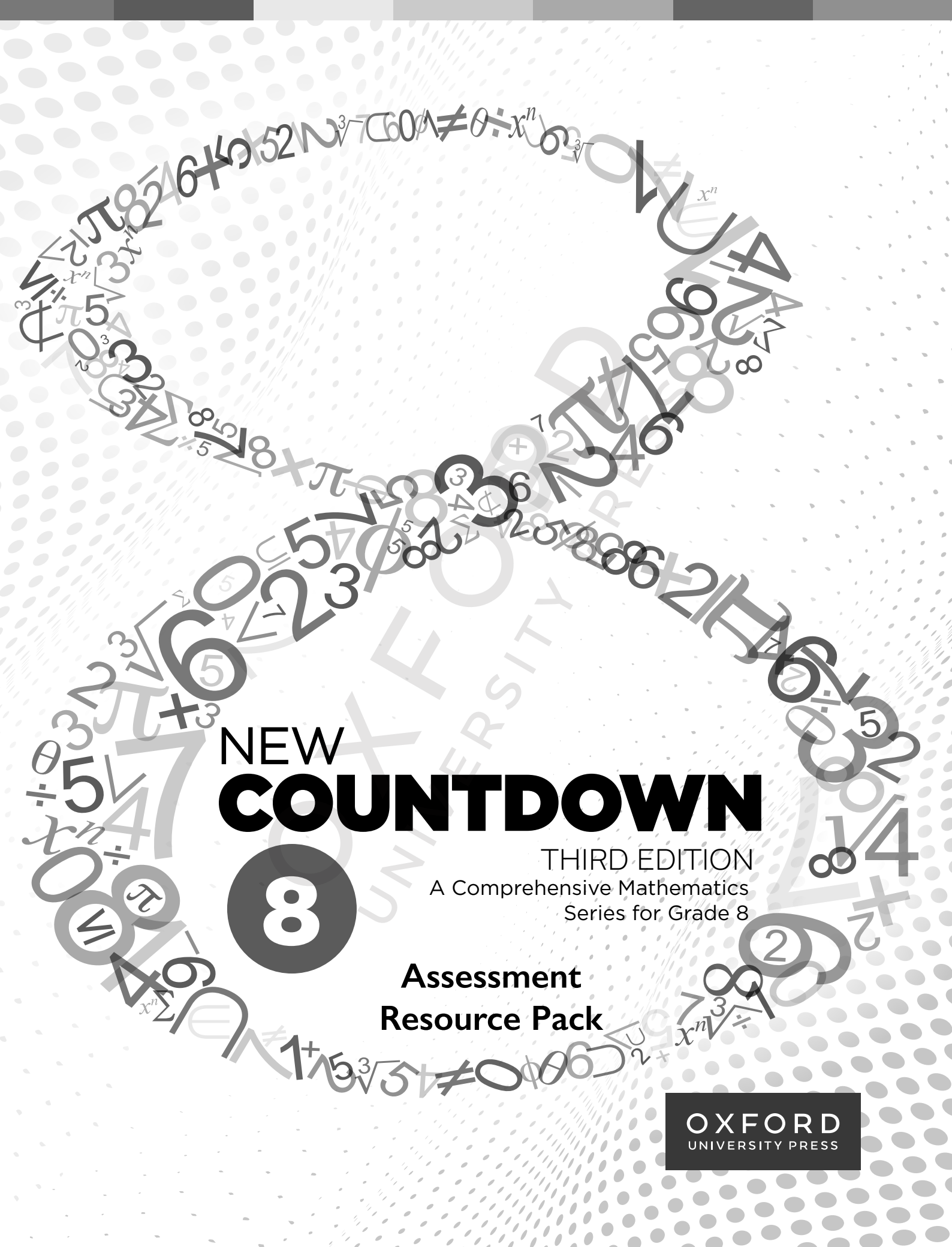


NEW COUNTDOWN 8

THIRD EDITION

A Comprehensive Mathematics Series for Grade 8

Assessment Resource Pack

OXFORD UNIVERSITY PRESS

Preface

Assessments are an appropriate way for teachers to assess the extent to which the students have grasped the learning objectives and their ability to apply their learned concepts. An effective assessment is based on the curriculum's expectations of a student's learning achievements at every level, as well as provides an evaluation of the process of judgments and the interpretations of the questions by the students when attempting the assessment itself. For an assessment to reach its full purpose, the teacher must also provide descriptive feedback upon return that helps guide the students towards improvement.

The **Assessment Resource Pack** therefore, helps direct the teachers on how to effectively make use of assessments in their classrooms. This resource pack comes with five model papers – two midyear, and three final papers – that serve as an appropriate example for students to know what to expect in an examination, and for teachers in guiding them on how to make assessment papers that test a student's knowledge, application, and reasoning. The multiple choice questions (MCQ) is a form of objective assessments and can be used to test a wide range of thinking skills focusing on content. They offer students an opportunity to reveal knowledge, skills, and abilities in a variety of ways. Short questions (SQ) generally require exact answers in a short time. Students are more familiar with this practice and they provide a better chances at scoring. Constructive response questions (CRQ) require more elaborate answers with explanation and reasoning. They demand students to create their own responses based on their understanding and prior knowledge. The Unit Weightage Grid also helps teachers balance the paper amongst these three to evaluate several learning objectives within one assessment.

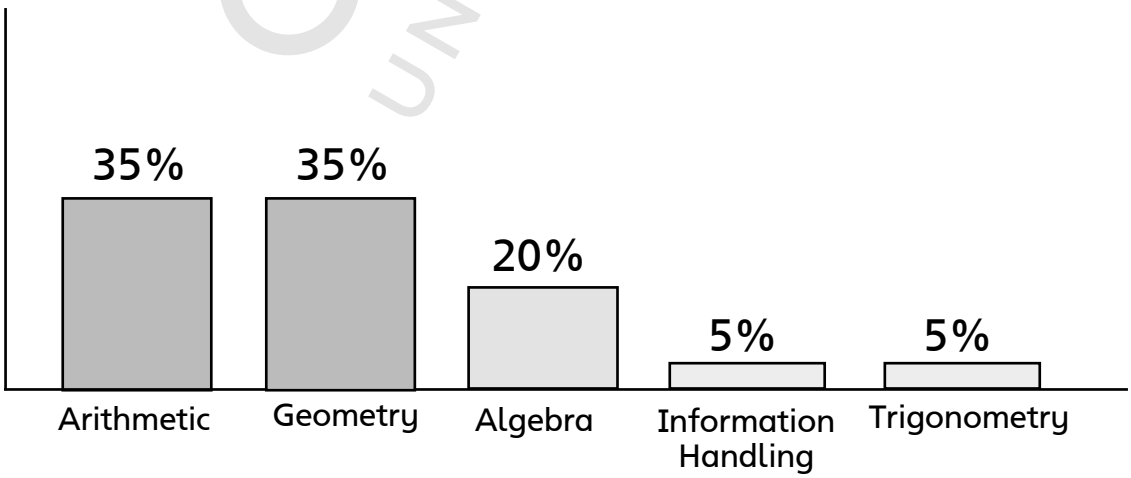
It is important to consider that summative assessments – i.e. term and final examinations – are not the only important kind of assessment in an academic setting. Formative assessments, such as class tests, worksheets, homework, and quizzes, are all of equal importance as they refer to the ongoing process the teacher and students engage in as they focus on common learning goals and work towards achieving them. Informal evaluations such as class discussions, group assignments, and activities all help further enhance the understanding of their learning objectives in different ways, thus challenging them to approach and decipher the same concepts from different angles.

All forms of assessment help the teachers diagnose the process and achievement of the students, and evaluate their ability to grasp and apply concepts in more than one way. The students also benefit from the different kinds of assessment as each kind offers the student more feedback that will eventually guide him or her towards successfully arriving at the learning objective.

Contents

Unit-wise Weightage Grid

Unit	Title	Weightage
1.	Operations on Sets	7%
2.	Real Numbers	12%
3.	Number Systems	8%
4.	Financial Arithmetic	8%
5.	Polynomials	5%
6.	Factorisation, Simultaneous Linear Equations	15%
7.	Fundamentals of Geometry	7%
8.	Practical Geometry	12%
9.	Areas and Volumes	6%
10.	Demonstrative Geometry	10%
11.	Introduction to Trigonometry	5%
12.	Information handling	5%
	Total	**100%**



