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represents a
collection of**

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**carefully selected
geometry
problems
designed for
passionate
geometers and
students preparing
for the IMO.**

**Assuming the
theory and the
techniques
presented in 106
and 107, the book**

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**presents a
multitude of
beautiful synthetic
solutions that are
meant to give a
sense of how one
should think about
difficult geometry
problems. On
average, each
problem comes
with at least two
such solutions and**

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**with additional
remarks about the
underlying
configuration.
This book
discusses the
relationships
between
mathematical
creativity and
mathematical
giftedness. It
gathers the results**

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**of a literature
review comprising
all papers
addressing
mathematical
creativity and
giftedness
presented at the
International
Congress on
Mathematical
Education (ICME)
conferences since**

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**2000. How can
mathematical
creativity
contribute to
children's
balanced
development?
What are the
characteristics of
mathematical
giftedness in early
ages? What about
these**

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**characteristics at
university level?**

**What teaching
strategies can
enhance creative
learning? How can
young children's
mathematical
promise be
preserved and
cultivated,
preparing them for
a variety of**

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professions?

**These are some of
the questions
addressed by this
book. The book
offers, among
others: analyses of
substantial
learning
environments that
promote creativity
in mathematics
lessons;**

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**discussions of a
variety of
strategies for
posing and solving
problems;
investigations of
students'
progress
throughout their
schooling; and
examinations of
technological tools
and virtual**

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**resources meant
to enhance**

**learning with
understanding.**

**Multiple
perspectives in the
interdisciplinary
fields of
mathematical
creativity and
giftedness are
developed to offer
a springboard for**

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**further research.
The theoretical
and empirical
studies included in
the book offer a
valuable resource
for researchers, as
well as for
teachers of gifted
students in
specialized or
inclusive settings,
at various levels of**

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education.

**This book contains
107 geometry
problems used in
the AwesomeMath
Year-Round
Program. The
problems offer
additional
challenges for
those who have
progressed
through the 106**

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Geometry

**Problems from the
AwesomeMath
Summer Camp
publication. The
book begins with a
theoretical
chapter, where the
authors review
basic facts and
familiarize the
reader with some
more advanced**

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techniques. The authors then proceed to the main part of the work, the problem sections. The problems are a carefully selected and balanced mix which offers a vast variety of flavors and difficulties, ranging from AMC

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**and AIME levels to
high-end IMO
problems. Out of
thousands of
Olympiad
problems from
around the globe
the authors chose
those which best
illustrate the
featured
techniques and
their applications.**

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The problems meet the authors' demanding taste and fully exhibit the enchanting beauty of classical geometry. For every problem the authors provide a detailed solution and strive to pass on the intuition and motivation

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behind it.

Numerous
problems have
multiple
solutions. Directly
experiencing
Olympiad
geometry both as
contestants and
instructors, the
authors are
convinced that a
neat diagram is

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**essential to
efficiently solve a
geometry problem.
Their diagrams do
not contain
anything
superfluous, yet
emphasize the key
elements and
benefit from a
good choice of
orientation. Many
of the proofs**

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**should be legible
only from looking
at the diagrams.**

**Many
mathematicians
have been drawn
to mathematics
through their
experience with
math circles:
extracurricular
programs
exposing teenage**

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**students to
advanced
mathematical
topics and a
myriad of problem
solving techniques
and inspiring in
them a lifelong
love for
mathematics.**

**Founded in 1998,
the Berkeley Math
Circle (BMC) is a**

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**pioneering model
of a U.S. math
circle, aspiring to
prepare our best
young minds for
their future roles
as mathematics
leaders. Over the
last decade, 50
instructors--from
university
professors to high
school teachers to**

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business
tycoons--have

**shared their
passion for
mathematics by
delivering more
than 320 BMC
sessions full of
mathematical
challenges and
wonders. Based
on a dozen of
these sessions,**

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**this book
encompasses a
wide variety of
enticing
mathematical
topics: from
inversion in the
plane to circle
geometry; from
combinatorics to
Rubik's cube and
abstract algebra;
from number**

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**theory to mass
point theory; from
complex numbers
to game theory via
invariants and
monovariants. The
treatments of
these subjects
encompass every
significant method
of proof and
emphasize ways of
thinking and**

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**reasoning via 100
problem solving
techniques. Also
featured are 300
problems, ranging
from beginner to
intermediate level,
with occasional
peaks of advanced
problems and even
some open
questions. The
book presents**

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**possible paths to
studying
mathematics and
inevitably falling in
love with it, via
teaching two
important skills:
thinking creatively
while still
``obeying the
rules," and making
connections
between problems,**

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ideas, and theories. The book encourages you to apply the newly acquired knowledge to problems and guides you along the way, but rarely gives you ready answers.

