1. Find the limit $\lim_{x \to 0} (1 + \sin 3x)^{\frac{1}{x}}$. (15%)

2. Solve the integral equation $y(x) = 2 + \int_0^x y(t)\ dt$, for all $x \in R$. (15%)

3. Evaluate the following integrals (20%)

(a) $\int_0^1 \dfrac{1}{2 + e^x}\ dx$.

(b) $\int_0^{\pi/2} \dfrac{1}{2 + \cos x}\ dx$.

4. Let $f(x) = \dfrac{x^3}{x^2 + 1}$, for $x \in R$ (15%)

(a) Show that $f(x)$ is one-to-one. (So it has an inverse $y = f^{-1}(x)$.)

(b) Find the slope of the function $y = f^{-1}(x)$ at the point $x = \frac{1}{2}$.

5. