1. (2 points) Fill in the missing information for the following two theorems.

**Mean Value Theorem** Let $f$ be a function that satisfies the following two hypotheses.

1. $f$ is __________________ on the closed interval $[a, b]$.
2. $f$ is __________________ on the open interval $(a, b)$.

Then there is a number $c$ in $(a, b)$ such that ____________________________.

**Rolle’s Theorem** Let $f$ be a function that satisfies the following three hypotheses.

1. $f$ is __________________ on the closed interval $[a, b]$.
2. $f$ is __________________ on the open interval $(a, b)$.
3. ____________________________.

Then there is a number $c$ in $(a, b)$ such that ____________________________.
2. (2 points) Evaluate the definite integral. Simplify your answer.

\[ \int_{1}^{e^2} \frac{24}{x \sqrt{9 + 8 \ln(x)}} \, dx \]

3. (2 points) Evaluate the indefinite integral.

\[ \int \frac{10e^{2x} \cos(e^{2x})}{\sin^2(e^{2x}) + 1} \, dx \]
4. (2 points) Evaluate the indefinite integral.

\[ \int \frac{4x^{11}}{(x^4 + 2)^3} \, dx \]
5. (2 points) Let $R$ be the finite region bounded by the given functions. In the following way, set up but do not evaluate definite integrals which represent the area of the region $R$.

\[
y = 10\sqrt{x} \\
y = 5x
\]

(a) Integrate with respect to $x$.

(b) Integrate with respect to $y$. (The integrands in parts (a) and (b) should be different.)