

Approved by Government of Nepal, Ministry of Education Science and Technology, Curriculum Development Centre, Sanathimi, Bhaktapur as an Additional Learning Material from 2079 to 2081 B.S.

The Quality Mathematics

Book 9

Dr. Lekha Nath Poudel

PhD (UK), MPhil (Denmark), M.A. in Mathematics (Nepal)

Hari Narayan Upadhyaya

M.Ed. in Mathematics (Gold Medalist), TU (Nepal)

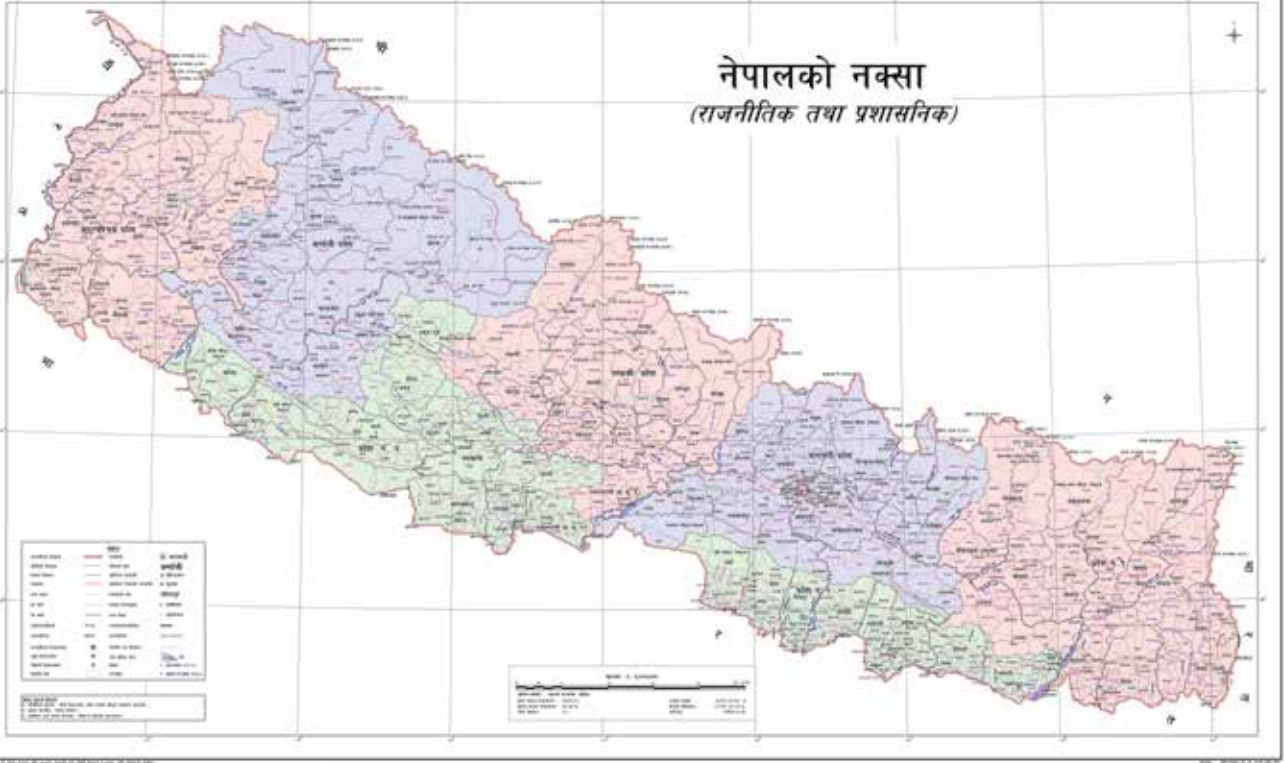
D. R. Lamichhane (Dhaka Ram)

M.Sc., Jawaharal Nehru University (India)

Gopal Acharaya

M.Sc., MPhil Mathematics, TU (Nepal)

नेपालको नक्सा
(राजनीतिक तथा प्रशासनिक)



The
Quality Mathematics
Book 9

© Publishers

Edition First 2013
Second 2014
Third 2015
Fourth 2016
Fifth 2022

Distributors: **Buddha Publications Pvt. Ltd.**
Anamnagar (Buddha Complex)
Kathmandu - 29, Nepal
Tel. 00977-1- 5705165, 5705210, 5705177
e-mail: buddha@wlink.com.np
www.buddhapublication.com

