Homework assignments:

(1) P.38–39 # 4c, 19, 35

Find the general solution of

$$y' + 2y = t + e^{-3t}.$$

Solve the initial value problem

$$y' + \frac{3}{t}y = \frac{\cos t}{t^3}, \quad y(\pi) = 0.$$

(2) P.45–47 #4, 14(a)

(3) Find an equation that implicitly determines the solution for each of the following problems

(a) $y' = (e^x - e^{-x})/(1 + y), \quad y(0) = 1$

(b) $y' = 5x/(2 + \sin y), \quad y(0) = 0$

(4) Find the equilibrium solutions for

(a) $y' = y^2 - 3y + 2$

(b) $y' = \sin y$

What can you say about their stability or instability?

P.85 # 9

(5) P59 #15, 16; P87 #22 (a) (b)

(6) P72–74 # 14, 22 (a) (b), 25, 26, 32

(7) Use the method of successive approximations for

$$y' = t + y^2, y(0) = 0 \quad \text{with} \quad y_0(t) \equiv 0$$

to calculate $y_5(t)$. Plot $y_0, y_1, y_2, y_3, y_4, y_5$ over $[0, 1]$.

(8) For $y' = .5t + ty$, $y(0) = 0$, and

(a) $h = .2$

(b) $h = .1$,

find $y_h(1)$ and compare to the actual solution.

P.103 #2(a) – (d)

(9) Find the general solution of

(a) $y'' + 5y' + 6y = 0$

(b) $9y'' + 6y' + y = 0$

(c) $y'' + 6y' + y = 0$

Solve the IVP and sketch the graph of the solution for

(a) $y'' + 5y' = 0, y(0) = 3, y'(0) = -2$

(b) $3y'' - 10y' + 3y = 0, y(0) = 1, y'(0) = 1$

(c) $2y'' + 7y' + 2y = 0, y(0) = 1, y'(0) = 0$

(10) Find the general solution of

(a) $2y'' + 5y' + 5y = 0$

(b) $y'' + 2y' + 3y = 0$

(c) $y'' + y' + 1.5y = 0$

Solve the IVP for

(d) (b) with $y(0) = 0, y'(0) = 6$

(e) $y'' + 4y = 0, y(0) = 1, y'(0) = 2$

(11) **pp. 145–6 #5, 22**

Show e^{rt}, t^2e^{rt} are linearly independent on any interval.

(12) **(§3.3)**

#1 Determine whether the following functions are linearly independent or not.

(a) e^t, e^{t+2}

(b) $5t$, $|t|$

(c) $\sin t$, $\sin(t-2)$

#2 Suppose $W(y_1, y_2)(t) = t^2 - t$. Are y_1 and y_2 linearly independent or not? Why?

(13) **(§4.2)** Solve

#1 $y''' + y' = 0$

#2 $y''' + y'' = 0$, $y(0) = 1$, $y'(0) = 2$, $y''(0) = 3$

#3 $y^{(4)} + 4y'' + 3y = 0$

#4 $y''' + 5y'' + 7y' + 3y = 0$

#5 $y''' - 5y'' - y' + 5y = 0$, $y(0) = 0 = y'(0)$, $y''(0) = 2$

(14) **(§4.2)**

#1 Express the following numbers in polar form ($\rho e^{i\theta}$) for all possible θ

(a) -3

(b) $2 + i$

#2 Find the following roots:

(a) $(-32)^{1/5}$

(b) $(1 + \sqrt{3}\, i)^{1/2}$

#3 Find the general solution of:

