1. Find a constant $c$ that satisfies the conclusion of the mean value theorem when applied to $f(x) = \ln x$ on $[1, e]$.

2. Suppose that $f$ is differentiable on $\mathbb{R}$ and satisfies $1 \leq f'(x) \leq 3$ for all values of $x$. Then find $a$ and $b$, where $a \leq f(7) - f(5) \leq b$. 

3. Find the critical point(s) of \( f(x) = \frac{x^2 + 1}{\sqrt{2x + 1}} \)

4. Find the absolute maximum and minimum of \( f(x) = 2 \cos x + 2 \cos^2 x, \quad \frac{\pi}{2} \leq x \leq 2\pi \)
5. If the function \( f(x) = axe^{bx^2} \) has the maximum value \( f(2) = 1 \) where \( a \) and \( b \) are real numbers, then find \( a \) and \( b \)