CHAPTER V

MATHEMATICS TEXT-BOOKS
A textbook is sometimes termed as the teacher in print, nevertheless it can, by no means, replace the teacher. It is rather to be used to aid and supplement his work. According to the Encyclopedia Americana, in the strict sense of the term, "Text-book is a book that represents a body of knowledge in an organised and usually simplified manner for the purpose of learning."¹ The textbook is frequently the most important teaching tool because it can determine not only what will be taught but also how it will be taught. Although television and other media are rivalling printed materials of communication, textbook continues to be the major resource in schools and colleges.

"Most students in high school and in the first two years of college are unable to take lecture notes on mathematics successfully, and unless the lecture or discussion follows the textbook fairly closely, they will be lost. On the other hand, of course, you should be careful not to give the impression that the book is the final authority and that the only way to do mathematics is to consult a textbook. Certainly the students should be convinced that an elementary textbook is merely a convenient reference work and that, generally, the logical demonstrations given there are not original with the author."²

Textbooks are essential both for teachers and students because new knowledge gets reflected in them as they get revised, re-edited or rewritten.
Professor Bryan Thwaites, speaking at the Southampton conference on Mathematic Education, highlighted the shortcomings of the 'progressive' British Education and remarked:

"There is an urgent need for textbooks which present the subject from a modern point of view, and no member of the Conference was able to name a single British school textbook which does so. Such books must be written as soon as possible."

On the present standard of production of textbooks in India, the Secondary Education Commission had commented:

"The bulk of the evidence that was tendered, particularly by teachers in Schools and Colleges, indicated that there was a great deterioration in the standard of textbooks at present prescribed to the students. It was pointed out by some that the change-over to the regional language as the medium of instruction in the different States had led to an aggravation to the problem ...... with the change-over to the regional language as the medium of instruction, there was no longer a possibility of books being published on all India basis and authors were limited to the regions concerned..... Textbooks could seldom be written by the best qualified and most competent teachers because of their ignorance and insufficient knowledge of the regional language.

The question, therefore, of producing proper textbooks for schools is one which should receive the earnest attention of both the state and Central Governments".
The Commission had further opined that:

"We are greatly dissatisfied with the present standard of production of school books and consider it essential that this should be radically improved. Most of the books submitted and prescribed are poor specimens in every way - the paper is usually bad, the printing is unsatisfactory, the illustrations are poor, and, there are, numerous printing mistakes. If such books are placed in the hands of students, it is idle to expect that they would acquire any love for books or feel interest in them or experience the joy that comes from handling an attractively produced publication."5

In the context of textbooks the Education Commission (1964-66) had stated:

"Basic to success of any attempt at curriculum improvement is the preparation of suitable textbooks, teachers' guides and other teaching and learning materials. These define the goals and the content of the new programmes in terms meaningful to the school, and as actual tools used by the teacher and the pupil, they lend substance and significance to the proposed changes."6

The Commission had also pointed out that:

"A good textbook, written by a qualified and competent specialist in the subject, and produced with due regard to quality of printing, illustrations and general get-up, stimulates the pupil's interest and helps the teacher considerably in his work. The provision of quality-
textbooks, and other teaching and learning materials, can thus be an effective programme for raising standards. The need to emphasise it is all the greater because it requires only a relatively small investment of resources. Moreover, a quality book need not cost appreciably more than the one that is indifferently produced."

With regard to quality of textbooks the Education Commission had opined:

"Unfortunately, textbook writing and production have not received the attention they deserve. In most school subjects, there is a proliferation of low quality, sub-standard and badly produced books, particularly in the regional languages. This has been due to a number of factors among which mention may be made of

- the lack of interest shown by top-ranking scholars so that the writing of textbooks has been generally undertaken by persons whose abilities are far from equal to the task;

- the malpractices in the selection and prescription of textbooks which defy control;

- the unscrupulous tactics adopted by several publishers;

- lack of research in the preparation and production of textbooks; and

- the almost total disregard by private publishers (who are interested only in profits) of the need to bring out ancillary books, such as teachers' guides to accompany textbooks."
At present textbooks-production is nationalised.

State Governments have taken the responsibility of textbook production. Upto the secondary stage, all the textbooks are produced by the State Governments. After the nationalisation of textbooks, improvements in different directions have been marked. Prices have been kept low, and the quality of books have been improved to some extent. But the general level of the standard of textbooks still remains poor. In the nationalised textbooks, some of the reasons for production of low quality books have been identified by the Commission:

"The main reasons for this failure is that the Education Departments which have taken over the responsibility of textbook production have not adequately organized themselves for it. It is this weakness that is largely responsible for the shortcomings one often sees in the State produced textbooks, viz., failure to revise books for long periods, misprints, poor production, failure to supply books in time, etc."9

Prof. D. K. Sinha had emphasised the use of textbooks. In his words,

"We must have something to intervene between the class and the teachers and it is thus, we find the necessity of textbook."10
TEXTBOOKS OF MATHEMATICS

In the teaching-learning process of mathematics, the textbook has a vital role to play. It is the sheet anchor in the learning process; and is the ladder that facilitates in scaling the heights of success. It is at once the resource and the regulatory mechanism for the teachers and the pupils. The textbook aids and supplements the teachers' effort to develop the thinking and reasoning powers by creating challenging situations for the students. It is evidently the most important tool. A good textbook of mathematics must conform to the aims and objectives of the subject.

