CLASS 9 MATHEMATICS

Ganita Manjari • Part I • Chapter 1

ORIENTING YOURSELF: THE USE OF COORDINATES

COORDINATE GEOMETRY FORMULA SHEET • Academic Session 2026–27

1. Coordinate system basics

Ordered pair	A point is written as P(x, y), where x is the x-coordinate and y is the y-coordinate.
Origin	O = (0, 0)
Axes	x-axis is horizontal; y-axis is vertical. They meet at the origin.
Point on x-axis	(x, 0) — the y-coordinate is 0.
Point on y-axis	(0, y) — the x-coordinate is 0.

2. Coordinates and distances

Horizontal distance	Between (x_1, y) and (x_2, y): $\lvert x_2 - x_1 \rvert$
Vertical distance	Between (x, y_1) and (x, y_2): $\lvert y_2 - y_1 \rvert$
Distance between two points	$d = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$

The distance formula is the Pythagorean relationship applied to the horizontal and vertical differences between two points.

3. Quadrants and signs

Quadrant I	(+ , +)
Quadrant II	(− , +)
Quadrant III	(− , −)
Quadrant IV	(+ , −)

COORDINATE TRANSFORMATIONS & EXAMPLES

Chapter 1 • The Use of Coordinates

4. Reflection rules

Reflection in x-axis	(x, y) → (x, −y)
Reflection in y-axis	(x, y) → (−x, y)
Distance from the reflecting axis	The distance from the relevant axis remains unchanged.

5. Horizontal and vertical shifts

Horizontal shift	(x, y) → (x + a, y): shift right by a if a > 0; left if a < 0.
Vertical shift	(x, y) → (x, y + b): shift up by b if b > 0; down if b < 0.

6. Worked examples

Question	Working	Answer
Find the horizontal distance between (−2, 3) and (5, 3).	|5 − (−2)|	7 units
Find the vertical distance between (4, −1) and (4, 6).	|6 − (−1)|	7 units
Find the distance between (1, 2) and (4, 6).	$\sqrt{[(4-1)^2 + (6-2)^2]} = \sqrt{25}$	5 units
Reflect (3, −5) in the x-axis.	(x, y) → (x, −y)	(3, 5)
Shift (−2, 4) three units right and two up.	(−2+3, 4+2)	(1, 6)

7. Quick practice

1. Find the horizontal distance between (−4, 2) and (3, 2).
2. Find the distance between (0, 0) and (6, 8).
3. In which quadrant is (−5, −2)?
4. Reflect (−3, 7) in the y-axis.
5. Shift (2, −1) two units left and four units down.

Answers

1. 7 units
2. 10 units
3. Quadrant III
4. (3, 7)
5. (0, −5)

Source note

Prepared from the coordinate-geometry summary diagram shared from the Oswaal CBSE Question Bank and the stated Chapter 1 topic in NCERT Ganita Manjari, Grade 9, Part I, “Orienting Yourself: The Use of Coordinates.” It covers coordinate notation, axes, quadrants, distances, reflections and shifts. Independent study aid; not an official NCERT/CBSE publication.

CHAPTER 2: INTRODUCTION TO LINEAR POLYNOMIALS

Ganita Manjari • Part I • Academic Session 2026–27 • Formula & Key-Concept Sheet

1. Algebraic Expressions and Polynomials

Term	Meaning	Example
Algebraic expression	An expression made using numbers, variables and operations.	$2x^2 + 5x - 3$
Term	A part separated by + or – signs; keep its sign.	In $4x^2 - 3x + 7$: $4x^2$, $-3x$, $+7$
Coefficient	The numerical factor of a variable term.	In $5y^3 + y^2 + 2y - 1$: coefficients are 5, 1, 2
Constant term	The term with no variable.	In $5y^3 + y^2 + 2y - 1$, it is -1
Univariate polynomial	A polynomial involving only one variable.	$3z + 7$; $x^2 + 5x + 1$

2. Degree and Types of Polynomials

Type	Example / general form	Degree
Constant polynomial	8 (or any non-zero constant)	0
Linear polynomial	$ax + b$, where $a \neq 0$	1
Quadratic polynomial	$ax^2 + bx + c$, where $a \neq 0$	2
Cubic polynomial	$ax^3 + bx^2 + cx + d$, where $a \neq 0$	3

Rule: The degree of a polynomial is the highest power of its variable with a non-zero coefficient.

