

2019 - 20

## **ISTANBUL OKAN ÜNİVERSİTESİ** MÜHENDİSLİK FAKÜLTESİ MÜHENDİSLİK TEMEL BİLİMLERİ BÖLÜMÜ

MATH216 Mathematics IV - Exercise Sheet 4

N. Course

Exercise 19 (Homogeneous Second Order Linear ODEs with constant coefficients). Find the general solution of the following ODEs:

(a) 
$$y'' - 2y' + 2y = 0$$
 (e)  $y'' + 6y' + 13y = 0$  (i)  $4y'' + 12y' + 9y = 0$ 

(e) 
$$y'' + 6y' + 13y = 0$$

(i) 
$$4y'' + 12y' + 9y = 0$$

(m) 
$$4y'' + 17y' + 4y = 0$$

(b) 
$$u'' + 2u' + 2u = 0$$

(f) 
$$9y'' + 16y = 0$$

(i) 
$$4y'' - 4y' - 3y =$$

(b) 
$$y'' + 2y' + 2y = 0$$
 (f)  $9y'' + 16y = 0$  (j)  $4y'' - 4y' - 3y = 0$  (n)  $4y'' + 20y' + 25y = 0$ 

(c) 
$$u'' + 2u' - 8u = 0$$

(g) 
$$y'' - 2y' + y = 0$$

(k) 
$$y'' - 2y' + 10y =$$

(c) 
$$y'' + 2y' - 8y = 0$$
 (g)  $y'' - 2y' + y = 0$  (k)  $y'' - 2y' + 10y = 0$  (o)  $25y'' - 20y' + 4y = 0$ 

(d) 
$$y'' - 2y' + 6y = 0$$

(h) 
$$9y'' + 6y' + y = 0$$
 (l)  $y'' - 6y' + 9y = 0$ 

(1) 
$$y'' - 6y' + 9y = 0$$

(p) 
$$2y'' + 2y' + y = 0$$

Solve the following IVPs:

(q) 
$$\begin{cases} 9y'' + 6y' + 82y = 0 \\ y(0) = -1 \\ y'(0) = 2 \end{cases}$$

(r) 
$$\begin{cases} y'' - 6y' + 9y = 0 \\ y(0) = 0 \\ y'(0) = 2 \end{cases}$$

Exercise 20 (Reduction of Order). In each of the following problems:

- (i) Check that  $y_1$  solves the ODE;
- (ii) Use the method of reduction of order to find a second, linearly independent solution,  $y_2$ [HINT: Start with  $y_2(t) = v(t)y_1(t)$ .];
- (iii) Check that your  $y_2$  solves the ODE; and
- (iv) Calculate the Wronskian of  $y_1$  and  $y_2$ .

(a) 
$$t^2y'' + 2ty' - 2y = 0$$
,  $t > 0$ ;  $y_1(t) = t$ 

(d) 
$$t^2y'' - t(t+2)y' + (t+2)y = 0$$
,  $t > 0$ ;  $y_1(t) = t$ 

(b) 
$$t^2y'' - 4ty' + 6y = 0$$
,  $t > 0$ ;  $y_1(t) = t^2$ 

(e) 
$$xy'' - y' + 4x^3y = 0$$
,  $x > 0$ ;  $y_1(x) = \sin x^2$ 

(c) 
$$t^2y'' + 3ty' + y = 0$$
,  $t > 0$ ;  $y_1(t) = t^{-1}$ 

(f) 
$$(x-1)y'' - xy' + y = 0$$
,  $x > 1$ ;  $y_1(x) = e^x$