

PEAK ACHIEVERS ONLINE ACADEMY

GRADE 9 MATHEMATICS

REVISION BOOK

FREE PREVIEW EDITION

Clear Notes • Worked Examples • Practice • Mock Papers

Curriculum-Aligned • Competency-Based • KJSEA-Focused

Prepared by Hezekiah Omweri Nyatuka

B.Ed. (Science), Kenyatta University • Chemistry & Physics

FREE SAMPLE • NOT FOR RESALE

Preface

Mathematics becomes easier when ideas are explained clearly, connected to everyday life and practised step by step. I prepared this book after working with learners who often understood a topic better once a difficult rule was broken into a simple idea, a worked example and purposeful practice.

This book is designed to help Grade 9 learners revise confidently, strengthen weak areas and prepare for competency-based assessment. The guiding principle throughout is: Simple where possible.

Detailed where necessary. Always clear.

Acknowledgements

I appreciate the learners, teachers, family members and friends whose questions, encouragement and classroom experiences continue to shape my teaching. I also acknowledge Kenya's curriculum institutions for the curriculum framework that guides Grade 9 Mathematics learning.

How to Use This Book

1. Read the learning outcomes before starting a chapter.
2. Study the Key Ideas and Worked Examples before attempting exercises.
3. Use Skill Builders for guided practice, then attempt KJSEA-style questions independently.
4. Complete each 30-minute, 25-mark Chapter Test without hints.
5. Check the worked solutions only after attempting the questions.
6. Finish with the mixed-topic revision tests and mock papers under timed conditions.

LEARNING FEATURES THINK BIG connects Mathematics to real life. REMEMBER highlights a rule worth keeping in mind. HINT gives a useful starting point without giving away the answer. EXAM FOCUS points to common assessment demands.

Contents

Chapter 1: Integers	5
Chapter 2: Cubes and Cube Roots	8
Chapter 3: Indices and Logarithms	11
Chapter 4: Compound Proportions and Rates of Work	14
Chapter 5: Matrices	17
Chapter 6: Equation of a Straight Line	20
Chapter 7: Linear Inequalities	24
Chapter 8: Area	27
Chapter 9: Volume of Solids	31
Chapter 10: Mass, Volume, Weight and Density	35
Chapter 11: Time, Distance and Speed	38
Chapter 12: Money	41
Chapter 13: Approximations and Errors	44
Chapter 14: Coordinates and Graphs	47
Chapter 15: Scale Drawing	51
Chapter 16: Similarity and Enlargement	54
Chapter 17: Trigonometry	57
Chapter 18: Data Interpretation - Grouped Data	60
Chapter 19: Probability	63
Mixed-Topic Revision Exercises	66
KJSEA-Style Mock Papers	71
About the Author	80

Chapter 1: Integers

Learning Outcomes

- describe positive and negative integers
- perform the four operations on integers
- apply order of operations
- solve real-life problems involving integers

THINK BIG How can positive and negative numbers describe money, temperature, floors and changes?

SPOTLIGHT: This chapter follows the Peak Achievers approach: understand the idea, study an example, practise, then apply it.

Key Concepts and Notes

Positive integers are greater than zero; negative integers are less than zero. Zero is neither positive nor negative.

On a number line, values increase to the right and decrease to the left.

For addition and subtraction, pay close attention to signs. Subtracting a negative is equivalent to adding.

For multiplication and division: same signs give a positive answer; different signs give a negative answer.

Use BODMAS for combined operations. Multiplication and division have equal priority and are handled left to right; so are addition and subtraction.

REMEMBER Write the key rule or formula first, keep units consistent, and show enough working for another learner to follow your reasoning.

REMEMBER! Positive integers are greater than zero; negative integers are less than zero. Zero is neither positive nor negative.

Worked Examples

Temperature: At 6 a.m. the temperature was -3°C . It rose by 8°C . New temperature = $-3 + 8 = 5^{\circ}\text{C}$.