3. Linear Polynomial: Key Form

General form	**$p(x) = ax + b$, where $a \neq 0$**
Value at x = k	**$p(k) = ak + b$**
Zero of a linear polynomial	**Set $p(x) = 0$; for $ax + b = 0$, $x = -b/a$**

4. Worked Examples

• **Example 1 — Find the degree:** $5y^3 + y^2 + 2y - 1 \rightarrow$ highest power is 3, so degree = 3.

• **Example 2 — Identify coefficients:** In $x^3 - 3x^3 + 6x^2 - 2x + 7$, coefficient of $x^3 = -3$ and coefficient of $x^2 = 6$.

• **Example 3 — Find a value:** If $p(x) = 2x + 1$, then $p(4) = 2(4) + 1 = 9$.

• **Example 4 — Find the zero:** $p(x) = 3x - 6$. Set $3x - 6 = 0$, so $x = 2$.

5. Quick Practice

1) Find the degree of $7x^3 + 2x - 4$. 2) Find the zero of $p(x) = 4x - 20$. 3) If $p(x) = 3x + 2$, find $p(5)$.

Answers: 1) 3 2) 5 3) 17

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Scope note: This sheet focuses on polynomial definitions, degree, coefficients and linear-polynomial forms. As requested, slope, intercept and graph formulas are kept out of this sheet and reserved for Part II, Chapter 13.

CLASS 9 MATHEMATICS

Ganita Manjari • Part I • Chapter 4

EXPLORING ALGEBRAIC IDENTITIES — FORMULA SHEET

Academic Session 2026–27. Prepared from the uploaded textbook's Chapter 4, "Exploring Algebraic Identities."

1. Square identities

$(x + y)^2$	$= x^2 + 2xy + y^2$
$(x - y)^2$	$= x^2 - 2xy + y^2$
$(x + y + z)^2$	$= x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$

2. Product and factorisation identities

$(x + y)(x - y)$	$= x^2 - y^2$
$(x + a)(x + b)$	$= x^2 + (a + b)x + ab$
$(ax + b)(cx + d)$	$= acx^2 + (ad + bc)x + bd$

3. Cube identities

$x^3 - y^3$	$= (x - y)(x^2 + xy + y^2)$
$x^3 + y^3$	$= (x + y)(x^2 - xy + y^2)$
$(x + y)^3$	$= x^3 + 3x^2y + 3xy^2 + y^3$
$(x - y)^3$	$= x^3 - 3x^2y + 3xy^2 - y^3$

4. Three-variable identity

$x^3 + y^3 + z^3 - 3xyz$	$= (x + y + z)(x^2 + y^2 + z^2 - xy - xz - yz)$

Remember: An algebraic identity is an equation that is true for all values of its variables. Identities help expand expressions, factorise expressions and simplify calculations.

HOW TO USE THE IDENTITIES

Quick examples • factorisation tips • common mistakes

5. Quick examples

Question	Identity used	Answer
$(x + 3)^2$	$(x + y)^2 = x^2 + 2xy + y^2$	$x^2 + 6x + 9$
$(2x - 5)^2$	$(x - y)^2 = x^2 - 2xy + y^2$	$4x^2 - 20x + 25$
$(x + 4)(x - 4)$	$(x + y)(x - y) = x^2 - y^2$	$x^2 - 16$
$(x + 2)(x + 7)$	$(x + a)(x + b) = x^2 + (a + b)x + ab$	$x^2 + 9x + 14$
$x^3 - 8$	$x^3 - y^3 = (x - y)(x^2 + xy + y^2)$	$(x - 2)(x^2 + 2x + 4)$
$x^3 + 8$	$x^3 + y^3 = (x + y)(x^2 - xy + y^2)$	$(x + 2)(x^2 - 2x + 4)$

6. Factorisation checklist

• For $x^2 + (a + b)x + ab$, find two numbers whose sum is the coefficient of x and whose product is the constant term.

• For a perfect-square trinomial, check that the first and last terms are squares and the middle term is ± twice the product of their square roots.

