

## MATH2130: Ordinary Differential Equations

### EXERCISE SHEET 5: EXACT DIFFERENTIAL EQUATIONS AND INTEGRATING FACTORS

Please hand solutions in at the lecture on Monday 1st March.

- 1.) Solve the following differential equations. First show that  $m(x, t)$  is an integrating factor.

(i)  $x(t) - t x'(t) = 0$  with  $m(x, t) = -\frac{1}{x^2}$ .

(ii)  $t x^2(t) (t x'(t) + x(t)) = 1$  with  $m(x, t) = 6t$ .

(iii)  $x^2(t) + t^2 + t + x(t) x'(t) = 0$  with  $m(x, t) = \frac{1}{t^2+x^2}$ .

- 2.) Test the following differential equation for exactness and find an integrating factor; then solve the differential equation.

$$y^2 + x^2 + 2x + 2y \frac{dy}{dx} = 0$$

*Hint:* Assume that the integrating factor is a function of  $x$  only.

- 3.) Revisit Exercise sheet 3: Try to solve those differential equations you have not done before, then read the extensive model solution and write down anything that is unclear.