5.1.13 You jump out of an airplane. Before your parachute opens you fall faster and faster, but your acceleration decreases as you fall because of air resistance. The table gives your acceleration, $a$ (in m/sec$^2$), after $t$ seconds.

<table>
<thead>
<tr>
<th>$t$</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a$</td>
<td>9.81</td>
<td>8.03</td>
<td>6.53</td>
<td>5.38</td>
<td>4.41</td>
<td>3.61</td>
</tr>
</tbody>
</table>

(a) Give upper and lower estimates of your speed at $t = 5$.

(b) Get a new estimate by taking the average of your upper and lower estimates. What does the concavity of the graph of acceleration tell you about your new estimate?

5.2.12 For $\int_0^1 x^3 \, dx$ construct left and right hand sums with 2, 10, 50, and 250 subdivisions. Observe the limit to which your sums are tending as the number of subdivisions gets larger, and hence estimate the value of the definite integral.

5.2.25 Without computing the integral, decide if $\int_0^{2\pi} e^{-x} \sin x \, dx$ is positive or negative and explain your decision.

5.2.27 Use the figure below to find the values of

(a) $\int_a^b f(x) \, dx$
(b) $\int_b^c f(x) \, dx$

(c) $\int_a^c f(x) \, dx$
(d) $\int_a^c |f(x)| \, dx$
5.3.3 If \( f(x) \) is measured in pounds and \( x \) is measured in feet, what are the units of \( \int_a^b f(x) \, dx \) ?

5.3.17 The following table gives the emissions, \( E \), of nitrogen oxides in millions of metric tons per year in the US. Let \( t \) be the number of years since 1940 and \( E = f(t) \).

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( E )</td>
<td>6.9</td>
<td>9.4</td>
<td>13.0</td>
<td>18.5</td>
<td>20.9</td>
<td>19.6</td>
</tr>
</tbody>
</table>

(a) What are the units and meaning of \( \int_0^{50} f(t) \, dt \) ?

(b) Estimate \( \int_0^{50} f(t) \, dt \).

5.3.29 (a) What is the average value of \( f(x) = \sqrt{1-x^2} \) over the interval \( 0 \leq x \leq 1 \) ?

(b) How can you tell whether this average value is more or less than 0.5 without doing any calculations?