident fund amount, which she received from her husband's office. The average daily sale from the store is Rs 577. If the sale of the first six-days be Rs 525.50, Rs 470.25, Rs 580, Rs 536.75, Rs 480.05 and Rs 656.90, find the sale of the last day of the week. |
| To highlight the growing participatory role of women in all walks of life including business. | | Sushma got a loan from the bank and opened a wool shop. She invested 0.5 part of that amount in the purchase of sweaters, 0.04 part in the purchase of wool and 0.25 part of the remaining amount in the purchase of a knitting machine. The remaining amount was spent in the decoration of the shop. If her loan was Rs 22,000, find the amount invested in each item. |
| To highlight the spirit of social participation and sense of sacrifice among women. | Area | Anuradha donated a 2-hectare plot of land for a women's hostel. If the length of the plot is twice its width, find the cost of fencing it at the rate of Rs 5 per metre. |
| To highlight the growing participatory role of women in all walks of life, including doing farming with modern techniques. | | Nadira has a farm whose length and width are respectively 360 m and 170 m. In order to increase the produce of the farm, she applied manure at the rate of 2 quintals per hectare. Find the cost of the manure if it was purchased at Rs 150 a quintal. |
| To inculcate among girls positive outlook for dignity of labour and also to inculcate in them the habits of using leisure time properly. | | Manju has a piece of land 165 m by 100 m. How many flower beds can she make if each bed measures 25 m×15 m ? |
| -do- | | Mary has roll of cloth 18 m by 15 m. How many handkerchieves of 30 cm by 30 cm can she make out of this roll ? |
| To inculcate among girls positive outlook for dignity of labour and also to inculcate in them the habit of utilizing their leisure time properly. | | Kanta has a kitchen garden 10 m by 8 m. She constructed a path 1/2 m wide along the boundary and within the kitchen garden. Find the area of the path. |
| To inculcate among women the spirit of doing social service and a sense of sacrifice for the cause of the society. | | Sadhna donated 2/5th of her land for a school building in her village. The donated part measures 200 m by 125 m. Find the area of the land donated. Also find the total area of her land. |

| 1 | 2 | 3 |
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| To emphasise the growing participatory role of women in all walks of life and also to highlight that women have equal rights in family property. | | Farida and her brother Rashid inherited equal rectangular pieces of land. Farida's piece of land measures 100 m by 80 m and length of Rashid's piece of land is 125 m. Find the breadth of Rashid's land. With the help of her husband Farida grew wheat and vegetables in half of the portion. Find the area of the portion left unused by her. |
| To emphasise among women the importance of small family and the proper age difference among children. | Sets | Sudha has 3 children named Shyam, Seema and Leena. Their ages are 5 years, 10 years and 14 years respectively. Sudha is 38 years old whereas her husband, Amit is 41 years old. From the above information write the following sets :<br>(i) Set of persons whose ages (in years) are even numbers.<br>(ii) Set of persons whose ages (in years) are odd numbers.<br>(iii) Set of those members of the family who are below 35 years of age.<br>(iv) Set of those members of the family who are below 12 years of age.<br>(v) Set of those members of the family who are above 45 years of age. |
| To highlight growing participatory role of women in all walks of life such as sports, etc. | | Dolly, Neeru, Anju, Kavita and Lovely play hockey and Neeru, Anju, Amita, Arti and Anu play basket ball.<br>(i) Write the set of girls who play both hockey and basket ball. Represent it by a Venn diagram.<br>(ii) Write the set of girls who play either hockey or basket ball. Represent it also by a Venn diagram. |
| To highlight the achievements of girls in educational field. | | Amita, Meenakshi, Vibha, Rehana and Mary got distinction in Mathematics and Mumtaz, Anu, Margret, Vibha and Meenakshi got distinctions in Science.<br>(i) Write the set of girls who got distinction in both Mathematics and Science. Represent it by a Venn diagram.<br>(ii) Write the set of girls who got distinction in Mathematics or in Science. Represent it by a Venn diagram. |

| 1 | 2 | 3 |
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| | To highlight the growing participatory role of women in all walks of life and their achievements in different fields. | Write the following sets in the Roster form :<br>A=(x : x is a woman Prime Minister of India).<br>B=(x : x is a woman who got Noble Prize in Science).<br>C=(x : x is a woman who is a Noble Prize winner for peace).<br>D=(x : x is an alphabet in the name of woman mathematician, Sophia, German).<br>Express the alphabets in the name of Sophia German in roster method. |

| *Values* (*What*) | *Unit* (*When*) | *Questions* (*How*) |
|---|---|---|
| To encourage women to take interest in relief measures and other social activities. | Statistics | A local women club collected donations for the National Relief Fund. Their donations are as under : |

| Donation (in Rs) | 110 | 130 | 150 | 170 | 190 | 210 | 230 |
|---|---|---|---|---|---|---|---|
| No. of persons | 5 | 7 | 10 | 15 | 13 | 16 | 14 |

Find the average donation per person.

To highlight the growing participatory role of women in all walks of life.

The following table gives the basic salary of the 80 women employees in a factory.

| Salary (in Rs) | 190 | 210 | 230 | 250 | 270 | 290 | 310 |
|---|---|---|---|---|---|---|---|
| No. of women | 7 | 10 | 5 | 15 | 13 | 14 | 16 |

Calculate the mean basic salary of women employees.

To encourage women to take interest in relief measures and other social activities.

Urmil distributed some food packets in a draught hit area, the figures of which are as under :

| No. of food packets | 0 | 1 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| No. of persons who received packet | 1 | 9 | 26 | 59 | 72 | 52 | 29 | 71 |

Calculate the mean number of packets per person.

To highlight the growing participatory role of women in all walks of life.

The following are the scores made by the women cricketers in a test match :

65, 10, 13, 100, 40, 20, 77, 35, 0, 15, 10

Calculate their arithmetic mean.

To highlight the fact that in the modern age early marriages are discarded.

The following table gives the number of girls marrying in different age-groups :

| Age-groups | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 |
|---|---|---|---|---|---|
| No. of girls | 100 | 125 | 112 | 50 | 10 |

Represent the data by a histogram. Also draw the frequency polygon of the above data.