“Learning from our own mistakes”

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**often occurs
through
discussions of non-
proofs and
common problem
solving pitfalls.
The reader has to
commit to
mastering the new
theories and
techniques by
"getting your
hands dirty" with**

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**the problems,
going back and
reviewing
necessary problem
solving techniques
and theory, and
persistently
moving forward in
the book. The
mathematical
world is huge:
you'll never know
everything, but**

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**you'll learn where
to find things, how
to connect and use
them. The rewards
will be substantial.
In the interest of
fostering a greater
awareness and
appreciation of
mathematics and
its connections to
other disciplines
and everyday life,**

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are publishing
books in the
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Circles Library
series as a service
to young people,
their parents and
teachers, and the
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Proving
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Theory Problems
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Inequalities
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***This book is
intended for the
Mathematical
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students who
wish to prepare
for the study of
inequalities, a
topic now of
frequent use at
various levels of
mathematical
competitions.***

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***In this volume
we present both
classic
inequalities and
the more useful
inequalities for
confronting and
solving
optimization
problems. An
important part
of this book
deals with***

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*geometric
inequalities and
this fact makes
a big difference
with respect to
most of the
books that deal
with this topic
in the
mathematical
olympiad. The
book has been
organized in*

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***four chapters
which have
each of them a
different
character.***

***Chapter 1 is
dedicated to
present basic
inequalities.
Most of them
are numerical
inequalities
generally***

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***lacking any
geometric
meaning.***

***However, where
it is possible to
provide a
geometric
interpretation,
we include it as
we go along. We
emphasize the
importance of
some of these***

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***inequalities,
such as the
inequality
between the
arithmetic
mean and the
geometric
mean, the
Cauchy-
Schwarz
inequality, the r
earrangement in
equality, the***

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***Jensen
inequality, the
Muirhead
theorem,
among others.
For all these,
besides giving
the proof, we
present several
examples that
show how to
use them in
mathematical***

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***olympiad
problems. We
also emphasize
how the
substitution
strategy is used
to deduce
several
inequalities.
This unique
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new and
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***problems
provides full
coverage of
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inequalities.
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exercises are
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detailed author-
prepared-
solutions,
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creativity and***

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***Algebraic
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be considered a
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new and***

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methods for
proving
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***This book is
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teacher's
manual and as
an independent-
study handbook***

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and***

***mathematical
competitors.***

***Based on a
traditional
teaching
philosophy and
a non-
traditional
writing
approach (the
stair-step***

method), this book consists of new problems with solutions created by the authors. The main idea of this approach is to start from relatively easy problems and “step-by-step” increase the

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***level of
difficulty
toward
effectively
maximizing
students'
learning
potential. In
addition to
providing
solutions, a
separate table
of answers is***

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***also given at
the end of the
book. A broad
view of
mathematics is
covered, well
beyond the
typical
elementary
level, by
providing more
in depth
treatment of***

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manual of
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college
students, and
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competitors.
The book
teaches new
and classical
proof
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through***

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challenging
problems. It is
arranged by
topics and
difficulty
level. It mainly
consists of new
problems
created by
authors with au-
thor-prepared-
solutions, some***

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***of these
problems were
proposed in
different
national and
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gives a broad
view of Number
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the typical
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providing
deeper
treatment of
the topics. This
book consists
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separate book
consisting of**

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Chapter 2 and
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2 is a separate
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Chapter 5 and
Chapter 6.
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theoretical
background for
several topics**

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in

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such as
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more than 300***

