Solutions to exercises in Section 4.5: #62, #73, #105, #109, #110, #111, #112, #113, #114.

**#62.** Let $u = x + 4$, then $du = dx$ and $2x + 1 = 2(u - 4) + 1 = 2u - 7$. So,

$$
\int \frac{2x + 1}{\sqrt{x + 4}} \, dx = \int \frac{2u - 7}{\sqrt{u}} \, du
$$

$$
= \int (2u^{1/2} - 7u^{-1/2}) \, du
$$

$$
= (4/3)u^{3/2} - 14u^{1/2} + C
$$

$$
= (4u/3 - 14)\sqrt{u} + C
$$

$$
= (4x - 26)\sqrt{x + 4/3} + C.
$$

**#73.** Let $u = 2 - x$, then $du = -dx$ and $x - 1 = 1 - u$. When $x = 1$, $u = 1$; when $x = 2$, $u = 0$. So,

$$
\int_1^2 (x - 1)\sqrt{2 - x} \, dx = \int_1^0 -(1 - u)\sqrt{u} \, du
$$

$$
= \int_1^0 (u^{3/2} - u^{1/2}) \, du
$$

$$
= \left[ \frac{2}{5}u^{5/2} - \frac{2}{3}u^{3/2} \right]_1^0
$$

$$
= 0 - (2/5 - 2/3)
$$

$$
= 4/15.
$$

**#105.** First,

$$
\int S(t) \, dt = \int \left( 74.50 + 43.75 \sin \frac{\pi t}{6} \right) \, dt = 74.50t - \frac{262.50}{\pi} \cos \frac{\pi t}{6} + C.
$$

(a) The average sales of the first quarter is

$$
\frac{1}{3} \left[ 74.50t - \frac{262.50}{\pi} \cos \frac{\pi t}{6} \right]_0^3 = 74.50 + 262.50/3\pi \approx 103.35.
$$

(b) The average sales of the second quarter is

$$
\frac{1}{3} \left[ 74.50t - \frac{262.50}{\pi} \cos \frac{\pi t}{6} \right]_3^6 = 74.50 + 262.50/3\pi \approx 103.35.
$$

(c) The average sales of the entire year is

$$
\frac{1}{12} \left[ 74.50t - \frac{262.50}{\pi} \cos \frac{\pi t}{6} \right]_0^{12} = 74.50.
$$
\#109. False. Notice that

\[ \int (2x + 1)^2 \, dx = \frac{1}{2} \int (2x + 1)^2 (2x + 1)' \, dx = \frac{1}{6} (2x + 1)^3 + C. \]

\#110. False. Notice that

\[ \int x(x^2 + 1) \, dx = \frac{1}{2} \int (x^2 + 1)(x^2 + 1)' \, dx = \frac{1}{4} (x^2 + 1)^2 + C. \]

\#111. True.

\#112. True.

\#113. True.

\#114. False. Notice that

\[ \int \sin^2 2x \cos 2x \, dx = \frac{1}{2} \int \sin^2 2x (\sin 2x)' \, dx = \frac{1}{6} \sin^3 2x + C. \]