| 1 | 2 | 3 |
|---|---|---|
| To highlight the equal participation in different activities and political awareness among women. | | In an election meeting, the age-wise distribution of the number of women present is as under :<br><br>Age-groups: 10-15 \| 15-20 \| 20-25 \| 25-30 \| 30-35 \| 35-40 \| 40-45<br>Frequency: 4 \| 9 \| 20 \| 18 \| 14 \| 25 \| 10<br><br>Draw the histogram and the frequency polygon from the above data. |
| To highlight the growing participatory role of women in all walks of life working in factories. | | Following are the daily earnings in rupees of 23 women employees of a factory :<br>20, 22, 22, 25, 15, 30, 40, 38, 27, 20, 40, 15, 17, 24, 27, 25, 20, 17, 24, 25, 30, 38, 40,<br>Represent this information in the form of a table having class intervals of size 3 and having one class interval as 15-18 (18 not included). |
| To highlight that women are competing well in education. | | In a class of 20 students the marks obtained in mathematics test are as under :<br>Manoj, Raghu, Sunder, Ramesh, Hari, Rajni,<br>31 57 56 64 56 36<br>Sudha, Raju, Madhu, Urmil, Sohan, Ram,<br>61 56 88 70 33 60<br>Abdul, Anu, Suresh, Arun, Prashant, Prem,<br>64 56 28 59 45 74<br>Rehana, Ravi<br>76 56<br>(a) What is the highest score and who scored it ?<br>(b) What is the lowest score and who scored it ?<br>(c) Prepare a frequency table with class-intervals of width 10 and one class interval being 25-35 (35 is not included). |
| To inculcate among women the spirit of co-operation and also to highlight growing participatory role of women in all walks of life. | Surface area and volume | Rekha, Fatima and Renu jointly purchased a farm measuring 80 m by 60 m. In 1/3 of it, Rekha opened a dairy, in 1/3 Fatima opened a poultry farm and in the rest of it Renu grew vegetables, after separating the three parts with the help of fencing. Find the area of each part. |

| 1 | 2 | 3 |
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| To highlight the growing participatory role of women in all walks of life. | | Kamla set up a box factory. She got an order of 300 tin boxes of size 90 cm × 50 cm × 40 cm. If a tin sheet measures 3 m by 2 m, how many such tin sheets are required to meet the order ? |
| To highlight the growing participatory role of women in all walks of life and also to highlight decision-making competence in women. | | Mary has a farm of size 500 m × 40 m. For irrigation purposes she got a tank constructed of dimensions 30 m × 20 m × 12 m. The earth so dug out was spread evenly in the remaining portion of land. Find the level of the farm raised. |
| To highlight that women are capable of shouldering responsibility of starting a business on their own. | | Pushpa, after completing her education started a factory of candles. The diameter and length of each candle are 4 cm and 14 cm respectively. How many such candles can be manufactured from a rectangular piece of wax measuring 32 cm × 22 cm × 12 cm. (Take $\pi = \frac{22}{7}$) |
| To inculcate among girls the readiness for taking up new roles in changing situation. | | In guiding camp, a group of girls put up a conical tent of hight 1.6 m. If the radius of the base is 2 m, find the area of the canvas used in making the tent. Also find the volume of air contained in it. |
| To highlight the growing participatory role of women in all walks of life. | | Pratima started a soap factory by taking loan from a co-operative bank. She manufactures soap-cakes of size 7 cm × 5 cm × 3 cm. How many such soap-cakes can be put in a box of size 60 cm × 40 cm × 35 cm. If the price of one soap-cake is Rs. 1.70, find the price of soap-cakes of one box. |

# SECONDARY SECTION

| *Values* (*What*) | *Unit* (*When*) | *Questions* (*How*) |
|---|---|---|
| To highlight the family welfare programmes and make the students appreciate the idea of carefully planning the age of marriage and child birth. | Sets and Mapping | If the age of mother exceeds that of her first child by 24 years, represent the age of mother as a function of the age of her child. Draw the mapping till the child is 10 years old. |
| To highlight dignity of work and also to highlight that ability-wise woman is not the weaker sex. | | Leela earns Rs 20 per day by selling news papers. Write the money (m) earned as a function of time (t). The unit of money being rupees and that of the time is day. |
| To inculcate the habit of saving regularly from their incomes. | | By curtailing her domestic expenses Mary deposited Rs 150 in a bank at 5% per annum simple interest for some period. Write the interest (I) as a function of the period (T) when T is measured in years and I is in Rupees. |
| To highlight growing participatory role of women in all walks of life. | | Represent the following sets in the Roster, set-builder form and also by venn diagram<br>(a) Women Prime Ministers of India<br>(b) Women Presidents of India<br>(c) Women Vice-Presidents of India<br>(d) Women Noble laureates<br>(e) Women swimmers who crossed the English Channel<br>(f) Indian Women Athletes who participated in Olympic games in 1976. |
| To highlight growing participatory role of women in all walks of life. | | Out of 500 women who are post graduates or employed 320 are post graduates and 248 are employed. Using venn diagram, find how many employed women are post graduates. |
| -do- | | Out of 150 women who are engineers or social workers, 120 are engineers and 130 are social workers. In the above how many engineers are social workers ? |
| To highlight the equal participation of women in all walks of life. | | Let A be the set of members of science club and B be the set of 8 members of sports club.<br>A={Sita, Mary, Ritu, Mohan, Satish, Rahman}<br>B={Ritu, Rahman, Sohan, Gopal, Amar Geeta}.<br>Find $A \cup B$ and $A \cap B$ |

| 1 | 2 | 3 |
|---|---|---|
| To highlight growing participatory role of women in all walks of life. | | 680 students of a girls school were N.C.C. Cadets in 1972 or 1973. Out of these, 350 were cadets in 1972 and 280 were in both the years 1972 and 1973. Find the number of N.C.C. Cadets in the school in the year 1973. |
| (i) To highlight decision-making competence in women in domestic work and shopping.<br>(ii) To minimise extravagance by understanding its arithmetical aspects. | | Mary decides to buy a mixture of coal and coke. Her fuel container has a capacity of 6 cubic metres while bags of coal and coke have approximate volumes of 1/2 cubic metres respectively.<br>(a) How many bags of coal would fill the container ?<br>(b) If she buys 4 bags of coke, how many bags of coal would she buy to fill the container ?<br>(c) What is the volume of x bags of coal and y bags of coke ?<br>(b) If for filling the container x is the number of bags of coal bought and y the number of bags of coke bought, plot the set of possible ordered pairs (x, y) as points on graph. |
| To minimise the allurement for gold and at the same time develop attitude towards saving schemes. | | In a survey conducted by an organisation it was found that out of 54 women, who are interested in savings or gold ornaments, 36 were interested in savings only, to build their own house in future ; 10 were interested in both gold ornaments and savings. Find how many were interested in gold ornaments only. |
| To highlight growing participation in all walks of life. | | Out of 80 women in a certain town, 50 are interested in mountaineering and 40 are interested in rowing, 40 of them are interested in mountaineering not in rowing. How many are interested in both mountaineering and rowing ? |
| To highlight the values commensurate with status of women, importance of small family and dowery, etc., as the social evil. | | $A=\{Se, Sn\}$, and $B=\{d, bp, sf, sw\}$ are two sets where Se=Social evil, Sn=Social necessities d=dowry, sf=small family sw=status of women, pb=bride price<br>(i) is $\{(Se, d), (Sn, Sf), (Sn, Sw)\}$ a function from A to B ?<br>(ii) is $\{(d, Se), (bp, Se), (Sf, Sn), (Sw, Sn)\}$ a function from B to A ? |