Syllabus Coverage Grid

KEY: MCQs ✹ SQs ■ CRQs ▲

Unit	SLOs (Learning Outcomes/Skills)	Mid-Year 1	Mid-Year 2	Annual 1	Annual 2	Annual 3
Sets	i) Recpgmoze set of					
	• natural numbers (N),		■			
	• whole numbers (W),	▲	■			
	• integers (Z),					
	• rational numbers (Q),					
	• even numbers (E),		✹	✹		
	• odd numbers (0),	✹				
	• prime numbers (P).	✹	✹			
	ii) Find a subset of a set.		✹			
	iii) Define proper (c) and improper (k) subsets of a set.					
	iv) Find power set peA) of a set A.	■	■			
	1.2 Operations on Sets					
	i) Verify commutative and associative laws with respect to union and intersection.	▲				
	ii) Verify the distributive laws.		▲			
	iii) State De Morgan's laws			✹		
	verify De Morgan's law	▲	▲			
	1.3 Venn Diagram					
	i) Demonstrate union and intersection of three overlapping sets through Venn diagram.	✹ ■	✹ ■			✹
	ii) Verify associative and distributive laws through Venn diagram	▲				
Real Numbers	**2.1 Irrational Number**					
	i) Define an irrational number.					
	ii) Recognize rational and irrational numbers.	✹	✹			
	iii) Define real numbers.					
	iv) Demonstrate non-terminating /non-repeating (or non-periodic) decimals.	✹				
	2.2 Squares					
	i) Find perfect square of a number.	■	✹			
	ii) Establish patterns for the squares of natural numbers (e.g., 42 = 1 + 2 + 3 + 4 + 3 + 2 + 1)			■	✹	

	2.3 Square Roots					
	i) Find square root of					
	• a natural number (e.g. 16,625, 1600),		✹		✹	✹
	• a common fraction e.g. (9 36 49) a common rac lOn e.g. 16' 49' 64 '	✹				
	• a decimal (e.g. 0.01, 1.21,0.64), given in perfect square form, by prime factorization and division method.	■	■			
	ii) Find square root of a number which is not a perfect square (e.g., the numbers 2, 3, 2.5).	■	▲			
	iii) Use the following rule to determine the number of digits in the square root of a perfect square. Rule: Let n be the number of digits in the perfect square then its square root contains n/2- digits if n is even, n+1/2 digits if ***n*** is odd.	✹				
	iv) Solve real life problems involving square roots.	▲	▲			
	2.4 Cubes and Cube Roots					
	i) Recognize cubes and perfect cubes.			■	✹	
	ii) Find cube roots of a number which are perfect cubes.	▲	✹			
	iii) Recognize properties of cubes of numbers.		▲			
Number Systems	**3.1 Number Systems**					
	i) Recognize base of a number system.	✹	✹		✹	✹
	ii) Define number system with base 2,5,8 and 10.					
	iii) Explain	✹				
	• number system with base 5,					
	• octal number system (system with base 8),					
	• decimal number system (system with base 10).					
	3.2 Conversions					
	i) Convert a number from decimal system to a system with base 2, 5 and 8, and vice versa.	▲	✹		✹	✹
	ii) Add, subtract and multiply numbers with base 2, 5 and 8.		■			
	iii) Add, subtract and multiply numbers with different bases.	▲	▲	✹		
Financial Arithmetic	**4.1 Compound Proportion**					
	i) Define compound proportion.				✹	
	ii) Solve real life problems involving compound proportion, partnership and inheritance.	▲	■ ▲			
	4.2 Banking					
	4.2.1 Types of a Bank Account					
	i) Define commercial bank deposits, types of a bank account (PLS savings bank account, current deposit account, PLS term deposit account and foreign currency account).	✹	✹			

	ii) Describe negotiable instruments like cheque, demand draft and pay order.	✹				✹
	4.2.2 On-line banking					
	iii) Explain on-line banking, transactions through ATM(Auto Teller Machine), debit card and credit card (Visa and Master).					
	4.2.3 Conversion of Currencies					
	iv) Convert Pakistani currency to well-known international currencies.	■	■		■	
	4.2.4 Profit! Markup					
	v) Calculate					
	• the profit! markup, (Interest)	▲				
	• the principal,					
	• the profit! markup rate,		▲			
	• the period.					
	• Amount		■			▲
	4.2.5 Types of Finance					
	vi) Explain Overdraft, running finance, demand finance, and leasing					
	Solve real-life problems related to finance and banking		▲			▲
	4.3 Percentage					
	4.3.1 Profit and Loss					
	i) Find percentage profit and percentage loss.	✹	■			▲
	4.3.2 Discount					
	ii) Find percentage discount.	✹				
	iii) Solve problems involving successive transactions.					
	sale price and marked price	▲				
	4.4 Insurance					
	i) Define insurance.					
	ii) Solve real life problems regarding life and vehicle insurance.	▲		■		
	4.5 Income Tax					
	i) Explain income tax, exempt income and taxable mcome.					
	ii) Solve simple real life problems related to individual income tax assessee.	✹	▲			
	Stocks and shares					
	stocks and shares	▲	✹		■	
	Calculate dividends		▲			
	Calculate nominal value of share	✹				

	Calculate market value of share	▲			■	
	Find out Par value		✹			✹
	Solve real-life problems related to brokerage		✹	✹		✹
	Solve real-life problems related to premium		■			
Polynomials	**5.1 Algebraic Expression**					
	recall variable, constant, literal and algebraic expression					
	5.1 Algebraic Expression					
	i) Define polynomial, degree of polynomial and coefficients of a polynomial	Alreday covered in NCD Book 7				
	ii) Recognize polynomial in one, two and more variables.					
	iii) Recognize polynomials of various degrees (e.g., linear, quadratic, cubic and biquadratic polynomials).					
	5.3 Operations on Polynomials					
	i) Add, subtract and multiply polynomials.				■	■
	ii) Divide a polynomial by a linear polynomial.			▲	✹ ■	▲
	Simplify algebraic expressions			✹	■	✹ ■
	Simplify expressions involving fractions			■ ▲	✹ ■	
Factorisation, Simultaneous Equations	**6.1 Basic Algebraic Formulas**					
	Recall the formulas:					
	• $(a + b)^2 = a^2 + 2ab + b^2$,			✹	✹	
	•$(a - b)^2 = a^2 - 2ab + b^2$,			✹	✹	■
	• $a^2 - b^2 = (a - b)(a + b)$,			✹		✹
	and apply them to solve problems like:					
	• Evaluate $(102)^2$, $(1.02)^2$, $(98)^2$ and $(0.98)^2$.					■
	• Find x^2 + --;.- and x^4 + -;				▲	
	6.2 Factorisation					
	Factorise expressions of the following types:					
	• ka + kb + ke,			✹		
	• $ae + ad + be + bd$,					
	• $a^2 \pm 2ab + b^2$,			✹	✹	
	• $a^2 - b^2$,			■		✹
	• $a^2 \pm 2ab + b^2 - e^2$				■	
	• $a^3 + 3a^2b + 3ab^2 + b^3$				■	✹
	Factorise expressions by breaking the middle term				▲	■
	More expressions			▲		

	6.3 Manipulation of Algebraic					
	Recognize the formulas:					
	Expression					
	• $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$,			■	■	
	• $(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$, and apply them to solve the problems like:			▲		✹
	• Find $x^3 + -\frac{1}{3}x$ and $x^3 - \frac{1}{x}3$ when the value of $x + \frac{1}{x}$ is given Prove algebraic equations using algebraic identities			▲	▲	■
	Prove algebraic equation using algebraic identities			▲		
	Solve equations involving algebraic fractions			■	✹	✹
	Solve real-life problems involving equations			■	▲	
	6.4 Simultaneous linear equations					
	i) Recognize simultaneous linear equations in one and two variables.			✹		▲
	ii) Give the concept of formation of linear equation in two variables.			▲		
	iii) Know that:					
	• a single linear equation in two unknowns is satisfied by as many pair of values as required.					✹
	• two linear equations in two unknowns have only one solution (i.e., one pair of values).			✹	✹	
	6.5 Solution of Simultaneous linear equations					
	i) Solve simultaneous linear equations using Linear Equations					
	• method of equating the coefficients,			▲	▲	
	• method of elimination by substitution,			■		▲
	• method of cross multiplication.					
	ii) Solve real life problems involving two simultaneous linear equations in two variables.			■	✹ ▲	▲
Fundamentals of Geometry	**7.1 Parallel Lines**	Alreday covered in NCD Book 7				
	i) Define parallel lines.					
	ii) Demonstrate through figures the following properties of parallel lines.					
	• Two lines which are parallel to the same given line are parallel to each other.					
	• If three parallel lines are intersected by two transversals in such a way that the two intercepts on one transversal are equal to each other, the two intercepts on the second transversal are also equal.					
	• A line through the midpoint of the side of a triangle parallel to another side bisects the third side (an application of above property).					

	iii) Draw a transversal to intersect two parallel lines and demonstrate corresponding angles, alternate interior angles, vertically opposite angles and interior angles on the same side of transversal.	Alreday covered in NCD Book 7				
	iv) Describe the following relations between the pairs of angles when a transversal intersects two parallel lines.			✹		■
	• Pairs of corresponding angles are equal.			✹	✹	■
	• Pairs of alternate interior angles are equal.			✹		■
	• Pair of interior angles on the same side of transversal is supplementary, and demonstrate them through figures.			✹		■
	7.2 Polygons	Alreday covered in NCD Book 7				
	i) Define a polygon.					
	ii) Demonstrate the following properties of a parallelogram.					
	• Opposite sides of a parallelogram are equal.					
	• Opposite angles of a parallelogram are equal.					
	• Diagonals of a parallelogram bisect each other.					
	iii) Define regular pentagon, hexagon and octagon.					
	7.3 Circle					
	i) Demonstrate a point lying in the interior and exterior of a circle.					
	ii) Describe the terms; sector, secant and chord of a circle, concyclic points, tangent to a circle and concentric circles.					
Practical Geometry	8.1 Construction of Quadrilaterals					
	i) Define and depict two converging lines and find the angle between them					
	ii) Bisect the angle between the two converging lines					
	iii) Construct a square					
	iv) Construct a rectangle					
	iv) Construct a rhombus			■		
	vi) Construct a parallelogram	Alreday covered in NCD Book 7				
	vii) Construct a kite					
	viii) Construct a regular pentagon					■
	Divide a line segment it equal parts				■	
	Drawing Tangent to a circle from a poit outside it				▲	
	Draw in-circle of a triangle					■

