



PM SHRI KENDRIYA VIDYALAYA

LESSON PLAN | Mathematics | Ganita Manjari, Grade 9 (Part II)

CHAPTER 9

DATE: ____ / ____ / ____

Name of the teacher:	Class: IX	Name of Unit/Lesson/Topic: Ch. 9 – Propositions and their Converses	No. of periods required: 4
Designation:	Subject: Mathematics		No. of students in the class:

Content	Learning Outcomes (Lesson specific)	Pedagogical Strategies
▪ Proposition: a statement that is either true or false; the “if X then Y” / “X implies Y” form. ▪ Converse: swapping to “if Y then X”; is the converse of a true proposition always true? ▪ Counterexample: one case that shows a statement is false (wet road $\neq$ rain; multiples of 3 are not all multiples of 6; equal area $\neq$ congruent triangles). ▪ Both true: perfect square $\Leftrightarrow$ odd number of factors (factor-partner pairs). ▪ Baudhayana–Pythagoras theorem and its converse, proved using SSS congruence. ▪ Other wordings of “if–then” (e.g., “Y when X”); Think and Reflect questions.	▪ Identifies propositions and writes the converse of a given statement. ▪ Decides whether a proposition and its converse are true or false. ▪ Justifies true statements with reasoning and disproves false ones using counterexamples. ▪ Understands that proving P does not prove its converse Q. ▪ Proves and applies the converse of the Pythagoras theorem.	▪ Hook: everyday “if–then” sentences (If it rains, the road is wet) – Think–Pair–Share on “is the reverse also true?” ▪ Break-it Challenge: groups hunt for counterexamples to quick claims; the best counterexample earns a star. ▪ Guided discovery: factor-partner pairs of 12, 25, 36 on the board to see why squares have an odd number of factors. ▪ Hands-on: construct triangles with sides 3-4-5 and 5-12-13 using strips/compass to verify the converse of Pythagoras; then prove with SSS. ▪ Discussion: Think and Reflect questions; students rewrite one proposition in at least two wordings. ▪ Practice: textbook exercise Q1–12 in pairs, with peer checking.

Integration (intra/inter/multi/trans disciplinary)	Assessment Strategies (Assessment as / of / for Learning)	Resources	21st Century Skills / Value Education
▪ Intra: geometry (congruence, Pythagoras) + number theory (factors, squares). ▪ Inter: English – conditional sentences; Science – cause and effect, hypothesis testing. ▪ IKS / History: Baudhayana (Sulba Sutras); Fermat’s claim disproved by Euler. ▪ Trans: logical reasoning in law and debate.	▪ For learning: oral rapid-fire – “State the converse and say true/false.” ▪ As learning: peer review of each other’s counterexamples. ▪ Of learning: 10-minute written quiz + exercise questions (converse, justification, counterexample).	▪ Ganita Manjari Part II, Ch. 9 and QR-code links ▪ Strips, compass, ruler, chart paper ▪ Worksheet of propositions ▪ Smart board / PPT	▪ Skills: critical thinking, logical reasoning, communication, collaboration. ▪ Values: honesty and intellectual humility (accepting “this is false”), perseverance, respect for others’ ideas.

1. Real-life Application:

A wet road does not prove it rained (fake-news and rumour checking); a doctor reasons from symptoms to disease with care; “if–then” conditions in computer programs; carpenters and masons use the 3-4-5 rope to check a right angle (converse of Pythagoras).

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CHAPTER 10

DATE: ____ / ____ / ____

Name of the teacher:	Class: IX	Name of Unit/Lesson/Topic: Ch. 10 – How Quantities Combine: Understanding Data	No. of periods required: 10
Designation:	Subject: Mathematics		No. of students in the class:

Content	Learning Outcomes (Lesson specific)	Pedagogical Strategies
▪ 10.1 Combining Things: why the plain average of averages can mislead. ▪ 10.1.1 Average of averages – weighted average of groups of different sizes (seniors vs juniors). ▪ 10.1.2 Mixtures – combining quantities at different rates/concentrations. ▪ 10.1.3 Custom weights – giving different importance to different items (e.g., exam components). ▪ 10.2 Visualising and Interpreting Data: ▪ 10.2.1 Stacking columns – stacked bar charts: totals and parts. ▪ 10.2.2 An alternative to the pie chart – 100% stacked bars to compare proportions; what charts show and hide.	▪ Explains why the average of averages is not always the overall average. ▪ Calculates weighted averages using appropriate weights. ▪ Solves mixture, rate and concentration problems. ▪ Constructs stacked and 100% stacked bar charts. ▪ Interprets charts, comparing totals and proportions, and makes reasoned inferences.	▪ Activity 1: compute the badminton academy's average height by two methods and discuss why they differ. ▪ Class survey: collect data (e.g., boys' and girls' marks or heights) and find the weighted average. ▪ Demonstration: mix juice/coloured water of two concentrations in measuring jars and predict the result. ▪ "Weights game": students propose their own weights for a report card and justify them. ▪ Chart Gallery Walk: compare a stacked chart and a 100% chart of the same data; discuss "what does each show or hide?" ▪ Technology: draw charts on graph paper and in a spreadsheet; use QR-code resources.