• For a difference of squares, use $x^2 - y^2 = (x + y)(x - y)$.

• For rational algebraic expressions, factorise numerator and denominator first. Cancel only complete common factors, and ensure the original denominator is not zero.

7. Common mistakes

• $(x + y)^2$ is not $x^2 + y^2$; the middle term $2xy$ is required.

• In $(x - y)^2$, the middle term is $-2xy$, but the final term remains $+y^2$.

• $x^3 - y^3$ and $x^3 + y^3$ have different factorisation signs—check each sign carefully.

• Do not cancel individual terms across a fraction; cancel only common factors.

Source note

Based on the uploaded NCERT Ganita Manjari, Grade 9, Part I, Chapter 4. The textbook lists these identities in its chapter summary on printed page 91. This is an independent study aid, not an official NCERT/CBSE publication.

CLASS 9 MATHEMATICS

Ganita Manjari • Part I • Chapter 5

I’M UP AND DOWN, AND ROUND AND ROUND

CIRCLE FORMULAS & THEOREM REVISION • Academic Session 2026–27

1. Circle basics

Radius and diameter	d = 2r; r = d/2
Pi (π)	π = circumference ÷ diameter ≈ 3.14 or 22/7
Circumference	C = 2πr = πd
Area of a circle	A = πr²

2. Arc length and sector area

Arc length (central angle θ)	l = (θ/360°) × 2πr
Area of a sector	A = (θ/360°) × πr²

Use θ for the central angle in degrees. The arc-length and sector-area formulas scale the full circumference or full circle area by θ/360°.

3. Triangle area formulas included in the chapter summary

Triangle area	Area = ½ × base × perpendicular height
Semi-perimeter	s = (a + b + c)/2
Heron’s formula	Area = √[s(s − a)(s − b)(s − c)]

Here a, b and c are the side lengths of the triangle and s is its semi-perimeter.

4. Cyclic quadrilateral formula

Semi-perimeter	s = (a + b + c + d)/2
Brahmagupta’s formula	Area = √[(s − a)(s − b)(s − c)(s − d)]

This formula applies to a cyclic quadrilateral: all four vertices lie on one circle. Here a, b, c and d are its side lengths.

THEOREMS, EXAMPLES & QUICK PRACTICE

Chapter 5 • I’m Up and Down, and Round and Round

5. Circle theorems highlighted in the chapter summary

• Equal chords subtend equal angles at the centre; conversely, equal central angles correspond to equal chords.
• A line from the centre to the midpoint of a chord is perpendicular to the chord; a perpendicular from the centre to a chord bisects it.
• Equal chords are equidistant from the centre; the longer of two unequal chords is closer to the centre.
• The angle subtended by an arc at the centre is twice the angle subtended at the circumference on the remaining part of the circle.
• The angle subtended by a diameter at a point on the circle is 90°.
• Opposite angles of a cyclic quadrilateral sum to 180°.

6. Worked examples

Question	Calculation	Answer
Radius = 7 cm. Find circumference.	$C = 2\pi r$; use $\pi = 22/7$	44 cm
Radius = 7 cm. Find circle area.	$A = \pi r^2$	154 cm², using $\pi = 22/7$
Central angle = 90°, radius = 4 cm. Find arc length.	$(90/360) \times 2\pi \times 4$	2π cm
Triangle sides are 3, 4, 5 cm. Find area using Heron’s formula.	$s = 6$; $\sqrt{[6(3)(2)(1)]}$	6 cm²
A cyclic quadrilateral has opposite angles 105° and x.	$105° + x = 180°$	$x = 75°$

7. Quick practice

1. A circle has diameter 14 cm. Find its circumference using $\pi = 22/7$.
2. Find the area of a sector with radius 6 cm and central angle 60°.
3. A triangle has sides 5 cm, 12 cm and 13 cm. Find its area using Heron’s formula.
4. One angle of a cyclic quadrilateral is 82°. Find its opposite angle.

Answers

1. 44 cm
2. 6π cm²
3. 30 cm²
4. 98°

Important reminders

• Perimeter/circumference, arc length and radius are measured in length units; area is measured in square units.
• Use the value of π specified in the question.
• In Heron’s formula, calculate the semi-perimeter first.
• Brahmagupta’s formula is for cyclic quadrilaterals, not every quadrilateral.

