5.4.2 Since $F(0) = 0$, $F(b) = \int_0^b f(t) \, dt$. For each $b$ we determine $F(b)$ graphically as follows:

<table>
<thead>
<tr>
<th>$b$</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F(b)$</td>
<td>0</td>
<td>1</td>
<td>1.5</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-1.5</td>
</tr>
</tbody>
</table>

5.4.4 Note that $\int_a^b g(x) \, dx = \int_a^b g(t) \, dt$.

Thus we have $\int_a^b (f(x) + g(x)) \, dx = \int_a^b f(x) \, dx + \int_a^b g(x) \, dx = 8 + 2 = 10$.

5.4.6 Note that $\int_a^b (g(x))^2 \, dx = \int_a^b (g(t))^2 \, dt$.

Thus we have $\int_a^b ((f(x))^2 - (g(x))^2) \, dx = \int_a^b ((f(x))^2 \, dx - \int_a^b (g(x))^2) \, dx = 12 - 3 = 9$.

5.4.10 We know we can divide the integral up as follows:

$$\int_0^3 f(x) \, dx = \int_0^1 f(x) \, dx + \int_1^3 f(x) \, dx.$$  

The graph suggests that $f$ is an even function for $-1 \leq x \leq 1$, so $\int_{-1}^1 f(x) \, dx = 2 \int_0^1 f(x) \, dx$. Substituting this in to the preceding equation, we have

$$\int_0^3 f(x) \, dx = \frac{1}{2} \int_{-1}^1 f(x) \, dx + \int_1^3 f(x) \, dx.$$  

5.4.12 (a) $\int_{-1}^1 e^{x^2} \, dx > 0$, since $e^{x^2} > 0$, and $\int_{-1}^1 e^{x^2} \, dx$ represents the area below the curve $y = e^{x^2}$.

(b) The function $f(x) = e^{x^2}$ is increasing for $0 \leq x \leq 1$, so $0 \leq e^{x^2} \leq e^1$ or $1 \leq e^{x^2} \leq e$. This implies that $1(1 - 0) \leq \int_{-1}^1 e^{x^2} \, dx \leq e(1 - 0)$. Hence $0 < 1 \leq \int_{-1}^1 e^{x^2} \, dx \leq e < 3$.

5.4.16 (a) 0, since the integrand is an odd function and the limits are symmetric around 0.

(b) 0, since the integrand is an odd function and the limits are symmetric around 0.
5.4.21 (a)  
\[
\frac{1}{\sqrt{2\pi}} \int_{0}^{3} e^{-x^2/2} \, dx = \frac{1}{\sqrt{2\pi}} \int_{0}^{1} e^{-x^2/2} \, dx - \frac{1}{\sqrt{2\pi}} \int_{0}^{1} e^{-x^2/2} \, dx \\
\approx 0.4987 - 0.3413 = 0.1574.
\]

(b) (By symmetry of \( e^{-x^2/2} \))  
\[
\frac{1}{\sqrt{2\pi}} \int_{-2}^{3} e^{-x^2/2} \, dx = \frac{1}{\sqrt{2\pi}} \int_{-2}^{0} e^{-x^2/2} \, dx + \frac{1}{\sqrt{2\pi}} \int_{0}^{3} e^{-x^2/2} \, dx \\
= \frac{1}{\sqrt{2\pi}} \int_{0}^{2} e^{-x^2/2} \, dx + \frac{1}{\sqrt{2\pi}} \int_{0}^{3} e^{-x^2/2} \, dx \\
\approx 0.4772 + 0.4987 = 0.9759
\]

6.1.2

6.1.4

6.1.10 (a) Critical points of \( F(x) \) are \( x = -1, x = 1, \) and \( x = 3. \)

(b) \( F(x) \) has a local minimum at \( x = -1, \) a local maximum at \( x = 1, \) and and local minimum at \( x = 3. \)

6.1.11 \( F(x) \) has a local maximum at \( x = x_1, \) a local minimum at \( x = x_3, \) and an inflection point at \( x = x_2. \)
6.1.14 Between \( t = 0 \) and \( t = 1 \), the particle moves at 10km/hr for 1 hour. Since it starts at \( x = 5 \), the particle is at \( x = 15 \) when \( t = 1 \). The graph of distance is a straight line between \( t = 0 \) and \( t = 1 \) because the velocity is constant then. Between \( t = 1 \) and \( t = 2 \), the particle moves 10 km to the left, ending at \( x = 5 \).

\[
\begin{array}{c|c|c}
\text{t (hr)} & \text{x(km)} \\
\hline
0 & 5 \\
1 & 10 \\
2 & 15 \\
3 & 10 \\
4 & 5 \\
5 & 10 \\
6 & 15 \\
\end{array}
\]

6.1.16 Start by finding four points on the graph of \( F(x) \):

\[
\begin{align*}
F(2) &= 3 \\
F(6) &= F(2) + \int_2^6 F'(x) \, dx = 3 - 7 = -4 \\
F(0) &= F(2) - \int_0^2 F'(x) \, dx = 3 - 2 = 1 \\
F(8) &= F(6) + \int_6^8 F'(x) \, dx = -4 + 4 = 0
\end{align*}
\]

6.2.6 \( \frac{2}{3} x^2 \)

6.2.12 \( \frac{2t^3}{3} + \frac{3t^4}{4} + \frac{4t^5}{5} \)

6.2.20 \( \frac{5x}{\ln 5} \)

6.2.30 \( P(t) = \int (2 + \sin t) \, dt = 2t - \cos t + C \)

6.2.58 \( \frac{1}{2} e^{2x} + C \)

6.2.68 \( \int_0^2 \left( \frac{x^3}{3} + 2x \right) \, dx = \left. \left( \frac{x^4}{12} + x^2 \right) \right|_0^2 = \frac{4}{3} + 4 = \frac{16}{3} \approx 5.333 \)
6.2.76 Since $\cos \theta \geq \sin \theta$ for $0 \leq \theta \leq \pi/4$, we have

$$
\text{Area} = \int_0^{\pi/4} (\cos \theta - \sin \theta) d\theta \\
= (\sin \theta + \cos \theta)|_0^{\pi/4} \\
= \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} - 1 = \sqrt{2} - 1
$$