	8.2 Construction of a Right Angled Triangle	Alreday covered in NCD Book 7				
	Construct a right angled triangle					
	• when hypotenuse and one side are given.					
	• when hypotenuse and the vertical height from its vertex to the hypotenuse are given.					
Area and Volume	**9.1 Pythagoras Theorem**					
	i) State the Pythagoras theorem and give its informal proof.			✹	✹	▲
	ii) Solve right angled triangles using Pythagoras theorem.			✹	▲	
	9.2 Hero's Formula					
	State and apply Hero's formula to find the areas of triangular and quadrilateral regions.			✹	✹	
	9.3 Surface Area and Volume					
	i) Find the surface area and volume of a sphere.			✹ ▲	✹	✹
	ii) Find the surface area and volume of a cone.				■	✹
	iii) Solve real life problems involving surface area and volume of sphere and cone.			▲	■ ▲	■ ▲
Demonstrative Geometry	**10.1 Demonstrative geometry**					
	i) Define demonstrative geometry.					
	10.1.1 Reasoning					
	ii) Describe the basics of reasoning.					
	10.1.2 Axioms, Postulates and Theorem					
	iii) Describe the types of assumptions (axioms and postulates).					
	iv) Describe parts of a proposition.					
	v) Describe the meanings of a geometrical theorem, corollary and converse of a theorem.					
	10.2 Theorems					
	Prove the following theorems along with corollaries and apply them to solve appropriate problems.					
	i) If a straight line stands on another straight line, the sum of measures of two angles so formed is equal to two right angles.				▲	
	ii) If the sum of measures of two adjacent angles is equal to two right angles, the external arms of the angles are in a straight line.					
	iii) If two lines intersect each other, then the opposite vertical angles are congruent.			▲	▲	■
	v) In any correspondence of two triangles, if two sides and included angle of one triangle are congruent to the corresponding sides and included angle of the other, the two triangles are congruent.				✹	

	v) If two sides of a triangle are congruent, then the angles opposite to these sides are congruent.					▲
	vi) An exterior angle of a triangle is greater in measure than either of its opposite interior angles.					
	vii) If a transversal intersects two lines such that the pair of alternate angles are congruent then the lines are parallel.				■	
	viii) If a transversal intersects two parallel lines the alternate angles so formed are congruent.					
	ix) The sum of measures of the three angles of a triangle is 180°			✹		▲
Introduction to Trigonometry	**11.1 Trigonometry**					
	11.2 Trigonometric Ratios of Acute Angles					
	i) Define trigonometry.					
	ii) Define trigonometric ratios of an acute angle.			✹	✹	
	iii) Find trigonometric ratios of acute angles (30 degrees, 60 degrees, and 45 degrees).			■	✹	✹
	iv) Define trigonometric ratios of complementary angles.					
	v) Solve right angled triangles using trigonometric ratios.			■	▲	▲
	vi) Solve real life problems to find heights (avoid naming angle of elevation).			■	▲	▲
Information Handling	**12.1 Frequency Distribution**					
	i) Define frequency, frequency distribution.					
	ii) Construct frequency table.			■		▲
	iii) Construct a histogram representing frequency table.			■	▲	▲
	12.2 Measures of Central Tendency					
	i) Describe measures of central tendency.					
	ii) Calculate mean (average), weighted mean, median and mode for ungrouped data.			✹	▲	✹
	iii) Solve real life problems involving mean (average), weighted mean, median and mode.			✹	✹ ■ ▲	■ ▲
Exponents and Radicals	Laws of Indices	✹ ■	✹	✹		
	Numbers with rational exponents	✹ ▲	■			
	Express rational numbers in radical form				■	
	Express radicals as rational numbers		✹			
	Add and subtract radicals		■			
	Surds		✹			
	Four operations	▲	▲	■		

Matrices	Types of matrices			✹	✹	
	Organising information in a matrix			■ ▲	■	■
	Transposition of a Matrix			■		✹
	Addition of Matrices				■	
	Subtraction of Matrices			✹ ▲		
	Solve real life problems			■ ▲		■
Averages	Average					
	Simple Average	▲	▲			
	Weighted Average		■			
	Average Speed	✹	✹	▲		✹
Logarithms	Express numbers in standard form		✹			✹
	Express numbers in scientific notation	✹			✹	
	Logarithms (find missing values)	■	✹ ▲			
	Laws of Logarithms	✹ ■	✹ ▲		✹	
Symmetry	Linear symmetry				✹	✹
	Properties of symmetrical figure				■	
	Properties of symmetry about a bisector			✹		

✶ **The highlighted SLOs are not included in National Curriculum for Grade VIII but are covered in New Countdown Book 8.**

Marking Scheme

Model Paper I

Mid-Year Examination

Mathematics

	Section A	Marking Criteria
Q1.	I. C VI. D XI. B XVI. D II. A VII. D XII. A XVII. C III. A VIII. D XIII. C XVIII. B IV. C IX. A XIV. C XIX. A V. D X. B XV. D XX. C	I mark for each correct option.
		[Total Marks: /20]

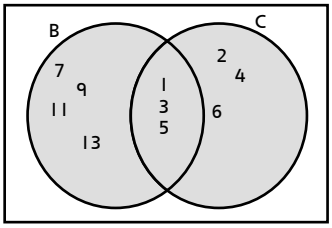
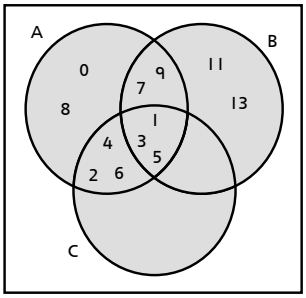
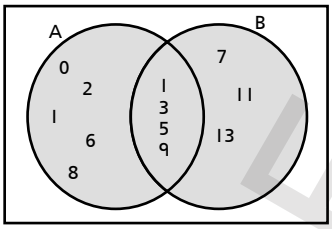
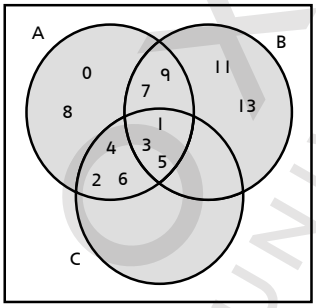
	Section B	Marking Criteria
Q2. a)	P(A) = { }, {pink}, {blue}, {purple}, {pink, blue}, {blue, purple}, {pink, blue, purple}	I mark for correct number of elements. I mark for the correct set.
b)	{Guavas, apples, mangoes, peaches} {mangoes and peaches}	I mark for each correct set.
c)	$\sqrt{\frac{256}{100}}$ $=\frac{16}{10}$ $= 1.6$	I mark for the conversion from decimal to fraction. I mark for the correct answer.
		[Total Marks: /6]
Q3. a)	$2^{\frac{-3}{5}-\frac{2}{5}}$ 2^{-1} or $\frac{1}{2}$	I mark for the correct operations on powers. I mark for the correct answer.
b)	$\left(\frac{4}{5}\right)^{-9+9}$ $\left(\frac{4}{5}\right)^{0} = 1$	I mark for the correct operations on powers. [any correct method for simplification will be accepted]. I mark for the correct answer.

c)	$\begin{array}{r\|l} & 8.3 \\ \hline 8 & 70 \\ 8 & -64 \\ \hline 163 & 600 \\ & -489 \\ \hline & 120 \end{array}$ $\sqrt{70} = 8.3$	1 mark for correct calculation. 1 mark for correct answer.
		[Total Marks: /6]
Q4 a)	$32 = 2^x$ $2^5 = 2^x$ $x = 5$	1 mark for the correct scientific notation. 1 mark for the correct value.
b)	$\text{Log}_x\ ab = \log_x a + \log_x b$	1 mark for the correct law.
c)	$\log_5 25 \times 5$ $\log_5 25 + \log_5 5$ $2 + 1 = 3$	1 mark for expressing 125 as a product of 5 and 25. 1 mark for correct application of first law. 1 mark for the correct value.
		[Total Marks: /6]
Q5 a)	Profit Rs 28000 – Rs 25000 = Rs 3000	1 mark for correct formula. 1 mark for correct answer.
b)	Percentage profit = $\frac{\text{profit}}{\text{cost price}} \times 100\%$ $= \frac{\text{Rs } 3000}{\text{Rs } 25000} \times 100\%$ $= 12\%$	1 mark for correct formula and substitution of values. 1 mark for correct answer.
c)	Average = $\frac{\text{total score in all tests}}{\text{number of tests}}$ $\frac{41 + 35 + 37 + 43}{4}$ $= 39$	1 mark for correct formula and values substitution. 1 mark for the correct answer.
		[Total Marks: /6]
Q6 a)	Amount in US$ = $\frac{\text{Amount in Rupees}}{\text{Exchange rate}}$ $= \frac{11250}{125}$ = US$ 90	1 mark for the correct formula and values substitution. I mark for the correct answer.

