

## Differential Equations. Week 3

Check that the following differential equations are exact

1. (Filippov 186)  $2xydx + (x^2 - y^2)dy = 0$ .
2. (Filippov 189)  $\frac{y}{x}dx + (y^3 + \ln x)dy = 0$ .
3. (Filippov 192)  $(1 + y^2 \sin 2x)dx - 2y \cos^2 x dy = 0$ .

Solve the following equations by finding an integrating factor of suitable form, or by making a suitable change of variables.

4. (Filippov 195)  $(x^2 + y^2 + x)dx + ydy = 0$ .
5. (Filippov 197)  $ydy = (xdy + ydx)\sqrt{1 + y^2}$ .
6. (Filippov 198)  $xy^2(xy' + y) = 1$ .
7. (Filippov 200)  $(y - \frac{1}{x})dx + \frac{dy}{y} = 0$ .

Solve linear first order differential equation.

8. (Filippov 137)  $(2x + 1)y' = 4x + 2y$ .
9. (Filippov 141)  $y = x(y' - x \cos x)$ .
10. (Filippov 153)  $y' = y^4 \cos x + y \tan x$ .
11. (Filippov 161) Choose the appropriate independent variable so that the equation  $x dx = (x^2 - 2y + 1)dy$  becomes linear and solve it.
12. (Filippov 165) Transform the integral equation  $y(x) = \int_0^x y(t)dt + x + 1$  to the differential equation and find its solution.
13. (Filippov 177) It is known that  $y_1$  and  $y_2$  are two distinct solutions of the first order linear differential equation. Express the general solution in terms of  $y_1$  and  $y_2$ .

**Homework:** Filippov 151, 178, 173.