| 1 | 2 | 3 |
|---|---|---|
| To highlight growing participatory role of women in all walks of life. | | Out of 60 working women of a locality 45 women are doing a part time course, 27 are interested in reading good magazines. How many are taking part in both the activities assuming that each one of them is engaged in one of the above activities ? |
| To highlight the biographies of women mathematicians and their contribution. | Quadratic Equations | In the curve $Y^2x+a^2(x-a)=0$ developed by the famous Italian woman mathematician MARIA AGNESI (1718-1799) find the value (s) of Y if $X=a/2$, when $a\neq 0$. |
| -do- | | SONYA KOVALEVSKY (1830-1891) was a famous Russian woman mathematician. Take the number of alphabets in her forname and that in her surname. Form a quadratic equation whose roots are these numbers. |
| To highlight that women can shoulder responsibility equally. | | The sum and product of the numbers of male in and female operators in a telephone exchange of 100 and 2500 respectively. Find the number are male and female operators in the exchange. |
| Participatory role of women in all walks of life. | | The square of the number of female employees in an Air-force office is 120 more than the number of women doctors working in a nearby hospital. If the number of women doctors is double that of women employees in the office, find the number of women employees in the Air-force office and women doctors in the hospital. |
| To highlight the importance of small family norm for the point of view of family welfare. | | Hema has a son and a daughter. The daughter is 4 years older than the son and the sum of the square of the ages of daughter and the son is 106, find their ages. |
| To highlight dignity of labour and participatory role of women in all walks of life. | | A social organisation organised a seminar on two topics namely (i) on dignity of labour for women and (ii) on the participatory role of women in all walks of life. If the number of seminars on Ist topic was less than that on the 2nd topic by unity and the product of the number of seminars on both topics be 12, find the number of seminars on each topic. |
| To highlight decision-making competence in both the sexes and shouldering equal responsibilities in family affairs. | Equations and Inequations (Simultaneous) | Finding it difficult to run the family with husband's income only, Amita decided to earn some money. She knits 5 mufflers and 4 sweaters in a weak and earns Rs 125. If the number of sweaters and mufflers are reversed then she earns Rs 145. How much does she charge for each ? |

| 1 | 2 | 3 |
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| Dignity of work in all walks of life and to highlight that women can shoulder responsibilities equally. | | In a village poultry farm, the total number of men and women workers is 12. If twice the number of women exceeds the number of men by 9, find the number of men and women workers. |
| To highlight the biographies of women Mathematicians. | | A famous French woman mathematician "Sophia Germain" lived 15 years more than an Egyptian woman mathematician "Hypatia". Eight times the age of Sophia at the time of her death was equal to eleven times that of Hypatia. Find how many years they lived. |
| To highlight the social and economic changes as indicators or raising levels of women. | | The average monthly income of working women of a locality in the year 1981 is Rs 90 more than that of in the year 1971. Difference in squares of these incomes is Rs 64,080. Find their average monthly income in 1971 and in 1981. |
| To highlight the biographies of women mathematicians. | | The difference between the years of birth and death in A.D. of a famous Egyptian woman mathematician "Hypatia" is 40 years and four times the year of her birth exceeds three times the year of her death by 255 years. Find the years of her birth and death. |
| | | The sum of years of living of a famous Italian woman mathematician EMILIE MARQUISE DU CHATELET and a famous British woman mathematician MARY SOMERVILLE is 135. Twice the age of Emilie at the time of her death is 6 years less than the age of SOMERVILLE at the time of her death. Find for how many years they lived. |
| To highlight that women can shoulder responsibilities equally and also to highlight the growing participatory role of women in all walks of life. | | In a diplomatic mission consisting of 8 members, the number of women exceeds that of men by 2. Find the number of men and women members by using graph. |
| To highlight equal participation of women in all walks of life. | Statistics | In the recent census of a town, the distribution of working women in various occupations were found to be as follows :<br>Doctors 2.6%, Engineers 13.6%, skilled labourers 51.9%, semi-skilled labourers 14.8%, unskilled labourers 17.1%. Illustrate this distribution by a pie chart. |

| 1 | 2 | 3 |
|---|---|---|
| To highlight the change in attitude of the people towards women literacy/ education. | | Number of literate women under the age-group (15-24 years) are given below :<br>*Year* — *Rural* — *Urban*<br>1951 — 210955 — 183957<br>1961 — 4142765 — 3451150<br>1971 — 8316906 — 6255393<br>Draw the bar diagram. |
| To highlight the growing participatory role of women in various walks of life. | | The number of regular female employees in Central Govt. Services appointed for the year 1967 to 1976 is given below :<br>*Year* — *No. of Female employees*<br>1967 — 55,400<br>1968 — 58,750<br>1969 — 61,900<br>1970 — 63,900<br>1971 — 67,350<br>1972 — 70,900<br>1973 — 73,000<br>1974 — 77,900<br>1975 — 84,200<br>1976 — 92,300<br>Draw the bar chart for the above data. |
| To highlight that participatory role of women in various walks of life. | | The following are the number of women employed in various occupations :<br>*Jobs* — *No. of women (in lakhs)*<br>1. Household industry — 13<br>2. Industry — 9<br>3. Construction — 2<br>4. Trade and Commerce — 5<br>5. Transport, storage and communication — 1<br>6. Other services — 20<br>Draw a pie chart for the above data. |
| To highlight the participatory role of women in all walks of life. | | No. of women members of Rajya Sabha in different years are given below :<br>Years 1952 1957 1962 1967 1972 1976<br>Numbers 15 20 18 24 18 24<br>Find the average number of women members in the Rajya Sabha for these years. |
| To highlight social and cultural changes in the country. | | Progress of women literacy (in percentage) in India for the respective years from 1901 to 1971 is given (approximately) by following table : |

| 1 | 2 | 3 |
|---|---|---|
| | | *Years* — *Literacy*<br>1901 — 0.70<br>1911 — 1.05<br>1921 — 1.80<br>1931 — 2.95<br>1951 — 2.95<br>1961 — 12.95<br>1971 — 18.70<br>Draw a bar diagram to represent the above data. |
| To highlight the growing participatory role of women in all walks of life. | | Given below are the number of women taking part in household industries in four different states (only in urban area) of India in the year 1971 :<br>Bihar — 5,700<br>Gujarat — 10,900<br>Haryana — 900<br>Assam — 2,000<br>Represent the above data by a pictograph. |
| To highlight the participation of women in all walks of life with equal responsibilities. | | In a women Hostel, out of 90 inhabitants 22 are in medical profession, 8 are teachers, 15 are telephone operators, 35 are students and 10 are in other professions.<br>Present the above data by means of a pie chart. |
| To highlight that women can shoulder responsibilities equally. | | Below is given a data showing the income of 182 women working to help their families financially : |

| Income (Rs) | 0-100 | 100-200 | 200-300 | 300-400 | 400-500 | 500-600 |
|---|---|---|---|---|---|---|
| No. of women | 40 | 20 | 29 | 38 | 32 | 23 |

(i) find the mean
(ii) draw a frequency polygon.

| | | | | | | |
|---|---|---|---|---|---|---|
| To highlight and eradicate the social evils such as dowry, etc. | | The following data shows the No. of women in different age-groups of a city who refused to marry for dowry. |

| Age-groups (in years) | 18-20 | 20-22 | 22-24 | 24-26 | 26-28 | 28-30 |
|---|---|---|---|---|---|---|
| No. of women | 14 | 24 | 36 | 40 | 34 | 28 |