b)	i) Perpendicular bisector of $\overline{AB}$ ii) Angle bisector of $\angle$ ABC	1 mark for the correct arcs. 1 mark for the correct construction of line bisector. 1 mark for correct arcs. 1 mark for correct construction of angle bisector.
		[Total Marks: /6]

	Section C	**Marking Criteria**
Q7 a)	**LHS** $(P \cup Q)' = \{c\}$ **RHS** $P' = \{c, l, m, n\}$ and $Q' = \{a, c, d, j\}$ $P' \cap Q' = \{c\}$ LHS = RHS	1 mark for correct $(P \cup Q)'$. 1 mark for correct P′ and Q′. 1 mark for $P' \cap Q'$. 1 mark for verification statement.
b)	Market value of each share at the time of purchase $= \text{Rs } \frac{12000}{100} = \text{Rs } 120$ Face value = 100 Rs 120 − Rs 100 = Rs 20 above par	1 mark for the correct formula and values substitution. 1 mark for correct subtraction of face value. 1 mark for the correct answer.
c)	Amount of premium=rate of premium x insurance amount $= \frac{4}{100} \times 150000$ = Rs 6000	1 mark for correct formula. 1 mark for correct values. 1 mark for correct working and answer.
		[Total Marks: /10]
Q8 a)	$\left[\frac{2}{3} \times 6 \div 10\right]^{-2}$ $= \left[\frac{2}{5}\right]^{-2} = \left[\frac{5}{2}\right]^{2}$ $= \frac{25}{4}$ = 6.25	1 mark for correct cube roots. 1 mark for correct application of exponent. 1 mark for correct simplification. 1 mark for correct answer.
b)	Number of rows = $\sqrt{1764}$ $= \sqrt{42 \times 42}$ = 42	1 mark for the correct method. 1 mark for correct square root 1 mark for the correct answer
c)	Height of the tank = 2744 $= \sqrt[3]{14 \times 14 \times 4}$ = 14 cm	1 mark for the correct method. 1 mark for correct cube root. 1 mark for the correct answer

		[Total Marks: /10]
Q9 a)	Amount of discount = 5 % of 500 = Rs 25 Sale price = Marked price − discount = 500 − 25 = Rs 475	1 mark for correct formula. 1 mark for correct amount of discount 1 mark for correct formula of sale price. 1 mark for the correct sale price.
b)	$10011_2 + 11001_2 + 10111_2$ 10011 11001 + 10111 100000 11	1 mark for the correct addition of two digits according to binary laws. 1 mark for correct addition with carrying. 1 mark for the correct answer.
c)	$332_5 + 131_5$ 332 + 131 1013	1 mark for the correct addition of two base 5 digits. 1 mark for converting sum into base 5 number. 1 mark for the correct answer.
		[Total Marks: /10]
Q10 a)	Average age of 25 girls $= \frac{\text{sum of all ages}}{\text{total number of girls}}$ Sum of the ages of 25 girls = 300 Average age of 30 girls $= \frac{300 + 13 + 14 + 15 + 16 + 16}{30}$ = 12.5 years	1 mark for the correct formula and values substitution. 1 mark for formula manipulation and sum of the ages. 1 mark for the formula and values for average age of 30 girls. 1 mark for the correct answer.
b)	$\frac{x}{100} = \frac{12 \times 18}{9 \times 20}$ x = 720 (number of key chains)	1 mark for the correct identification of proportion. 1 mark for correct equation. 1 mark for the correct answer.
c)	$A = P(1 + \frac{R}{100})^T$ Rs 44100= Rs 40000 $(1 + \frac{R}{100})^2$ R = 5 5% is the required rate	1 mark for the correct formula and substitution. 1 mark for formula manipulation. 1 mark for the correct answer.
		[Total Marks: /10]

Q11 a)	i) $A \cup (B \cup C) = (A \cup B) \cup C$ **LHS**  $B \cup C = \{1, 2, 3, 4, 5, 6, 7, 9, 11, 13\}$  $A \cup (B \cup C) = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 13\}$ **RHS**  $A \cup B = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 13\}$  $(A \cup B) \cup C = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 13\}$ Since, LHS = RHS Hence, $A \cup (B \cup C) = (A \cup B) \cup C$	1 mark for the correct property statement. 1 mark for the correct elements in each set. 1 mark for the correct illustration of first Venn diagram for both LHS and RHS. 1 mark for the final Venn diagram.

b)	2 | 84 ------ 0 2 | 42 ------ 0 2 | 10 ------ 1 2 | 5 ------ 0 2 | 2 ------ 1 2 | 1 ------ 0 $84 = 1010100_2$	1 mark for correct method. 1 mark for the correct division. 1 mark for the correct answer.
c)	$1\times2^4 + 1\times2^3 + 0\times2^4 + 0\times2^3 + 0\times2^2 + 1\times2^1 + 0\times2^0$ $= 64 + 32 + 0 + 0 + 0 + 2 + 0$ $= 98$	1 mark for correct method. 1 mark for the correct division.
		[Total Marks: /10]

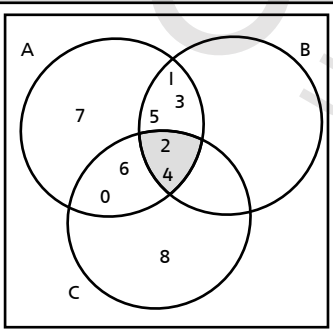
Marking Scheme

Model Paper 2

Mid-Year Examination

Mathematics

	Section A	Marking Criteria
Q1.	I. C VI. C XI. A XVI. B II. A VII. B XII. C XVII. D III. D VIII. D XIII. C XVIII. B IV. A IX. B XIV. D XIX. C V. A X. B XV. D XX. A	1 mark for each correct option.
		[Total Marks: /20]

	Section B	Marking Criteria
Q2.		
a)	$P(A) = 2^n$ $= 2^3 = 8$ P(A) is a set of 8 sets	1 mark for the correct formula. 1 mark for the correct answer.
b)	$(125)^{\frac{-4}{3}}$ $(\sqrt[3]{125})^{-4} = 5^{-4}$ $= \frac{1}{5^4}$ $= \frac{1}{625}$	1 mark for correct radical index. 1 mark for correct application of indices. 1 mark for the correct answer.
c)	$(18a + 15b) - (12a + 7b)$ $16a + 6b$	1 mark for the correct calculation and answer.
		[Total Marks: /6]
Q3.		
a)		1 mark for correct placement of element. 1 mark for correct shading.
b)	$\sqrt{\frac{625}{100}}$ $\frac{25}{10} = 2.5$	1 mark for equivalent fraction or correct working if division method is followed. 1 mark for the correct answer.

c)	$\log_2 32 = 5$	1 mark for the correct notation
d)	$25 - x$	1 mark for the correct expression.
		[Total Marks: /6]
Q4. a)	No. of pipes time 5 90 x 30 $30x = 5 \times 90$ x = 15 pipes	1 mark for the correct proportion. 1 mark for the correct equation. 1 mark for the correct answer.
b)	i) Profit =selling price - cost price=Rs 20	1 mark for correct formula and answer.
	ii) Profit % = $\frac{\text{profit}}{\text{cost price}}$ 100% = 11.11%	1 mark for correct formula. 1 mark for the correct percentage.
		[Total Marks: /6]
Q5. a)	$8\sqrt[8]{23} - 3\sqrt[8]{23}$ $= (8 - 3)\sqrt[8]{23}$ $= 5\sqrt[8]{23}$	1 mark for the correct method. 1 mark for the correct answer.
b)	$3 \times 5^2 + 2 \times 5^1 + 0 \times 5^0$ 75 + 10 + 0 = 85	1 mark for the correct method. 1 mark for the correct decimal number.
c)	2 | 15 2 | 7 --------- 1 2 | 3 --------- 1 | 1 --------- 1 $(15)_{10} = (1111)_2$	1 mark for the correct method. 1 mark for the correct binary number.
		[Total Marks: /6]
Q6. a)	$\log_4 16 = \log_4 4^2$ $= 2 \log_4 4 = 2 \times 1 = 2$	1 mark for correct manipulation. 1 mark for correct application of third law and answer.
b)	Amount in rupees = amount in US$ exchange rate = 15 × 110 = Rs 1650	1 mark for correct formula and values substitution. 1 mark for correct answer.
c)	Market value of each share=25 + 15= Rs 40 Cost of 10 shares = 40 x 100 = Rs 4000	1 mark for the correct method. 1 mark for correct answer.
		[Total Marks: /6]