Design by: **Gyanu Karki**

Illustration: **Devendra Thumkeli**
Narayan Prasad Bohaju

ISBN: 978-9937-30-407-8

Printed in Nepal



नेपाल सरकार
शिक्षा, विज्ञान तथा प्रविधि मन्त्रालय

पाठ्यक्रम विकास केन्द्र

सानोठिमी, भक्तपुर

(मान्यता, समकक्षता सम्पन्न मूल्याङ्कित शाखा)

फोन नं. ९६२०५८८

९६३४१११

९६३००८८

फ्याक्स : ९६३०७१७

नोटिस बोर्ड : ९६१८०१६६३०७१७

सानोठिमी, भक्तपुर

www.moecd.gov.np

२०७८/०७९

पत्र संख्या:-

जलानी नं. १६३४

२०७८/१२/१४

मिति:

विषय : पाठ्यसामग्री स्वीकृति सम्बन्धमा ।

श्री बुद्ध प्रकाशन प्रा. लि,
काठमाडौं ।

प्रस्तुत विषयमा त्थस प्रकाशनबाट मूल्याङ्कित र स्वीकृतिका लागि तोकिएको अवधिभित्र पस हुन आएका तपसिलबमोजिमका पाठ्यसामग्री आवश्यक निर्णयार्थ पाठ्यसामग्री व्यवस्थापन तथा मूल्याङ्कन समितिमा पस हुँदा विद्यालय शिक्षाको राष्ट्रिय पाठ्यक्रम प्रारूप, २०७९, माध्यमिक शिक्षा पाठ्यक्रम (कक्षा ९-१०), २०७८, पाठ्यसामग्री विकाससम्बन्धी विद्यमान प्रावधान, ऐन, कानून, निर्देशिका, कार्यविधि, प्रकाशन गैरीतिका प्रावधान, पाठ्यक्रम विकास केन्द्रले विभिन्न समयमा जारी गरेका र पाठ्यसामग्री सुधार/परिमार्जन/पुनर्लेखनका लागि दिइएका सुझाव र निर्देशनको परिपालना गरी स्वीकृति दिन निम्ति भएअनुसार यस कार्यविधिमा मिति २०७८/१२/१४ गतेको निर्णयानुसार तपसिलमा उल्लिखित निर्देशनको पूर्ण परिपालना गरी शैक्षिक वर्ष २०७९, २०८० र २०८१ गरी तीन शैक्षिक वर्षका लागि गुणस्तरीय एवम् कृत्रिमित पाठ्यसामग्री विकास गरी प्रकाशन गर्न स्वीकृति प्रदान गरिएको छ । विद्यमान सैद्धान्तिक व्यवस्था, ऐन, कानून, निर्देशिका, कार्यविधि, पाठ्यक्रम विकास केन्द्रले विभिन्न समयमा जारी गरेका निर्देशनलगायतका प्रावधानहरूको पूर्ण परिपालना नगरी गुणस्तरीय पाठ्यसामग्रीको विकास, प्रकाशन र विक्री वितरण गरेको पाइएमा, पाठ्यक्रम परिवर्तन भएमा वा यस केन्द्रबाट अन्य निर्णय भएमा यो स्वीकृति जूनसुक्ने बेला रद्द हुने छ ।

