1. Show that $|x|$ is continuous everywhere.　(10 points)

2. Let $f(x) = ax^2 + bx + c, a > 0$. Find f^{-1} if the domain of f is restricted to (a) $x \geq -b/(2a)$,　(b) $x \leq -b/(2a)$.　(10 points)

3. Prove $\dfrac{d}{dx}[\log_b x] = \dfrac{1}{x \ln b}$, $x > 0$.　(10 points)

4. Evaluate the integral $\displaystyle\int \frac{1}{x^3 - x}\, dx$. For what values of x is your result valid?　(10 points)

5. Find values of $a, b, c,$ and d so that the function $f(x) = ax^3 + bx^2 + cx + d$ has a relative minimum at $(0,0)$ and a relative maximum at $(1,1)$.　(10 points)

6. Evaluate the following definite integrals:
$$\int_{-\ln 3}^{\ln 3} \frac{e^x}{e^x + 4}\, dx .\qquad \int_{-1}^{1} |e^x - 1|\, dx$$
　(10 points)

7. Let $w = (x_1^2 + x_2^2 + \ldots + x_n^2)^k$, where $n \geq 2$. For what value of k does $\dfrac{\partial^2 w}{\partial x_1^2} + \dfrac{\partial^2 w}{\partial x_2^2} + \ldots + \dfrac{\partial^2 w}{\partial x_n^2} = 0$ hold?　(10 points)

8. Find the average value of $f(x,y) = x^2 - xy$ over the region enclosed by $y = x$ and $y = 3x - x^2$.　(10 points)

9. Solve the following differential equation. Where reasonable, express the family of solutions as explicit functions of x.
$$\frac{\sqrt{1+x^2}}{1+y}\frac{dy}{dx} = -x$$
　(10 points)

10. Approximate $\sqrt{2}$ by applying Newton's Method to the equation $x^2 - 2 = 0$.　(10 points)