Debt: A learner has KSh 250 and owes KSh 420. Net position = $250 - 420 = -170$, meaning a KSh 170 deficit.

BODMAS: Evaluate $18 - 3 \times 4 + 2$. First multiply: $18 - 12 + 2 = 8$.

HINT Before calculating, identify what is given, what is required, and the rule or relationship that connects them.

Skill Builder

1. $-7 + 12$

2. $15 - 23$
3. $(-6) \times (-4)$
4. $42 \div (-7)$
5. $20 - 3 \times 5$

Skill Builder Answers

1. 5
2. -8
3. 24
4. -6
5. 5

KJSEA-Style Practice

1. A freezer temperature is -6°C . It rises by 11°C . What is the new temperature?
2. A bank account is overdrawn by KSh 850. KSh 1,200 is deposited. Find the new balance.
3. Evaluate $-18 \div 3 + 4 \times (-2)$, showing the order of operations.
4. A lift moves from floor -3 to floor 8. How many floors does it rise?
5. Create a real-life situation represented by $-12 + 20 - 9$ and explain the meaning of the answer.

Challenge Corner

Connect Integers to another Mathematics topic in this book. Construct and solve one problem that uses both ideas.

EXAM FOCUS Read every instruction carefully, show working in structured questions, include units where required, and check whether your final answer is reasonable.

Chapter 1 Test

Time: 30 minutes | Marks: 25

Section A - Multiple Choice (5 marks)

1. Evaluate $-9 + 14$. [1]
A. -23 B. -5 C. 5 D. 23
2. Which expression has a value of -24? [1]
A. $(-6)(-4)$ B. $(-6)(4)$ C. 6×4 D. $-6 \div 4$
3. Evaluate $20 - 3 \times 6$. [1]
A. 102 B. 2 C. 17 D. -2
4. A bank balance of -KSh 450 means the account is [1]
A. KSh 450 in credit B. empty C. KSh 450 overdrawn D. KSh 450 profit
5. Which integer is greatest? [1]

A. -12 B. -3 C. 0 D. -1

Section B - Structured Questions (20 marks)

6. At dawn, the temperature was -5°C . It rose by 9°C by midday and later fell by 7°C . Find the final temperature. [4]

7. Evaluate: $36 \div (-6) + 4 \times (-3)$. Show the order of operations. [4]

8. A shopkeeper starts the day owing KSh 1,800. During the day, KSh 4,500 is received and KSh 2,100 is paid out. Determine the final net position and interpret your answer. [4]

9. A lift starts at floor -2. It rises 8 floors, descends 11 floors, then rises 4 floors. Determine its final floor. [4]

10. Evaluate: $18 - [6 - 2(5 - 8)]$. [4]

Answers and Worked Solutions

Section A: 1. C 2. B 3. B 4. C 5. C

6. Final temperature = $-5 + 9 - 7 = -3^{\circ}\text{C}$.

7. $36 \div (-6) + 4 \times (-3) = -6 - 12 = -18$.

8. Net position = $-1,800 + 4,500 - 2,100 = \text{KSh } 600$. This is a positive balance.

9. Final floor = $-2 + 8 - 11 + 4 = -1$.

10. $18 - [6 - 2(5 - 8)] = 18 - [6 - 2(-3)] = 18 - 12 = 6$.

Common Mistakes

- Skipping working and writing only a final answer.
- Mixing units before calculation.
- Copying a rule without checking whether its conditions apply.
- Rounding too early in a multi-step calculation.

Learner Checkpoint

Tick what you can now do confidently:

- ☐ describe positive and negative integers
- ☐ perform the four operations on integers
- ☐ apply order of operations
- ☐ solve real-life problems involving integers

Chapter 5: Matrices

Learning Outcomes

- represent information using matrices
- state the order of a matrix
- identify matrix elements
- add and subtract compatible matrices
- apply matrices to practical data

THINK BIG How can matrices organise information such as sales, scores or transport data?