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by
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for researchers
that apply
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theory that
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perspectives
from high-
energy, conden
sed-matter, and
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Quantum field
theory was
originally
developed to
describe
quantum
electrodynamics and other
fundamental
problems in
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physics, but***

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across physics,
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of applications
has come a new
and deeper
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provides a fully
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quantum field
theory,
covering the
full breadth of
its applications
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the main text
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Takes students
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should be
taught to
someone with
little familiarity
in the subject.
In some sense,
the text also
represents an
unofficial
sequel to the
recent problem***

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first and third
authors, but
the two books**

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designed as a
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Lemmas in
classical
geometry in a
relatively linear
fashion:***

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starting from
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common results
to more
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topics, where
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prove to be
tremendously
useful. We treat***

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a short story of
its own and
include
numerous
solved
exercises with
detailed
explanations
and related
insights that
will hopefully
make your***

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computational
science. Optimization
formulations and
methods are proving
to be vital in
designing algorithms
to extract essential
knowledge from huge
volumes of data.

Machine learning,
however, is not
simply a consumer of

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optimization
technology but a
rapidly evolving field
that is itself
generating new
optimization ideas.
This book captures
the state of the art of
the interaction
between optimization
and machine learning
in a way that is
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researchers in both

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fields. Optimization approaches have enjoyed prominence in machine learning because of their wide applicability and attractive theoretical properties. The increasing complexity, size, and variety of today's machine learning models call for the reassessment of

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community.

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circles, area
relationships,
Ptolemy and the
cyclic
quadrilateral,
collinearity and
concurrency and
more. Arranged
in order of
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aptitude in
number theory
with powerful
problems that
have concrete
examples which
reflect the
potential and
impact of
theoretical
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chapter focuses
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Problems” framed
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Rajeev Rastogi
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(Rajasthan)

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engaging and
unusual
problems, this
book
demonstrates
methods of
reasoning
necessary for
learning number
theory. Every
technique is
followed by

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problems (as well as detailed hints and solutions) that apply theorems immediately, so readers can solve a variety of abstract problems in a systematic, creative manner. New solutions often require

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the ingenious
use of earlier
mathematical
concepts - not
the memorization
of formulas and
facts. Questions
also often
permit
experimental
numeric
validation or
visual
interpretation

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to encourage the combined use of deductive and intuitive thinking. The first chapter starts with simple topics like even and odd numbers, divisibility, and prime numbers and helps the reader

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to solve quite complex, Olympiad-type problems right away. It also covers properties of the perfect, amicable, and figurate numbers and introduces congruence. The next chapter begins with the

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Euclidean algorithm, explores the representations of integer numbers in different bases, and examines continued fractions, quadratic irrationalities, and the Lagrange Theorem. The

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last section of
Chapter Two is
an exploration
of different
methods of
proofs. The
third chapter is
dedicated to
solving
Diophantine
linear and
nonlinear
equations and
includes

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different
methods of
solving Fermat's
(Pell's)
equations. It
also covers
Fermat's
factorization
techniques and
methods of
solving
challenging
problems
involving

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exponent and
factorials.
Chapter Four
reviews the
Pythagorean
triple and
quadruple and
emphasizes their
connection with
geometry,
trigonometry,
algebraic
geometry, and
stereographic

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projection. A special case of Waring's problem as a representation of a number by the sum of the squares or cubes of other numbers is covered, as well as quadratic residuals, Legendre and

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Jacobi symbols,
and interesting
word problems
related to the
properties of
numbers.

Appendices
provide a
historic
overview of
number theory
and its main
developments
from the ancient

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cultures in
Greece, Babylon,
and Egypt to the
modern day.

Drawing from
cases collected
by an
accomplished
female
mathematician,
Methods in
Solving Number
Theory Problems
is designed as a

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self-study guide
or supplementary
textbook for a
one-semester
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number theory.
It can also be
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for mathematical
Olympiads.
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algebra,
arithmetic and

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some calculus
knowledge are
the only
prerequisites.
Number theory
gives precise
proofs and
theorems of an
irreproachable
rigor and
sharpens
analytical
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makes this book

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astronomy.