"A good textbook furnishes a large collection of well-selected and graded exercises in teaching of mathematics. After the pupils have learnt a certain new rule or principle, the pages of the textbook may be referred to for application of the rule and homework."\[11

The writers of textbooks should be able to produce textbooks based on actual class-room experience in mathematics and closely conforming to the syllabus.

Prof. D.K. Sinha states,

"The purpose of a textbook is to present material to be acquired under the direct guidance of the teacher and the acquisition on the part of the students
has to be gradually automatic so that gifted students need a minimum help and that the teacher can direct his attention to the less fitted noes. Further, the class must have textbook for out of school practice, reading, oral exercises, written work and home work.\textsuperscript{12}

In India, more specifically in Orissa, the teaching seems to be according to the syllabus and textbooks. In this context Sinha opined that:

"On the otherhand, a textbook can do something which a teacher cannot do. It is the textbook alone that can put the topics in proper sequence, limit the number of topics, etc. according to the curriculum guide, that might often be overlooked in framing the oral drills.\textsuperscript{13}

The textbooks of mathematics serve two significant purposes. The teachers get outlines of lessons, examples, exercises, motivation although the textbooks are written for the pupils. There is a conscious effort to graduate the gradients of conceptual difficulty in the textbooks by the writers who are themselves practitioners of the craft.

The International Commission on Mathematical Instruction, in its Report, expressed the view that,

"A general desire can be noted on the part of textbook authors to appeal more directly to pupils; the presentation is more-attractive; the contents are
varied; the partition into lessons and exercises is often considered questionable; one finds open situations covering all kinds of areas supported by photographs, drawings, sketches, graphs, etc. A pupil can organise his work better than before by following his work." 14

The mathematics textbooks should be attractive to the pupils as well as to the teachers with coloured photographs, drawings, sketches and graphs. These not only motivate but also help in understanding; and in clarifying the concepts and ideas. In the Unesco Source Book, "Teaching School Mathematics", edited by W. Jervais and T. Varga, the qualities of a good textbook have been described in these words:

"School mathematics books are becoming more attractive, in contrast with the forbidding aspects of the traditional textbooks. Figures and diagrams are enlivened by the use of two or more colours. The style, instead of being general and impersonal, adopts a more familiar and individualised tone, bringing it closer to the language of everyday conversation. Illustrations often include humorous drawings which put the reader in a good mood and show that, although mathematics is a serious science, this is no reason for presenting it glumly. Documentation about the pioneers of mathematics brings home the point that mathematics was created by men.

Textbooks are more stimulating and richer in ideas. Dynamic relations are indicated by numerous graphs and diagrams. Definitions and proofs can
be presented clearly and concisely, thanks to comprehensive modern symbolism. Photographs illustrate the part played by mathematics in the arts, sciences and industry."

At present mathematics textbooks in the advanced countries of the world are written with much care for better understanding of the pupils. The Unesco Source Book described that,

"Textbooks are written with greater rigour than they used to be. Even those written for beginners endeavour to bring out the rules of the mathematical game: axioms. Definitions have become more precise with the acquisition of the basic notions of sets. Proofs are stricter and reduced more nearly to essentials. Stripped of inessentials, they often have a more widespread validity than formerly. The elementary symbolism now used can convey clearer ideas."16

Therefore, the textbooks form the most important component of the teaching material. But to Krygowska, the textbooks are meant for the classroom teachers than for the pupils. According to him,

"But the textbooks available are not very often written for the pupil, from this point of view. They are aimed rather at the teacher, inspite of appearances. Moreover, we have still no clear awareness of the working of mathematics textbooks and of the criteria for their assessment."17
The author has attempted to collect opinions of teachers on various aspects of the textbooks meant for classes VIII, IX and X on compulsory mathematics prescribed by the Board of Secondary Education, Orissa. It was found that the teachers greatly differed in their opinions on each item of the questionnaire. There was no general agreement on most of the issues. However, their opinions have been presented in tabular forms, wherever necessary.

**Study Findings:**

The Board of Secondary Education, Orissa has prescribed six textbooks in total for the classes VIII to X for compulsory mathematics. In each class two textbooks are to be followed by the teachers and students. The names of the books for the different classes have been indicated in Table 5.1.

<table>
<thead>
<tr>
<th>Class</th>
<th>Name of the books</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIII</td>
<td>ALGEBRA AND APPLICATION</td>
<td>246</td>
</tr>
<tr>
<td></td>
<td>GEOMETRY AND APPLICATION</td>
<td>170</td>
</tr>
<tr>
<td>IX</td>
<td>ALGEBRA AND APPLICATION</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>GEOMETRY AND APPLICATION</td>
<td>172</td>
</tr>
</tbody>
</table>
Objectives of Writing Textbooks:

Besides the objectives of teaching mathematics, four questions were addressed to the teachers of mathematics on the objectives of writing mathematics textbooks. Their responses have been presented in Table 5.2.

