Calculus 1
Final Exam
October 27, 2026 (18:15 – 20:15)

university of groningen

Please read the instructions!

1) Solve the initial value problem $y'(x) + 3x^2\, y(x) = x^2$, $y(0) = 1$.

2) Find the area of the region that lies under the curve $x^2 y = e^{A/x}$ (with $A < 0$) in the first quadrant of the xy-plane.

3) Use Taylor Series to find the limit $\lim\limits_{x \to 0} \dfrac{4\sin(2x) - 2\sin(4x)}{3x - \arctan(3x)}$.

4) Among all isoceles triangles of a fixed perimeter, show that the equilateral triangle has the greatest area.

5) Solve the following initial value problem

$$y''(x) + 3y'(x) + 2y(x) = 0, \quad y(0) = 1, \quad y'(0) = 2.$$

6) Calculate the volume of the solid obtained by rotating the curve $y = \tan(x/2)$, $0 \le x \le \pi/2$ about the x-axis.

Instructions

- **write your name and student number on the top of each sheet of writing paper!**
- use the writing (lined) and scratch (blank) paper provided, raise your hand if you need more paper
- start each question on a new page
- use a pen with black or blue ink
- do not use any kind of correcting fluid or tape
- any rough work should be crossed through neatly so it can be seen
- this is a closed-book exam (books & notes are not permitted)
- you may use your own handwritten formula sheet (a 2-sided A4 paper) – the invigilators will check these
- you are also allowed to use a simple pocket calculator
- programmable/graphing calculators are not allowed
- your work should be clearly and logically structured
- **explain your reasoning using words**
- show all your calculations, an answer without any computation will not be rewarded
- each problem is worth 15 points
- upon completion* remain seated and raise your hand to submit your work

*At the end of the exam or after you finished whichever is sooner.