SPOTLIGHT: This chapter follows the Peak Achievers approach: understand the idea, study an example, practise, then apply it.

Key Concepts and Notes

A matrix is a rectangular arrangement of numbers in rows and columns.

A matrix with 2 rows and 3 columns has order 2×3 .

Matrices can be added or subtracted only when they have the same order.

Corresponding elements are combined.

REMEMBER Write the key rule or formula first, keep units consistent, and show enough working for another learner to follow your reasoning.

REMEMBER! A matrix is a rectangular arrangement of numbers in rows and columns.

Worked Examples

Order: $[[2,4,6],[1,3,5]]$ has order 2×3 .

Addition: $[[2,1],[4,3]] + [[5,2],[1,6]] = [[7,3],[5,9]]$.

Data: Rows can represent shops and columns can represent products, making totals easy to compare.

HINT Before calculating, identify what is given, what is required, and the rule or relationship that connects them.

Skill Builder

1. State order of $[[1,2,3],[4,5,6]]$.
2. Find a_{21} in $[[3,7],[5,9]]$.
3. Add $[[1,2],[3,4]]$ and $[[4,3],[2,1]]$.
4. Subtract $[[8,7],[6,5]] - [[3,2],[1,4]]$.
5. Can a 2×3 matrix be added to a 3×2 matrix?

Skill Builder Answers

1. 2×3
2. 5
3. $[[5,5],[5,5]]$
4. $[[5,5],[5,1]]$
5. No

KJSEA-Style Practice

EXAM FOCUS: Show working clearly, use correct units where required, and interpret the final answer in context.

1. State the order of the matrix $[[3,1,4],[2,5,7]]$.
2. For $A = [[6,2],[4,9]]$, state a_{21} .
3. Find $[[2,5],[1,3]] + [[4,1],[6,2]]$.
4. Find $[[9,7],[5,4]] - [[3,2],[1,6]]$.
5. A matrix records sales of two products in two shops. Explain what one chosen entry could represent.

Challenge Corner

Connect Matrices to another Mathematics topic in this book. Construct and solve one problem that uses both ideas.

EXAM FOCUS Read every instruction carefully, show working in structured questions, include units where required, and check whether your final answer is reasonable.

Chapter 5 Test

Time: 30 minutes | Marks: 25

Section A - Multiple Choice (5 marks)

1. The order of a matrix with 3 rows and 2 columns is [1]
A. 2×3 B. 3×2 C. 3×3 D. 2×2
2. In a_{ij} , i identifies the [1]
A. column B. value C. row D. matrix order
3. Matrices can be added only when they have [1]
A. the same order B. equal totals C. two rows D. positive entries
4. $[[2,1],[3,4]] + [[1,5],[2,0]]$ equals [1]
A. $[[3,6],[5,4]]$ B. $[[2,5],[6,0]]$ C. $[[1,4],[1,4]]$ D. $[[3,5],[5,0]]$
5. Which operation is included in this chapter? [1]
A. matrix inverse B. determinant C. matrix addition and subtraction D. matrix multiplication

Section B - Structured Questions (20 marks)

Chapter 15: Scale Drawing

Learning Outcomes

- use compass directions and true bearings
- determine reverse bearings
- convert actual distances to drawing distances using a given scale
- locate points using bearing and distance
- distinguish angles of elevation and depression
- apply scale drawing in simple surveying situations

THINK BIG How do scale drawings and bearings help in maps, surveying and navigation?