TABLE 5.2
OBJECTIVES OF WRITING TEXTBOOKS

<table>
<thead>
<tr>
<th>No.</th>
<th>Objectives</th>
<th>Opinions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>1.</td>
<td>Are the objectives of writing the books in mathematics stated in the preface?</td>
<td>68</td>
</tr>
<tr>
<td>2.</td>
<td>Does the treatment of the subject in the book help the achievement of the objectives stated in the preface?</td>
<td>30</td>
</tr>
<tr>
<td>3.</td>
<td>Are the objectives specified in the syllabus achieved in the achievement of the objectives stated in the preface?</td>
<td>143</td>
</tr>
</tbody>
</table>
4. Does the development of topics in the book help in achieving the objectives of teaching mathematics?

(Vide Question No. 1, 2, 3 and 4 of 'Objective of Teaching' section of the Teachers' Questionnaire.)

Table 5.2 reveals that out of 220 mathematics teachers, 68 i.e. 30.90% teachers were of the opinion that the objectives of writing the mathematics textbooks were stated in the preface. But 152 teachers i.e. 69.09% teachers denied the statement. The author accepted the views of the majority of the teachers. He had gone through the prefaces of all the six books meant for classes VIII, IX and X in mathematics. The objectives of writing the textbooks were not at all mentioned in the prefaces except a few words on the publication of the textbooks by the Secretary, Board of Secondary Education, Orissa. Of course, in a separate page, some symbols and their explanations were given. The teachers who had gone in favour of the opinion might have misunderstood the symbols and their explanations as the objectives of writing the textbooks. It was evident that they did not have clear conception on the objectives of writing textbooks.
In response to Question No. 2 in the Table 5.2 on a three-point scale, 30 teachers had opined that the treatment of the subject in the book helped the achievement of the objectives stated in the preface whereas 74 teachers opined negatively and 106 teachers stated that it was to some extent. The teachers who were in favour of the statement and opined 'to some extent' were ignorant of the objectives of writing textbooks. When the objectives had not clearly been mentioned in the prefaces of the textbooks, there was no possibility of the achievement of the objectives in the treatment of topics in the books.

Two types of opinions were elicited from the responses of the mathematics teachers to question No. 3 of the Table 5.2. 143 teachers i.e. 65% of teachers agreed that the objectives specified in the syllabus were achieved in the treatment of the subjects in the books. But 77 teachers i.e. 35% teachers did not agree to the statement. The author alongwith the subject experts and some outstanding teachers of mathematics analysed the statement. It was the unanimous opinion that the objectives stated in the syllabus were exhaustive, no doubt, but were simply jotted down from various sources. Due care was not taken to treat the subjects in the textbooks in conformity with the objectives. However, majority of the objectives had been embodied in the course of treating the subjects.
The item No.4 of the Table 5.2 was related to the teaching of mathematics. Teaching of mathematics had definite objectives which were dealt with in a separate chapter. The topics included in the textbooks should help to achieve the objectives of teaching mathematics. While responding to the item, 72 teachers fully agreed that the development of the topics helped in achieving the objectives of teaching mathematics. In contrast to their opinion, 33 teachers completely disagreed, and 115 teachers were of the opinion that the objectives were realised to some extent.

The author accepted the views of the 115 teachers. However, the objectives of teaching as per Bloom's Taxonomy were not fully achieved through the development of the topics in the book. This was due to the ignorance of taxonomy on the part of most of the teachers; and their consequent inability to translate the taxonomic scheme into operational reality.

Get-up of the books:

The get-up of the textbooks of mathematics for the students reading in secondary schools of Orissa should be attractive so as to stimulate the pupils' interest in reading the books.

47.27 % of mathematics teachers appreciated the get-up of the textbooks of mathematics prescribed by the Board of Secondary Education, Orissa. But 52.72 % teachers did not appreciate the get-up. The views of the students on the topic have been summarised in Table 5.3.
TABLE 5.3

VIEWS OF STUDENTS ON THE GET-UP OF THE BOOKS

<table>
<thead>
<tr>
<th>Get-up of the books</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>432</td>
<td>77.7</td>
</tr>
<tr>
<td>Average</td>
<td>77</td>
<td>13.8</td>
</tr>
<tr>
<td>Not satisfactory</td>
<td>47</td>
<td>8.4</td>
</tr>
</tbody>
</table>

N = 556

(Vide Question No. 39 of the Students' Questionnaire)

The opinions of the teachers as well as the students were in contrast to each other. The teachers differed in their opinions in deciding the quality of the get-up of the textbooks of mathematics. Since the students of Orissa had no opportunity to see the textbooks of other countries and even the textbooks of other states of India, they considered their books better than any other so far they have used in the earlier stages of their education. The majority of the teachers disliked the get-up of the books; and some students agreed with them.

As a matter of fact, the get-up of the books in mathematics is not attractive. Care should be taken by the Board of Secondary Education, Orissa to produce textbooks whose get-up would invite the appreciation of both the teachers and the students,
Quality of Paper of the Cover Pages

The quality of the cover pages should be strong and durable enough for frequent use. 62.27% teachers of Orissa liked the quality of its cover page; and 37.72% teachers disliked it.