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and David

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describe how,
before 1900, a
woman who
wanted to study
the stars had to
have a father,
brother, or
husband to

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provide entry, and how the considerable intellectual skills of women astronomers were still not enough to enable them to pry open doors of opportunity for much of the twentieth century.

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evidence that it had indeed spread worldwide. While I was greatly overwhelmed and humbled that so many people across the world read my notes and presumably found them useful, I also felt it necessary to

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these seemingly
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U.S. and around the world. Just as the camp offers both introductory and advanced courses, this book also builds up the material gradually. The authors begin with a theoretical chapter where they familiarize the

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reader with basic facts and problem-solving techniques. Then they proceed to the main part of the work, the problem sections. The problems are a carefully selected and balanced mix

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which offers a vast variety of flavors and difficulties, ranging from AMC and AIME levels to high-end IMO problems. Out of thousands of Olympiad problems from around the globe, the authors chose

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those which best illustrate the featured techniques and their applications. The problems meet the authors' demanding taste and fully exhibit the enchanting beauty of classical geometry. For

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every problem,
they provide a
detailed solution
and strive to pass
on the intuition and
motivation behind
it. Many problems
have multiple
solutions. Directly
experiencing
Olympiad
geometry both as

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contestants and
instructors, the
authors are
convinced that a
neat diagram is
essential to
efficiently solve a
geometry problem.
Their diagrams do
not contain
anything
superfluous, yet

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emphasize the key elements and benefit from a good choice of orientation. Many of the proofs should be legible only from looking at the diagrams.

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logical reasoning. Focusing on the development of geometric intuition while avoiding the axiomatic method, a problem solving approach is encouraged throughout. The book is strategically divided into three

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sections: Part One
focuses on

Euclidean geometry,
which provides the
foundation for the
rest of the material
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Part Two discusses
Euclidean
transformations of
the plane, as well as
groups and their
use in studying

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transformations;
and Part Three
covers inversive and
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Transformational,
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Multiple
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elegant geometry
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Competition during
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are engaged in
mathematical
competition
teaching and
researching. Some
of the solutions are
from national
training team and
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members, their
wonderful solutions
being the feature of
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is second, extended
edition.

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proposing here to the
English-speaking reader
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qualified at the
beginning of the
previous century as a
book of "Modern
Geometry" of the
triangle and
quadrilateral. Most of
the results were obtained

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in the second half of the
19th century and the
first half of the 20th
century. The author was
a retired artillery colonel
and an enthusiastic
amateur mathematician.
This should come as no
surprise, as for any
artillery officer
mathematics (and,
especially, geometry)
plays an important part
in his formation. As the

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title surely suggests, this book is a rich collection of some of the most important properties of numerous points, lines, and circles related to triangles and quadrilaterals, as they were known by the mid-1950s. These include the nine-point circle, the Simson line, the orthopolar triangles, the orthopole, the

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Gergonne and Nagel points, the Miquel point and circle, the Carnot circle, the Brocard points, the Lemoine point and circles, the Newton-Gauss line, and many others. It was, probably, one of the most complete descriptions of the subject at the moment of the writing. The book was primarily addressed

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to young students but will be of interest to problem solvers in elementary geometry as well. Even geometers will find here new problems to inspire them.

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researchers use to think through a problem to its solution—or failing that, to smartly guess the answer—before starting any calculations. In typical physics classrooms, students seek to master an enormous toolbox of mathematical methods, which are necessary to do the precise calculations used in

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physics. Consequently, students often develop the unfortunate impression that physics consists of well-defined problems that can be solved with tightly reasoned and logical steps. Idealized textbook exercises and homework problems reinforce this erroneous impression. As a result, even the best students can find

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themselves completely
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with back of the
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introduction to
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by providing a
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comprehensive analysis
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methods, approaching
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analysis of algorithms
from various algorithmic
and mathematical
perspectives, and going
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methods by connecting
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the idea of

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symmedian and
the mixtilinear
incircle, as well as
the theorems of
Euler, Ceva,
Menelaus, and
Pascal. Another
part is dedicated
to the use of
complex numbers
and barycentric
coordinates,
granting the reader

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both a traditional and computational viewpoint of the material. The final part consists of some more advanced topics, such as inversion in the plane, the cross ratio and projective transformations, and the theory of

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