

MAST10006 Calculus 2, Semester 2, 2020

Assignment 5

School of Mathematics and Statistics, The University of Melbourne

- Submit your assignment solutions online in Canvas before **6pm, Monday 21 September 2020**
- Submit your solutions as a single PDF file with the pages in the right order and correct orientation. You may be penalised a mark if you do not.
- This assignment is worth 2.22% of your final MAST10006 mark.
- Answer all questions below. Of these questions, one will be chosen for marking.
- Marks may be awarded for:
 - Correct use of appropriate mathematical techniques
 - Accuracy and validity of any calculations or algebraic manipulations
 - Clear justification or explanation of techniques and rules used
 - Use of correct mathematical notation and terminology
- You must use methods taught in MAST10006 Calculus 2 to solve the assignment questions.

1. Consider the differential equation

$$x \frac{dy}{dx} = y + \sqrt{x^2 + y^2}, \quad x > 0 \quad (1)$$

(a) Make the substitution $u = \frac{y}{x}$ and show that the differential equation reduces to

$$\frac{du}{dx} = \frac{\sqrt{1+u^2}}{x}. \quad (2)$$

(b) Find the general solution to the ODE (2) for $u(x)$.

(c) Use your answer from part (b) to solve the ODE (1), subject to the condition $\lim_{x \rightarrow 0+} y(x) = -\frac{e}{2}$.

2. Find the general solution to the ODE

$$t \log(t) \frac{dr}{dt} + r = \frac{t}{(2t^2 - 9)^{\frac{3}{2}}}.$$

End of assignment