Source note

Prepared from the chapter-summary material shared from NCERT Ganita Manjari, Grade 9, Part I, Chapter 5, “I’m Up and Down, and Round and Round.” Circle formulas, triangle-area formulas, Brahmagupta’s formula and the listed circle theorems reflect that shared summary. Independent study aid; not an official NCERT/CBSE publication.

CLASS 9 MATHEMATICS

Ganita Manjari • Part I • Chapter 6

MEASURING SPACE: PERIMETER AND AREA

FORMULA SHEET • Academic Session 2026–27

Symbols: P = perimeter, A = area, l = length, b = breadth/base, h = perpendicular height, a = side, r = radius, d = diameter, θ = central angle.

1. Perimeter of common shapes

Square (side a)	P = 4a
Rectangle (length l, breadth b)	P = 2(l + b)
Equilateral triangle (side a)	P = 3a
Any polygon	Perimeter = sum of all side lengths
Circle circumference	C = 2πr = πd; d = 2r

2. Area of common shapes

Square	A = a^2
Rectangle	A = l × b
Parallelogram	A = base × perpendicular height
Triangle	A = ½ × base × perpendicular height
Regular polygon (general idea)	A = ½ × perimeter × apothem (perpendicular distance from centre to a side)

3. Circle and sector formulas

Pi (π)	π = circumference ÷ diameter ≈ 22/7 or 3.14; π is irrational
Area of a circle	A = πr^2
Arc length	l = (θ/360°) × 2πr
Area of a sector	A = (θ/360°) × πr^2

In arc-length and sector-area formulas, θ is the central angle in degrees. Use the value of π specified in the question.

TRIANGLE FORMULAS, EXAMPLES & PRACTICE

Chapter 6 • Measuring Space: Perimeter and Area

4. Triangle area when side lengths are given

Semi-perimeter	$s = (a + b + c)/2$
Heron’s formula	$A = \sqrt{[s(s - a)(s - b)(s - c)]}$

Here a, b and c are the three side lengths of the triangle. Find s first, then substitute into Heron’s formula.

5. Cyclic quadrilateral

Semi-perimeter	$s = (a + b + c + d)/2$
Brahmagupta’s formula	$A = \sqrt{[(s - a)(s - b)(s - c)(s - d)]}$

Use Brahmagupta’s formula only for a cyclic quadrilateral (all four vertices lie on one circle).

6. Worked examples

Question	Calculation	Answer
Square side = 5 cm. Find perimeter and area.	$P = 4\times5$; $A = 5^2$	20 cm; 25 cm²
Rectangle 8 cm by 3 cm. Find perimeter and area.	$P = 2(8+3)$; $A = 8\times3$	22 cm; 24 cm²
Circle radius = 7 cm. Find circumference.	$C = 2\pi r$; $\pi = 22/7$	44 cm
Triangle sides = 3, 4, 5 cm. Find area.	$s = 6$; $A = \sqrt{[6\times3\times2\times1]}$	6 cm²
Sector radius = 6 cm, angle = 60°. Find area.	$(60/360) \times \pi \times 6^2$	6π cm²

7. Quick practice

1. A rectangle is 12 cm long and 5 cm wide. Find its perimeter and area.
2. A parallelogram has base 9 cm and perpendicular height 4 cm. Find its area.
3. A circle has diameter 14 cm. Find its area using $\pi = 22/7$.
4. A triangle has sides 5 cm, 12 cm and 13 cm. Find its area using Heron’s formula.

Answers

1. 34 cm; 60 cm²
2. 36 cm²
3. 154 cm²
4. 30 cm²

8. Important reminders

• Perimeter is measured in units of length; area is measured in square units.
• For triangle area using base and height, use the perpendicular height—not a sloping side.
• For Heron’s formula, calculate the semi-perimeter first.
• The arc-length and sector-area formulas use θ in degrees.
• The chapter summary also lists historical estimates for π (Archimedes, Zu Chongzhi, Āryabhaṭa and Mādhava) and notes that π is irrational.

