

## DIFFERENTIAL EQUATIONS (751873001, 114-1) - HOMEWORK 2

Return by September 26, 2025 (Friday) 23:59

Total marks: 50

**Special requirement.** All homeworks must be prepared by using L<sup>A</sup>T<sub>E</sub>X.

**Exercise 1** (10 points). Find the general solution of

$$\frac{du}{dt} = \frac{3t^2 + 4t + 2}{2(u - 1)}.$$

**Exercise 2** (10 points). Find the general solution of

$$\frac{du}{dt} = \frac{4t - t^3}{4 + u^3}.$$

**Exercise 3** (10 points). Given any  $f \in C^1(\mathbb{R})$ , solve the equation  $(1 + t^2)\partial_t u + \partial_x u = 0$  with  $u(0, x) = f(x)$  and identify the range of  $x$ .

**Exercise 4** (10 points). Given any  $f \in C^1(\mathbb{R})$ , solve the equation  $t\partial_t u + x\partial_x u = 0$  with  $u(0, x) = f(x)$  and identify the range of  $x$ .

**Exercise 5** (10 points). Solve the equation  $x\partial_t u + t\partial_x u = 0$  with  $u(0, x) = e^{-x^2}$ .