MATH 520 (Section 001) University of South Carolina
Prof. Meade Fall 2011

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Instructions:

1. Solve each problem. Find the general solution. If initial conditions are provided, find the solution.
2. In #40 – #44, find a recursion formula for the coefficients of the power series solution near $x_0 = 0$. Also find the first four non-zero terms in the series solution (unless the solution terminates earlier.)
3. In #48, follow the directions for Problems 7(a) on page 360 of the textbook.

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1. $y' = y^2 x^3$
2. $y^4 y' = x + 1$
3. $x' = x^2 t + x^2$
4. $\frac{ds}{dt} = \frac{t^2}{s^2+6s+9}$
5. $\frac{dr}{dx} = \frac{r^3+3r^2+3r+1}{x^2-2x+1}$
6. $dy/dt = y(t-2)$
7. $\frac{dz}{dt} = \frac{z+1}{t}$
8. $\frac{dy}{dt} = \frac{ty^4+2y^2t}{(y^3+y)(t^2+1)}$
9. $\frac{dv}{dx} = \frac{1+v^2}{xv}$
10. $\frac{dv}{dx} = \frac{-v\sqrt{v}}{x(1+\sqrt{v})}$
11. $dy/dx + 3y = 8$
12. $y\frac{du}{dy} = -\frac{u+u^5}{2+u^4}$
13. $y' = (y+x)/x$
14. $y' = \frac{2y^4+x^4}{xy^3}$
15. $\frac{dz}{dt} = z^3 t^2$, $z(2) = 3$
16. $(1+x^2)y' + 2xy = 0$
17. $ye^{xy} + xe^{xy}y' = 0$
18. $(2t^3 + 3y) + (3t + y - 1)y' = 0$
19. $\frac{dy}{dx} = \frac{x+\sin y}{2y - x\cos y}$, $y(2) = \pi$
20. $\frac{dy}{dx} + \frac{4}{x}y = x^4$
21. $(x-2)y' = y + 2(x-2)^3$

22. $y'' + y' - 6y = 0$

23. $y''' - y'' - 12y' = 0$

24. $x'' + 8x' + 25x = 0$

25. $\frac{d^2I}{dt^2} + 40\frac{dI}{dt} + 500I = 0$

26. $x'' - 10x' + 25x = 0$

27. $y'' - 9y' = 3e^{3x}$

28. $y'' - 9y = 3e^{3x}$

29. $\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 8x = e^{-2t}$

30. $y'' - 7y' = (3 - 36x)e^{4x}$

31. $x'' + 25x = 2\sin(2s)$

32. $x'' + 16x = 2\sin(4t)$

33. $y'' - y' - 2y = e^{3x} + 2e^{-x}$

34. $y'' - 2y' + y = \frac{e^x}{x}$

35. $y'' + y = \sec x$

36. $x'' + 64x = \sec(8t)$

37. $y'' + \frac{1}{t}y' - \frac{1}{t^2}y = \ln(t)$

38. $y''' - 3y'' + 3y' - y = \frac{e^x}{x}$

39. $y''' + 6y'' + 12y' + 8y = 12e^{-2x}$

40. $y'' + y = 0$

41. $(x^2 - 1)y'' + xy' - y = 0$

42. $y'' - 2xy' - 2y = 0$

43. $y'' - xy' = e^{-x}$ Hint: $e^{-x} = \sum_{n=0}^{\infty} \frac{(-x)^n}{n!}$.

44. $y'' - xy' + 2y = 0$, $y(0) = 2$, $y'(0) = 3$

45. $x'' + x = 3$, $x(\pi) = 1$, $x'(\pi) = 2$

46. $y'' + 4y' + 4y = 0$, $y(0) = 2$, $y'(0) = -2$

47. $y'' + 20y' + 64y = 0$, $y(0) = -1$, $y'(0) = 4$

48. $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}' = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$