Integration (intra/inter/multi/trans disciplinary)	Assessment Strategies (Assessment as / of / for Learning)	Resources	21st Century Skills / Value Education
▪ Intra: ratio and proportion, percentages, statistics. ▪ Inter: Science – concentration of solutions, alloys; Social Science – population and literacy data; Economics – prices. ▪ Multi: Computer Science – spreadsheet charts. ▪ Trans: data literacy for media reports.	▪ For learning: mini-whiteboard answers on averages and weights. ▪ As learning: self-check – "Does my weight choice make sense?"; peer critique of charts. ▪ Of learning: class test (weighted average, mixture and chart interpretation) + chart project.	▪ Ganita Manjari Part II, Ch. 10 ▪ Graph paper, coloured pencils ▪ Measuring jars, juice/coloured water ▪ Spreadsheet software, school data	▪ Skills: data literacy, analytical thinking, digital skills, communication. ▪ Values: fairness in choosing weights, honesty in presenting data, cooperation.

1. Real-life
Application:

Report-card and entrance-exam weighted scores; mixing milk and water or blending fuel; nutrition labels; election vote shares; average speed and cricket batting averages; reading media charts critically.

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CHAPTER 11

DATE: ____ / ____ / ____

Name of the teacher:	Class: IX	Name of Unit/Lesson/Topic: Ch. 11 – The World of Algorithms	No. of periods required: 8
Designation:	Subject: Mathematics		No. of students in the class:

Content	Learning Outcomes (Lesson specific)	Pedagogical Strategies
11.1 Adding numbers – 11.1.1 digit-by-digit addition with carry as an example of an algorithm. 11.2 Greatest Common Divisor – 11.2.1 listing divisors; 11.2.2 finding the GCD; 11.2.3 the first GCD algorithm. 11.3 Data structures – naming intermediate values, lists in order. 11.3.1 Improving the algorithm (divisors in pairs). 11.3.2 Analysing algorithms (counting steps). 11.3.3 Euclid's subtraction algorithm for GCD. 11.3.4 Aryabhata's division algorithm – a faster remainder-based method.	- Describes an algorithm as a precise step-by-step procedure. - Writes and traces algorithms (addition, GCD, LCM) with named variables. - Finds the GCD by divisor lists and by Euclid's method. - Compares algorithms by the number of steps needed. - Appreciates Aryabhata's division-based improvement.	Unplugged activity: "Human robot" – one student follows written steps exactly to add $473 + 695$. Flowchart/pseudo-code writing for adding two numbers. Tile-the-block model: paper rectangles show why $\gcd(m, n) = \gcd(m - n, n)$. Race: pairs find gcd of large numbers using the divisor-list method and the Euclid method, then compare the number of steps. Trace tables for the improved (division) algorithm; explain why it is faster. Exploration: write an algorithm for LCM; Think and Reflect.

Integration (intra/inter/multi/trans disciplinary)	Assessment Strategies (Assessment as / of / for Learning)	Resources	21st Century Skills / Value Education
Intra: number theory (factors, GCD, LCM), arithmetic. Inter: Computer Science – coding, programming and data structures; Science – step-wise procedures in experiments. IKS / History: Euclid and Aryabhata. Trans: computational thinking.	For learning: teacher observes the "human robot" activity and gives immediate feedback. As learning: students debug each other's algorithms. Of learning: worksheet – write and trace algorithms; compute GCD by two methods.	- Ganita Manjari Part II, Ch. 11 - Paper rectangles/grid sheets - Flowchart sheets, trace-table templates - Computer lab (optional, simple code)	Skills: computational thinking, problem-solving, precision in communication, creativity. Values: patience, accuracy, respect for the contributions of ancient Indian mathematicians.

1. Real-life Application:

Recipes and instruction manuals; how calculators and phone apps add numbers; GCD in simplifying fractions and cutting the largest equal square tiles; ATM, search and navigation apps all run on algorithms; encryption relies on number-theory algorithms.