Source note

Prepared using the uploaded NCERT Ganita Manjari, Grade 9, Part I, Chapter 6, “Measuring Space: Perimeter and Area,” including the chapter summary on printed page 154. The formulas are organized as a study aid; check any class-specific requirements with the teacher. Not an official NCERT/CBSE publication.

CLASS 9 MATHEMATICS

Ganita Manjari • Part I • Chapter 7

THE MATHEMATICS OF MAYBE: INTRODUCTION TO PROBABILITY

FORMULA SHEET • Academic Session 2026–27

1. Probability formulas

Experimental probability	P(E) = Number of times event E occurred ÷ Total number of trials
Theoretical probability	P(A) = Number of favourable outcomes ÷ Number of possible outcomes
Probability bounds	$0 \leq P(E) \leq 1$

Theoretical probability formula applies to a fair situation where all possible outcomes are equally likely.

2. Key terms and notation

Sample space	S = set of all possible outcomes of a random experiment
Sample size	n(S) = number of outcomes listed in the sample space
Event	A single outcome or a group of outcomes from the sample space
Favourable outcomes	Outcomes that satisfy the event being asked about

3. Worked examples

Question	Calculation	Answer
A fair die is rolled. Find P(rolling a 4).	1 favourable outcome; 6 possible outcomes	1/6
A coin lands heads 18 times in 30 tosses. Find experimental probability of heads.	18/30 = 3/5	3/5
Find the probability of an even number on a fair die.	Favourable outcomes {2, 4, 6}; 3/6	1/2
A fair coin is tossed twice. List the sample space.	Each toss can be H or T	S = {HH, HT, TH, TT}

QUICK REVISION & PRACTICE

Chapter 7 • Probability

4. Tree diagrams and sample spaces

A tree diagram shows possible outcomes in a multi-step random experiment. Each complete path represents one outcome. For two tosses of a coin, the sample space is S = {HH, HT, TH, TT}.

5. Quick method

1. Identify the random experiment and the event.
2. List all possible outcomes in the sample space.
3. Count the favourable outcomes.
4. If outcomes are equally likely, divide favourable outcomes by total possible outcomes.
5. For experimental probability, use observed results divided by total trials.

6. Practice questions

1. A fair die is rolled. Find the theoretical probability of getting a 6.
2. A coin is tossed 40 times and lands tails 22 times. Find the experimental probability of tails.
3. A fair die is rolled. Find the probability of getting a number greater than 4.
4. Write the sample space for one toss of a fair coin.

Answers

1. 1/6
2. 22/40 = 11/20
3. 2/6 = 1/3
4. S = {H, T}

Important reminders

• Probability is between 0 and 1, inclusive.
• Probability 0 means impossible; probability 1 means certain.
• Experimental probability comes from observations or trials; theoretical probability uses equally likely possible outcomes.
• A sample space must include every possible outcome without repeating any outcome.

Source note

Prepared from the uploaded NCERT Ganita Manjari, Grade 9, Part I, Chapter 7, “The Mathematics of Maybe: Introduction to Probability.” The two probability formulas and probability bounds are taken from the chapter summary on printed page 173. This is an independent study aid, not an official NCERT/CBSE publication.

CLASS 9 MATHEMATICS

Ganita Manjari • Part I • Chapter 8

PREDICTING WHAT COMES NEXT: SEQUENCES AND PROGRESSIONS

FORMULA SHEET • Academic Session 2026–27

1. Triangular numbers

Sequence	1, 3, 6, 10, 15, …
nth term	$t_n = n(n + 1)/2$
Sum of first n natural numbers	$1 + 2 + 3 + \ldots + n = n(n + 1)/2$

2. Arithmetic progression (AP)

Common difference	$d = t_2 - t_1$ (or any term minus the preceding term)
nth term	$t_n = a + (n - 1)d$
General form	a, a + d, a + 2d, a + 3d, …

Here, a is the first term, d is the common difference and n is the term position.

3. Geometric progression (GP)

Common ratio	$r = t_2/t_1$ (for a non-zero preceding term); consecutive terms have the same ratio
nth term	$t_n = ar^{n-1}$
General form	a, ar, ar^2, ar^3, …

Here, a is the first term, r is the common ratio and n is the term position.

