

Mathematics 1110H – Calculus I: Limits, Derivatives, and Integrals

TRENT UNIVERSITY, Summer 2026 (S62) [reading course]

Assignment #4

*Due on Friday, 17 July.**

Please take a look at Sections 1.11 and 4.22 of Gregory Bard's *Sage for Undergraduates* before tackling this assignment.

1. Consider the differential equation $x \frac{dy}{dx} - y = 0$.
 - a. Use SageMath to find a general solution to this differential equation. [1]
 - b. Use SageMath to find a solution to this differential equation satisfying the initial condition $y = 1$ when $x = 1$. How many such solutions are there? [1.5]
 - c. Verify – by hand! – that any solutions you obtained in part **b** satisfy the given differential equation with the given initial conditions. [1]
2. Consider the differential equation $y \frac{dy}{dx} - x = 0$.
 - a. Use SageMath to find a general solution to this differential equation. [1]
 - b. Use SageMath to find a solution to this differential equation satisfying the initial condition $y = 0$ when $x = 0$. How many such solutions are there? [1.5]
 - c. Verify – by hand! – that any solutions you obtained in part **b** satisfy the given differential equation with the given initial conditions. [1]
3. Find all the general solutions to the differential equation

$$xy \left(\frac{dy}{dx} \right)^2 - (x^2 + y^2) \frac{dy}{dx} + xy = 0.$$

Explain why the solutions you found work. [3]

Hint: A little algebra can make this much easier.

* You should submit your solutions via Blackboard's Assignments module, preferably as a single pdf. If that fails, please submit directly to the instructor on paper or via email to sbilaniuk@trentu.ca. You may work with others, use whatever tools you like, and look things up, so long as you write up your submission by yourself and give due credit to your collaborators and any tools or sources you actually used.