4.1 Particular Solutions for Integrals

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35) $\int f'(x) = \int 6x$

$f(x) = 3x^2 + C$

$8 = 3(0)^2 + C$

$8 = C$

$\boxed{f(x) = 3x^2 + 8}$

36) $\int g'(x) = \int 4x^2$

$g(x) = \frac{4}{3}x^3 + C$

$3 = \frac{4}{3}(-1)^3 + C$

$3 = -\frac{4}{3} + C$

$\frac{13}{3} = C$

$\boxed{g(x) = \frac{4}{3}x^3 + \frac{13}{3}}$

37) $\int h'(t) = \int 8t^3 + 5$

$h(t) = 2t^4 + 5t + C$

$-4 = 2(1)^4 + 5(1) + C$

$-4 = 2 + 5 + C$

$-11 = C$

$\boxed{h(t) = 2t^4 + 5t - 11}$

38) $\int f'(s) = \int 10s - 12s^3$

$f(s) = 5s^2 - 3s^4 + C$

$2 = 5(3)^2 - 3(3)^4 + C$

$2 = 45 - 243 + C$

$200 = C$

$\boxed{f(s) = 5s^2 - 3s^4 + 200}$

39) $\int f''(x) = \int 2$

$f'(x) = 2x + C$

$5 = 2(2) + C$

$5 = 4 + C$

$1 = C$

$\int f'(x) = \int 2x + 1$

$f(x) = x^2 + x + C_2$

$10 = 2^2 + 2 + C_2$

$4 = C_2$

$\boxed{f(x) = x^2 + x + 4}$

40) $f''(x) = x^2$

$f'(x) = \frac{1}{3}x^3 + C$

$8 = \frac{1}{3}(0)^3 + C$

$8 = C$

$\int f'(x) = \int \frac{1}{3}x^3 + 8$

$f(x) = \frac{1}{12}x^4 + 8x + C_2$

$4 = \frac{1}{12}(0)^4 + 8(0) + C_2$

$4 = C_2$

$\boxed{f(x) = \frac{1}{12}x^4 + 8x + 4}$

41) $\int f''(x) = \int x^{-3/2}$

$f'(x) = -2x^{-1/2} + C$

$2 = \frac{-2}{\sqrt{4}} + C$

$2 = \frac{-2}{2} + C$

$2 = -1 + C$

$3 = C$

$\int f'(x) = \int -2x^{-1/2} + 3$

$f(x) = -4x^{1/2} + 3x + C_2$

$0 = -4(0)^{1/2} + 3(0) + C_2$

$0 = C_2$

$\boxed{f(x) = -4\sqrt{x} + 3x}$

42) $\int f''(x) = \int \sin x$ $\quad \int f'(x) = \int -\cos x + 2$

$f'(x) = -\cos x + C$

$1 = -\cos(0) + C$

$1 = -1 + C$

$2 = C$

$f(x) = -\sin x + 2x + C_2$

$6 = -\sin(0) + 2(0) + C_2$

$6 = C_2$

$\boxed{f(x) = -\sin x + 2x + 6}$

51) $\int \frac{dh}{dt} = \int 1.5t + 5$

$h = \frac{3}{4}t^2 + 5t + C$

$12 = \frac{3}{4}(0)^2 + 5(0) + C$

$12 = C$

a) $\boxed{h = \frac{3}{4}t^2 + 5t + 12}$

b) $h(6) = \frac{3}{4}(6)^2 + 5(6) + 12$

$\boxed{h(6) = 69 \text{ cm}}$

52) $\int \frac{dP}{dt} = \int kt^{1/2}$

$P = \frac{2}{3}kt^{3/2} + C$

$500 = \frac{2}{3}k(0)^{3/2} + C$

$500 = C$

$P = \frac{2}{3}kt^{3/2} + 500$

$600 = \frac{2}{3}k(1)^{3/2} + 500$

$600 = \frac{2}{3}k + 500$

$100 = \frac{2}{3}k$

$150 = k$

$P = \frac{2}{3}(150)t^{3/2} + 500$

$P = 100t^{3/2} + 500$

$P(7) = 100(7)^{3/2} + 500$

$\boxed{P(7) \approx 2352 \text{ bacteria}}$