On this point, opinions of the reputed book-publishers were sought. They opined that the cover pages were neither strong, durable nor attractive. Therefore, the majority of the teachers might have responded carelessly or had limited knowledge relating to book-production.

Quality of Paper used in the Books:

Besides the cover pages, the paper used for printing of the mathematics textbooks, should be strong, durable and smooth for daily use. The students as well as the teachers ought to appreciate and love a textbook and feel interested to read it, if produced properly. They experience joy in handling a well designed textbook.

70.9% of the respondents were of the opinion that the quality of paper used in the mathematics textbooks was good but 29.09% of them disliked the quality of paper.

On discussion with the producers of books and specialists of the trade, it transpired that the quality of paper was not up to the standard. Therefore, the majority
of teachers, as indicated earlier, were ignorant of the quality of paper to be used in the textbooks.

**Printings**

The printing should be clearly visible, neat and clean, and attractive. Sometimes, in printing, the impression of letters on the pages of the books get partly omitted. Such a situation engenders confusion among the students and the teachers. All the teachers did not appreciate the quality of printing of the textbooks of mathematics.

The researcher agreed with the teachers in connection with the quality of printing of the mathematics textbooks. He consulted specialists in printing technology. They were of the view that the printing of textbooks was on the outdated and manual block system. The blocks were preserved for years together and books were printed with the old blocks whenever the need for the books was felt. The researcher elicited the views of the authorities of the printing section of the Board, and the views and opinions were corroborated. All of them advocated the use of the off-set printing system to enhance the attractiveness and ensure accuracy.

**Letters used for Printing:**

Size of the letters used in printing the textbooks plays significant role in attractive printing. Letters of
12-point pica were used in printing the mathematics textbooks which was the traditional approach.

70.45% of the mathematics teachers appreciated the type of letters used in printing and the rest of them disagreed with the statement.

The size of the letters used for printing mathematics textbooks was of standard size but due to repeated use of the blocks of printing in subsequent years, the impressions were not very clear and adversely affected the quality of the textbook.

**Table 5.4**

RESPONSES OF STUDENTS REGARDING THE TYPE OF LETTERS USED IN PRINTING.

<table>
<thead>
<tr>
<th>Type of Letters</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Printed in good letters and easy to read.</td>
<td>307</td>
</tr>
<tr>
<td>ii. Letters of printing are not so good.</td>
<td>167</td>
</tr>
<tr>
<td>iii. Difficult to read due to bad letters.</td>
<td>84</td>
</tr>
</tbody>
</table>

(Vide Question No.40 of the Students' Questionnaire)

From the Table 5.4 it was evident that 55.21% of students of Orissa opined that the letters used were good, but as many as 44.78% of them considered them bad.

The 12-point pica letter-size was considered appropriate for the secondary school stage. However, the outdated printing technology was largely responsible for defective and blurred impressions. Textbooks are produced in millions, and no steps are taken to weed out the substandard products. The hapless
students, falling a victim to the defective copy of the textbook, strikes his head in despair and despondency. Most of the students hail from lower strata of the society and they can ill afford to purchase an additional copy. Greater care in printing and production can obviate these defects.

**Printing mistakes and Errors:**

Textbooks of mathematics must be free from printing mistakes, otherwise it would create confusion in the minds of the teachers as well as that of the students.

All the teachers opined that there were printing mistakes in all the textbooks of mathematics prescribed for the students of the secondary school stage of Orissa.

The textbooks of mathematics for the secondary schools of Orissa were not free from errors. The responding teachers pointed out a large number of errors that had crept into the textbooks prescribed for all the three classes VIII, IX and X. Table 5.5 provides a detailed picture of the errors class-wise.

The mathematical problems with mistakes confuse both the teachers and the students. Sometimes, the teachers face delicate situations in solving erroneous problems. Students, at times, lose faith in the ability and integrity of the teachers. The errors mislead the teachers and erode their credibility.

All possible precautions should be taken to eliminate all human and technological errors.
### Table 5.5