4. Explicit and recursive rules

Explicit rule	Gives a term directly using its position n.
Recursive rule	Defines a term using one or more earlier terms and a starting term.
Example: AP	$t_1 = 1$; $t_n = t_{n-1} + 3$ for $n \geq 2$ gives 1, 4, 7, 10, …
Example: GP	$t_1 = 3$; $t_n = 2t_{n-1}$ for $n \geq 2$ gives 3, 6, 12, 24, …

WORKED EXAMPLES & QUICK PRACTICE

Chapter 8 • Sequences and Progressions

5. Worked examples

Question	Method	Answer
Find the 8th triangular number.	$8 \times 9 \div 2$	36
Find the 10th term of 4, 7, 10, 13, …	$a = 4$, $d = 3$; $t_{10} = 4 + 9 \times 3$	31
Find the 6th term of 2, 6, 18, 54, …	$a = 2$, $r = 3$; $t_6 = 2 \times 3^5$	486
Write a recursive rule for 5, 9, 13, 17, …	First term 5; add 4 each time	$t_1 = 5$; $t_n = t_{n-1} + 4$ for $n \geq 2$

6. Quick practice

1. Find the 12th triangular number.
2. Find the 15th term of the AP 6, 10, 14, 18, …
3. Find the 5th term of the GP 4, 8, 16, 32, …
4. Write a recursive rule for 2, 7, 12, 17, …

Answers

1. 78
2. 62
3. 64
4. $t_1 = 2$; $t_n = t_{n-1} + 5$ for $n \geq 2$

7. Formula reminders

• AP: add the same common difference each time.
• GP: multiply by the same common ratio each time.
• The n in t_n is the position of the term, not the term’s value.
• The textbook chapter summary does not list a sum formula for all terms of an AP or GP, so this sheet does not add those formulas.

Source note

Prepared from the uploaded NCERT Ganita Manjari, Grade 9, Part I, Chapter 8, “Predicting What Comes Next: Exploring Sequences and Progressions.” The triangular-number, AP and GP formulas match the chapter summary on printed page 196. Explicit/recursive rules are included because they are taught in the same chapter. This is an independent study aid, not an official NCERT/CBSE publication.

CLASS 9 MATHEMATICS

Ganita Manjari • Part II • Chapter 10

HOW QUANTITIES COMBINE: UNDERSTANDING DATA

FORMULA & REVISION SHEET • Academic Session 2026–27

1. Weighted average (weighted mean)

General formula	$\bar{x} = (w_1x_1 + w_2x_2 + \ldots + w_nx_n) \div (w_1 + w_2 + \ldots + w_n)$
Two groups	Combined mean = $(n_1\bar{x}_1 + n_2\bar{x}_2) \div (n_1 + n_2)$
Meaning of symbols	x_i = value or group mean; w_i = corresponding weight; n_1, n_2 = number of values in each group

Use a weighted mean when groups have different sizes or when values have different levels of importance. The weights must match the values they represent.

2. Combining two groups of data

If Group A has n_1 values with mean $\bar{x}_1$ and Group B has n_2 values with mean $\bar{x}_2$, first find each group's total by multiplying its mean by its number of values. Add the totals, then divide by the combined number of values.

Worked example

Given	Section A: mean = 72, 30 students. Section B: mean = 76, 25 students.
Combined mean	(72 × 30 + 76 × 25) ÷ (30 + 25)
Calculation	(2160 + 1900) ÷ 55 = 4060 ÷ 55
Answer	73.82 approximately

3. Weighted ratings or marks

Weighted score	(score$_1$ × weight$_1$ + score$_2$ × weight$_2$ + …) ÷ total of weights
Example	Ratings 5, 4, 3 with weights 4, 3, 2: (5×4 + 4×3 + 3×2) ÷ (4+3+2) = 39/9 ≈ 4.33

4. Mixtures and concentrations

For quantities with different concentrations, combine the amount of each ingredient first. For percentage concentration:

Combined concentration (%)	(Σ [quantity × concentration %]) ÷ total quantity
Important	Use consistent units for all quantities; do not simply average the percentages unless the quantities/weights are equal.