Draw a histogram and a frequency polygon.

| 1 | 2 | 3 |
|---|---|---|
| To highlight decision-making competence in women. | | Rama decided to save 10% of her family income. Therefore she made her budget in the following manner :<br><br>*Item* — *Expenditure*<br>Food — 45%<br>Education of children — 20%<br>Clothes — 10%<br>Conveyance — 9%<br>Miscellaneous — 6%<br>Savings — 10%<br><br>Draw a pie chart for the above data. |
| To highlight the minimisation for the allurement of gold ornaments and other valuables. | | Below is given a data showing the liking towards gold ornaments (in percentage) of different age-groups of women in a locality :<br><br>Age-groups: 150- \| 15-20 \| 20-25 \| 25-30 \| 30-35 \| 35-40 \| 40-45<br>Percentage of women: 15 \| 31 \| 27 \| 21 \| 15 \| 11 \| 5<br><br>Draw histogram for the above data. |
| To highlight the social and cultural changes showing intention of women to participate in all walks of life. | | In a survey conducted by a reputed women organisation on the choices of different profession among women in a locality the following data was collected.<br><br>Choice of profession: Doctors \| Engineers \| IAS \| Defence \| Teaching \| Other profession<br>No. of women percentage: 55% \| 25% \| 4% \| 2% \| 8% \| 6%<br><br>Draw the pie chart for the above data. |
| To highlight the participatory role of women in all walks of life. | | Let $\omega_1, \omega_2, \omega_3 \ldots\ldots \omega_{10}$ be the number of women's employees in 10 different offices in Delhi. If $\bar{\omega}$ be the arithmetic means of the above numbers, prove that<br><br>$\sum_{i=1}^{10} (\omega_i - \bar{\omega}) = 0$ |

| 1 | 2 | 3 |
|---|---|---|
| To highlight the importance of small family. | Commercial Mathematics | Sohan's and Sarita's salaries are equal. Sohan whose family consists of five members, saves $5\frac{1}{2}\%$ of his salary, whereas Sarita whose family consists of four members saves 19% of her salary. Sarita's savings are Rs 135.00 more than that of Sohan. Find their respective expenditure. |
| To highlight that women have equal rights in all walks of life. | | In 1977 Lok Sabha election the total number of electorates of Haryana was 4768740 of which 53% were male voters. If 55% of women voters and 60% of male voters voted in the election, calculate the total number of voters polled. |
| To inculcate the sense of social responsibility as well as the habit of saving for family security. | | Lajwanti donated 5% of her income to a school for the blind and saved 15% of the rest in the bank. If she is now left with Rs 1292 for her household expenditure, find her total income. |

# Some Women Mathematicians

If we have a little glance over a history of Mathematics, we shall find that both in the ancient and more recent times, the names mentioned are almost always those of men and very little has been mentioned about the contribution of women to Mathematics. If we try to find out the reasons for the above, we may come across one of the reasons as, "the female mind is not naturally Mathematical and so women do not easily take to Mathematical reasoning". On the other hand, someone may say, "the small part played by women is due to the prejudices that deprived women of any opportunity of pursuing a career in the field of Mathematics". As we notice that these prejudices exist even today, there appears to be some truth in the latter. However, we do not wish to discuss this controversy here because without sufficient proof it is difficult to reach at any conclusion. We are simply highlighting the contributions to Mathematics made by some women Mathematicians who in spite of facing numerous obstacles, were able to succeed in making their names and leaving their imprints in the history of Mathematics. They are :

1. Hypatia
2. Maria Gaetana Agnesi.
3. Mary Somerville.
4. Sophie Germain.
5. Sonya Kovalevsky.
6. Amalie Emmy Noether.
7. Emilie, Marquise Du Chatelet.
8. Ada Augusta, Countess of Lovelace.

Unfortunately, we have not been able to find any references of Indian women Mathematicians of ancient times who have left their imprints on the record of the development of Mathematics.

## 1. Hypatia

Hypatia is the first women mathematician to be mentioned in the history of mathematics. Born at 375 A.D. in Alexandria, she was the daughter of Theon a learned mathematician and astronomer who was the director of university of Alexandria. Alexandria was considered one of the best intellectual centres of the world where

scholars of every nationality and personality used to come to lecture the students and converse with each other. In this environment, Hypatia was reared up in close touch with the university atmosphere although very little is known about her childhood and about her early education, probably she must have received her early education from her father. Books or articles dealing with her do not give us any specific details as to how or where she received greater part of education.

Hypatia flourished at the prime of her life and was universally admired for her knowledge, talents and modesty. She taught at the university and gave lectures not only on philosophy but also on mathematics and astronomy. It is said that she excelled her father in astronomy. Her lectures were so interesting that they drew a large number of students not only from Egypt but also from abroad. The time in which Hypatia lived was a time of social conflicts and as a result of a desperate quarrel between two of the leading men of her time namely Orestes the governor of Egypt and Cyril the Bishop, she was set upon by a mob of religious fanatics, followers of Bishop and brutally murdered her in March 415 A.D. She was leader of Neoplatonic school of philosophers at Alexandria.

*Contributions* : She is reputed to have been an algebraist. She wrote a treatise on the Conic Section of Apollonius of Perga. She also wrote a commentary on some work of Diophantus of Alexandria known as Diophantine Analysis. It is believed that she also wrote a treatise on the Astronomical Canon of Ptolemy and published some kind of an astronomical table. One of her students, Synesius, who later became Bishop of Ptolemais (410 A.D.) had given references to an astrolabe which was constructed by Hypatia and to an Hydroscope which he requested her to construct. This suggests that she might also have taught the rudiments of mechanics. But unfortunately all works of hers were lost when the library at Alexandaria was destroyed in 640 A. D.

## 2. Maria Gaetana Agnesi

Maria Gaetana Agnesi was born on May 16, 1718 in Milan (Italy). Her father was a professor of mathematics in the university of Bologna. She was extremely religious minded and it is said that she might have made her mark in various ways had she not been so religious and unselfish. She spoke French at the age of five and at the age of nine she had obtained such a command of Latin that she was able to publish an elaborate justification in that language, in favour of the idea that the liberal arts were not improper for members of her sex. By the age of thirteen, she had mastered Greek, German, French, Spanish, Hebrew and many other languages. At the age of nineteen, she seriously became interested in mathematics. In that task, her principal teachers were her father and Oliveton Father Rampinelli. Her aptitute for mathematics was extraordinary and it is said that she had worked out some difficult mathematical problems in her sleep. About this Cajouri (in his history of mathematics, 1919, Page 250) says :

"Several times it happened that she went in a somnambulist state, made a light and solved problems, she left incomplete when awake. In the morning, she was surprised to find the solution carefully worked out on the paper."