	Section C	Marking Criteria
Q7. a)	**LHS** A∩B = {cats, pigeons} (A∩B)' = {sparrows, parrots, cows, dogs, goats, hens, rabbits} **RHS** A' = {sparrows, cows, dogs, goats, hens, rabbits} B' = {sparrows, parrots, cows, goats, hens} A'∪B' = {sparrows, parrots, cows, dogs, goats, hens, rabbits}	
b)	No. of men Height of wall No. Of days 25 60 8 x 300 20 $\frac{x}{25} = \frac{300 \times 8}{60 \times 20}$ x = 50 men	1 mark for the correct proportion. 1 mark for the correct equation. 1 mark for the correct answer.
b)	$729 = x^3$ $729 = 9^3$ $x = 9$	1 mark for correct logarithm. 1 mark for correct value of x.
		[Total Marks: /10]
Q8. a)	A∪(B∩C) = (A∪B)∩(A∪C)	1 mark for the correct statement.
b)	**LHS** (B∩C) = {-1, 1, 3} A∪(B∩C) = {-1, 0, 1, 2, 3, 4, 5, 6, 7} **RHS** A∪B = {-2, -1, 0, 1, 2, 3, 4, 5, 6, 7} A∪C = { -5, -3, -1, 0, 1, 2, 3, 4, 5, 6, 7, 9} (A∪B)∩(A∪C) = {-1, 0, 1, 2, 3, 4, 5, 6, 7} LHS=RHS Property proved	1 mark for the correct B∩C (LHS). 1 mark for the correct sets for A∪B, and A∪C. (RHS) 1 mark for final sets for LHS and RHS. 1 mark for the final statement.

c)	To find simple interest first calculate the principle. Compound interest = Amount − Principal $500 = P\left(\frac{1+R}{100}\right)^T - P$ $500 = P\left[\left(\frac{1+5}{100}\right)^2 - 1\right]$ $500 = 0.05P$ Principle = Rs 10000 Simple interest = $\frac{PRT}{100}$ $= \frac{10000 \times 5 \times 2}{100}$ = Rs 1000	1 mark for correct formula. 1 mark for formula manipulation. 1 mark for correct principle. 1 mark for correct formula of simple interest. 1 mark for correct answer.
		[Total Marks: /10]
Q9.		
a)	Area of square = l^2 $l^2 = \frac{324}{81}\ m^2$ $l = \sqrt{\frac{324}{81}}\ m$ l = 2 m	1 mark for the correct formula. 1 mark for correct square roots. (square root of simplified fraction or simplification after taking square roots of numerator and denominator, both methods are acceptable). 1 mark for the correct answer.
b)	Tax on salary income=tax rate x salary income $= \frac{3}{100} \times 300000$ = Rs 9000 Tax on business income=$\frac{5}{100} \times 200000$ = Rs 10000 Income from agriculture= 800000−300000−200000 = Rs 200000 Tax on agricultural income = $\frac{8}{100} \times 200000$ = Rs 16000 Total income tax = Rs 35000	1 mark for the correct formula for calculating tax. 1 mark for correct amount of individual taxes. 1 mark for correct amount of agricultural income. 1 mark for the correct total income tax.
c)	Prime factors of 200 = 2×2×2×5×5 $= 2^3 \times 5^2$ 2 occurs thrice but 5 occurs only twice. Therefore n = 5 is the number by which 200 must be multiplied with to make it a perfect cube.	1 mark for correct prime factors. 1 mark for correct reasoning. 1 mark for the correct answer.
		[Total Marks: /10]

Q10. a)	$\begin{array}{r} 1101_2 \\ \times\ 101_2 \\ \hline 1101 \\ 0000x \\ +\ 1101xx \\ \hline 1000001 \end{array}$	1 mark for correct multiplication with each digit. 1 mark for correct carrying. 1 mark for correct addition.
b)	$\begin{array}{r} 111010_2 \\ -\ \ 10111_2 \\ \hline 100011 \\ +\ \ \ 1111_2 \\ \hline 110001_2 \end{array}$	1 mark for correct borrowing. 1 mark for correct subtraction. 1 mark for correct addition.
c)	Total investment = $900 \times 400 = 360000$ Dividend earned = $\left(\frac{100 \times 30}{100}\right) \times 400$ = Rs 12000 Earning per cent = $\frac{\text{dividend earned}}{\text{total investment}} \times 100\%$ = $\frac{12000}{360000} \times 100\% = 3.33\%$	1 mark for the correct total investment. 1 mark for the correct dividend earned. 1 mark for the correct formula. 1 mark for the correct answer.
		[Total Marks: /10]
Q11. a)	Average marks = $\frac{\{(2\times50)+(4\times48)+(10\times43)+(7\times40)+(4\times37)+(3\times34)\}}{(2+4+10+7+4+3)}$ = $\frac{(100+192+430+280+148+102)}{30}$ = $\frac{1252}{30} = 41.7$	1 mark for the correct formula. 1 mark for the correct values for weighted average. 1 mark for the correct average.
b)	$\frac{5^{-1} \times 5^{3\times\frac{1}{2}}}{\sqrt{5}}$ $5^{-1+\frac{3}{2}-\frac{1}{2}}$ $5^{-1+1} = 5^0 = 1$	1 mark for making the base same. 1 mark for correct operations on exponents. 1 mark for the correct answer.

c)	Average speed of the train $= \frac{\text{total distance covered}}{\text{total time taken}}$ Distance 1 = 600 km Time 1 = $\frac{\text{distance}}{\text{speed}} = \frac{600}{60}$ = 10 hrs Distance 2 = 400 km Time 2 = $\frac{400}{40}$ = 10 hrs Average speed = $\frac{(600+400)}{(10+10)}$ $= \frac{1000}{20}$ = 50 km/hr	1 mark for the correct formula for distance and values substitution. 1 mark for distance 1 and distance 2. 1 mark for correct formula for average speed. 1 mark for the correct answer.
		[Total Marks: /10]

Marking Scheme

Model Paper I

Annual Examination

Mathematics

	Section A	Marking Criteria
Q1.	I. C VI. A XI. B XVI. B II. B VII. C XII. D XVII. D III. B VIII. C XIII. B XVIII. B IV. D IX. A XIV. A XIX. D V. C X. B XV. A XX. A	I mark for each correct option.
		[Total Marks: 20]

	Section B	Marking Criteria
Q2. a)	$x + y = 31$ $x - y = 5$	I mark for correct equations.
b)	From first equation, $x = 31 - y$ substitute in second equation $31 - y - y = 5$ $y = 13$ years $x = 31-13 = 18$ years	I mark for making a variable subject and correct substitution. I mark correct value of y. I mark for correct value of x.
c)	$\frac{(x-1)(x+1)}{(x-1)(x^2+x+1)}$ $\frac{(x+1)}{(x^2+x+1)}$	I mark for correct factorisation. I mark for correct simplification.
		[Total Marks: /6]
Q3. a)	Shuja's sister would get Rs $\frac{25x}{10} = \frac{5x}{2}$	I mark for correct expression.
b)	$x + \frac{5x}{2} = 84$	I mark for correct equation.

c)	$\frac{7x}{2} = 84$ $x = 24$ Shuja's brother gets Rs 24 and his sister gets Rs 60	1 mark for the correct value of x. 1 mark for the correct value of the amount they both receive.
d)	$\sqrt[3]{\frac{343}{-343}}$ $= \sqrt[3]{-1} = -1$	1 mark for correct method. 1 mark for correct answer.
		[Total Marks: /6]
Q4. a)	Green yellow blue $\begin{bmatrix} 2 & 1 & 3 \\ 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 3 & 1 \end{bmatrix}$ Circle triangle rectangle pentagon	1 mark for the correct elements in rows. 1 mark for the correct elements in columns.
b)	Circle triangle rectangle pentagon $\begin{bmatrix} 2 & 1 & 2 & 1 \\ 1 & 2 & 1 & 3 \\ 3 & 1 & 1 & 1 \end{bmatrix}$ green yellow blue	1 mark for the correct transpose.
c)	Amount of premium = rate of premium × insurance amount = 3% × 150000 $= \frac{3}{100} \times 150000$ = Rs 4500	1 mark for the correct formula. 1 mark for the correct substitution of values. 1 mark for the correct answer.
		[Total Marks: /6]
Q5. a)	$\tan 60^\circ = \frac{\text{perpendicular}}{\text{base}}$ $= \frac{x}{50}$ $\sqrt{3} = \frac{x}{50}$ $x = 50\sqrt{3}$ m	1 mark for the correct ratio. 1 mark for the correct value of $\tan 60^\circ$. 1 mark for the correct answer.
b)	$4(3x-1)=2(x+5)$ $12x - 4 = 2x + 10$ $x = \frac{7}{5}$	1 mark for the elimination of denominators. 1 mark for the formula manipulation. 1 mark for the correct answer.
		[Total Marks: /6]
Q6. a)	35	1 mark
b)	7 25000 – 30000	1 mark for each missing value.

c)	Arcs of radius 4 cm on either sides of $\overline{AC}$. Arcs of radius 8 cm on either sides of $\overline{AC}$ cutting previous arcs. Naming the joining points as B and D and form a kite by joining A to B, B to C, C to D, and D to A	1 mark for correctly constructed arcs with radius 4 cm. 1 mark for correctly constructed arcs with radius 8 cm. 1 mark for constructing the complete kite.
		[Total Marks: /6]