तपसिल

(क) पाठ्यसामग्रीको नाम

१	Quality Mathematics	माध्यमिक तह/ कक्षा : ९
---	---------------------	------------------------

(ख) निर्देशन

- पाठ्यसामग्री विकाससम्बन्धी विद्यमान प्रावधान तथा पाठ्यसामग्री सुधार र परिमार्जनका लागि यस अघि दिइएका निर्देशनको पूर्ण परिपालना गर्ने ।
- पाठ्यक्रमको मूल धर्म र भावनाप्रकृत पाठ्यक्रमको सम्पूर्ण वक्ष एवम् विषयवस्तु समावेश गरी पाठ्यसामग्रीलाई गुणस्तरीय बनाउने ।
- आवरण पृष्ठको अघिल्लो (Front) नागको नागो (Verso) पृष्ठमा नेपालको आधिकारिक नक्सा र आवरण पृष्ठको पछिल्लो (Back) नागको दायाँ (Recto) पृष्ठमा लेखिदि १९ सङ्कलन रोकवामसम्बन्धी सूचना यस केन्द्रको वेबसाइटबाट डाउनलोड गरी समावेश गर्ने । विषयवस्तुको प्रकृति र आवश्यकताका आधारमा पाठ्यसामग्री भित्रका विषयवस्तु र पाठमा समावेश गरिने तथ्यांक तथा नक्सा आधिकारिक र प्रामाणिक हुनुपर्ने ।
- स्वीकृति प्रव स्थान गरी पाठ्यसामग्रीको शीर्षक पृष्ठभन्दा पछि दायाँ (Recto) पृष्ठमा समावेश गर्ने । पाठ्यसामग्रीको प्रत्येक पृष्ठको पुच्छर (Footer) मा पाठ्यक्रम विकास केन्द्रबाट स्वीकृत भन्ने व्यहोरा उल्लेख गरी प्रकाशन गरेका पाठ्यसामग्रीका तीन प्रति यस केन्द्रमा पस भर्नेपछि मात्र विक्री वितरण गर्ने । शिक्षा, विज्ञान तथा प्रविधि मन्त्रालयको निर्णयानुसारको मूल्य कायम गर्ने तथा मूल्य र मुद्रण प्रतिको सङ्ख्या संशोधक पृष्ठमा अनिवार्यरूपमा राख्नुपर्ने । प्रतिलिपि अधिकार (Copy right) को सम्बन्धमा लेखक र प्रकाशक स्वयम् जिम्मेवार हुने ।
- राष्ट्र, राष्ट्रिय एकता, सार्वभौमिकता, भौगोलिक अखण्डता, स्वाधीनता, राष्ट्रिय हित, प्रतिष्ठान, सम्मान र समृद्धिमा आघात आउने तथा विभिन्न जातजाति, भाषा, धर्म, संस्कृति, सामाजिक सशष्पता, सङ्भाव, सांस्कृतिक मूल्यमान्यता, रहनसहन आदिमा प्रतिकूल प्रभाव पार्ने कुनै पनि विषयवस्तु, उदाहरण, चित्र, अभ्यास, सिकाइ क्रियाकलाप समावेश गर्नु ।
- जातजाति, भाषा, धर्म, संस्कृति, वर्ण, लैंग, वैज्ञानिकता, अपाङ्गता, पस, व्यवसाय, सामाजिक सांस्कृतिक अवस्थाका आधारमा भावनात्मक रूपमा थोटा मुल्याङ्कन, आक्षेप लाग्ने, होच्चाउने र विभेदीकरण गर्ने किसिमका विषयवस्तु, उदाहरण, चित्र, अभ्यास, सिकाइ क्रियाकलाप समावेश नगर्ने ।
- पाठ्यसामग्रीमा समावेश गरिएका चित्र, नक्सा, चिह्न, सङ्केत आदि शुद्ध, स्पष्ट र बोधगम्य हुनुपर्ने ।
- विद्यार्थीलाई धन भार पर्ने गरी पाठ्यक्रममा समावेश नगरिएका विषयवस्तु, अभ्यास तथा सिकाइ क्रियाकलाप पाठ्यसामग्रीमा समावेश गर्नु ।
- पाठ्यक्रम एवम् दिइएका सुझाव र निर्देशनबमोजिम पुर्णरूप दिइएको कृत्रिमित गुणस्तरीय पाठ्यसामग्री मात्र प्रकाशन र विक्री वितरण गर्ने ।

पुनश्च : यो स्वीकृति शैक्षिक वर्ष २०७९, २०८० र २०८१ का लागि प्रदान गरिएकाले सोहीबमोजिम प्रकाशन, विक्री वितरण र प्रयोग गर्नु गराउनहुन सम्बन्धित सरोकारवाला सबैमा अनुरोध छ ।

**कोरोना भाइरस रोग
(कोभिड-१९)**

1. On phylogenetic analysis, the *Trigonostemon* species 2 is clearly most like the "A. repens" because it has the same unique characters (cellular shape and wall thickness).

I have written two surveys on statistics lately, mainly, I think, to make the field to each other before it is too late for statistics education in the United States.

कोरीमा आडरस रोजको गरुण लक्ष्मणान्न



2000



1000



100

यस्मा लक्षणहरु देसा परेना लजिपको लेखिपको स्मारकस्य कंवदना सजपकं गवी ।

यस रोजको संक्रान्तिको जोशिलाबाट मच्चको लागि विजय उपख्यत्रु मायापनपार्ने ।

[illegible]

for more information
please telephone 01452 854400
please allow a 10 min waiting period
before you get through to the
help line. A 10 min waiting period
before the call is free of charge.



124. 100



100%
 100%
 100%
 100%
 100%



संस्कृत-विभाग
प्रमुख



2



केंद्रमा स



PREFACE

The Quality Mathematics series for school students is developed to promote meaningful and enjoyable learning resources in school mathematics. This series is developed according to the existing school curriculum of Nepal. While developing this series we incorporated the global practices as well as local need and interest of the students. This series is developed considering our experiences in the development of mathematics curriculum, learning materials, training materials and textbook, and in teaching and conducting teachers' training. The results from the experiments conducted during the process of writing this book have also been considered while developing this book. **The Quality Mathematics Book 9**, one of the books of the series, has been designed for grade nine students of Nepal following strictly the curriculum developed by the Curriculum Development Centre, Government of Nepal.

