Mathematics 1a, Section 5.3 Solutions

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2. $\int_a^b I(t)dt = \int_a^b Q'(t)dt = Q(b) - Q(a)$ by the Total Change Theorem, so it represents the change in the charge Q from time $t = a$ to $t = b$.

8. The units for $a(x)$ are pounds per foot and te units for x are feet, so the units for da/dx are pounds per foot per foot, denoted (lb/ft)/ft. The unit of measurement for $\int_2^8 a(x)dx$ is the product of pounds per food and feet; that is, pounds.

12.

$$\int_0^4 (1 + 3y - y^2)dy = \left[y + \frac{3}{2}y^2 - \frac{1}{3}y^3\right]_0^4 = \left(4 + \frac{3}{2}\cdot 16 - \frac{1}{3}\cdot 64\right) - (0) = \frac{20}{3}$$

16.

$$\int_0^1 x^{3/7}dx = \left[\frac{x^{10/7}}{10/7}\right]_0^1 = \left[\frac{7}{10}x^{10/7}\right]_0^1 = \frac{7}{10} - 0 = \frac{7}{10}$$

26.

$$\begin{aligned}\int_1^8 \frac{x-1}{\sqrt[3]{x^2}}dx &= \int_1^8 \left(x^{1/3} - x^{-2/3}\right) dx \\ &= \left[\frac{x^{4/3}}{4/3} - \frac{x^{1/3}}{1/3}\right]_1^8 = \left[\frac{3}{4}x^{4/3} - 3x^{1/3}\right]_1^8 \\ &= \left(\frac{3}{4}\cdot 16 - 3\cdot 2\right) - \left(\frac{3}{4} - 3\right) = \frac{33}{4}\end{aligned}$$

48.

$$\int \frac{\sin 2x}{\sin x}dx = \int \frac{2\sin x\cos x}{\sin x}dx = \int 2\cos x dx = 2\sin x + C$$

56.

$$n(10) - n(4) = \int_4^{10} (200 + 50t)dt = \left[200t + 25t^2\right]_4^{10} = 2000 + 2500 - (800 + 400) = 3300$$

64. $B = 3A$, so:

$$\int_0^b e^x dx = 3 \int_0^a e^x dx$$
$$[e^x]_0^b = 3\,[e^x]_0^a$$
$$e^b - 1 = 3(e^a - 1)$$
$$e^b = 3e^a - 2$$
$$b = \ln(3e^a - 2)$$