Each problem is worth 5 points. Show complete justification for full credit.

1. By reading values from the graph of $f(x)$ below, use three rectangles to find an upper estimate and a lower estimate for the area under the graph of $f(x)$ but above the $x$-axis between $x=0$ and $x=9$.

Upper
\[ 3 \cdot f(0) + 3 \cdot f(6) + 3 \cdot f(9) \]
\[ 3 \cdot 6 + 3 \cdot 5 + 3 \cdot 5 \]
\[ 18 + 15 + 15 \]
\[ 48 \]

Lower
\[ 3 \cdot f(3) + 3 \cdot f(3) + 3 \cdot f(9) \]
\[ 3 \cdot 3 + 3 \cdot 3 + 3 \cdot 1 \]
\[ 9 + 9 + 3 \]
\[ 21 \]

2. Use the midpoint rule with $n=4$ to approximate $\int_0^9 (x^3 - 5x) \, dx$. [You don’t need to simplify your answer – things like $\sqrt{(4.5)^3 - 5(4.5)}$ are perfectly acceptable here.]

\[ 1 \cdot f(4.5) + 1 \cdot f(5.5) + 1 \cdot f(6.5) + 1 \cdot f(7.5) \]
\[ \frac{4.5 + 5.5 + 6.5 + 7.5}{4} \]
\[ \frac{4 \times 5 \times 6 \times 7 \times 8}{4} \]
\[ \sqrt{(4.5)^3 - 5(4.5)} + \sqrt{(5.5)^3 - 5(5.5)} + \sqrt{(6.5)^3 - 5(6.5)} + \sqrt{(7.5)^3 - 5(7.5)} \]

**Nice!**