	Section C	**Marking Criteria**
Q7. a)	$60a + 120b = 420$	1 mark for the correct equation.
b)	$100a + 120b = 540$	1 mark for the correct equation.
c)	Subtract first equation from second to eliminate b. $40a = 120$ $a = 3$ substitute in any of the above two equations $60(3) + 120b = 420$ $b = 2$ Jahangir drinks 3 glasses and Laraib drinks 2 glasses of fruit shakes.	1 mark for correct operation and elimination of a variable. 1 mark for the correct value of a. 1 mark for correct substitution. 1 mark for correct value of b.
d)	Let $x = m + n$ and $y = a + b$ Then we get the expression, $4x^2 - 12xy + 9y^2 = (2x)^2 - 2(2)(3)xy + (3y)^2$ By applying algebraic identity, $a^2 - 2ab + b^2 = (a + b)$ we have $(2x)^2 - 2(2)(3)xy + (3y)^2 = (2x - 3y)^2$ $4(m + n)^2 - 12(m + n)(a + b) + 9(a + b)^2$ $= (2(m + n) - 3(a + b))^2$	1 mark for substituting variables for expressions $m + n$ and $a + b$. 1 mark for correct application of algebraic identity. 1 mark for correct factorisation. 1 mark for the correct answer.
		[Total Marks: /10]
Q8. a)	$Hyp^2 = per^2 + base^2$ $x^2 = 75^2 + 100^2$ $x^2 = 5625 + 10000 = 15625$ $x^2 = \sqrt{15625}$ $x = 125$ km	1 mark for the correct application of Pythagoras' theorem. 1 mark for the correct formula. 1 mark for correct squares. 1 mark for the correct answer.

b)	Son daughter Son daughter $\begin{bmatrix}10 & 7\\16 & 12\end{bmatrix} - \begin{bmatrix}8 & 4\\3 & 10\end{bmatrix}$ erasers pencils $= \begin{bmatrix}10-1 & 7-4\\16-3 & 12-10\end{bmatrix}$ erasers pencils $= \begin{bmatrix}2 & 3\\13 & 2\end{bmatrix}$ erasers pencils	1 mark for the matrix formation. 1 mark for correct operation. 1 mark for the correct answer.
c)	number of goody bags Ali can buy $= (b^2 + 11b + 30) \div (b + 5)$ $b + 6$ $b + 5 \overline{)\ b^2 + 11b + 30}$ $b^2 + 5b$ $- \quad -$ $6b + 30$ $6b + 30$ $- \quad -$ 0 Ali can buy $b + 6$ goody bags.	1 mark for the correct method. 1 mark for correct division. 1 mark for the correct answer.
		[Total Marks: /10]
Q9.		
a)	Surface Area of sphere = $4\pi r^2$ $4\pi r^2 = 144\pi$ $4r^2 = 144$ $r^2 = 36$ $r = \sqrt{36} = 6$ cm	1 mark for the correct formula. 1 mark for the correct values substitution. 1 mark for the correct answer.
b)	Volume of sphere = $\frac{4}{3}\pi r^3$ $= \frac{4}{3} \times \pi \times 6^3$ $= 288\ \pi$ cm^3	1 mark for the correct formula. 1 mark for the values substitution. 1 mark for the correct answer.
c)	Volume of a sphere with radius 3 cm $= \frac{4}{3} \times \pi \times 3^3$ $= 36\ \pi$ cm^3 Number of small spheres $= \frac{288\ \pi}{36\ \pi}$ $= 8$	1 mark for the correct formula and working. 1 mark for the correct volume of smaller sphere. 1 mark for the correct method. 1 mark for the correct answer.
		[Total Marks: /10]

Q10. a)	m∠POL = m∠QOM (vertically opposite angles m∠ROL = m∠SOM (vertically opposite angles But it is given that m∠POL = m∠ROL m∠QOM = m∠SOM Thus $\overrightarrow{OM}$ bisects m∠QOS	1 mark for the correct theorem. 1 mark for correct reasoning for vertically opposite angles. 1 mark for the statements of equal angles. 1 mark for the conclusion.
b)	$x + y = -\frac{1}{3}$ Cube both the sides $(x + y)^3 = \left(\frac{-1}{3}\right)^3$ $x^3 + y^3 + 3xy\,(x + y) = -\frac{1}{27}$ $x^3 + y^3 + 3xy\left(\frac{-1}{3}\right) = -\frac{1}{27}$ $x^3 + y^3 + xy\,(-1) = -\frac{1}{27}$ $x3 + y3 - xy = -\frac{1}{27}$	1 mark for cubing both the sides. 1 mark for correct expansion. 1 mark for correct substitution. 1 mark for the deduced proved equation.
c)	$(3x - 2)^3$ $= (3x)^3 - 3(3a)^2(2) + 3(3a)(2)^2 - (2)^3$ $= 27a^3 - 54a^2 + 36a - 8$	1 mark for correct formula and substitution of values. 1 mark for the correct answer.
		[Total Marks: /10]
Q11. a)	$\frac{x\,(x + 2)}{(x + 3)\,(2x-1)} \times \frac{2x-1}{(x + 2)\,(x + 2)} \times \frac{(x + 3)}{x\,(x - 2)}$ $= \frac{1}{(x + 2)\,(x - 2)}$ $= \frac{1}{x^2 - 2^2}$ $= \frac{1}{x^2 - 4}$	1 mark for correct factorisation by taking common factor. 1 mark for correct factorisation by breaking middle term. 1 mark for correct application of algebraic identity. 1 mark for correct division. 1 mark for the correct simplified form.
b)	Drawing $\overline{AB}$ measuring 6 cm. Construction of angle measuring 55°. (∠OAB) Intersecting the $\overline{AO}$ using arc with radius 6 cm at vertex D. Drawing arcs to find the vertex C. Joining C to D, and B to C to get the required rhombus.	1 mark for drawing line with correct measurement. 1 mark for constructing correct angle. 1 mark for vertex D. 1 mark for vertex C. 1 mark for the final figure of required rhombus.
		[Total Marks: /10]

Marking Scheme

Model Paper 2

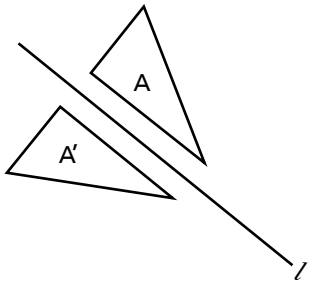
Annual Examination

Mathematics

	Section A	Marking Criteria
Q1.	I. C VI. D XI. C XVI. C II. B VII. C XII. D XVII. B III. C VIII. A XIII. A XVIII. B IV. B IX. C XIV. B XIX. C V. C X. C XV. C XX. C	1 mark for each correct option.
		[Total Marks: /20]

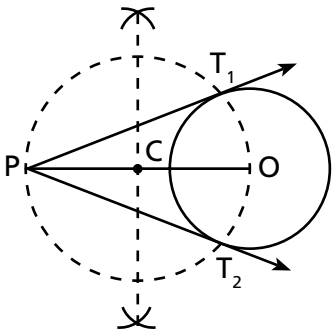
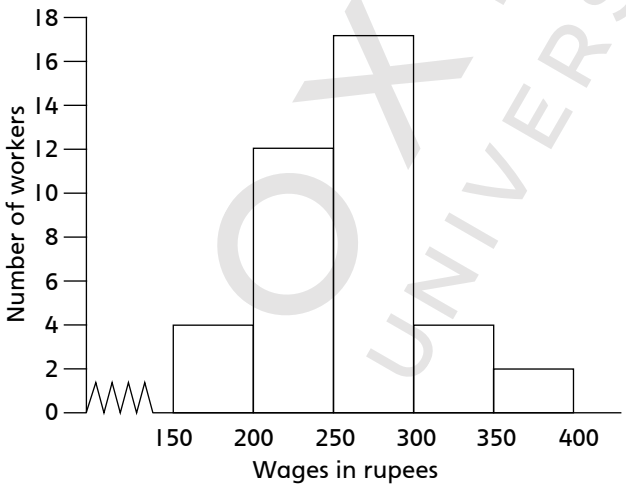
	Section B	Marking Criteria
Q2. a)	A = Male Female $\begin{bmatrix} 14 & 13 \\ 4 & 2 \end{bmatrix}$ Karachi office Islamabad office B = Male Female $\begin{bmatrix} 12 & 3 \\ 11 & 1 \end{bmatrix}$ Karachi office Islamabad office	1 mark for matrix A. 1 mark for matrix B.
b)	$A + B = \begin{bmatrix} 14+12 & 13+3 \\ 4+2 & 11+1 \end{bmatrix}$ Male Female $= \begin{bmatrix} 26 & 16 \\ 15 & 3 \end{bmatrix}$ Karachi office Islamabad office	1 mark for the correct operation. 1 mark for the correct answer.
c)	Surface area = πrl $= \pi \times 3 \times 5$ $= 15\ \pi\ cm^2$	1 mark for the correct formula and values substitution. 1 mark for the correct answer.
		[Total Marks: /6]
Q3. a)	Let x cm be the height of Qadir $\text{Mean} = \frac{\text{Sum of all heights}}{\text{Number of heights}}$ $102 = \frac{105+100+102+103+x}{5}$ $x = 510 - 410 = 100$ cm	1 mark for correct formula. 1 mark for correct values. 1 mark for the correct height.

