

SEE Mathematics: Key Formulas and Worked Examples

Mathematics is the subject where a short, well-organised formula sheet saves the most marks. Use this one for revision: read a section, close the page, and try to rewrite the formulas from memory. Then do the worked example without looking.

This is a revision aid, not a full course. Follow the topics and marks in your current textbook and syllabus.

1. Algebra identities

- $(a + b)^2 = a^2 + 2ab + b^2$
- $(a - b)^2 = a^2 - 2ab + b^2$
- $a^2 - b^2 = (a + b)(a - b)$
- $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
- $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Example: Find 99^2 . Write it as $(100 - 1)^2 = 10,000 - 200 + 1 = 9,801$.

2. Indices and logs

- $a^m \times a^n = a^{m+n}$; $a^m / a^n = a^{m-n}$; $(a^m)^n = a^{mn}$; $a^0 = 1$.
- $\log(mn) = \log m + \log n$; $\log(m/n) = \log m - \log n$; $\log m^n = n \log m$.

3. Quadratic equation

For $ax^2 + bx + c = 0$, $x = (-b \pm \sqrt{b^2 - 4ac}) / 2a$. The discriminant $b^2 - 4ac$ tells you the roots: positive means two real roots, zero means equal roots, negative means no real roots.

Example: $x^2 - 5x + 6 = 0$ factorises as $(x - 2)(x - 3) = 0$, so $x = 2$ or 3 .

4. Arithmetic: percentage, interest, profit and loss

- Simple interest $I = PTR / 100$; amount $A = P + I$.
- Compound amount $A = P(1 + R/100)^T$.
- Profit = $SP - CP$; profit % = $\text{profit} / CP \times 100$; $SP = CP(1 + \text{profit}\%/100)$.

Example: Compound interest on Rs 10,000 at 10% for 2 years: $A = 10,000 \times 1.1 \times 1.1 = \text{Rs } 12,100$, so the interest is Rs 2,100.

5. Mensuration

Shape	Area	Perimeter / other
Rectangle	$l \times b$	$2(l + b)$
Square	a^2	$4a$
Triangle	$\frac{1}{2} \times \text{base} \times \text{height}$	sum of the sides
Circle	πr^2	circumference $2\pi r$
Cuboid	Volume lbh	Total surface $2(lb + bh + hl)$
Cylinder	Volume $\pi r^2 h$	Curved surface $2\pi r h$
Cone	Volume $\frac{1}{3} \pi r^2 h$	Curved surface $\pi r l$
Sphere	Volume $\frac{4}{3} \pi r^3$	Surface $4\pi r^2$

Example: A cylinder has radius 7 cm and height 10 cm. Volume = $(\frac{22}{7}) \times 49 \times 10 = 1,540 \text{ cm}^3$.

6. Geometry and Pythagoras

- In a right-angled triangle, $\text{hypotenuse}^2 = \text{base}^2 + \text{perpendicular}^2$.
- Angles of a triangle add up to 180 degrees; angles of a quadrilateral to 360 degrees.
- The angle at the centre of a circle is twice the angle at the circumference on the same arc.
- Angles in the same segment are equal; opposite angles of a cyclic quadrilateral add up to 180 degrees.

7. Trigonometry

- $\sin = \text{perpendicular} / \text{hypotenuse}$; $\cos = \text{base} / \text{hypotenuse}$; $\tan = \text{perpendicular} / \text{base}$.
- $\sin^2 A + \cos^2 A = 1$; $\tan A = \sin A / \cos A$.

Angle	0	30	45	60	90
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	not defined

Example: A ladder 10 m long leans at 60 degrees to the ground. It reaches a height of $10 \times \sin 60 = 10 \times \frac{\sqrt{3}}{2} = 5\sqrt{3}$, about 8.66 m.

8. Statistics

- Mean = sum of values / number of values.
- Median: the middle value after sorting (average of the two middle ones if the count is even).
- Mode: the most frequent value.

Example: For 3, 5, 5, 7, 10 the mean is 6, the median 5 and the mode 5.

9. How to use this sheet

1. Rewrite it on one page from memory every few days.
2. For each formula, solve two textbook questions straight away.
3. In the exam, write the formula first; method marks are often given even if a calculation slips.

Practice questions

1. Factorise $x^2 - 49$.
2. Find the area of a circle of radius 14 cm (use $\frac{22}{7}$).
3. Find x if $x^2 - 7x + 12 = 0$.
4. Find the hypotenuse of a right-angled triangle with sides 9 and 12.

Answers: 1) $(x + 7)(x - 7)$. 2) $(\frac{22}{7}) \times 196 = 616 \text{ cm}^2$. 3) $x = 3$ or 4. 4) $\sqrt{81 + 144} = \sqrt{225} = 15$.

This is an original revision summary written by MeroSir. It is not the official syllabus and does not replace your textbook or teacher. Syllabus, marks and rules change, so always check the current version with the Curriculum Development Centre (moecdc.gov.np) and the National Examinations Board (neb.gov.np). Spotted a mistake? Tell us through the Contact page and we will fix it.