1. How many points of inflection does the graph of \( y = 2x + \cos(x^2) \) have in the interval \((0, 5)\)?

2. The graph of part of a linear function \( f \) is given. Each tick mark represents a unit of 1. Find \( h'(1) \) if \( h(x) = \sqrt{f(x)} + x^2 \).

3. Water flowed into a tank at an increasing rate \( r(t) \) from \( t = 0 \) to \( t = 10 \). The rate of flow \( r(t) \) in \( \text{m}^3/\text{min} \) was measured at one minute intervals with the results shown in the table below.

<table>
<thead>
<tr>
<th>( t )</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r(t) )</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>11</td>
<td>15</td>
<td>17</td>
<td>20</td>
<td>22</td>
<td>26</td>
<td>30</td>
<td>32</td>
</tr>
</tbody>
</table>

Use Riemann sums with **five rectangles** to estimate the total amount of water that flowed into the tank. Let \( A \) be the left rectangular approximation. Let \( B \) be the right rectangular approximation. Let \( C \) be the midpoint rectangular approximation. Find \( A + B + C \).

4. Let \( R \) be the region in the first quadrant enclosed by \( y = 5 - x^3 \), \( y = -\cos(x) + 1 \), and \( x = 0 \). To the nearest thousandth find the volume of the solid generated when \( R \) is revolved about the \( x \)-axis.

5. List the letters of the functions that are differentiable at \( x = 0 \).
   
   \( A) \ y = |x^2 - 3x| \quad B) \ y = |x^3 - 4x^2| \quad C) \ y = \sqrt{x^2 + 0.01} - |x - 1| \)
   
   \( D) \ y = \sin^2(x) \quad E) \ y = \frac{e^x}{\cos(x)} \quad F) \ y = \sqrt{x^2 + 0.01 - 0.01} \)

6. \( f'(x) = ax^2 + bx \). At \( x = 2 \) the normal is parallel to \( x - 4y = 2 \). \( f''(2) = 10 \). Find \( f'(1) \).

7. A meteorologist determines that the temperature \( T \) (in \(^\circ\)F) on a cold winter day is given by \( T = \frac{1}{20} t(t-12)(24-t) \), where \( t \) is time (in hours) and \( t = 0 \) corresponds to midnight.
   
   **To the nearest thousandth** let \( A \) be the average temperature between 7 a.m. and 12 noon.
   
   **To the nearest hour** (after midnight), let \( B \) be the hour when the temperature is increasing at the fastest rate.
   
   **To the nearest thousandth** let \( C \) be the highest temperature attained during the day.

   **To the nearest thousandth** let \( D \) be the average rate of change in the temperature from 6 a.m. to 1 p.m. Find \( A + B + C + D \).

8. Let \( A(w) \) be the area in square centimeters of the region in the first quadrant enclosed by the \( x \)-axis and the graph of \( f(x) = 36x^2 - 18x^3 \) between \( x = 0 \) and \( x = w \), \( 0 < w < 2 \). If \( w \) moves right at a constant rate of 0.04 cm/s, how fast is \( A(w) \) changing in cm\(^2\)/s, when \( w = 0.5? \).
9. A target is in the shape of a closed polygon whose area is equal to that bounded by \( y = 4 \ln(x) \) and \( y = 1.5x - 2 \). Painted on the polygon is a red shape whose area is equal to that bounded by \( x = 0, y = e^x \) and \( y = 2 \cos(x) \) in quadrant 1. If a randomly thrown dart hits the polygon what is the probability to the nearest thousandth that it lands in the red area?

10. Use the local linearization of \( x^4 + x \tan(y) = 16, \ -\frac{\pi}{2} < y < \frac{\pi}{2} \) at \( x = 2 \) to estimate the value of \( y \) at \( x = 2.1 \).

\[
\begin{align*}
11. \quad f(x) &= \begin{cases} 
(x + 2)^2 - 2, & -4 \leq x \leq -2 \\
-x, & -2 < x < 0 \\
\tan(x), & 0 \leq x \leq \frac{\pi}{4} \\
e^{-x - \frac{\pi}{4}}, & \frac{\pi}{4} < x \leq 3 
\end{cases}
\end{align*}
\]

Find the area bounded by \( f \) and the x-axis to the nearest thousandth.

12. List the letters of the statements that are true.
   A) If \( f \) is a one to one function then \( f \) is always increasing or always decreasing throughout its domain.
   B) A critical value of \( f \) occurs only when \( f'(x) = 0 \).
   C) If \( u = 2x \), then \( \int_0^a \sin(2x) \, dx = \frac{1}{2} \int_0^{2a} \sin(u) \, du \).
   D) If \( f \) and \( g \) are even functions then \( \int_{-a}^{a} [f(x) + g(x)] \, dx = 2 \int_0^a [f(x) + g(x)] \, dx \).
   E) If the velocity of a particle moving along the x-axis is \( v(t) = \sin(t) \), then to the nearest thousandth the total distance traveled from \( t = 0 \) to \( t = 4 \) is 2.346.
   F) A particle moving rectilinearly along the x-axis having velocity \( v(t) = \frac{1}{1+t^2} \), \( t \geq 0 \), starting at \( (4, 0) \) when \( t = 0 \) has an x-coordinate of \( \ln 8 \) when \( t = 7 \).

13. A rectangle has its base on the x-axis and its upper vertices on the parabola \( y = 16 - x^2 \). What is the largest area the rectangle can have?

14. \( \int_1^5 f(x) \, dx = 3 \). Find \( \int_1^5 [2(f(x) + x^2) \, dx - \int_1^5 [3f(x) - x + 4] \, dx \)

15. Find the area bounded by \( x = -y^3 + 2y + 4 \) and \( x = y^2 - 2y \).