(a) $y^{(5)} + 32y = 0$

(b) $y^{(6)} + y'' = 0$

(c) $y^{(4)} - 6y'' + 13y = 0$

(15) **(§4.3)**

#1 Write the following in operator- and factored-operator form

(a) $y'' + 9y' + 20y = 0$

(b) $y'' + 6y' - 7y = 0$

#2 Find the general solution of

$$(D - 2)(D + 1)(D + 3)^2(D^2 + 1)y = 0.$$

(16) (§4.3) Solve $y'' + y = t^2, \;\; y(0) = 2, \; y'(0) = 0$

Solve

#1 $y'' + 2y' + y = t^3 + \sin t$

#2 $y^{(4)} + 2y^{(3)} + 2y^{(2)} = t$

#3 $y'' + 3y' + 2y = e^t \sin t$

(17) (§4.4) For #1, 2, leave u_1, u_2 in the form of an integral

#1 $y'' - y = \frac{t}{t^2+1}$

#2 $y'' + 3y' + 2y = \sqrt{t^2 + 1}$

#3 $y'' + y = \csc x \cot x, \; y(\frac{\pi}{2}) = 0, \; y'(\frac{\pi}{2}) = 1$

(18) (§3.8) P.197 #7, 10 (find u and graph the solution), 28

(19) (§3.8–3.9) For $\omega \neq 2$, solve

$$y'' + 4y = 2\cos \omega t$$

(a) for $y(0) = y'(0) = 0$

(b) for $y(0) = 1, \; y'(0) = 1$

(c) Plot the solutions in (a) and (b) for $\omega = 2.3$ and $\omega = 2.1$.

(20) (§3.8–3.9) For the equation

$$y'' + \omega_0^2 y = A \cos \omega_0 t,$$

show the solution is

$$y = c_1 \cos \omega_0 t + c_2 \sin \omega_0 t + \frac{A}{2\omega_0} t \sin \omega_0 t$$

(21) (§3.8–3.9)

#1 Solve $y'' + y' + 4y = \sin 5t, \; y(0) = 0, \; y'(0) = 1$. What is the transient solution; the steady state solution?

#2 P206 #15

(22) (§6.1) P.298–99 #2, 5c, 9, 14, 16

(23) (§6.1) Find the partial fraction decomposition of:

#1 $\frac{s^3-3s^2-4s+5}{(s-1)(s-2)(s-3)(s-4)}$

#2 $\frac{s+7}{(s+2)^2}$

#3 $\frac{s^3-s-1}{(s^2+1)(s^2+2)}$

#4 $\frac{s^3-s^2+s-1}{(s+1)(s+2)(s^2+9)}$

(24) (§6.2) P.307 #15, 18, 23, 25

(25) (§6.3) P.314 #1, 9, 16, 18, 28, 30

(26) (§6.4) P.321–23 #1, 6, 16ab, 18ab

(27) (§6.5) P.328 #3,4

(28) (§6.6) P.335 #6, 9, 10, 16, 19

(29) (§7.1) Transform into a first order system

#1 $y'' + y = e^t$

#2 $y'' + ty' + \sin(ty) = \cos t$

#3 $y^{(5)} + y = 0$

(30) (§7.2)

#1 Find $A + B$ if

$$A = \begin{pmatrix} 1 & 0 & 7 \\ 3 & 1 & 9 \end{pmatrix} \quad B = \begin{pmatrix} 7 & 2 & 1 \\ 5 & 5 & 2 \end{pmatrix}$$

#2 Find $C + D$ if

$$C = \begin{pmatrix} 4 & 8 \\ 6 & 2 \end{pmatrix} \quad D = \begin{pmatrix} 1 & 3 \\ 5 & 7 \end{pmatrix}$$

#3 Find $E + F$ if

$$E = \begin{pmatrix} 1 & 9 \\ 2 & 8 \\ 3 & 7 \end{pmatrix}, \quad F = \begin{pmatrix} 1 & 6 \\ 7 & 0 \\ 3 & 5 \end{pmatrix}$$

#4 Calculate (a) CD (c) BF

(b) DA (d) EA

(31) (§7.2)

#1 If $v(t) = \begin{pmatrix} e^{-t} \\ e^{3t} \end{pmatrix}$, find $v'(t)$.

#2 If $A = \begin{pmatrix} 2e^{-2t} & \cos t \\ 3e^{-2t} & \sin t \end{pmatrix}$, find $A'(t), A''(t)$.

P.356–7 #24, 25

(32) (§7.3) P.367 #15, 17, 19, 21

(33) (§7.5) P.381 #2, 3, 15, 16 Sketch the solutions.

(34) (§7.6) P.391 #4, 10, 15, 18, 24a

(35) (§7.8) P.407–10 #1, 9

(36) (§9.1) P.468–470

Do abc for #1, 2, 9, 11

(37) (§9.1) P.468–470

Do abc for #6, 7, 17

(38) (§9.2) P.478 #7a, 9a, 12a, 15, 22

(39) (§9.3) P.487 #5abc, 9, 13

(40) (§9.4) P.501 #1abcdf

(41) (§9.4) P.501 #6abcdf

(42) (§9.5) P.509 #1(a–f), 3(a–f)