Solve the differential equations. Be sure to check for possible constant solutions. If necessary, write your answer implicitly.

1. $y' = 4x^3 y$
2. $3y^2 y' = 5x$
3. $y' = \dfrac{x}{2y}$
4. $y' = 3x^2 y^3$
5. $y' = \dfrac{e^y + 1}{e^y}$
6. $y' = \dfrac{x\sqrt{y^2+1}}{y}$
7. $\dfrac{dy}{dx} = \dfrac{x^2 \sec y}{(x^3+1)^3}$
8. $y' = e^x y\sqrt{e^x + 4}$
9. $y' = y + \dfrac{1}{y^2}$
10. $y' = t^2 e^{t^3} y^3$
11. $y' = y^2 - 1$
12. $y' = \dfrac{\sin^2 y}{t}$
13. $y' = \dfrac{e^{x+2y}}{e^y + 1}$
14. $y' = \dfrac{t}{(t^2+1)(y^4+1)}$
15. $y' = 3x^2 y(y+1)^2(y^2+1)$
16. $y' = 2y(1 - \dfrac{y}{100})$ $\qquad y(0) = 30$
17. $y' = 3y(1 - \dfrac{y}{100})(\dfrac{y}{50} - 1)$ $\qquad y(0) = 400$
18. $y' = e^{2t} \sin^2 y$ $\qquad y(0) = \dfrac{\pi}{4}$
19. $y' = y + \dfrac{4}{y}$ $\qquad y(0) = 3$
20. $y' = 2x + xy$ $\qquad y(0) = 1$

Solve the following differential equations.

1. $y'' - 6y' + 5y = 0$
2. $y'' - 4y' - 5y = 0$
3. $y'' - 8y' + 15y = 0$
4. $y'' - 9y = 0$
5. $y''' + 6y'' + 12y' + 8y = 0$
6. $y''' + 4y'' + 4y' = 0$
7. $y''' - y' = 0$
8. $y''' - 3y'' + 3y' - y = 0$
9. $2y'' - y' - y = 0$
10. $y'' - y' = 0, \quad y(0) = 0, \quad y'(0) = -1.$