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Pg. 524 #1-31 eoo, 42-43, 45

1.  $y' = 5x^4$

$$= x^5 + C \quad (1)$$

$$= x^5, \quad x^5 - 1, \quad x^5 + 1 \quad (2)$$

5.  $y' = \frac{8}{x} - x^2 + x^5$

$$= 8 \ln |x| - \frac{x^3}{3} + \frac{x^6}{6} + C \quad (3)$$

$$= 8 \ln |x| - \frac{x^3}{3} + \frac{x^6}{6}, \quad 8 \ln |x| - \frac{x^3}{3} + \frac{x^6}{6} - 1, \quad 8 \ln |x| - \frac{x^3}{3} + \frac{x^6}{6} + 1 \quad (4)$$

9.  $f'(x) = x^{2/3} - x; \quad f(1) = -6$

$$= \frac{3}{5}x^{5/3} - \frac{x^2}{2} + C \quad (5)$$

$$-6 = \frac{3}{5}(1)^{5/3} - \frac{(1)^2}{2} + C \quad (6)$$

$$C = -6 - \frac{3}{5} + \frac{1}{2} = -\frac{61}{10} \quad (7)$$

$$f(x) = \frac{3}{5}x^{5/3} - \frac{x^2}{2} - \frac{61}{10} \quad (8)$$

13. Show that  $y = e^x + 3xe^x$  is a solution of  $y'' - 2y' + y = 0$ .

$$y' = e^x + 3(xe^x - e^x) \quad (9)$$

$$y'' = e^x + 3(xe^x - e^x - e^x) \quad (10)$$

$$(e^x + 3(xe^x - e^x - e^x)) - 2(e^x + 3(xe^x - e^x)) + (e^x + 3xe^x) = 0 \quad (11)$$

$$e^x + 3xe^x - 3e^x - 3e^x - 2e^x - 6xe^x + 6e^x + e^x + 3xe^x = 0 \quad \checkmark \quad (12)$$

17.  $3y^2 \frac{dy}{dx} = 8x$

$$3 \int y^2 dy = 8 \int x dx \quad (13)$$

$$y^3 = 4x^2 + C \quad (14)$$

$$y = \sqrt[3]{4x^2 + C} \quad (15)$$

21.  $\frac{dy}{dx} = \frac{6}{y}$

$$\int y dy = 6 \int dx \quad (16)$$

$$\frac{y^2}{2} = 6x + C \quad (17)$$

$$y = \sqrt{12x + C} \quad (18)$$

25.  $y' = 5y^{-2}; \quad y = 3 \text{ when } x = 2$

$$\frac{dy}{dx} = 5y^{-2} \quad (19)$$

$$\frac{1}{5} \int y^2 dy = \int dx \quad (20)$$

$$\frac{1}{15} y^3 = x + C \quad (21)$$

$$y = \sqrt[3]{15x + C} \quad (22)$$

$$3 = \sqrt[3]{15(2) + C} \quad (23)$$

$$27 = 30 + C \quad (24)$$

$$C = -3 \quad (25)$$

$$y = \sqrt[3]{15x - 3} \quad (26)$$

29.  $\frac{dP}{dt} = 2P$

$$\frac{1}{2} \int \frac{dP}{P} = \int dt \quad (27)$$

$$\frac{1}{2} \ln |P| = t + C \quad (28)$$

$$P = C_1 e^{2t}, \quad \text{where } C_1 = \pm e^C \quad (29)$$

42.  $\frac{dP}{dt} = kP$

(a)

$$\frac{1}{k} \int \frac{dP}{P} = \int dt \quad (30)$$

$$\frac{1}{k} \ln |P| = t + C \quad (31)$$

$$P = C_1 e^{kt} \quad (32)$$

(b)

$$P_0 = 0 \quad (33)$$

$$P = P_0 e^{kt} \quad (34)$$

43.  $\frac{dR}{dS} = k \cdot \frac{R}{S}$

$$S \cdot dR = k \cdot R \cdot dS \quad (35)$$

$$\int \frac{dR}{R} = k \int \frac{dS}{S} \quad (36)$$

$$\ln |R| = k \ln |S| + C \quad (37)$$

$$R = C_1 e^{k \ln S} \quad (38)$$

$$= C_1 S^k, \quad \text{where } C_1 = e^C \quad (39)$$

$$45. \quad e^{-1/x} \cdot \frac{dy}{dx} = x^{-2} \cdot y^2$$

$$\int y^{-2} \, dy = \int x^{-2} e^{x^{-1}} \, dx \tag{40}$$

$$\int x^{-2} e^{x^{-1}} \, dx = \left[ \begin{array}{l} u = x^{-1} \\ du = -x^{-2} \, dx \end{array} \right] = - \int e^u \, du \tag{41}$$

$$-y^{-1} = -e^{x^{-1}} + C \tag{42}$$

$$y = \frac{1}{e^{1/x} - C} \tag{43}$$