1. Let \( f(x) = x^2 - x + 1 \) over the interval \([0, 2]\). The graph of \( f(x) \) is shown below.

(a) Approximate the area under the graph of \( f(x) \) over \([0, 2]\) by computing \( R_4 \). Sketch the rectangles you use on the graph of \( f(x) \).

(b) Approximate the area under the graph of \( f(x) \) over \([0, 2]\) by computing \( L_4 \). Sketch the rectangles you use on the graph of \( f(x) \).

2. Suppose that \( f(x) \) is a continuous function that is positive, increasing and concave up on the interval \([a, b]\).

(a) If we approximate the area under the graph of \( f(x) \) over \([a, b]\) using rectangles with right endpoints, is the approximation greater than or less than the actual area?

(b) If we approximate the area under the graph of \( f(x) \) over \([a, b]\) using rectangles with left endpoints, is the approximation greater than or less than the actual area?

(c) Do the answers in parts (a) and (b) change if \( f(x) \) is increasing and concave down on \([a, b]\)?

(d) Do the answers in parts (a) and (b) change if \( f(x) \) is decreasing and concave up on \([a, b]\)?

3. Coal gas is produced at gasworks. Pollutants in the gas are removed by scrubbers, which become steadily less efficient as time goes on. The following measurements, made at the start of each month, show the rate (in tons/month) at which pollutants are being removed.

<table>
<thead>
<tr>
<th>Time (months)</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>Rate at which pollutants escape (tons/mo)</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>13</td>
<td>16</td>
<td>20</td>
</tr>
</tbody>
</table>

(a) Find an upper estimate for the total quantity of pollutants that are removed in during the six months.

(b) Find an underestimate for the total quantity of pollutants that are removed in during the six months.