This trial exam consists of two parts. The first part focuses on proficiency in algebra, at the level of Algebra I. The second part includes simple exercises in statistics and probability theory.

Please note: This trial exam contains more questions than the real test in order to provide candidates more exercises.

More specifically, the test will focus on the following mathematical abilities:

a) Solving linear equations and inequalities with a single variable;

b) Solving and analysing quadratic functions;

c) Solving absolute value equations;

d) Adding, subtracting and multiplying polynomial expressions;

e) Calculating descriptive statistics such as arithmetic mean and variance;

f) Solving simple exercises in probability theory.
Part 1:

1. Solve the following equation. Give your final answer, no need to submit the intermediate steps.
   (a) \( x^3 + 4x^2 + x = 2x^2 \)
   (b) \( 3x^3 - 12x^2 + 12x = 3x \)
   (c) \( 5x^3 + 55x^2 + 150x = 0 \)
   (d) \( x^4 - 3x^2 = x^2 \)
   (e) \( -\frac{x^2}{4} - \frac{2x}{3} + \frac{2}{3} = \frac{3}{3} \)
   (f) \( -\frac{x^2}{4} - 2y^2 + \frac{4y}{9} = -\frac{y^2}{2} \)

2. Solve the following equation. Give your final answer, no need to submit the intermediate steps.
   (a) \( |x^3 - 1| = \sqrt{5} \)
   (b) \( |x^2 - 4| = \sqrt{9} \)
   (c) \( |\sqrt{x} + \frac{1}{3}| = \frac{4}{6} \)
   (d) \( |\frac{x}{2} + 1| = \frac{\sqrt{x-4}}{2} - \frac{\sqrt{x-4}}{2} \)

3. Solve the following inequalities. Give your final answer, no need to submit the intermediate steps.
   (a) \( \frac{x}{9} - \frac{1}{8} \leq \sqrt{12} \)
   (b) \( |\frac{x^2}{4} - 4| \leq \sqrt{9} \)
   (c) \( \frac{\sqrt{x}}{2} + \sqrt{10} \leq \sqrt{250} \)
   (d) \( \frac{\sqrt{14y}}{2} + \sqrt{12} \geq \frac{1}{6} \)

4. Solve the following system of equations. Give your final answer, no need to submit the intermediate steps.
   (a) \[
   \begin{align*}
   x + 2y - 2 &= 6 \\
   \frac{x}{4} + \frac{y}{2} + 4 &= 10
   \end{align*}
   \]
   (b) \[
   \begin{align*}
   \frac{11x}{4} + \frac{2y}{3} - \frac{x}{4} &= \frac{2x}{8} + \frac{1}{4} \\
   \frac{2x}{5} + \frac{y}{3} + \frac{8}{10} &= \frac{1}{2}
   \end{align*}
   \]

5. Solve the following system of inequalities. Give your final answer, no need to submit the intermediate steps.
   (a) \[
   \begin{align*}
   3y - 11 &\leq \sqrt{64} \\
   \frac{2y}{7} + \frac{\sqrt{2}}{2} &\geq \frac{1}{2}
   \end{align*}
   \]
   (b) \[
   \begin{align*}
   \sqrt{3x} - \sqrt{6} &\leq \sqrt{24} \\
   \frac{2x}{3} - \frac{1}{64} &\geq \frac{64}{128}
   \end{align*}
   \]
   (c) \[
   \begin{align*}
   |\frac{x}{3} - 1| &\leq \frac{21}{3} \\
   \frac{2x}{3} - 2 &\geq -\frac{1}{3}
   \end{align*}
   \]

If there is any question regarding the trial exam, please don’t hesitate to contact us by email (x.wang@uva.nl).
Part 2:

6. Calculate the mean, median, and sample variance of the following set of observations.
   (a) (10, 2, 3, 6, 18, 9, 3, 23, 54, 9, 6)
   (b) (2, 8, 9, 10, 10, 4, 5, 6)
   (c) (9, 10, 4, 5, 12, 65, 12, 10)

7. Use your knowledge of probability theory to answer the following questions.
   Suppose one ball is picked at random from a box containing 60 balls with 15 in red, 15 in blue, 15 in yellow and 15 in green.
   (a) Let A denote the probability of obtaining a red ball, and let B denote the probability of obtaining a blue ball. Calculate \( P[A \cup B] \)
   (b) Suppose for each color the balls are marked with numbers ranking from 1 to 15, such that there are 15 red, 15 blue, 15 yellow, and 15 green balls with numbers ranking from 1 to 15. Let A denote the probability of obtaining a ball with a number of 15, and let B denote the probability of obtaining a ball in red. Calculate \( P[A \cup B] \)
   (c) Suppose the balls are marked with numbers raking from 1 to 60. Let A denote the probability of obtaining a ball with a number no less than 20, and let B denote the probability of obtaining a ball with a number no more than 40. Calculate \( P[A \cap B] \)

8. Use your knowledge of probability theory to answer the following questions.
   Consider: You have an investment opportunity right now to invest in three different projects A, B or C. Due to the income constraints it is only possible for you to invest in one of those projects. Suppose that you are a rational person and you will make your investment decision fully based on the expectation of the payoffs of the projects. Each project will turn out to be either a ”good” one or ”bad” one with different probabilities and payoffs after one year (ignore time value in this question). Any of those three projects needs an initial investment of 100 euro today.
   Project A: There is a chance that the project turns out to be a success and it will be worth 150 euro in one year. There is also a chance that the project turns out to be a failure and it will only be worth 75 euro in one year. The probability of success is \( \frac{1}{3} \) and the probability of failure is \( \frac{2}{3} \).
   Project B: There is a chance that the project turns out to be a success and this project will be worth 200 euro in one year. There is also a chance that the project turns out to be a failure and it will only be worth 40 euro in one year. The probability of success is \( \frac{1}{6} \) and the probability of failure is \( \frac{5}{6} \).
   Project C: There is a chance that the project turns out to be a big success and this project will be worth 300 euro in one year. However, there is also a chance that the project turns out to be a big failure and it will be worthless (0 euro). The probability of success is \( \frac{2}{10} \) and the probability of failure is \( \frac{3}{10} \). Besides these scenarios, the project might also keep the value as your initial investment (100 euro) after one year, with the probability of \( \frac{1}{2} \).
   (a) Calculate the expected payoff for each project and conclude in which project you would like to invest. (Note: Payoff = Project value in one year−Initial investment)
   (b) Calculate the variance of the payoff for project A, B, and C separately.