# Selected Solutions, Section 4.9

10. Note that $e^2$ is a constant, so the antiderivative is $e^2 C$

17. The antiderivative is $-2\cos(\theta) - \tan(\theta) + C$, but notice that the $C$ can change because $\sec(\theta)$ has a lot of vertical asymptotes, breaking up the real line. Therefore, you might specify the interval, like "for $x$ in $(-\pi/2, \pi/2)$, and the constant can change for other intervals". Or, you can specify the intervals like they do in the text solution.

42. The hint on these types of problems is to rewrite them first. In this case,

$$f''(t) = 3t^{-1/2} \quad \Rightarrow \quad f'(t) = 3 \cdot 2t^{1/2} + C = 6t^{1/2} + C$$

Using $f'(4) = 7$, we get $C = -5$, and then

$$f(t) = 6 \cdot \frac{2}{3} t^{3/2} - 5t + C_2 = 4t^{3/2} - 5t + C_2 \qquad f(4) = 20$$

We recognize that $4^{3/2} = 2^3 = 8$, so substituting $x = 4$, we get

$$12 + C_2 = 20 \quad \Rightarrow \quad C_2 = 8$$

so $f(t) = 4t^{3/2} - 5t + 8$.

46. We should find that

$$f(t) = 2e^t - 3\sin(t) + \frac{2 - 2e^{\pi}}{\pi} t - 2$$

50. From what is given, we know that the antiderivative is $f(x) = \frac{1}{4}x^4 + C$ for some $C$. We also know that $y = -x$ is the equation of the tangent line at some value of $x$. Since $f'(x) = x^3$, that point must be at $x = -1$. From the equation of the line, $y = -(-1) = 1$, so the point $(-1, 1)$ must be on the graph of $f$, and so

$$f(x) = \frac{1}{4}x^4 + \frac{3}{4}$$

52. You should find that $a$ is the antiderivative.

54. (Graphed in class)

77. In this problem (like in 74, done in class), we have to be careful about mixing units. We're told that

$$v(0) = 100 \qquad a(t) = -k \quad \Rightarrow \quad v(t) = -kt + 100$$

The vehicle will therefore stop at time $-kt + 100 = 0$, or $t = 100/k$.

The position is

$$s(t) = -\frac{1}{2}k^2 t + 100t + C$$

If we assume $S(0) = 0 = C$, then wanting to stop within 80 meters means (in km):

$$s(100/k) = 80 \quad \Rightarrow \quad -\frac{k}{2}\left(\frac{100}{k}\right)^2 + 100 \cdot \frac{100}{k} = 0.08$$

Solving for $k$, we get

$$k = \frac{100^3}{16} = 62,500\text{km/hr}^2$$

If we want to convert this into meters and seconds, the answer would be

$$\frac{62500 \text{ km}}{1 \text{ hr}^2} \cdot \frac{1000 \text{ m}}{1 \text{ km}} \cdot \frac{1 \text{ hr}}{3600 \text{ sec}} \frac{1 \text{ hr}}{3600 \text{ sec}} \approx 4.82\text{m/s}^2$$