Key Concepts and Notes

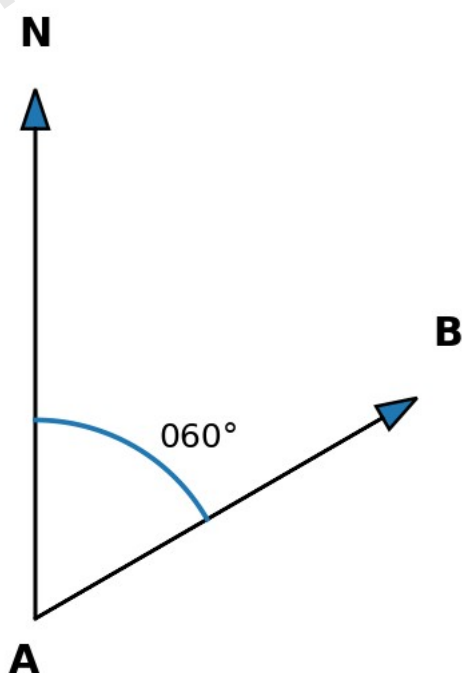
True bearings are measured clockwise from North, from 000° to 360° , and are written using three digits. Thus 35° is written as 035° .

Reverse bearing: add 180° if the original bearing is less than 180° ; subtract 180° if it is 180° or greater.

A scale links drawing distance to actual distance. For example, at 1 cm represents 2 km, 14 km is represented by 7 cm.

An angle of elevation is measured upward from a horizontal line. An angle of depression is measured downward from a horizontal line.

REMEMBER Write the key rule or formula first, keep units consistent, and show enough working for another learner to follow your reasoning.



Chapter 17: Trigonometry

Learning Outcomes

- identify opposite, adjacent and hypotenuse sides
- use sine, cosine and tangent
- find unknown lengths and angles
- use a calculator in degree mode
- apply trigonometry to heights and distances
- work with angles of elevation and depression

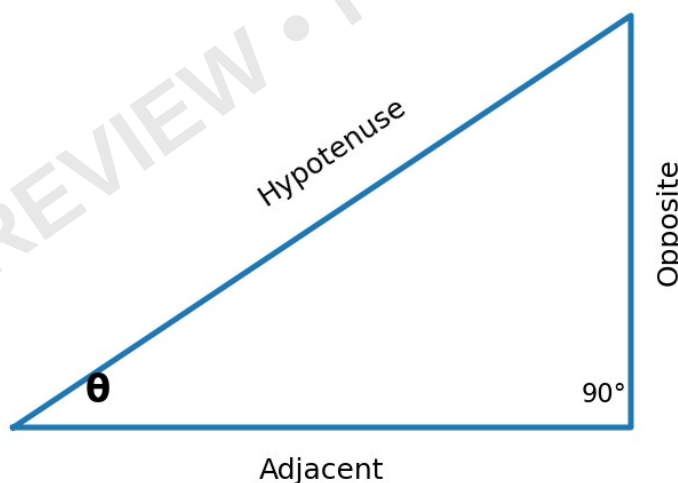
THINK BIG How can trigonometry estimate heights and distances that are difficult to measure directly?

Key Concepts and Notes

SOH: $\sin \theta = \text{opposite/hypotenuse}$. CAH: $\cos \theta = \text{adjacent/hypotenuse}$. TOA: $\tan \theta = \text{opposite/adjacent}$.

The hypotenuse is opposite the 90° angle. Opposite and adjacent depend on the chosen acute angle. Use DEG mode for angles in degrees.

REMEMBER Write the key rule or formula first, keep units consistent, and show enough working for another learner to follow your reasoning.



Visual Guide: Identify opposite, adjacent and hypotenuse relative to angle θ .

Worked Examples

1. $H=12$ cm, $\theta=30^\circ$: $O=12 \sin 30^\circ=6$ cm.
2. $H=20$ cm, $\theta=60^\circ$: $A=20 \cos 60^\circ=10$ cm.
3. $A=8$ cm, $\theta=45^\circ$: $O=8 \tan 45^\circ=8$ cm.
4. $O=6$, $A=8$: $\theta=\tan^{-1}(6/8)\approx 36.9^\circ$.