**Errors in Mathematics Textbooks.**

<table>
<thead>
<tr>
<th>Class</th>
<th>Topics</th>
<th>Page</th>
<th>Example/Question No.</th>
<th>Errors</th>
<th>Corrections</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIII</td>
<td>Algebra and its Application.</td>
<td>89</td>
<td>Example 2</td>
<td>Find out the quotient -&lt;br&gt;1) (x^2 - 15x + 54 + x - 6)</td>
<td>(x^2 - 15x + 54) (\div) (x - 6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No. 9</td>
<td>Find out the factors -&lt;br&gt;1) (x^2 + (4 + 1)x + 4 \times 1)</td>
<td>(x^2 + (4 + 1)x + 4 \times 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No. 10</td>
<td>Find out the factors -&lt;br&gt;1) (x^2 + (8 + (-2)) + (8) (-2))</td>
<td>(x^2 + 8 + (-2)) (\times) ((8) (-2))</td>
</tr>
<tr>
<td></td>
<td>Simple factorisation and Identity.</td>
<td>149</td>
<td>No. (1)</td>
<td>(a^2 - b^2 = (a - b) (a + b))</td>
<td>(a^2 - b^2 = (a - b) (a + b))</td>
</tr>
<tr>
<td>IX</td>
<td>Algebra and its Application.</td>
<td>17</td>
<td>No. (XI)</td>
<td>Find out the L.C.M. of (x^2 - 3xy - 10) and (x^2 - 6xy + 5)</td>
<td>(x^2 - 3xy - 10y^2) and (x^2 - 6xy + 5y^2)</td>
</tr>
<tr>
<td></td>
<td>Lowest Common Multiple.</td>
<td>22</td>
<td>No. 14</td>
<td>Reduce to the lowest form -&lt;br&gt;1) (3x^2 + 4x + 1)</td>
<td>(5x^2 + 4x + 1) (\div) (1 - 3x - 10x^2)</td>
</tr>
<tr>
<td></td>
<td>Fraction</td>
<td></td>
<td>Example 1</td>
<td>Express the fractions in the lowest common denominator.&lt;br&gt;2x + 3x = 2x (\times) 4x</td>
<td>(8x^2) (\times) 3y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No. 4</td>
<td>Simplify - (incorrect)&lt;br&gt;(a^2 + ab + b^2) (\div) (a^2 + ab + b^2)&lt;br&gt;(a^2 + b^2) (\div) (a^2 + ab + b^2)&lt;br&gt;(a^2 - b^2) (\div) (a^2 + ab + b^2)</td>
<td>(a^2 + ab + b^2) (\div) (a^2 + ab + b^2)&lt;br&gt;(a^2 + b^2) (\div) (a^2 + ab + b^2)&lt;br&gt;(a^2 - b^2) (\div) (a^2 + ab + b^2)</td>
</tr>
<tr>
<td>Topic</td>
<td>Page</td>
<td>No.</td>
<td>Question/Problem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------</td>
<td>-----</td>
<td>------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First degree equation with one unknown.</td>
<td>44</td>
<td>No. 19</td>
<td>Solve ( \frac{a}{bx} + \frac{b}{cx} = a^2 + b^2 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>49</td>
<td>No. 4</td>
<td>Solve ( \frac{2}{x-2} + \frac{5}{x-3} = \frac{3}{x-1} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problems involving a first degree equation</td>
<td>56</td>
<td>No. 24</td>
<td>What should be the catalogue price of a watch purchased for Rs. 300.00 so that the seller will get 8% profit even if 10% discount on catalogue price is given.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logarithms</td>
<td>116</td>
<td>No. 8</td>
<td>Express in a single term logarithm with base ( a ):</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>viii) ( \frac{1}{2} \log x^6 - \frac{1}{2} \log x^9 + \frac{1}{2} \log x^6 y^4 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>viiiii) ( \frac{1}{3} \log x^6 + \frac{1}{3} \log x^9 + \frac{1}{2} \log x^6 y^4 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factorisation</td>
<td>8</td>
<td>No. 16</td>
<td>Find out the factors -</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>No. 31</td>
<td>Fill up the gaps -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graph</td>
<td>68</td>
<td>Example-1</td>
<td>Solve with the help of graphs -</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- \( 2x - 2y = 1 \) ..........(1)  
- \( 3x + 4y = 0 \) ..........(2)
225

**Geometry and Its Application**

(A) 1 (B) 5 (C) 2 (D) -2

Correct answer is not given in the options. The correct answer is 25/8.
<table>
<thead>
<tr>
<th>IX</th>
<th>Geometry and its Applications</th>
<th>4th line</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>Area</td>
<td>No. 12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>Projection</td>
<td>No. 13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99</td>
<td>No. 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>No. 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>162</td>
<td>Construction</td>
<td>No. 6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A square and a rhombus situated on the same base and on the same side are equal in area. Prove that they will lie on same pair of parallel straight lines.

### 1. AB Prove that

\[ AC = 4BX \]

### 2. AC = \( 4BX \)

### 3. In an isosceles right-angled triangle \( ABC \) \( m\angle = 90^\circ \) and \( DX \perp AC \). Prove that

\[ AC^2 = 48X^2 \]

### 4. In an isosceles obtuse-angled triangle \( ABC \) \( m\angle > m\angle \). Prove that

\[ BC^2 = AB^2 \]

### 5. In a quadrilateral \( ABCD \)

\( m\angle AC \), \( m\angle AC \)

The data are excess \( (AB = 5 \text{ cms.}, \text{ or } CD = 5 \text{ cms. is sufficient}) \) or

\( AD = 5 \text{ cms.} \)

Construct the quadrilateral.
Whole surface area 84 cubic centimetre.

In a right, circular cylinder, height is three times the radius of the base. Its volume is 3432 cubic centimetre. Find out its whole surface area.

The whole surface area of a prism is \(84\sqrt{3}\) cubic centimetre, height is 5 cms. Base is an equilateral triangle. Find out the side of the base.

(Vide Question No.9 in the 'General Information on the Mathematics Books' section of the Teachers' Questionnaire)
Binding:

Binding of the textbooks should be perfect. It should not be loose so that pages of the books will be separated during frequent use by the students and the teachers as well.