Each lesson of this book is structured in such a way that student will be able to develop basic concepts on the contents of the lesson and apply those concepts in solving problems. The main objective of such structure of lesson is to make learning meaningful and provide students with contextual and motivating learning environment. The structure of the book encourages and provides opportunity to the students to work themselves with the suggested activities. It also encourages working in small groups or pairs for suggested activities or solving the problems. In each chapter conceptualization begins with either recalling previous knowledge and experiences or presenting relevant examples and activities. The lessons in the book provide opportunity to identify relevant relations, methods, rules and formulas through contextual examples and activities. Contextual examples, pictures and activities have been included to create meaningful and interesting learning environment. Mathematics laboratory activities are suggested to encourage students' creativity and providing them with participatory and learning by doing environment. In order to reinforce problem solving skills and motivating students for practicing similar problems varieties of workout examples are included in each lesson.

Generally, there are four categories of problems in each exercise. Oral exercises are designed for immediate feedback to the students by evaluating their mastery in basic concepts and ideas learnt in the lesson. Three groups (A, B and C) of written exercises are arranged according

to their level of increasing difficulties and the level and forms of application. These groups are a kind of hierarchical chain of group A, group B and group C. Therefore, mastery of previous group is required to move on the other group. The mastery on oral exercises and groups A and B are the minimum requirement to every student. However, the exercises in group C are mostly related to some higher skills of problem solving and therefore students are also encouraged to complete the problems on group C. In each group A, B and C there are at least a pair of similar nature of exercises, so that the odd numbered exercises can be used for basic regular practices and the even-numbered exercises can be used for further practice whenever necessary. Interested students can go for the challenging problems (Try these), but not necessarily compulsory to all.

We acknowledge all the students participated in our trials and experiments in various time. We thank to all the contributors including teachers and experts who have provided useful suggestion and support in developing this books. Similarly, we appreciate for the contribution of the persons involved in type setting, designing and drawing the useful pictures and figures.

We thank Mr Nabaraj Bajgain, Managing Director of Buddha Publications Pvt. Ltd. and the team of the publication for publishing this book and bringing innovative ideas.

Finally, we highly appreciate constructive comments and suggestions about the book and commit for continue improvement of the book in order to promote meaningful and enjoyable learning materials to the students.

Authors

CONTENTS

CHAPTER ONE

Sets

1.1	Review	2
1.2	Use of Venn-diagrams	14

CHAPTER TWO

Commission, Taxation Dividend and Domestic Arithmetic

2.1	Commission, Bonus and Dividend	24
2.2	Taxation	30
2.3	Household Arithmetic	38

CHAPTER THREE

Mensuration

3.1	Length, Perimeter and Area	58
3.2	Area of Irregular Triangle	61
3.3	Area of a Triangle	61
3.4	Problems on Area	70
3.5	Surface Area and Volume Cylinder and Sphere	80

CHAPTER FOUR

Sequence & Series & Algebraic Expressions

4.1	(a) Sequence and Series	90
4.1	(b) Series and Σ Notation	97
4.3	Arithmetic and Geometric Sequences & Series	102
4.4	Review of Factors and Factorisation	116
4.5	Factorisation of Expressions of the Type $ax^2 \pm bx \pm c$	126
4.6	Factorising Expressions of the form $a^4 + a^2b^2 + b^4$	131

4.7	Linear Equation in Two Variables	135
4.8	Laws of Indices	142
4.9	Highest Common Factor (HCF)	149
4.10	Lowest Common Multiple (LCM)	150

CHAPTER FIVE

Triangles and Circle Quadrilaterals

5.1	Review of Basic Terms and Concepts	158
5.2	Experimental Verifications	162
5.3	Inequalities in a Triangle	168
5.4	Isosceles Triangle and its Properties	173
5.5	Review of Quadrilaterals	182
5.6	Construction of Isosceles Triangles and parallelograms	203
5.7	Similar Triangles and Similar Polygons	207
5.8	Circle	217

CHAPTER SIX

Statistics

6.1	Cumulative Frequency Table	232
6.2	Histogram	236
6.3	Arithmetic Mean Individual and Discrete Series	242
6.4	Median and Mode	246
6.5	Probability	251

CHAPTER SEVEN

Trigonometry

7.1	Trigonometric Ratios	264
7.2	Values of Trigonometric Ratios of some Standard Angles	270
7.3	Application of Trigonometric Ratio	273