In 1750, she was appointed professor of mathematics at the university of Bologna by Pope Benedict XIV to fill the chair of Mathematics and Natural Philosophy during her father illness. This position she held untill his death two years later. After that she was not having any ambitions in worldly things except religious work which is evident from the following incident. When she was 44 years of age, she was asked to give her thoughtful opinion by the university of Turin on some recent scientific work including most original articles by the young mathematician Lagrange on calculus of variations. She refused and replied that such matters no longer occupied her thoughts. Even during her father's lifetime, she devoted much of her time to the sick of the hospital of Maggiore and to the poor of her Parish, San Nazaro and ultimately established her own hospital for the same from the savings on her dresses, meals etc. In 1771, Archbishop Tozzobonelli opened home named Pio Instituto Trivulzio for the aged, sick and poor. Maria was asked to serve as a directress in the women's section. She accepted this charitable work (in addition to her own hospital) and proved worthy of it as an angel of consolation to the sick and dying women. She continued in this charitable work untill her death on January 9, 1799 at the age of eighty one.

*Contributions* : Agnesi's first mathematical effort is connected with Hospital's *Traite des sections coniques*. She wrote, translated but never published it. In 1748, after being elected to the Bologna Academy of Sciences, she published *Instituzioni Analitiche*. This book was translated in French in 1775 under direction of Bossuet and into English in 1801 by James Colson. This book is said to be one of the first and most complete work on the finite and infinitesimal analysis. Its first volume deals with the analysis of finite quantities, construction loci (including conic sections), simple problems of maxima and minima, tangents and inflections.

In this volume, she has also discussed the cubic curve which was first studied by Fermat by starting with geomatrical fact that if corresponding points on the curve and a certain semicircle have equal abscissa, the square of the radius of the semicircle is equal to the ratio in which the abscissa would divide the diameter of the semicircle. The equation of this curve is presented as being $y(a^2+x^2)=a^3$ (which had been given earlier by Fermat, and was named versiera, later translated to 'witch' by Guido Grandi in 1718) is well known as the witch of Agnesi.

In the second volume, infinitely small quantities have been dealt with and there is a detailed discussion on infinitesimals, maxima and minima, flexure and evolutes.

The 3rd volume deals with the integral calculus in which some specific rules for integration and a section on the expression of a function as a power series is given. The 4th volume deals with "Inverse method of tangents" in which some very simple differential equations have been discussed.

### 3. Mary Somerville

Mary was born on December 28, 1780 at the home of her mother's brother in Jedburgh (England). She was reared at Burntisland, a small seaport town on the coast of Fife, opposite Edinburgh in Scotland. Her father was captain, later Vice-Admiral Sir William Fairfax of the Royal Navy in England. He used to go on long sea vovages and as a consequence Mary lived the early years of her life as a very lonely child. Her only companions were flowers, birds and sea-shells. She had no formal schooling upto the age of eight or nine years, but she was able to read, probably having been taught to do so by her mother. Once when her father was back home from the sea, he was very much hurt to see that his daughter is allowed to roam around leading such a carefree existence. He therefore, sent her to a boarding school for girls run by a Miss Primrose. Mary did not like the school because of the rigid and severe discipline there to which she was not accustomed and remained only for a short time. After coming home she started again roaming around leading a carefree life. But her father did not approve the way she was spending her time and was sent to a sewing school where she was taught sewing and embroidery like other girls.

When she was 13 years of age, her mother took an apartment in Edinburgh and it was here Mary studied arithmetic and writing. The following summer, she went to meet her uncle at Jedburgh where she learned to play the piano and studied Latin. When she returned home at Burntisland, one day in tea party, she was given a fashion magazine containing some problems in algebra which attracted her very much. She was very much anxious to know about the queer combinations of x's and y's given in it but she was unable to find its meaning. Curiously enough she searched her family library and was able to find a copy of Robertson's Navigation which had a little of algebra. However, from its study she did realize that astronomy was more than just star gazing. At about this time, she also studied dancing and painting at Naysmith's Academy and here in one of the discussions on perspective she learned from her teacher that the study of Euclid's Elements was not only necessary for the understanding of perspective but also essential for the study of astronomy and mechanics. As such, when she returned to her home at Burntisland, she started studying about Euclid and algebra. Her father was against the study of such "silly things" and he ordered to remove all candles from her room. To face this difficulty, she started memorizing the theorems in geometry and repeating them to herself in bed at night.

In 1804, she was married to Mr. Samuel Greig but unfortunately her husband died about three years after their marriage. After the death of her husband, she returned to Burntisland and started the study of mathematics and astronomy. In this task, she received the help of Williams Wallace who was a mathematics teacher at the Military College of Marlowe. In 1812, she was remarried to a Naval surgeon Dr. Somerville who was an excellent scholar with a good command on English.

Though he himself never attempted to write, he assisted his wife in all possible ways namely correction of proofs, criticizing the manuscripts, etc.

They lived at various places depending on the postings of Dr. Somerville. During her stay at these places, she learned different languages and subjects, e.g. Greek, Botany, Calculus, etc. After the death of her husband in 1860, she spent her later years in Italy. Even at the old age, she had not left her love for learning. At the age of 90, she studied Linear Associative Algebra of Peirce. At the time of her death, when she was 92, she was interested in higher algebra and calculus of quaternions. She died on November 29, 1872.

*Contributions* : She is believed to have written her first paper in connection with the solution of a prize problem on Diophantine equations in 1812. It is not certain whether it was published or not but this much is certain that she was awarded a silver medal for the solution. The most famous of her mathematical work was her translation of Laplace's *Mecanique Celeste*. This translation was published in 1831 under the title of *Mechanisms of the Heavens*. After its publication, Poisson encouraged her to write another book on the Form and Rotation of the earth and other planets as a sequel to Mechanisms of Heavens. She completed this work but it was never published. Nearly during the same period, she also wrote a work on curves and surfaces of the second and higher orders. This work also was never published. Her *connexion of the Physical Sciences* was published in 1834. It was also translated into German and Italian. One of her papers entitled "On the Magnetizing Power of more Refrangible Solar Rays" was printed in the Philosophical Transactions of the *Royal Society of London*. Her another paper entitled "The Transmission of the Chemical Rays of the Solar Spectrum through Differential Media" was printed in the *Edinburgh Philosophical Journal* in 1838. Her work entitled *Physical Geography* was published in 1848 and for it she was awarded the Victoria Medal by the Royal Geographical Society. Lastly, she also wrote on *Molecular and Microscopic Science* which was published in 1869. Thus, one can say that though Mary was primarily a mathematician, she wrote on other related subjects also.

**4. Sophie Germain**

Sophie Germain was born on April 1, 1776 in Paris. In fact, leaving Hypatia, about whom we do not know much, Sophie Germain was the first female mathematician to undertake original problems boldly though at a number of places her solutions were doubtful. In 1789, when she was hardly thirteen, she was inspired to study mathematics after getting deeply impressed by an incident connected with the death of Archimedes. It so happened that one day in her father's library, she was reading Montucla's *History of Mathematics*. There she read that how a Greek mathematician Archimedes helped in the defence of his city, namely the Greek city state of Suracuse on the island of Sicily, against the Romans by inventing machines

to repel the enemy and how, when the city finally fell in 212 B.C., he was killed by a Roman soldier while he was engrossed in the study of a geometrical figure in the sand. Her desire for studying mathematics was opposed by her family members contending that it was not proper for her sex.