69.09% of the respondents, while opining to question No.7 in the 'General Information on Mathematics Books' section of the teachers' questionnaire, said that the binding of the books was perfect and, therefore, they liked the binding of the textbooks on mathematics, although 30.90% of the teachers disliked the binding. So far as the opinions of the experts were concerned they did not approve of the binding. Therefore, majority of the teachers were superficial in taking their decision.

Cost:

The textbooks for the students of the secondary schools of Orissa, have been nationalised. The cost of the books is fixed by the authorities of the Board. However, the textbooks should not cost appreciably more than other books. The prices should be kept as low as possible to enable the poorer students of low income group to procure their personal copies. In exceptional cases, subsidising the cost, may be considered.
<table>
<thead>
<tr>
<th>Cost</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>12</td>
</tr>
<tr>
<td>Moderate</td>
<td>151</td>
</tr>
<tr>
<td>High</td>
<td>57</td>
</tr>
</tbody>
</table>

\(N=220\)

(Vide Question No.8 in the "General Information on Mathematics Books" section of the Teachers' Questionnaire)

The table 5.6 revealed that the cost was considered to be moderate by 68.63% of teachers, high by 25.90% of teachers and low by 5.45% of teachers.

The price of the textbooks was arrived at in a judicious manner by the Board. It is a nonprofitable organisation, and as such, the prices were considered to be moderate.

**Language:**

The role of language cannot be ignored in writing the textbooks of mathematics. The language used should be simple, lucid and convey the exact and precise meaning that is purported to be conveyed in the problems of mathematics. There should not be any ambiguity in the language.
It was seen that 59.54% of teachers testified as to the adequacy and accuracy of the language used in the textbooks. To them, language used was within the level of comprehension of the students. 63 teachers (28.63%) opined that in a few cases, the language used was not appropriate. But 26 teachers (11.81%) were of the opinion that the language used was not within the level of comprehension of the students. However, they did not corroborate their views with specific examples from the text. They were evasive in this respect and so their opinions carried little weight.

Terms translated from English to Oriya:

The mathematical terms used in the textbooks of mathematics have been translated from English to Oriya. The Oriya terms must convey the exact meaning of the English terms.

209 teachers (95%) of Orissa were of the view that the Oriya equivalents were correct and appropriate. However, 11 teachers did not agree with them.

Mathematics is an international language with its own symbols and notations. Patriotic and overzealous authors, sometimes, try to overtranslate and hypertranslate the standard international vocabulary of mathematical terms. This is a grave danger which all earnest mathematicians must guard against.
All terms and notations should not be translated; as at tertiary level of education the students have to switch over to the English medium.

STYLE OF WRITING

Explanations of Concepts:

The concepts of number, space, volume, weight and time have a major influence on mathematics education. Concepts are constructed from a series of experiences. There are two types of concepts viz. accommodation, which is a modification of the existing concept and assimilation, which is an absorption of new experiences.

The textbooks of mathematics should be written with a view to clarifying concepts. In this connection a question was added in the teachers' questionnaire to elicit the opinions of the teachers. The tabulation of their responses has been shown in Table 5.7.

**Table 5.7**

**Methods Used for Explaining Concepts**

<table>
<thead>
<tr>
<th>Methods</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Solved examples - By giving practical examples.</td>
<td>141</td>
</tr>
<tr>
<td>2. Discussion - Posing a question and answering it.</td>
<td>109</td>
</tr>
<tr>
<td>3. Description - Direct narration</td>
<td>85</td>
</tr>
<tr>
<td>4. Analysis-cum-Discussion</td>
<td>9</td>
</tr>
</tbody>
</table>

(Vide Question No.1 in the 'Style of Writing' section of the Teachers' Questionnaire)
The teachers were free to choose one or more methods if found adopted in writing textbooks.

The Table 5.7 revealed that 64.0% of teachers were of the opinion that concepts dealt with in textbooks were clarified through solved examples - by giving practical examples. 49.54% of teachers viewed that 'discussion' method was adopted for clarification of concepts in the textbooks. 'Direct narration' method was used according to 38.6% of teachers; and only 4.0% of teachers viewed that 'analysis - cum-discussion' method was used for the purpose.

Analysis-cum-discussion method proves to be the best method for explaining concepts; and sadly enough, this was the method that was least used. It indicates the lack of adequately trained pedagogies with good grounding in mathematics. Mathematicians are blissfully unaware of the latest methods of pedagogical presentation; and pedagogues, by and large, lack adequate depth in the subject matter.

There should be greater exchange of ideas between these two categories of experts. Steps should be taken to initiate dialogues at the institutional level.

Explanation of New Terms:

The 'new terms' used in the textbooks of mathematics should be explained in clear and definite manner so that students can understand the new terms with ease.
64.54% of teachers were of the view that the new terms used in each topic had been explained in clear and definite terms. But 35.45% of teachers did not agree with them. They opined to the contrary.

On discussion with the experts and the experienced teachers of mathematics, it was felt that the new terms were not adequately explained in precise terms.

**Principles:**

All the mathematics teachers opined that the principles involved in a topic were discussed in a manipulative form in the textbooks of mathematics.

**Pictorial and Graphic Illustrations:**

For clarification of concepts, pictorial and graphic illustrations should be given in the textbooks. These promote the understanding of the pupils. Mathematics, being an abstract subject, can be interesting through pictures and graphs.

