

Chapter 1: Review Problems

Find general solutions of the differential equations in Problems 1 through 30. Primes denote derivatives with respect to x .

1. $x^3 + 3y - xy' = 0$

2. $xy^2 + 3y^2 - x^2y' = 0$

3. $xy + y^2 - x^2y' = 0$

4. $2xy^3 + e^x + (3x^2y^2 + \sin y)y' = 0$

5. $3y + x^4y' = 2xy$

6. $2xy^2 + x^2y' = y^2$

7. $2x^2y + x^3y' = 1$

8. $2xy + x^2y' = y^2$

9. $xy' + 2y = 6x^2\sqrt{y}$

10. $y' = 1 + x^2 + y^2 + x^2y^2$

11. $x^2y' = xy + 3y^2$

12. $6xy^3 + 2y^4 + (9x^2y^2 + 8xy^3)y' = 0$

13. $4xy^2 + y' = 5x^4y^2$

14. $x^3y' = x^2y - y^3$

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

16. $y' = x^2 - 2xy + y^2$

17. $e^x + ye^{xy} + (e^y + xe^{yx})y' = 0$

18. $2x^2y - x^3y' = y^3$

19. $3x^5y^2 + x^3y' = 2y^2$

20. $xy' + 3y = 3x^{-3/2}$

21. $(x^2 - 1)y' + (x - 1)y = 1$

22. $xy' = 6y + 12x^4y^{2/3}$

23. $e^y + y \cos x + (xe^y + \sin x)y' = 0$

24. $9x^2y^2 + x^{3/2}y' = y^2$

25. $2y + (x + 1)y' = 3x + 3$

26. $9x^{1/2}y^{4/3} - 12x^{1/5}y^{3/2} + (8x^{3/2}y^{1/3} - 15x^{6/5}y^{1/2})y' = 0$

27. $3y + x^3y^4 + 3xy' = 0$

28. $y + xy' = 2e^{2x}$

29. $(2x + 1)y' + y = (2x + 1)^{3/2}$

30. $y' = \sqrt{x + y}$

Each of the differential equations in Problems 31 through 36 is of two different types considered in this chapter—separable, linear, homogeneous, Bernoulli, exact, and so on. Hence, derive general solutions for each of these equations in two different ways; then reconcile your results.

31. $\frac{dy}{dx} = 3(y + 7)x^2$

32. $\frac{dy}{dx} = xy^3 - xy$

33. $\frac{dy}{dx} = -\frac{3x^2 + 2y^2}{4xy}$

34. $\frac{dy}{dx} = \frac{x + 3y}{y - 3x}$

35. $\frac{dy}{dx} = \frac{2xy + 2x}{x^2 + 1}$

36. $\frac{dy}{dx} = \frac{\sqrt{y} - y}{\tan x}$