CHARTS, EXAMPLES & QUICK PRACTICE

Chapter 10 • Understanding Data

5. Stacked bar charts vs 100% stacked bar charts

Stacked bar chart	Useful when both the parts and the total for each category matter.
100% stacked bar chart	Each bar represents 100%; useful for comparing proportions, not absolute totals.
Key limitation	A 100% stacked chart alone does not show the original totals.

6. Quick worked examples

Question	Calculation	Answer
Group 1: mean 10, 4 values. Group 2: mean 16, 6 values. Find combined mean.	(10×4 + 16×6) ÷ 10	13.6
Mix 100 mL at 5% with 200 mL at 10%. Find concentration.	(100×5 + 200×10) ÷ 300	8.33%
Marks: 80 with weight 2, 90 with weight 3.	(80×2 + 90×3) ÷ 5	86

7. Quick practice

1. Group A has 12 students with mean 65; Group B has 18 students with mean 75. Find the combined mean.
2. A 200 mL mixture is 10% juice and a 300 mL mixture is 20% juice. Find the combined concentration.
3. Scores 70 and 90 have weights 1 and 4. Find the weighted mean.

Answers

1. (12×65 + 18×75) ÷ 30 = 71
2. (200×10 + 300×20) ÷ 500 = 16%
3. (70×1 + 90×4) ÷ 5 = 86

8. Remember

- Weighted mean = weighted total ÷ total weight.
- An average of averages must account for how many observations each average represents.
- Weighted averages also apply to mixtures, ratings and mark schemes.
- Stacked bar charts help compare totals; 100% stacked bar charts compare proportions.

Source note

Based on the uploaded NCERT Ganita Manjari, Grade 9, Part II, Chapter 10, “How Quantities Combine: Understanding Data.” The weighted-mean formula and statements about stacked and 100% stacked bar charts follow the textbook chapter summary. Worked examples are supplementary. This is an independent study aid, not an official NCERT/CBSE publication.

CLASS 9 MATHEMATICS

Ganita Manjari • Part II • Chapter 13

TWO VARIABLES, ONE LINE

FORMULA & REVISION SHEET • Academic Session 2026–27

1. Linear equation in two variables

General form	ax + by + c = 0, where a and b are not both zero.
Slope-intercept form	y = mx + d
Slope	m is the slope of the line.
y-intercept	d; the line crosses the y-axis at (0, d).
Solutions	Every ordered pair (x, y) satisfying the equation is a solution; a linear equation in two variables has infinitely many solutions.

2. Graph of a linear equation

Plotting	Find at least two solution points, plot them, then draw the straight line through them.
Point on graph	Every point on the graph is a solution of the equation, and every solution point lies on the graph.
x-intercept	Set y = 0 and solve for x, when the resulting equation allows it.
y-intercept	Set x = 0 and solve for y, when the resulting equation allows it.

3. Solving a pair of linear equations

Methods	Substitution method; elimination method; graphical method.
Unique solution	The two lines intersect at one point.
No solution	The two lines are parallel and distinct.
Infinitely many solutions	The two lines coincide.

4. Conditions for ax + by + c = 0 and $a_1x + b_1y + c_1 = 0$

Unique solution	$a/b \neq a_1/b_1$ (when the ratios are defined).
No solution	$a/b = a_1/b_1 \neq c/c_1$ (when the ratios are defined).
Infinitely many solutions	$a/a_1 = b/b_1 = c/c_1$ (when the ratios are defined).

WORKED EXAMPLES & PRACTICE

Chapter 13 • Two Variables, One Line

5. Worked examples

Question	Method	Answer
Write $y = 2x + 3$ in general form.	Move all terms to one side.	$2x - y + 3 = 0$
Find the y-intercept of $y = -3x + 5$.	Compare with $y = mx + d$.	$(0, 5)$
Find two points on $y = x + 1$.	Choose $x = 0$ and $x = 1$.	$(0, 1)$, $(1, 2)$
Classify $y = 2x + 1$ and $y = 2x - 4$.	Same slope, different intercepts.	Parallel; no solution

6. Quick practice

1. Find the y-intercept of $y = 4x - 7$.
2. Give two points on $y = 3x - 2$.
3. Are $y = -x + 4$ and $y = -x - 1$ intersecting or parallel?
4. Name two algebraic methods for solving a pair of linear equations.