**TABLE 5.8**

**PICTORIAL AND GRAPHIC ILLUSTRATIONS**

<table>
<thead>
<tr>
<th>Pictorial and Graphic Illustrations</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Adequate</td>
<td>106</td>
</tr>
<tr>
<td>(b) Inadequate</td>
<td>104</td>
</tr>
<tr>
<td>(c) More than adequate</td>
<td>10</td>
</tr>
<tr>
<td><strong>N=220</strong></td>
<td></td>
</tr>
</tbody>
</table>

(Vide Question No.4 in the 'Style of Writing' section of the Teachers' Questionnaire).
Table 5.8 presents a highly confused picture with 106 teachers opining the pictorial and graphic illustrations adequate; 104 teachers opining inadequate and 10 teachers opining more than adequate.

The researcher had to consult mathematicians of repute for their judicious opinion. They opined that the pictorial and graphic illustrations were adequate in the prevailing techno-economic situation of book production. They opined that better graphics and illustrations, including multicolour-illustrations can be provided to bring them at par with books of the developed nations, but that basic purpose of greater access to education for the masses is likely to be jeopardised. But a constant effort should be on to upgrade the mechanism of textbook production without escalating the prices.

**Pictorial and Graphic Illustrations for Understanding:**

An open-ended question was included in the Teachers' Questionnaire inviting a brief answer on the contribution of pictorial and graphic illustrations to the understanding of mathematics by the students.

The responses were almost identical. Their responses were as follows:

1- Clarifies understanding
2- Aids in solving problems and in self-study
3- Arouses attention and curiosity
4- Clarifies doubts
5- Contributes to clear concept formation
6- Provides systematic thinking
7- Concretises ideas

Characteristics of Presentation:

The topics were presented in a definite manner in the textbooks. The characteristics of presentation of the topics were indicated in the questionnaire. The teachers were asked to state whether the textbooks conformed to the requisite characteristics.

| TABLE 5.9 |
| PRESENTATION OF TOPICS |

<table>
<thead>
<tr>
<th>Methods of presentation</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Answers to the sums in the exercises</td>
<td>220</td>
</tr>
<tr>
<td>2. Exercises for revision</td>
<td>220</td>
</tr>
<tr>
<td>3. Illustrative solved examples</td>
<td>220</td>
</tr>
<tr>
<td>4. Description in narrative form</td>
<td>121</td>
</tr>
<tr>
<td>5. Practical exercises</td>
<td>92</td>
</tr>
<tr>
<td>6. Description in question-answer form</td>
<td>36</td>
</tr>
</tbody>
</table>

(Vide Question No.6 in the 'Style of Writing' section of the Teachers' Questionnaire)
The table 5.9 revealed that all the teachers were of the opinion that the answer to the sums in the exercises were provided in the textbooks of mathematics. Moreover all of them agreed that exercises had been provided in the mathematics textbooks for revision.

All the teachers also agreed that illustrative-solved-examples were provided in the textbooks.

55% of teachers were of the opinion that topics were presented with description in narrative form.

41.8% of teachers viewed that there were practical exercises. Only 16.36% of teachers opined that the topics were in the form of description and question-answer in the textbooks.

**Solved Examples:**

Solved examples are beneficial to both the teachers and students. Students get clues for their self-study. Teachers sometimes refer to solved examples in the solution of problems provided in the books.

The teachers unanimously agreed that solved examples had been included in the textbooks of mathematics.

**Clarification of Concepts:**

Generally, solved examples are provided at the beginning of each topic with a view to clarify new concepts to be presented.
It was revealed that 78.18% of teachers agreed to the statement; but 21.81% of teachers viewed that solved examples did not clarify concepts.

Self-Study:

Bright students can take up their study by means of their own effort. Sometimes they do not seek the help of the teachers. The textbooks should provide necessary scope to them.

65.45% of teachers were of the opinion that there was scope for bright students to pursue their studies through their own efforts with the help of the textbooks of mathematics at the secondary school stage. But 34.54% of teachers did not subscribe to the view.

Individual Differences:

A class consists of students of varying mental abilities such as bright, average, dull, etc. The textbooks should satisfy the needs of all categories of students.

57.27% of teachers of mathematics opined that the textbooks of mathematics were written with a view to meeting the individual differences of the pupils. But 42.73% of them viewed that it was targeted to meet the needs of the average students only.
Psychological theory impels and practical pedagogical considerations compel to take cognisance of individual differences. But graduating the textbook to meet the needs of all categories of students is a tall order and is beyond the common capability of the ordinary authors. The programmed-texts can go a long way in this regard; but well-designed programmed-texts are a far off cry in a developing country like India. Programmed-teaching is more of a theory than a practical reality in the realm of pedagogy.

Exercises:

In the textbooks of mathematics, exercises are included for revision and practice of the students.

All the teachers opined that exercises had been given at the end of each topic and after, all the topics were covered in the textbooks of mathematics for the secondary schools of Orissa.

Problems:

In order to generate interest in studying mathematics, the problems from day to day life-situations should be included. It would also facilitate the application of their knowledge in real life-situations.

