

TOPICS FOR EKOLA MATHEMATICS PLACEMENT TEST:

I. FUNDAMENTALS AND NUMBERS AND ALGEBRA

- I.1. Sets and operations on sets (union, intersection, difference, complementary set).
- I.2. Logical operators/connectives (at least of: 'and', 'or' in the context of I.1. above).
- I.3. Number types/sets: natural numbers, integers, rational and irrational, real numbers.
- I.4. Real number line, use of inequalities, $<$, \leq , $>$, \geq and intervals.
- I.5. Rounding, decimal approximations and significant figures; errors.
- I.6. Definition, elementary treatment and geometrical interpretation of absolute value (modulus), $|a|$.
- I.7. Use of addition, subtraction, multiplication and division using integers, decimals and fractions, including order of operations. Equivalent forms of fractions (fraction \leftrightarrow decimal \leftrightarrow percent)
- I.8. Divisibility, prime numbers, factors (divisors) and multiples; greatest common factor (divisor) and least common multiples.
- I.9. Simple applications of ratio, percentage and proportion.
- I.10. Powers, basic index laws. Evaluating exponential expressions with integer exponents.
- I.11. Expression of numbers in exponential/scientific form $a \times 10^k$, $1 \leq a < 10, k \in \mathbb{Z}$.
- I.12. Roots (of any degree). Operations with and manipulation of square roots only (including rationalisation of fractions' denominators).
- I.13. Simple equations/inequalities with absolute value, e.g. $|3x - 1| = 5$, $|2x + 7| \leq 3$, $|2x - 3| \geq 5$. (HL)

II. ALGEBRA

- II.1. Variables substitution with numbers / evaluation.
- II.2. Manipulation of algebraic expressions (expansion, factoring out, simple factorization).
- II.3. Use of: $(a \pm b)^2 = a^2 \pm 2ab + b^2$, $a^2 - b^2 = (a - b)(a + b)$.
- II.4. Formulae rearrangement.
- II.5. Solving of linear equations and inequalities.
- II.6. Solving quadratic equations and inequalities.
- II.7. Solving systems of linear equations in two variables. Lines intersection (see III.3).
- II.8. Use of: $(a \pm b)^3 = a^3 \pm 3a^2b + 3ab^2 + b^3$, $a^3 \pm b^3 = (a \pm b)(a^2 \mp ab + b^2)$. (HL)
- II.9. Evaluating exponential expressions with rational exponents. (HL)
- II.10. Addition and subtraction of algebraic fractions. (HL)

III. FUNCTIONS

- III.1. Mappings of the elements of one set to another. Illustration by means of sets of ordered pairs, tables, diagrams and graphs.
- III.2. Reading information from graphs.
- III.3. Graphing lines / linear functions. Gradient of a line, parallel/perpendicular lines.
- III.4. Graphs of quadratic functions. (HL)

IV. GEOMETRY AND TRIGONOMETRY

- IV.1. Pythagoras' theorem and its converse.
- IV.2. Cartesian plane.
- IV.3. Mid-point of a line segment and the distance between two points in the Cartesian plane.
- IV.4. Geometric concepts: point, line, plane, angle. Angle measurement in degrees, compass directions.
- IV.5. The triangle sum theorem; acute-angle trigonometry in right-angled triangles, including simple applications for solving triangles.
- IV.6. Simple geometric transformations: translation, reflection, rotation.
- IV.7. The circle, its centre and radius, area and circumference. The terms diameter, arc, sector, chord, tangent and segment.
- IV.8. Perimeter and area of plane figures. Properties of triangles and quadrilaterals, including parallelograms, rhombi, rectangles, squares, kites and trapezoids; compound shapes.
- IV.9. Elementary knowledge of three-dimensional shapes (cube, cuboid, prisms, pyramids, spheres, cylinders and cones) – incl. their volumes.

V. STATISTICS AND PROBABILITY

- V.1. The collection of data and its representation in bar charts, pie charts, pictograms, and line graphs.
- V.2. Obtaining simple statistics from discrete data: mean, median, mode, range.
- V.3. Venn diagrams for sorting data.

VI. MISCELLANEOUS

Familiarity with commonly accepted world currencies. SI (Système International) units for mass, time, length and their derived units, eg. speed, area and volume. Speed = distance/time (for uniform motion).