Due to this opposition, she used to get up at night and study until dawn. Since she did not have better idea about the books in the begining, she had to learn fundamentals from some mediocre books that too, were full of gaps and imperfections. However, gradually she understood the language of analysis and during the period 1793-94, she studied differential calculus. In 1794, Ecole Polytechnique was opened but Sophie could not get admission there because it was not meant for women. However, she was able to obtain the lecture notes of some of the professors. While reading these notes, she was attracted to the new analysis of Lagrange. She took up the opportunity provided to the students of giving their written comments to the professor at the end of a course and submitted her comments on it to Lagrange under a false name M. LeBlanc. Her comments were praised by Lagrange and when he came to know about the reality, he commended her. In 1804, she entered into correspondence with Gauss by sending him some of the results of her investigations pertaining to number theory again under the false name of M. LeBlanc. Gauss became impressed by the sagacity of many of her observations and when he came to know the reality about the name, he too did not hesitate to compliment her.

From number theory her attention was diverted to the subject of elastics when a prize was offered by Institute de France for the discovery of the underlying mathematical laws for viberations of elastic membranes. She presented three memoirs on the theoretical explanation of the above phenomenon in 1811, 1813 and 1815 respectively. On the last one she was awarded the prize. Several of her theorems were included by Legendre in the supplement to the second edition of his *Theory of Numbers*.

In addition to mathematics, Sophie also studied chemistry, physics, geography, history and philosophy with equal interest. Although Sophie Germain and Gauss never met, she was so highly esteemed by him that he recommended her name for an honorary degree from the University of Gottingen. But the degree could not be awarded to her due to her unfortunate death on June 26, 1831 in Paris from tuberculosis.

*Contributions* : It is believed that she had written alteast three monographs on elastic surfaces. They are : (1) "Recherches sur la Theorie des Surfaces elastiques" (1824) "Ramarques sur la nature, les bornes et l'etendude la question des surfaces" (1826) and (3) "Memoire sur l' epaisseur dans la Theorie des Surfaces Elastiques" (1824). Her interest in theory of numbers is evident from the fact that Legendre, on Page 17 of his mongraphs "Sur le Theoreme de Fermat", mentions with high praise the proof given by her of the theorem that Fermat's equation

$x^n+y^n=z^n$ is not soluble for x, y, z; n not divisible by an odd prime where $n < 100$ She wrote an article "Sur la courbure des Surfaces" which was printed in Crelle Vol. 7 in 1831 after her death. In it, she had discussed mean curvature which she defines as the sum of the reciprocals of the radii of principal curvatures. She has also made a reference to Gauss in this article. From lhis article, it also appears that she was familiar with the work of Meunier.

### 5. Sonya Kovalevsky

Like Sophie Germain, about whom we have discussed above, there was one more ancient female mathematician who had started with her original work instead of translating some of the works of others. Her name was Sonya Kovalevsky. Nearly everything connected with her was unusual. There are a number of ways in which her name is spelled. Also there is some doubt about the exact year of her birth. But it is said that she was born on January 15, 1850 in Moscow. She was a Russain by birth but a West European in her advanced mathematical training and profession. She received her early education at Polibino. There are two factors that inspired her to the study of mathematics. The first was her uncle Pyotr who had studied the subjcct on his own and the second was a curious "wallpaper" that was used to cover one of the children's rooms at Polibino. In fact, they were the lecture notes on differential and integral calculus that had been purchased by her father during his student life. These sheets fascinated her and she used to spend hours in trying to decipher separate phrases and also find the correct ordering of the pages.

In the autumn of 1967, Sonya went to St. Petersburg where she studied calculus with Alexander Strannolyubsky who was a mathematics teacher at the naval school. There she also consulted a prominent Russian mathematician Chebyshev regarding her mathematical studied. But in those days women were not allowed to study in Russian Universities, therefore, there was no possibility that she could pursue her studied in Russia. The only way to pursue her higher education was to study at a foreign university. But that too was difficult for her due to her parental opposition. To overcome this difficulty she got herself married in September 1868 to a person of her own choice named Vladimir Kovalevsky who had progressive views on such matters. She stayed in St. Petersburg for sometime with her husband and then the couple went to Heidelberg where she continued her study of mathematics. During the stay at Heidelberg, she attended lectures of a number of mathematicians and physisicts including Konigsberger who was an old student of Karl Weiestrass of the University of Berlin. Having gained enthusiasm from Kenigsberger she wished to attend the lectures of Weierstrass and therefore she went to Berlin in 1870.But there she found that being a women she would not be able to get the admission in the University. She then directly approached Weierstrass who some how agreed to give her private lesson.

She studied with him for four years and not only covered the University course of mathematics but also wrote three important works which are being mentioned in the next paragraph. In 1874, she was awarded a Ph.D. degree from the Gottingen University, in absentia and because of the remarkable excellence of the papers submitted by her she was even exempted from oral examination. In 1883, she was appointed as Privat Docent to lecture at the newly opened Stockholm University in Sweden. After some time she was promoted to the rank of University professor and she held that post until her death. She died of influenza on February 10, 1891.

*Contributions* : Her doctorate dissertation "Zur Theorie der partiellen differentialgleichungen" was published in Crelle, Vol. 80. In it, she has dealt with a very general system of equations of the first order in any number of variables. In it, she has also extended the analogous structure (given by Weierstrass) from total equations to partial equations. One of her articles entitled "Ueber die Reduction einer bestimmten Klasse Abelscher Integrale 3ten Ranges" was printed in Vol IV of the "Acta Mathematica." Her work "Zusatz und Bemerkungen Zu Laplace's Untersucnungen" is found in "Astronomische Nachrichten 2643 of 1885 in which she has highlighted some improvised work done by Weierstrass over Laplace· Her "Sur une propriete d'un systeme d'equations" was printed in "Acta Mathematica" of 1890 based on an earlier studies of hers and a short article entitled "Sur La Theorie de M. Bruns" in Acta Mathematica of 1891. Her most famous work entitled "Sur un cas particulier du probleme de la rotation d'un corps autour d'un point fixe" was published in *Memoires presentes a l' Academie des Sciences* (*Memoires ertrangers*) Vol. 31 of 1884. For this article she was awarded the "*Prix Bordin*" by the French Academie in 1888. It is interesting to note that this paper was rated of so much merit the amount of the prize was raised from 3,000 francs to 5,000 francs. Besides mathematics, she wrote on other fields also. After her work on the problem of rotation she wrote *The Rayevsky Sisters*, which was in fact a sketch of her own youth, was published in 1889 and was highly appreciated by literacy critics. Encouraged with this success, she continued to write but her works remain unfinished because of her premature death.