All the teachers viewed that a few problems in the textbooks for the secondary schools of Orissa were included from real life-situations. However, it was considered that there was ample scope in this regard.
Absurd Problems:

Sometimes, problems are included in the topics which have no relevance to the topics. These problems are considered with respect to the topics.

The mathematics teachers were asked to find out absurdity regarding the problems in the mathematics textbooks.

The teachers opined that they did not find any absurdity regarding the problems included in the mathematics textbooks for the secondary classes of Orissa.

Sequence of Topics:

The topics included in the textbooks should be arranged in a sequential order. It is logically and psychologically sound that the development of thought process follows sequence. Both teaching and learning would be easy if the topics are arranged in sequential order.

All the teachers expressed their satisfaction at the sequencing of topics. However, no systematic effort has been made to formulate a conceptual flow-chart showing therein the gradual development of inter-related concepts.
Gradation of Sums:

The sums included in the exercises for practice should be arranged from simple to complex. So that the students may proceed with the problems with greater satisfaction and interest.

It was revealed that the sums in the exercises were graded from simple to complex. However, the realistic and practical achievement in graduating the gradients of conceptual difficulty can only be explored as and when programmed texts are prepared and tried out. Uptill that time, it remains to be a crude assessment.

Calculation:

Problems requiring lengthy calculations create boredom, sap interest and flag attention. Such problems are counter-productive. Therefore, such problems are to be avoided in writing the textbooks of mathematics.

Except for a few problems, most other problems did not require lengthy and boring calculations. Teachers stoutly defended the inclusion of a few problems requiring lengthy calculations as they demanded steadfastness, tenacity and concentration.

Experimental Works

Mathematics is considered by some to be a dry and uninteresting subject. Experiments make it interesting, especially in the lower classes; and at the secondary classes also.
Therefore, in suitable situations, experiments should be attempted. The textbooks should make provision and suggestions for conducting such experiments.

The mathematics teachers of Orissa (57.27%) observed that there were no suggestions in the mathematics textbooks for experimental work by the students. But 42.73% of teachers opined that there was some scope for experimental work.

Under such situation, the researcher consulted experienced mathematicians. They opined that suggestions for experiments were there in the book 'Geometry and its applications' but not in 'Algebra and its applications'.

**Use of Textbooks:**

The textbooks are valuable only when these are used properly. These should be used as aids in teaching and be followed carefully, intelligently and not slavishly. For an average teacher, the textbook is all his stock-in-trade. The greater the capacity, knowledge, professional training and experience of the teachers, the less he needs to depend on his textbook.

However, the use of textbooks by the mathematics teachers was shown in Table 5.10.
TABLE 5.10
USE OF TEXT BOOKS BY TEACHERS

<table>
<thead>
<tr>
<th>Use of textbooks</th>
<th>Frequently</th>
<th>Occasionally</th>
<th>Never</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the class</td>
<td>74</td>
<td>131</td>
<td>15</td>
<td>220</td>
</tr>
<tr>
<td>For test questions</td>
<td>136</td>
<td>65</td>
<td>19</td>
<td>220</td>
</tr>
<tr>
<td>For homework</td>
<td>137</td>
<td>56</td>
<td>27</td>
<td>220</td>
</tr>
</tbody>
</table>

(Vide Question No. 22 in the 'Style of Writing' section of the Teachers' Questionnaire)

The Table 5.10 revealed that majority of the teachers used the textbooks to set questions and to assign homework. Dependence on the textbook was comparatively less in teaching. Mathematics is a process-oriented subject, and as such experienced teachers hardly take recourse to the textbook in teaching. It is the newcomers who cling to the apron-strings of the textbook before gaining confidence.

No teacher can afford to work entirely without a textbook. Therefore, even experienced teachers should follow the broad guidelines of the textbooks for their reference and preparation work. In preparing test questions, textbooks provide useful directions for test construction i.e., preparation of items of the test.
Without the use of textbooks, test items may not be valid. However, it was noted that 8.63% of the teachers did not use the textbooks for preparing test questions.

A teacher of mathematics commands the class, gains confidence of the students only when he comes well-prepared to the class. For preparation, homework for teachers is essential. Excepting a small minority of 12.21% of the teachers, all others used textbook as a guide for preparation.

**Number of Problems in the Exercises**

Number of problems in the exercises should be adequate for practice of the students in the class, during leisure hours and at home.

54.54% of the teachers were satisfied with the number of problems in the exercises; but 45.45% of teachers advocated the inclusion of more problems in the exercises.

**Correct Answers:**

The answers to the questions included in the exercises of mathematics textbooks, should be absolutely correct. Sometimes it so happens that the students believe that the answers given in the books are correct even if the answers are wrong and doubt the proficiency of their own teachers.
All the teachers opined that some answers given in the textbooks of mathematics for the secondary classes were not correct.

The incorrect answers provided in the mathematics textbooks created doubts in the minds of the pupils. In connection with the incorrect answers provided in the textbooks of mathematics for the secondary schools of Orissa, the researcher wanted to know whether the teachers were misled by them and their mathematical capability was suspected in the eyes of the students. The printed word is more sacred and has greater weightage.

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