Chapter 18: Data Interpretation - Grouped Data

Learning Outcomes

- organise data into grouped frequency tables
- choose and interpret class intervals
- find class midpoints
- identify modal and median classes
- calculate grouped mean
- use cumulative frequency to locate the median
- interpret grouped data in context

THINK BIG How can grouped data summarise many measurements and reveal patterns?

Key Concepts and Notes

Grouped data places values into class intervals. The class width should be consistent unless the question states otherwise.

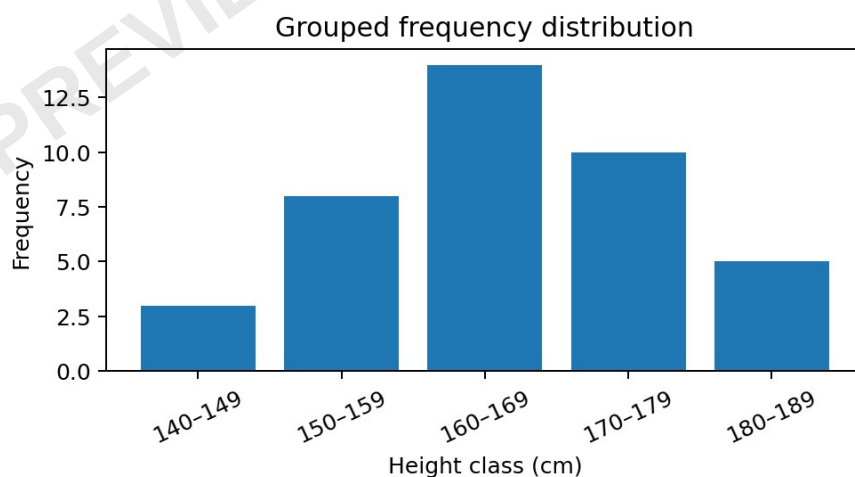
Class midpoint = $(\text{lower limit} + \text{upper limit}) \div 2$.

Grouped mean = $\Sigma fx \div \Sigma f$, where f is frequency and x is the class midpoint.

The modal class is the class with the greatest frequency.

Cumulative frequency is a running total of frequencies. For N observations, locate the $N/2$ position to identify the median class.

REMEMBER Write the key rule or formula first, keep units consistent, and show enough working for another learner to follow your reasoning.



Visual Guide: A grouped frequency display makes the modal class easy to identify.

Worked Example

Heights 140-149, 150-159, 160-169, 170-179, 180-189 have frequencies 3, 8, 14, 10, 5. Midpoints are 144.5, 154.5, 164.5, 174.5, 184.5. $\Sigma f = 40$ and $\Sigma fx = 6640$, so grouped mean = 166 cm. The modal class is 160-169. Cumulative frequencies are 3, 11, 25, 35, 40; the 20th item lies in 160-169, so this is the median class.

Chapter 19: Probability

Learning Outcomes

- describe probability on a scale from 0 to 1
- list sample spaces and events
- calculate simple probabilities
- use complementary probability
- work with mutually exclusive events
- calculate probabilities for simple independent events
- use simple tree diagrams

THINK BIG How can probability help describe uncertainty and make sense of chance events?

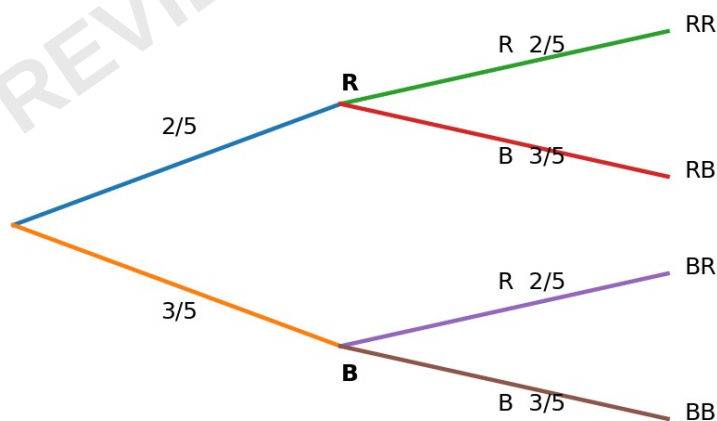
Key Concepts and Notes

Probability measures how likely an event is: $0 \leq P(E) \leq 1$. An impossible event has probability 0 and a certain event has probability 1.