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CHAPTER 12

DATE: ____ / ____ / ____

Name of the teacher:	Class: IX	Name of Unit/Lesson/Topic: Ch. 12 – Quadrilaterals	No. of periods required: 12
Designation:	Subject: Mathematics		No. of students in the class:

Content	Learning Outcomes (Lesson specific)	Pedagogical Strategies
12.1 What exactly is a quadrilateral? Tiling the plane with rectangles and parallelograms. 12.2 Parallelograms – properties: opposite sides equal, opposite angles equal, diagonals bisect each other (Theorem 1); converses (Theorems 2–4); equal & parallel sides test (Theorem 5). 12.3 Applications: 12.3.1 Midpoint Theorem and its converse (Theorems 6–7); 12.3.2 Medians and the Centroid Theorem (Theorem 8). - Varignon parallelogram – Midpoint Theorem for quadrilaterals (Theorem 9). 12.4 Tiling the plane using any 4-gon.	- Classifies quadrilaterals and states properties of parallelograms. - Proves and applies the parallelogram theorems and their converses. - Uses tests to decide whether a quadrilateral is a parallelogram. - Applies the Midpoint Theorem, its converse and the Centroid Theorem. - Explains why every quadrilateral tiles the plane.	Hook: a grid of sticks – slide the sticks to turn a rectangular tiling into parallelograms. Paper folding / cut-outs: verify properties of parallelograms and the Midpoint Theorem. Geoboard/GeoGebra: drag vertices to see which properties stay the same. Proof building: students build proofs step by step (congruence – ASA, SAS, SSS); write the converse of each theorem. Investigation: join midpoints of any quadrilateral to discover the Varignon parallelogram. Art project: tile a sheet using cut-outs of an irregular 4-gon (Escher-style); Think and Reflect.

Integration (intra/inter/multi/trans disciplinary)	Assessment Strategies (Assessment as / of / for Learning)	Resources	21st Century Skills / Value Education
Intra: triangles, congruence, coordinate ideas, proof and converse (links to Ch. 9). Inter: Art – tessellation and Escher; Science – honeycomb; Architecture – flooring. IKS / History: Pierre Varignon; patterns in Indian mosaics and jaali work. Trans: design and engineering.	For learning: “Is it a parallelogram?” – true/false with reasons. As learning: proof walk-through with peers; self-checklist for proofs. Of learning: unit test (theorems, proofs, applications) + tiling project rubric.	- Ganita Manjari Part II, Ch. 12 - Sticks/strips, paper, scissors - Geoboard, GeoGebra - Chart paper, coloured pens	Skills: spatial reasoning, logical proof, creativity, collaboration. Values: appreciation of beauty and patterns, rigour, perseverance.

1. Real-life Application:

Floor and wall tiling; frames, gates and folding scissor-lifts; hinged parallelogram mechanisms in cranes and drawing boards; truss bridges; honeycombs; fabric and rangoli patterns; finding the balance point (centroid) of a flat object.

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CHAPTER 13

DATE: ____ / ____ / ____

Name of the teacher:	Class: IX	Name of Unit/Lesson/Topic: Ch. 13 – Two Variables, One Line	No. of periods required: 14
Designation:	Subject: Mathematics		No. of students in the class:

Content	Learning Outcomes (Lesson specific)	Pedagogical Strategies	
▪ 13.1 Linear equations in two variables: forming equations; 13.1.1 standard form $ax + by + c = 0$. ▪ 13.2 Solutions: 13.2.1 algebraic meaning (ordered pairs); 13.2.2 geometric visualisation – points on a line. ▪ 13.3 Slope-intercept form: 13.3.1 understanding slope; 13.3.2 $y = mx + c$. ▪ 13.4 Pair of linear equations in two variables – framing from real situations. ▪ 13.5 Finding solutions: 13.5.1 algebraic methods (substitution, elimination). ▪ 13.6 Graphical method: unique, no, or infinitely many solutions (intersecting, parallel and coincident lines).	▪ Frames linear equations and pairs of equations from situations. ▪ Finds and verifies solutions; plots the graph as a straight line. ▪ Finds the slope and intercept and writes $y = mx + c$. ▪ Solves a pair of equations by substitution, elimination and graphs. ▪ Classifies pairs as having a unique, no or infinitely many solutions, and interprets the answer.	▪ Hook: Radha’s fruit cart (₹60 mangoes, ₹50 bananas, ₹280) – students list all possible combinations. ▪ Plot-the-points: tabulate solutions and plot them on graph paper to see the line. ▪ Slope hands-on: a ladder/ramp (rise ÷ run) with a string and ruler; vary m and c using GeoGebra sliders. ▪ Concept map: substitution vs elimination, with “which method when?” ▪ Role-play: the science-exhibition ticket problem (two groups, two bills). ▪ Graph-it: each pair draws two lines and classifies them (intersect, parallel, coincide).	
Integration (intra/inter/multi/trans disciplinary)	Assessment Strategies (Assessment as / of / for Learning)	Resources	21st Century Skills / Value Education
▪ Intra: algebra, coordinate geometry (Part I Ch. 2), ratio. ▪ Inter: Science – distance–time graphs; Economics – cost and break-even; Geography – slopes and gradients. ▪ IKS / History: Aryabhata and Brahmagupta on systems of equations. ▪ Multi: Computer Science – graphing tools.	▪ For learning: exit tickets – frame an equation from a story. ▪ As learning: students check their solution by substituting into both equations; peer graph check. ▪ Of learning: unit test (framing, algebraic and graphical methods) + a real-life problem poster.	▪ Ganita Manjari Part II, Ch. 13 ▪ Graph paper, rulers, strings ▪ GeoGebra/Desmos ▪ Price lists, ticket-bill cards	▪ Skills: mathematical modelling, problem-solving, visualisation, digital literacy. ▪ Values: accuracy, financial awareness and fair dealing, teamwork.

1. Real-life Application:

Shopping bills and ticket pricing; taxi fare = fixed charge + rate $\times$ distance; mobile-plan comparisons; speed–distance problems; mixing and budgeting; slope of ramps and roads; break-even in a small business.

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CHAPTER 14

DATE: ____ / ____ / ____

Name of the teacher:	Class: IX	Name of Unit/Lesson/Topic: Ch. 14 – Math of Space: Surface Area and Volume	No. of periods required: 12
Designation:	Subject: Mathematics		No. of students in the class:

Content	Learning Outcomes (Lesson specific)	Pedagogical Strategies
14.1 Cuboids and cubes – surface area, lateral surface area and volume. 14.2 Right circular cylinder – 14.2.1 another way of understanding the curved surface area formula. 14.3 Cones – curved and total surface area, volume. 14.4 Pyramidal shapes. 14.5 Spheres and hemispheres – 14.5.1 hands-on activity to verify the surface-area formula; 14.5.2 hemisphere. 14.6 Areas and volumes around us – 14.6.1 guesstimates (“Did you ever wonder?”).	- Derives and uses surface-area and volume formulas for cuboid, cube, cylinder, cone, pyramid, sphere and hemisphere. - Differentiates lateral/curved and total surface area. - Solves multi-step problems with composite solids and unit conversion ($1000 \text{ cm}^3 = 1 \text{ litre}$). - Makes sensible estimates (guesstimates) for real objects.	Net-making: students make nets of cuboid, cylinder and cone from chart paper and unroll them to get area formulas. Water-filling activity: compare the volume of a cone with that of a cylinder of the same base and height. Sphere activity: wrap string/peel an orange to verify that the surface area of a sphere is $4\pi r^2$. Estimation task: find the approximate volume of a bucket, gas cylinder or water tank in class. Guesstimate talk: Lallan’s golgappa stall – guess first, then calculate. Group project: “Solids around us” photo-poster with measurements.

Integration (intra/inter/multi/trans disciplinary)	Assessment Strategies (Assessment as / of / for Learning)	Resources	21st Century Skills / Value Education
Intra: mensuration (Part I), algebra, π and ratios. Inter: Science – density, capacity; Geography – reservoirs, globe; Art – model making. Multi: Architecture and packaging design; Computer Science – 3D modelling. Trans: sustainability (reducing packaging material).	For learning: quick “which formula?” cards and net-matching. As learning: self-assessment on estimating before calculating; peer review of posters. Of learning: problem-solving test on surface area/volume + project rubric.	- Ganita Manjari Part II, Ch. 14 - Chart paper, scissors, glue, tape - Models of solids, measuring jars/water - String, orange/ball, ruler	Skills: spatial visualisation, estimation, practical problem-solving, creativity. Values: resource-saving and sustainability, accuracy, collaboration.

1. Real-life Application:

Painting a room (surface area); capacity of water tanks, tumblers and gas cylinders; ice-cream cones; tent and packaging design; football and globe; how many golgappas fill a vessel – everyday estimation.

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