



# MMP I

## Tutorial 6

HS 2017  
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### Exercise 1: Ordinary differential equations (9 Pts.)

Solve the following ordinary differential equations in the form  $y = y(x)$  or  $f(x, y) = C$ .

a)  $y' + 2y = 4x^2$  (1 Pt.)

b)  $(3x + 2y) + (x + \frac{6y^2}{x})y' = 0$  with the initial condition  $y(0) = 3$ . (2 Pts.)

c)  $y'' + y' - 6y = 0$ . In addition, show that the two solutions form a fundamental system. (2 Pts.)

d)  $x^2y'' + 7xy' - 7y = 0$  (1 Pt.)

e)  $x^4y^{(4)} + 6x^3y^{(3)} + 7x^2y^{(2)} + xy' - y = 3 \ln x$  (3 Pts.)

### Exercise 2: Homogenous systems of differential equations (2 Pts.)

Find the fundamental system of solutions for the following systems of linear differential equations:

a)

$$\begin{aligned}x' &= x \\y' &= 2x + y - 2z \\z' &= 3x + 2y + z\end{aligned}\tag{2.1}$$

b)

$$\begin{aligned}x' &= x - y + 2z \\y' &= -x + y + 2z \\z' &= x + y\end{aligned}\tag{2.2}$$

**Exercise 3:** Non-homogenous systems of differential equations (4 Pts.)

Solve the following non-homogenous systems of linear differential equations:

a)

$$\begin{aligned}x' &= -\frac{5}{4}x + \frac{3}{4}y + \frac{2}{1+e^t}, \quad x(0) = 2 \\y' &= \frac{3}{4}x - \frac{5}{4}y, \quad y(0) = 0\end{aligned}\tag{3.1}$$

b)

$$\begin{aligned}x' &= 4x + 2y - 15te^{-2t}, \quad x(0) = 7 \\y' &= 3x - y - 4te^{-2t}, \quad y(0) = 3\end{aligned}\tag{3.2}$$