Answers

1. $(0, -7)$
2. For example, $(0, -2)$ and $(1, 1)$
3. Parallel; no solution
4. Substitution and elimination.

Remember

• Use the textbook’s slope-intercept form $y = mx + d$: m is slope and d is the y-intercept.
• Do not confuse the y-intercept value d with the intercept point $(0, d)$.
• For ratios such as a/b, use care when a denominator is zero; the graphical interpretation remains the safest general test.

Source note

Prepared from the uploaded NCERT Ganita Manjari, Grade 9, Part II, Chapter 13, “Two Variables, One Line,” including the chapter summary on printed page 122. This is an independent study aid, not an official NCERT/CBSE publication.

CLASS 9 MATHEMATICS

Ganita Manjari • Part II • Chapter 14

MATH OF SPACE: SURFACE AREA AND VOLUME

FORMULA SHEET • Academic Session 2026–27

Symbols: l = length, b = breadth, h = perpendicular height, a = side, r = radius, ℓ = slant height. Use consistent units.

1. Cuboid and cube

Cuboid volume	V = l × b × h
Cuboid total surface area	TSA = 2(lb + bh + hl)
Cube volume	V = a^3
Cube total surface area	TSA = $6a^2$

2. Cylinder

Volume	V = $\pi r^2 h$
Curved surface area (CSA)	CSA = $2\pi rh$
Total surface area (TSA)	TSA = $2\pi r(h + r)$

3. Cone

Slant height (right circular cone)	$\ell = \sqrt{(r^2 + h^2)}$
Volume	V = $\frac{1}{3}\pi r^2 h$
Curved surface area (CSA)	CSA = $\pi r\ell$
Total surface area (TSA)	TSA = $\pi r(\ell + r)$

4. Pyramid

Volume of a pyramid	V = ⅓ × base area × perpendicular height
Surface area	Total surface area = base area + areas of all triangular side faces

SPHERES, HEMISPHERES & APPLICATIONS

Chapter 14 • Surface Area and Volume

5. Sphere

Surface area	SA = $4\pi r^2$
Volume	V = $\frac{4}{3}\pi r^3$

6. Hemisphere

Curved surface area (CSA)	CSA = $2\pi r^2$
Total surface area (TSA)	TSA = $3\pi r^2$ (includes the circular base)
Volume	V = $\frac{2}{3}\pi r^3$

7. Quick comparison table

Solid	Volume	Surface area to remember
Cuboid	lbh	$2(lb + bh + hl)$
Cube	a^3	$6a^2$
Cylinder	$\pi r^2 h$	CSA $2\pi rh$; TSA $2\pi r(h + r)$
Cone	$\frac{1}{3}\pi r^2 h$	CSA $\pi r\ell$; TSA $\pi r(\ell + r)$
Sphere	$\frac{4}{3}\pi r^3$	$4\pi r^2$
Hemisphere	$\frac{2}{3}\pi r^3$	CSA $2\pi r^2$; TSA $3\pi r^2$
Pyramid	$\frac{1}{3}$ × base area × h	Base area + side-face areas

8. Worked examples

Question	Calculation	Answer
Cube side = 4 cm. Find volume.	4^3	64 cm^3
Cylinder r = 3 cm, h = 5 cm. Find volume.	$\pi \times 3^2 \times 5$	45π cm^3
Sphere radius = 2 cm. Find surface area.	$4\pi \times 2^2$	16π cm^2

9. Important reminders

- Surface area is measured in square units (cm^2, m^2); volume is measured in cubic units (cm^3, m^3).
- A hemisphere’s total surface area includes its flat circular base; curved surface area does not.
- For a cone, use perpendicular height h for volume and slant height ℓ for curved surface area.
- For a composite solid, identify which surfaces are exposed before adding surface areas.
- Use the value of π requested in the question, or a suitable approximation if none is specified.

Source note

Prepared as an independent revision aid based on the topics in the uploaded NCERT Ganita Manjari, Grade 9, Part II, Chapter 14, “Math of Space: Surface Area and Volume.” The chapter discusses cuboids, cylinders, cones, pyramids, spheres and hemispheres. Check the exact notation and examples against your textbook and teacher’s instructions.