b)	$(2x+y)^3$ $= (2x)^3 + 3(2x)^2 (y) + 3(2x)(y)^2 + y^3$ $= 8x^3 + 6x^2 y + 6xy^2 + y^3$	1 mark for the correct formula application. 1 mark for the correct answer.
c)	$12 = \sqrt[3]{12\times12\times12}$ $= \sqrt[3]{172}$	1 mark for correct answer
		[Total Marks: /6]
Q4. a)	$y(y + 1)(y + 2)$	1 mark for the correct expression
b)	$(y^2 + y)(y + 2)$ $= y^2 (y+2) + y(y + 2)$ $= y^3 + 2y^2 + y^2 + 2y$ $= y^3 + 3y^2 + 2y$	1 mark for the first product. 1 mark for the second product. 1 mark for the simplification and correct answer.
c)	$20^3 + 3(20)^2 + 2(20)$ $=8000 + 1200 + 40$ $= 9240\ m^3$	1 mark for the correct substitution. 1 mark for the correct answer.
		[Total Marks: /6]
Q5. a)	Price paid for each share = market price + brokerage $= \text{Rs } 50 + (\text{Rs } 50 \times \frac{2}{100})$ = Rs 50 + 1 = Rs 51	1 mark for correct formula. 1 mark for correct amount of brokerage. 1 mark for the correct answer.
b)	Number of shares x price paid for each share = 3000 × Rs 51 = Rs 153000	1 mark for the correct formula. 1 mark for the correct answer.
c)	Amount in rupees = amount in US Dollars x exchange rate= = 20 × 115 = Rs 2300	1 mark for the correct answer.
		[Total Marks: /6]
Q6. a)	$\frac{a(b-c)+b(c-a)+c(a-b)}{abc}$ $\frac{ab-ca+bc-ab+ca-bc}{abc} = 0$	1 mark for correct denominator. 1 mark for correct numerator. 1 mark for correct answer.
b)	Mark three points P, Q, and R on AX, such that $m\overline{AP} = m\overline{PQ} = m\overline{QR}$. Join R to B. Drawing lines from P and Q to $\overline{AB}$ parallel to $\overline{RB}$.	1 mark for marking the three points correctly. 1 mark for dividing AB in three equal parts.

c)		1 mark for the correct figure.
		[Total Marks: /6]

	Section C	**Marking Criteria**
Q7. a)	$x+y$) $x^2 + 2xy + y^2$ $x^3 + 3x^2y + 3xy^2 + y^3$ $x^3 + x^2y$ - - $2x^2y + 3xy^2 + y^3$ $2x^2y + 2xy^2$ - - $xy^2 + y^3$ $xy^2 + y^3$ - - 0	1 mark for correct method. 1 mark for correct placement of terms. 1 mark for correct answer.
b)	$a + b + 3 = 0$ $a + b = -3$ cube both the sides $(a + b)^3 = -27$ $a3 + 3a^2b + 3ab^2 + b^3 = -27$ $a^3 + b^3 + 3ab(a + b) = -27$ $a^3 + b^3 + 3ab(-3) = -27$ $a^3 + b^3 - 9ab = -27$	1 mark for cubing both the sides. 1 mark for the correct expansion of $(a+b)^3$. 1 mark for formula manipulation and substitution of $a + b = -3$ 1 mark for the correct value.
c)	Let the fraction be $\frac{x}{x+4}$ It is given that, $\frac{x+8}{x+5} = \frac{x}{x+5} + 1$ $\frac{x+8-x}{x+5} = 1$ $x + 5 = 8$ $x = 3$ $\therefore$ The required fraction is $\frac{3}{7}$.	1 mark for the correct equation. 1 mark for the correct value of x. 1 mark for the correct fraction.

		[Total Marks: /10]
Q8. a)	fx = 24, 36, 72, 52, 28 Σf = 19 Σfx = 212 Mean = $\frac{\Sigma fx}{\Sigma f}$ = $\frac{212}{19}$ = 11.15	1 mark for the correct values of fx. 1 mark for the correct value of Σf. 1 mark for the correct value of Σfx. 1 mark for the correct formula of mean. 1 mark for the correct answer.
b)	$\frac{a^2+3a+2}{a^2-4a-12} \times \frac{a^2-7a+6}{a^2-1)}$ $\frac{(a+2)(a+1)}{(a-6)(a+2)} \times \frac{(a-6)(a-1)}{(a+1)(a-1)}$ = 1	1 mark each for correct factorization of the four expressions. 1 mark for correct answer.
		[Total Marks: /10]
Q9, a)	Volume of ice-cream = volume of cone + volume of hemisphere = $\frac{1}{3}\pi r^2 h + \pi r^3$ = $\frac{1}{3} \times 3^2 \times 9\pi + \frac{2}{3} \times 3^3 \pi$ = $27\pi + 18\pi$ = 45 π cm^3	1 mark for correct formula of volume of cone. 1 mark for correct formula of volume of hemisphere. 1 mark for correct values substitution. 1 mark for adding both the volumes. 1 mark for the correct answer.
b)	**Statements** / **Reasons** m∠YOA +m∠XOA = 180° / XOY is a straight line. Non-common arms of two adjacent angles are collinear. m∠YOA + m∠YOB = 180° / Same as above. m∠YOA + m∠XOA =m∠YOA + m∠YOB / Two quantities equal to a quantity are equal to two other quantities equal to this quantity. m∠XOA = m∠YOB / Cancel m∠YOA from both sides of the equation. OR m∠XOA = m∠YOB / Two angles equal in measure are congruent. Similarly, m∠YOA = m∠XOB / Same as above.	1 mark for each correct statement along with its reason.
		[Total Marks: /10]

Q10. a)	$2a + 2b$ = Rs 270 $4a + 3b$ = Rs 455 $4a + 4b$ = 540 $-(4a + 3b = 455)$ b = Rs 85 substitute in first equation $2a + 2(85) = 270$ $2a = 270 - 170 = 100$ a = Rs 50	1 mark for the correct equations. 1 mark for making the coefficient same. 1 mark for subtracting the equation 1 mark for correct value of b. 1 mark for correct value of a.
b)		1 mark for joining P to O. 1 mark for bisecting $\overline{PO}$. 1 mark for correctly drawing a circle to cut the given circle at two points. 1 mark for drawing two tangents.
c)	Tangent 1 = tangent 2 OR $\overline{PT}_1 = \overline{PT}_2$	1 mark for the correct conclusion
		[Total Marks: /10]
Q11. a)		1 mark for the correct axes and labeling. 1 mark for correct values and divisions. 1 mark for correct histogram
b)	i) $hyp^2 = per^2 + base^2$ $= 1^2 + 1^2 = 2$ hyp = $\sqrt{2}$ cm	1 mark for the correct formula. 1 mark for correct values substitution. 1 mark for the correct answer.

	ii) $\cos\theta = \frac{\text{base}}{\text{hypotenuse}}$ $\cos\theta = \frac{1}{\sqrt{2}}$ $\theta = \cos^{-1}(\frac{1}{\sqrt{2}})$ $m\angle CAB = 45^\circ$	1 mark for correct formula. 1 mark for correct ratio. 1 mark for correct answer.
	iii) $m\angle ABC = 180^\circ - 90^\circ - 45^\circ$ $= 45^\circ$	1 mark for correct answer.
		[Total Marks: /10]

Marking Scheme

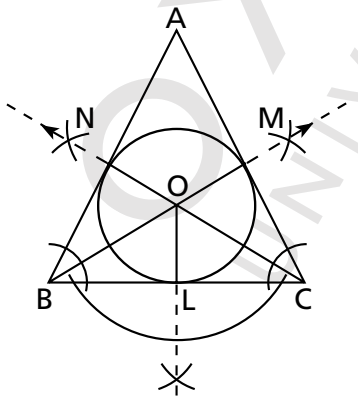
Model Paper 3

Annual Examination

Mathematics

	Section A	Marking Criteria
Q1.	I. A VI. A XI. A XVI. C II. B VII. A XII. A XVII. A III. B VIII. A XIII. C XVIII. B IV. C IX. B XIV. A XIX. B V. A X. C XV. D XX. C	1 mark for each correct option.
		[Total Marks: /20]

	Section B	Marking Criteria
Q2. a)	Volume $= l^3$ Volume $= (2x - y)^3$ $= (2x)^3 - (2x)^2 y + 2xy^2 - y^3$ $= 8x^3 - 4x^2 y + 2xy^2 - y^3$	1 mark for correct formula and expansion. 1 mark for correct answer.
b)	$\angle 6 = 45°$ (vertically opposite angle) $\angle 6 + 5x + 35° = 180°$ (interior angles) $45° + 5x + 35° = 180°$ $x = 20$	1 mark for identification of vertically opposite angles and interior angles. 1 mark for the correct value of x.
c)	10 15 16 ⑰ ⑱ 18 19 20 Median $= \frac{(17 + 18)}{2}$ $= 17.5$	1 mark for writing numbers in correct order. 1 mark for correct median
		[Total Marks: /6]
Q3. a)	$(100 + 1)^2$ $= 100^2 + 200 + 1$ $= 10201$	1 mark for the correct conversion. 1 mark for correct formula application. 1 mark for the correct answer.
b)	$x^4 - 4x - x + 4$ $= x(x - 4) - 1(x - 4)$ $= (x - 4)(x - 1)$	1 mark for correctly breaking the middle term. 1 mark for correct common factors. 1 mark for correct factorisation.
		[Total Marks: /6]