**6. Amalie Emmy Noether**

Amalie Emmy Noether was born on 23rd March, 1882 in the small South German University town of Erlangen. Her father Max Noether was himself a great mathematician and was a professor of mathematics at the University of Erlangen. At the same place, she grew up in a cordeal atmosphere of stability, spiritual Values and love for learning. Besides her, in the same atmosphere grew up her brother Fritz who was two and a half years younger to her and he later became a Professor of applied mathematics. When Emmy was a young girl, she took part in the household work and also learned dancing. It is said that her life would have been that of a typical women had it not so happened that just during her time it became possible in

Germany for a girl to pursue a Scientific career without meeting any too much marked resistance. The two persons who had influenced her early life were her father and the mathematician, Paul Gordon who, too, was associated with the University of Erlangen and was a close friend of her father. Her father was strong on structure while Gordon was an "algorithmiker." Under Gordon's guidance in 1907, Emmy wrote thesis for her doctorate entitled "On complete Systems of Invariants for Ternary Biquadratic Forms." It is entirely in line with the Gordon thinking and as an extreme example of formal computations, it contrasts sharply with works of her maturity, which are extreme examples of conceptual axiomatic thinking in mathematics. After the retirement of Gordon in 1910, his place was first filled by Erhard Schmidt and next year by Ernst Fischer whose field was also algebra and, in particular, the theory of elimination and of invariants. Fischer exerted a more penetrating influence on Emmy and under his guidance the transtition from Gordon's formal standpoint to the Hilbert method of approach was accomplished. In about 1913, she lectured occasionally at Erlangen in place of her father during his illness. During the war in 1916, she went to Gottingen and due to the direct influence of Hilbert and Klein, she stayed there. She was welcomed by both of them because she was able to help them with her invariant theoretical knowledge. Still during the war, Hilbert tried his best for her "Habilitation" (admission as an academic lecturer formally) in the Philosophical Faculty at Gottingen but he could not succeed in his efforts due to the opposition of some of the faculty members. It is said that Hilbert supported her application at the faculty meeting by saying, "*I do not see that the sex of the candidate is an argument against her admission on as Privatdozent. After all, we are a Uinversity and not a bathing establishment.*" However, she was able to give lectures but they were announced under the name of Hilbert. After the end of the war and the proclamation of the German Republic in 1919, her "Habilitation" became possible. In 1922, she was named as a "nichtbeamteter ausseror-dentlicher Professor" but this was simply a title and she was not paid anything for it. However, she was interested with a "Lehrauftrag" for algebra which did carry some remuneration. She worked in this position at Gottingen until 1933. During the later part of this period, she worked in the new Mathematical Institute that had come up in Gottingen mainly by Courant's energy and the financial help of the Rockefeller Foundation.

One of her chief methods of research was to introduce her ideas in a still unfinished state during her lectures and then discuss them with her students. In general certainly her lectures were not good from the technical point of view because she was too erratic and cared very little for a well arranged form. However, it can be said that she was an inspiring teacher and those who were capable of adjusting themselves to her style could learn much from her. Besides professional affairs, she also took interest in the personal affairs of her students. In Gottingen they were called "the Noether boys." Considering both the fertility of her research programme and her influence upon large number of students it can be said, without any doubt, that

she was the strongest centre of mathematical activity at Gottingen during the period 1930-33.

In the spring of 1933, when Germany was in the grips of a National Revolution, she along with many others was prohibited from taking part in any type of academic activity and finally her "Lehnauftrag" and the salary giving with it were also withdrawn. These circumstances brought her to Bryn Mawr college, and as a guest professor at the Institute for Advanced study, Princeton in America. She died on 14th April, 1935. In May 1935, in his tribute to Emmy Noether, Albert Einstein wrote the following lines :

"In the judgment of the most competent living mathematicians, Fraulein Noether was the most significant creative mathematical genius thus far produced since the higher education of women began. In the realm of algebra in which the most gifted mathematicians have been busy for centuries, she discovered methods which have proved of enormous importance in the development of the present day younger generation of mathematicians."

*Contributions* : As we have already remarked that Emmy's first paper namely her doctorate thesis is entirely written in line with the Gordon thinking. As an extreme example of formal computations and it contrasts sharply with works of her maturity which are extreme examples of conceptual axiomatic thinking in mathematics. The first paper giving indication of her conceptual way of thinking in algebra appeared in 1920 (she was then thirty eight) and was written in collaboration with Schmeidler and deals with differential operators. In 1920, she also published a brief report on the arithmatical theory of algebraic functions that parallels the corresponding notions in the competing theories in the Jahresberichte der Deutschen Mathematikervereinigung. By its publication she has supplemented the wellknown report by Brill and her father on the algebraic-geomatric theory that had appeared in one of starting volumes of the "Jahresberichte" in 1894. Noether's residual theorem was later fitted by Emmy into her general theory of ideals in arbitrary rings. In 1916, she gave the genuine and universal mathematical formulation for two of the most significant sides of the relativity theory. First, the reduction of the problem of differential invariants to a purely algebraic problem by using "normal coordinates" and second, the identities between the left sides of Euler's equation of a problem of variation which occur when the (multiple) integral is invariant with respect to group of transformations involving arbitrary functions. During the period 1920-26, her researches were grouped around the general theory of ideals and on an axiomatic basis that comprised all cases. Her main axiom is the Teiler-Kettensatz : the hypothesis that a chain of ideals $a_1, a_2, a_3 \ldots$ necessarily comes to an end after a finite number of steps if each term $a_i$ contains the preceding $a_{i-1}$ as a proper part. She also showed how one can descend in the same axiomatic manner to the polynomial ideals on the one hand, and to the classical case of ideals in algebraic number fields on the other hand. From the year 1927 onward, she centred her atten-

tion on the non-commutative algebras their representations by linear transformations, and their application to the study of commutative number fields and their arithmetics. This theory was built up in a new unified and purely conceptual manner by making use of all results that were obtained by Molien, Frobenius, Dickson, Wedderburn and others. In active cooperation with Hasse and Brauer, she investigated the structure of non-commutative algebras and applied the theory by means of her verschranktes Produkt (cross product) to study the ordinary commutative number fields and their arithmetics. "Hyperkomplexe Grossen and Darstellungs-theorie" (1929), "Nicht-Kommutative Algebra" (1933) and three smaller papers on norm rests and the principal genus theorem were the most important papers of that period.

In fact, she had a great stimulating power and thus a number of her suggestions took the final form only in the works of her students and co-workers. For example, a large part of the second volume of van der Waerden's "Modern Algebra" must be considered as Emmy's property. The same is true for some parts of Deuring's book on algebras in which she collaborated intensively. Even Hasse had also acknowledged that he owed the suggestions for his papers on the connection between hypercomplex quantities and the theory of class fields to casual remarks by Emmy Noether. Her theory of cross products was published by Hasse for the purpose of his researches regarding the theory of cyclic algebreas. A paper jointly written by Brauer, Hasse and Emmy Noether, in which they have proved the fact that every simple algebra over an ordinary algebraic number field is cyclic in the Dickson's sense, is considered of high mark in the history of algebra. In addition to the above, she was an ardent collaborator in the editing of the Mathematische Annalen, although this work of hers was never explicitly recognized. She also took an active part in the editing of Dedekind's works.

