Math 305 Handout 2

For each of the following, state whether or not the equation is linear. Also give the order.

1. $y' + ay = \sin^2 x$
2. $\left[\frac{d^2x}{dt^2}\right]^3 - 3x\frac{dx}{dt} = 4\cos t$
3. $s''' - s'' = 0$
4. $\frac{d^5y}{dx^5} = 0$
5. $y' + y = 0$
6. $\left[\frac{dx}{dt}\right]^3 = x$
7. $\frac{dx}{dt} = x^5$
8. $x' - x^2 = 3x'''$
9. $\frac{d^2x}{dt^2} - 2x\frac{dx}{dt} = \sin t$
10. $(x''')^2 = 0$
11. $x'' + (2\sin t)x' = 0$
12. $x' = e^{x+t}$

Solve:

13. $y' = \frac{e^x}{2y}$
14. $xy' = 3y$
15. $y' = \frac{e^y x}{e^y + x^2 e^y}$
16. $x' - x\ln y = y^y$
17. $(x - y\cos x)dx - (\sin x)dy = 0,\ y\left[\frac{\pi}{2}\right] = 1$
18. $\frac{dz}{dr} = r^2(1 + z^2)$
19. $\frac{dx}{dt} + (\cos t)e^x = 0$
20. $y' + y = \frac{1}{1 + e^{2x}}$
21. $xydx + (x^2 + 2y^2 + 2)dy = 0$
22. $(x^2 + y^2)dx = 2xydy,\ y(-1) = 0$
23. $y' = \sqrt{1 - y^2}$
24. $y' + y = y(xe^{x^2} + 1), y(0) = 1$
25. $\frac{dx}{dy} = x\cos y,\ x\left(\frac{\pi}{2}\right) = 1$
26. $\left[\frac{1}{x} - \frac{y}{x^2 + y^2}\right]dx + \left[\frac{x}{x^2 + y^2} - \frac{1}{y}\right]dy = 0$
27. $(xe^{y/x} + y)dx = xdy,\ y(1) = 0$
28. $\frac{dP}{dQ} = P(\cos Q + \sin Q)$
29. $\frac{ds}{dt} + 2s = st^2,\ s(0) = 1$
30. $x' - 2x = t^2e^{2t}$
31. $y' + a(x)y = f(x)y\ln\, y$
32. $y' = -y^3xe^{-2x} + y$
33. $y' = y^2(1 + x^2),\ y(0) = 1$
34. $(1 + x)dy + 3ydx = 0,\ y(6) = 7$
35. $(y + 3)dx + (\cot x)dy = 0$
36. $xdy - ydx = \sqrt{xy}dx$
37. $(y^2 - 2xy)dx + (2xy - x^2)dy = 0,\ y(1) = 2$
38. $\sqrt{x^2 + y^2}dx = xdy - ydx$
39 $(ye^{xy} + 4y^3)dx + (xe^{xy} + 12xy^2 - 2y)dy = 0$
40. $2xydy + (x^2 + 1)dx = 0$
41 $(3x^2\ln x + x^2 - y)dx - xdy = 0,\ y(1) = 5$
42. $(x^2 + y^2)dx + 3xydy = 0$
43 $(x^2 + 2y)dx - xdy = 0$
44. $y' + ay = \sin^2 x$