## Mathematical skills for University of Amsterdam: Bachelor's Actuarial Science, Bachelor's Business Analytics and Bachelor's Econometrics and Data Science

You should have sufficient knowledge on the following domains which are defined for Dutch highschool students who take VWO-B level of mathematics:

- Domain A: Skills
- Domain B: Functions, graphs, and equations
- Domain C: Differential and Integral Calculus
- Domain D: Trigonometric functions
- Domain E: Coordinate Geometry

More specific details on these domains are found below.

For international students, they should check if all domains are covered by their studies/diploma. Entry requirements are the same as for Dutch students. Any prospective student should have a diploma at the level of the Dutch program, or higher.

Especially, candidates should check their knowledge on domains C and D, on trigonometry and integration techniques. Especially knowledge on integration is indispensable for our programs. Parts could well be missing in your high-school education (as is our experience). It remains the responsibility of you as applicant to repair these gaps in knowledge before the start of our programs.

## DOMAIN A: SKILLS

General Skills: You have knowledge of the role of mathematics in society, can gather targeted information about it, and communicate the results to others.

Profile-Specific Skills: You can analyze profile-specific problem situations in mathematical terms, solve them, and translate the result back to the original problem.

Mathematical Skills: You possess the appropriate mathematical skills for the examination program, including modeling and algebraic skills, organization and structuring, analytical thinking and problem-solving, manipulating formulas, abstracting, and using logical reasoning and proofs, including functional use of ICT.

## DOMAIN B: FUNCTIONS, GRAPHS, AND EQUATIONS

Functions: You can interpret and manipulate formulas, draw graphs for relationships between two variables on a coordinate system, and determine if a given formula can be rewritten as a function expression.

Standard Functions: You can draw and recognize graphs of the following standard functions: power functions with rational exponents, exponential functions, logarithmic functions, trigonometric functions, and the absolute value function. You can also identify and utilize the characteristic properties of these different types of functions.

Functions and Graphs: You can formulate, edit, combine function expressions, draw their corresponding graphs, and make qualitative statements about the function and its graph without aids based on a function expression.

Inverse Functions: You can conceptually handle, formulate, and use inverse functions.

Equations and Inequalities: You can solve equations, inequalities, and systems of two linear equations and interpret their solutions.
In particular, you should be able to solve linear equations, quadratic equations, root equations, fractional equations.

Asymptotes and the Limit Behavior of Functions: You can determine the asymptotic behavior of functions and demonstrate it through limit calculations. You should be able to identify horizontal, vertical and skewed asymptotes of combinations of standard functions. You should be able to indicate perforations.

Calculation of extreme values and inflection points: You can apply derivatives to find extreme values of a function and apply second order derivatives to judge their nature (maximum, minimum).

## DOMAIN C: DIFFERENTIAL AND INTEGRAL CALCULUS

Derivatives of Functions: You can conceptually interpret the first and second derivatives of a function and use them to investigate the function. You can also use the first and second derivatives in applications.

Differentiation Techniques: You can determine the first and second derivatives of functions using differentiation rules and apply algebraic techniques.
Specifically, you should know the following techniques: product rule, quotient rule, chain rule for differentiation for compound functions. Derivatives of above mentioned standard functions should be known by heart.

Integral Calculus: You can set up and exactly calculate definite integrals in appropriate applications. Specifically, you should know the following:
Approximate areas under graphs of functions, main theorem of integration theory, primitives of standard functions, the connection of integrals and areas, connection of integrals and volume (body of revolution).

## DOMAIN D: TRIGONOMETRIC FUNCTIONS

You can formulate and manipulate formulas for periodic phenomena, draw their corresponding graphs, solve equations, and use periodicity with insight.
Specifically, you should know the following: the main trigonometric functions and their properties, like sine, cosine, tangent. You should know the relation with geometry. You should be able to solve equations with these functions.

## DOMAIN E: COORDINATE GEOMETRY

Geometric Skills: You can investigate and prove geometric properties of objects using geometric and algebraic techniques and ICT when necessary.

Algebraic Methods in Plane Geometry: You can examine the properties and mutual relationships of points, lines, circles, and other suitable figures using algebraic representations. You can create algebraic representations of figures in a given or self-chosen coordinate system and use algebraic representations to solve geometric problems.

Vectors and Dot Products: You can derive properties of plane figures and perform calculations using vectors and dot products.

Applications: You can apply the indicated techniques in suitable natural science and technical situations.