### 7. Emilie, Marquise Du Chatelet

The Marquise du chatelet was born on 17th December, 1706. Her father was a rich and powerful civil servant, and one of the effective rulers of France. He trained his daughter in many languages, and also in mathematics which later became her major interest. At the age of 19 she was married to Marquis du chatelet an amiable regimental colonel whose only interest was in the army. Marquise du chatelet's interest and talent for mathematics were remarkable. Her closest mathematical friends were Koenig, John Bernoulli, Maupertuis and especially Clairaut. She learned English from voltaire in order to master the works of Newton and subsequently, with the same teacher, read the works of Tasso and Ariosto in Italian.

*Contributions* : Marquise du chatelet's edition of Newton was published in 1759 with an enlogistic preface by Voltaire. This book perhaps remain the only French translation of the Principia Mathematica. Madama du chatelet also wrote an article on fire for a prize offered by the Academy of Science. This article did not receive the prize, but was printed at the Academy's expense.

**8. Ada Augusta, Countess of Lovelace**

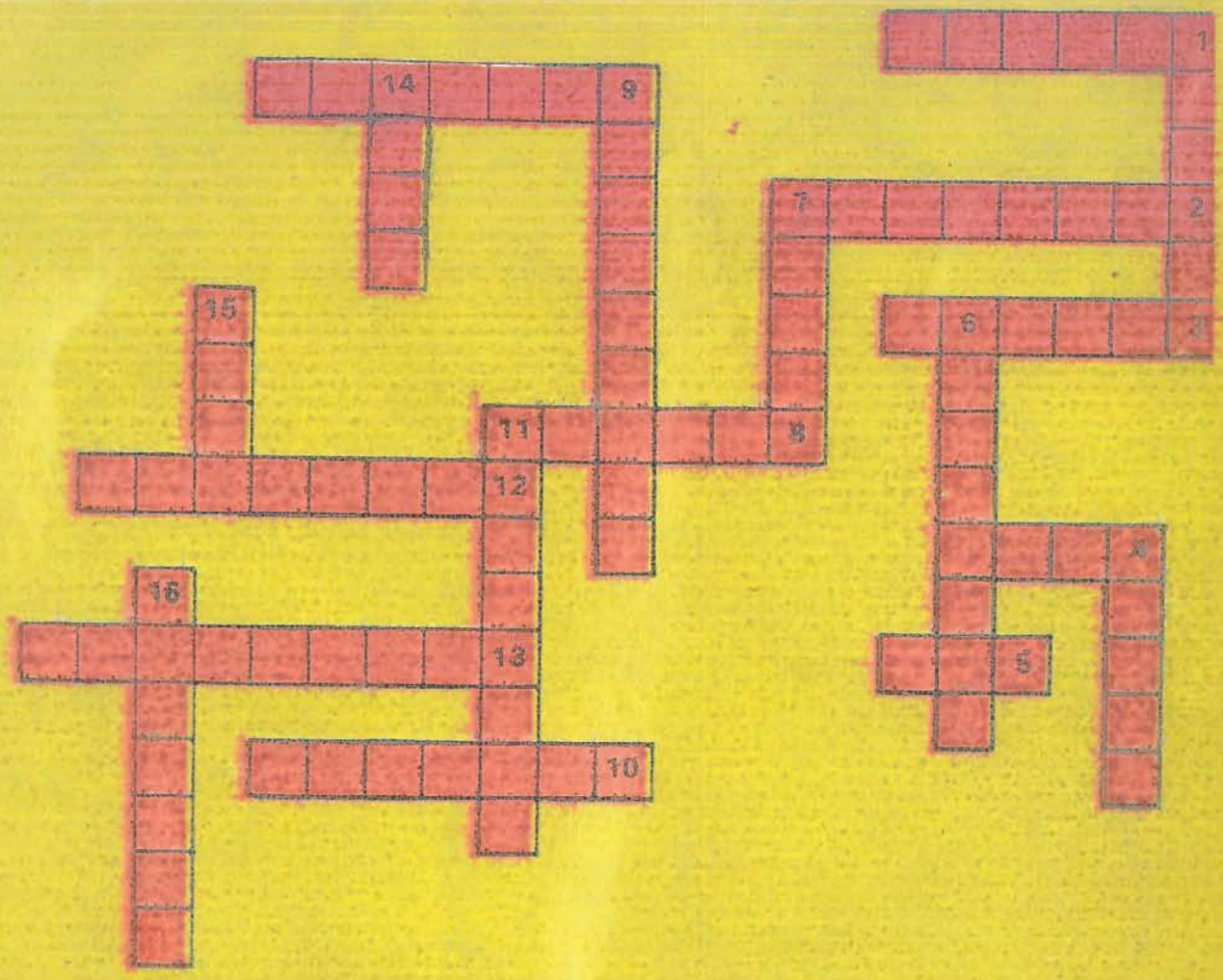
Ada Augusta, the only legitimate child of Lord Byron, was born on 10th December, 1815. Her mother, Lady Byron, had great liking for mathematics and was one of the favourite pupils of William Frend who taught her astronomy, algebra, latin and geometry. Ada Byron was educated by the best tutors available at that time. She, like her mother, studied mathematics with great interest and was mainly helped by Augustus De Morgan, the first Professor of Mathematics at University College, London. Ada had an ambition to become a famous scientist which was very unusual for women at that time. Ada was not keeping good health and at the age of 14 her legs became paralysed. She used crutches and then a walking stick for some years. Later, she became an ardent rider of horses. At the age of 19 Ada married the William, Lord King, who was then 30, and who was soon after created the 1st Earl of Lovelace. He was proud of his wife's intellect. Lady Lovelace pursued her study even after marriage.

Lady Lovelace had two sons and one daughter. At the age of 27 Ada's health deteriorated marked and was hardly benefited from medical treatment, she died apparently of cancer and in very great pain in 1852 at the age of 36.

Contributions : At the age of 18, Ada had understood the working of Mr. Babbage's analytical engine which an ordinary man or woman could not understand. She translated L.F. Menabrea's sketch of the Analytical Engine (in French) invented by Charles Babbage Esq. It is the copious annotations, signed A.A.L., which shows her to have fully understood the principles of a programmed computer a century before its time. On the advice of Mr. Babbage she added some original notes to Menabrea's memoir. These notes extended to about three times the length of the original memoir. She entered fully into almost all the very difficult and abstract questions connected with the subject.

During the discussions on various illustrations that might be introduced in memoir, Mr. Babbage once offered algebraic working out of the problem of numbers of Bernouilli to save Ada's trouble. But Ada sent back this problem for an amendment having detected a grave mistake which Mr. Babbage had made in the process. This shows her unusual power of grasping strong points and apptitude for mathematics. Had she been keeping good health perhaps Ada would have been original mathematical investigator of first rate eminence.

Ada's memoir was reprinted in a book about Babbage's engine in 1889 and thereafter both Babbage and Ada were forgotten almost completely untill computers were reinvented during World War II. Dr. B.V. Bowden, an english pioneer in computing, rediscovered Ada's paper which had originally appeared in Taylor Scientific Memoirs 1843 and reprinted in Dover Book. This publication resulted in her present reknown as the patron Saint of computer programming.

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एन सी ई आर टी
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