

Utica Academy for International Studies
Entrance Testing Preparation
Subject Area: *Mathematics*

Students considering attendance of the Utica Academy for International Studies should have completed Algebra 1 prior to entering the program. A strong algebra background encourages continued success in the mathematics and science courses offered at UAIS.

Entrance Exam Content:

The following topics* are potential areas of focus for the entrance test:

Numbers and Algebra

- Basic use of the four operations of arithmetic, using integers, decimals and fractions, including order of operations.
- Prime numbers, factors and multiples.
- Simple applications of ratio, percentage and proportion.
- Natural numbers, Integers, Rational Numbers & Real Numbers; \mathbb{N} , \mathbb{Z} , \mathbb{Q} & \mathbb{R} .
- Basic manipulation of simple algebraic expressions, including factorization and expansion.
- Rearranging formulae.
- Evaluating expressions by substitution.
- Solving linear equations in one variable.
- Solving systems of linear equations in two variables.
- Evaluating exponential expressions with integer values.
- SI units for length and area.
- Approximation: decimal places, significant figures.
- Estimation.
- Expressing numbers in the form $a \times 10^k$, where $1 \leq a < 10$ and k is an integer.
- Convert between different metric units.

Mathematical Models

- Linear models; Linear functions & their graphs.
- Quadratic models; Quadratic functions & their graphs (parabolas).
- Properties of a parabola: symmetry; vertex; intercepts on the x-axis & y-axis.
Equation of the axis of symmetry, $x = -\frac{b}{2a}$.
- Conversion between the various forms of linear and quadratic equations, e.g. convert point-slope form to slope-intercept form.

- Exponential models; Exponential functions & their graphs.
- Concept of asymptote.
- Drawing accurate graphs.
- Reading, interpreting and making predictions using graphs.

Probability

- Probability of an event.
- Probability of a complementary event.
- Probability of combined events, mutually exclusive events, independent events.
- Use of tree diagrams, Venn diagrams, sample space diagrams and tables of outcomes.
- Probability using “with replacement” and “without replacement”.
- Conditional probability.

Geometry

- Pythagoras’ theorem.
- Coordinates in two dimensions.
- Midpoints, distance between points.
- Equation of a line in two dimensions: the forms $y = mx + b$ and $Ax + By = C$.
- Gradient (slope).
- Intercepts.
- Points of intersection of lines.
- Lines with gradients, m_1 and m_2 .
- Parallel lines $m_1 = m_2$.
- Perpendicular lines, $m_1 \times m_2 = -1$.
- Construction of labeled diagrams from verbal statements.
- Geometry of three-dimensional solids: cuboid; right prism; right pyramid; right cone; cylinder; sphere; hemisphere; and combinations of these solids.
- The distance between two points; e.g. between two vertices or vertices with midpoints or midpoints with midpoints.

*Most topics listed above are printed in the *IB Mathematical studies SL guide, First Examinations 2014* as “Content” and released by the International Baccalaureate Organization.

Recommended Resources from the Mathematics Department:

The following websites have been provided to freshman as recommended resources to review algebra skills for students continuing on to Algebra II at UAIS:

<https://www.ixl.com/math/algebra-1>

Topics to review:

1. Solving Equations: j.1-j.9
2. Single Variable Inequalities: k.1-k.15
3. Absolute Value Equations & Inequalities: l.1-l.4
4. Linear Functions: s.1-s.20
5. Linear Inequalities: t.1-t.5
6. Systems of Linear Equations: u.1-u.15
7. Factoring: aa.1-aa.7
8. Quadratic Equations: bb.1-bb.11

To further help you the Algebra II teachers suggest the following sites:

<http://www.mathplanet.com/education/algebra-1>

http://www.classzone.com/books/algebra_1/lessonquiz_national.cfm

Exam Question Examples:

The following questions are written in the same format as the entrance exam for mathematics. The method of grading is also included to indicate the importance of presenting the process of solving each question provided. Students are awarded “follow through” points. These points take into consideration minor arithmetic errors that are carried through an entire problem when the process of solving is accurate.

(Total 6 points)

A field is 91.4 m long and 68.5 m wide.

- (a) Calculate the area of the field in m^2 .
- (b) Calculate the area of the field in cm^2 .
- (c) Express your answer to (b) in scientific notation.

Prompt	Process	Points Awarded
(a) Calculate the area of the field in m^2 .	$\text{Area} = \text{length} \times \text{width}$ $A = 91.4 \times 68.5$ $6260.9 \text{ m}^2 \text{ (accept 6260 or 6261)}$	For multiplying 2 lengths (+1) Accurate value recorded (+1)
(b) Calculate the area of the field in cm^2 .	$100 \text{ cm} = 1 \text{ m}$ $A = 9140 \times 6850$ $A = 62609000 \text{ m}^2 \text{ (accept 62,600,000 or 62,610,000)}$	For multiplying each length by 100 (+1) Accurate value recorded (+1) Note: Award (+0) if multiplying their (a) by 100.
(c) Express your answer to (b) in scientific notation.	6.2609×10^7 $\text{Accept } 6.26 \times 10^7 \text{ or } 6.261 \times 10^7$	For 6.2609 (or 6.26 or 6.261) (+1) For 10^7 (+1)

(Total 6 points)

- (a) Factor the expression $x^2 - 25$.
- (b) Factor the expression $x^2 - 3x - 4$.
- (c) Using your answer to part (b), or otherwise, solve the equation $x^2 - 3x - 4 = 0$.

Prompt	Process	Points Awarded
(a) Factor the expression $x^2 - 25$.	$(x + 5)(x - 5)$	For $x + 5$ (+1), for $x - 5$ (+1)
(b) Factor the expression $x^2 - 3x - 4$.	$(x - 4)(x + 1)$	For $x - 4$ (+1), for $x + 1$ (+1)
(c) Using your answer to part (b), or otherwise, solve the equation $x^2 - 3x - 4 = 0$.	$x^2 - 3x - 4 = 0$ $(x - 4)(x + 1) = 0$ $x = 4 \text{ or } x = -1$	For $x = 4$ (+1) and $x = -1$ (+1) Note: Allow follow through points from (b) if justified.