Q4. a)	$(x^2)^3 - (y^2)^3 - 3x^2y^2(x^2 - y^2)$ $= (x^2 - y^2)^3$ $= (z^2)^3 = z^6$	1 mark for the correct manipulation of expression. 1 mark for correct factorisation. 1 mark for correct answer.
b)	Trees rose plant $\begin{bmatrix} 5 & 6 \\ 6 & 4 \end{bmatrix}$ Monday Tuesday	1 mark for correct labeling. 1 mark for correct placement of elements.
c)	Monday	1 mark for correct answer.
		[Total Marks: /6]
Q5. a)	$(x+4)(x+5)(x+6)$	1 mark for the correct expression.
b)	$(x+4)\{x(x+6) + 5(x+6)\}$ $x(x^2 + 11x + 30) + 4(x^2 + 11x + 30)$ $x^3 + 15x^2 + 74x + 120$	1 mark for correct product of two expressions. 1 mark for the second product. 1 mark for the correct simplified answer.
c)	$2^3 + 15(2^2) + 74(2) + 120$ $= 8 + 70 + 148 + 120$ $= 346$	1 mark for correct substitution. 1 mark for the correct answer.
		[Total Marks: /6]
Q6. a)	Surface area of cone = π r l $= \frac{22}{7} \times 4 \times 14$ $= 176\ cm^2$	1 mark for correct formula. 1 mark for correct values. 1 mark for correct answer.
b)		1 mark for constructing bisectors $\overline{BM}$ an $\overline{CN}$ of $\angle B$ and $\angle C$ to get common point O. 1 mark for drawing a perpendicular OL. 1 mark for correctly drawn circle with centre O and radius $\overline{OL}$ touching all sides of triangle.
		[Total Marks: /6]

	Section C	Marking Criteria
Q7. a) i	Let x and y be the number of adult tickets and children tickets respectively. Then $x + y = 1000$ $85x + 45y = 73000$	1 mark for the correct equations
ii	From first equation, $x = 1000 - y$ Substitute in second equation $85(1000 - y) + 45y = 7300$ $85000 - 85y + 45y = 73000$ $40y = 12000$ $y = 300$ (children tickets) $x = 700$ (adult tickets)	1 mark for making a variable subject. 1 mark for correct substitution of that variable. 1 mark for correct equation manipulation. 1 mark for correct value of x. 1 mark for correct value of y.
b)	$a^3 + 2a^2 + 4a$ $a - 2 \;\overline{)\; a^4 + 0a^3 + 0a^2 - 6a - 4}$ $a^4 - 2a^3$ $+2a^3 + 0a^2$ $+2a^3 - 4a^2$ $4a^2 - 6a$ $4a^2 - 8a$ $2a - 4$ $2a - 4$ 0	1 mark for correct method. 1 mark for correct expressions providing terms for missing powers. 1 mark for correct division. 1 mark for correct answer.
		[Total Marks: /10]
Q8. a)	Amount $= P\left(1 + \frac{R}{100}\right)^T$ $= 150000\left(1 + \frac{5}{100}\right)^2$ $= 150000\left(\frac{105}{100}\right)^2$ $= 150000\left(\frac{11025}{10000}\right)$ = Rs 165375	1 mark for correct formula. 1 mark for correct values substitution. 1 mark for correct squares. 1 mark for correct answer.

b)	Volume of sphere = $\frac{2}{3}$ of volume of cone (given) Or Volume of cone = $\frac{3}{2}$ (Volume of sphere) ---- 1 Volume of sphere = $\frac{4}{3}\pi r^3$ $= \frac{4}{3}\pi (5)^3 = \frac{4}{3} \times 125\pi$ Subtitute in equation 1 Volume of cone = $\frac{3}{2}(\frac{4}{3} \times 125\pi)$ $= 250\pi$ $= 250 \times 3.14 = 785\ cm^3$	1 mark for correct formula formation. 1 mark for the formula of volume of sphere. 1 mark for values substitution. 1 mark for volume of sphere. 1 mark for substituting the volume of sphere in volume of cone equation. 1 mark for correct answer.
		[Total Marks: /10]
Q9. a)	$Hyp^2 = base^2 + per^2$ If it is a right angle triangle then 13 is its hypotenuse as it is the longest side. $13^2 = 12^2 + 5^2$ **LHS** $13^2 = 169$ **RHS** $144 + 25 = 169$ LHS = RHS The triangle is a right angled triangle.	1 mark for the correct formula. 1 mark for correct identification of hypotenuse. 1 mark for the correct answer with proof.
b)	$\sin 30^\circ = \frac{per}{hyp}$ $\frac{\sqrt{3}}{2} = \frac{3}{x}$ $x = 3\left(\frac{2}{\sqrt{3}}\right) = 2\sqrt{3}$ m	1 mark for the correct ratio. 1 mark for correct value of sin 30° 1 mark for correct answer.
c)	$\frac{x+2}{3} - \frac{3x-2}{5} = 1$ $\frac{5(x+2)}{15} - \frac{3(3x-2)}{15} = 1$ $5(x+2) - 3(3x-2) = 15$ $5x + 10 - 9x + 6 = 15$ $-4x = -1$ $x = \frac{1}{4}$	1 mark for making the denominators same. 1 mark for eliminating the denominators. 1 mark for expansion of expressions. 1 mark for the correct answer.
		[Total Marks: /10]

Q10.

a) Profit = selling price − cost price

= Rs 500

Profit percent = $\frac{\text{pofit}}{\text{cost}} \times 100\%$

$\frac{500}{300} \times 100 = 16.66\%$

1 mark for the correct formula and value of profit.

1 mark for correct formula for percentage.

1 mark for the correct answer.

b)

Scores (x)	frequency f	fx
0	3	0
1	4	4
2	5	10
3	6	18
4	1	4
5	2	10

1 mark for the correct column labeling.

1 mark for correct placement of values (x).

1 mark for correct placement of frequencies (f)

c) $\Sigma f = 21$

$\Sigma fx = 46$

Mean = $\frac{\Sigma fx}{\Sigma f}$

= $\frac{46}{21}$

= 2.19 = 2.2

1 mark for correct Σf.

1 mark for correct Σfx.

1 mark for correct formula for mean.

1 mark for the correct answer.

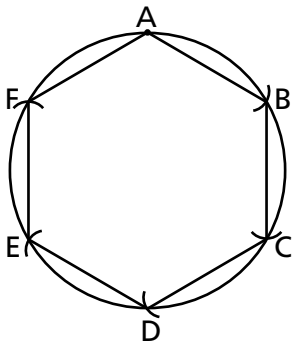
[Total Marks: /10]

Q11.

a)

Statements	Reasons
$\Delta CBD \leftrightarrow \Delta CAD$	
$\overline{AC} \cong \overline{BC}$	Given
$\angle 1 \cong \angle 2$	Given
$\overline{CD} \cong \overline{CD}$	Common side to both triangles
$\therefore \Delta CBD \cong \Delta CAD$	SAS postulate
$\therefore m\angle A = m\angle B$	Corresponding angles of congruent triangle.

1 mark for each correct statement with it reasoning.

b)		1 mark for drawing a circle with radius 7 cm. 1 mark for marking a point A on its circumference and making it as a centre to draw an arc of radius 7 cm . 1 mark for intersecting at point B and making it a centre to draw another arc . 1 mark for repeating the steps to get 5 points on the circumference. 1 mark for joining those points to get the required pentagon
		[Total Marks: /10]

Evaluation Feedback to Student
Exemplar

Annual Examination Model Paper I **Your Marks: 78/100**

	Section A			
	Question	**Your Answer**	**Correct Answer**	**Marks**
Q1 I.	If A = [2, 4, 6, 8}, AB = {6, 8}, and AB = {2, 4, 5, 6, 7, 8}, which one of the following shows the elements of set B? A. {2, 4, 5, 6, 7, 8} B. {2, 4, 5, 6} C. {5, 6, 7, 8} D. {2, 4, 6, 8}	C	C	1 / 1

	Section B			
	Question	**Your Answer**	**Correct Answer**	**Marks**
Q2 (a)	The ages of two brothers Sarim and Umair add upto 31 and the difference between their ages is 5 years. Form two simultaneous equations.	$x + y = 31$ $x - y = 5$	$x + y = 31$ $x - y = 5$	1/1
(b)	Find out their ages.	13 years, 44 years You calculated value of x correct whereas the value of y is wrong.	13 years, 18 years	2/3

	Section C			
	Question	**Your Answer**	**Correct Answer**	**Marks**
Q7 (a)	One fine day Jahangir drinks "a" number of glasses of banana shake and Laraib drinks "b" number of glasses of strawberry shake at a restaurant. Their total bill is Rs 420. The rates are given in the following table. Write down the equation for the above statement.	$60a + 100b = 420$ First term of the equation is correct whereas the second term is incorrect since the price of one glass of strawberry shake is 120.	$60a + 120b = 420$	0/1