MATHEMATICS EXAMAMINATION MATERIAL FOR THE ISA SCHOLARSHIPS

The content that will be examined in the scholarship exam for Mathematics will be from the topics of Algebra, Functions, Geometry and Trigonometry, which has been covered throughout Grades 7 to 10.

The problems given require strong algebraic skills, problem solving skills and conceptual understanding of the content. The content can be found in the table below.

Content
Absolute values of Real numbers and variables
Surds
Linear, Quadratic, and Algebraic expressions
Sequences, Series, and Number Patterns
Solving Equalities and Inequalities in various situations (covering all of the above)
Linear, Quadratic, and Cubic functions, and the corresponding graphs
Geometry and Measurement
Trigonometry in Right Angled triangles

The examination consists of three sections.

Section A: 6 short questions. Students are required to solve all of them.

Section B: 3 long question. Students are asked to select two of the three questions.

Section C: In this section the students' critical thinking skills, and their ability to identify patterns and generalize will be assessed.

We are aware that, due to students coming from various curricula, some content might not have been covered by the time of the scholarship exam. This is why the "quality" of the answers provided will be assessed along with the final mark achieved.

Examples of problems that could appear are given below:

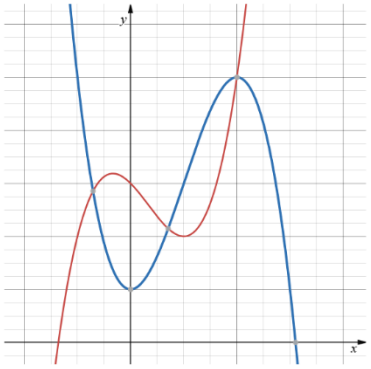
1. **Determine** whether the value of the expression $A = \left(\sqrt{\frac{2}{3}} + \sqrt{\frac{3}{2}}\right)^2$ is an irrational number.

2. Consider the natural number x, with $x \neq 9$. **Show** that $\frac{\sqrt{x}}{\sqrt{x}-3} - \frac{3}{\sqrt{x}+3} \neq 1$.

3. The function $f(x) = ax^2 + b\,x + c$, with $a = 2$ and Vertex at $(-1, -3)$ can be <u>uniquely</u> written in the form $y = \sqrt{m}\,(x + h)^2 + k$. **Find** the values of m, b and c.

4. If the inequality $x^2 - 2x + c > 0$ is true for all $x \in \mathbb{R}$, **find** the possible values of c.

5. Let $f(x) = x^3 - x^2 - x + 3$ and $g(x) = -x^3 + 3x^2 + 1$. The diagram below shows the graphs of $y = f(x)$ and $y = g(x)$.



   a. **Write down** the coordinates of the y intercept of the graph of $y = g(x)$.
   b. **Find** the value of $f(2)$.
   c. **Solve** the inequality $f(x) \geq g(x)$.
   d. **Show that** $f(0)$, $g(0)$, and $g(2)$ are terms of the sequence $u_n = 2n + 1$, with $n \in \mathbb{Z}$.

Best of luck,

Pavlos Meratzis

Head of Mathematics