For equally likely outcomes, $P(E) = \text{number of favourable outcomes} \div \text{total number of possible outcomes}$.

Complementary events satisfy $P(E') = 1 - P(E)$. Mutually exclusive events cannot happen at the same time, so their probabilities may be added. For independent successive events, multiply probabilities along a branch.

REMEMBER Write the key rule or formula first, keep units consistent, and show enough working for another learner to follow your reasoning.



Visual Guide: Multiply probabilities along a branch; add suitable end branches.

Worked Examples

1. Fair die: $P(\text{rolling } 4) = 1/6$.
2. Fair die: $P(\text{number greater than } 4) = 2/6 = 1/3$.
3. Two fair coins: $P(HH) = 1/2 \times 1/2 = 1/4$.

KJSEA-Style Mock Papers

The following papers are original practice assessments prepared for revision. They follow the current KJSEA Mathematics paper structure: one paper, 2 hours, 100 marks, Section A with 20 multiple-choice questions (20 marks) and Section B with structured/essay questions (80 marks). They are not official KNEC papers.

Instructions to Learners

1. Answer all questions.
2. Show all necessary working in Section B.
3. Give answers to a reasonable degree of accuracy where necessary.
4. Use $\pi = 22/7$ where stated; otherwise use the value appropriate to the question.
5. The time allowed for each mock paper is 2 hours.

Mock Paper 1 — Confidence Builder

Time: 2 hours | Total: 100 marks

SECTION A: MULTIPLE-CHOICE QUESTIONS (20 marks)

Choose the correct answer in each question.

1. Evaluate $-7 + 3 \times 5$.
A. 8 B. -20 C. 22 D. -10
2. Which number is a perfect cube?
A. 144 B. 216 C. 324 D. 400
3. Simplify $3^4 \times 3^2 \div 3^3$.
A. 3 B. 9 C. 27 D. 81
4. If 6 workers complete a task in 12 days, how many days will 8 workers take at the same rate?
A. 6 B. 8 C. 9 D. 16
5. The order of the matrix $\begin{bmatrix} 2 & 4 & 1 \\ 5 & 3 & 7 \end{bmatrix}$ is
A. 2×2 B. 2×3 C. 3×2 D. 3×3
6. The gradient of the line through (1,2) and (3,8) is
A. 2 B. 3 C. 4 D. 5
7. Solve $x + 4 < 9$.
A. $x < 5$ B. $x > 5$ C. $x \leq 13$ D. $x \geq 5$
8. The area of a 90° sector of radius 14 cm is
A. 44 cm^2 B. 77 cm^2 C. 154 cm^2 D. 616 cm^2
9. The volume of a cone of radius 3 cm and height 4 cm is
A. $12\pi \text{ cm}^3$ B. $18\pi \text{ cm}^3$ C. $24\pi \text{ cm}^3$ D. $36\pi \text{ cm}^3$

CONTINUE WITH THE COMPLETE BOOK

The full edition includes:

- All 19 Grade 9 Mathematics chapters
- Worked examples and Skill Builders
- Chapter tests with worked solutions
- Mixed-topic revision exercises
- Three original KJSEA-style mock papers
- Diagrams, exam-focus prompts and learner checkpoints



Peak Achievers Online Academy

Call / SMS / WhatsApp: 0740166105

Email: hezekiahomweri@gmail.com

Author: Hezekiah Omweri Nyatuka

Learn • Revise • Excel

Thank you for previewing Peak Achievers Grade 9 Mathematics.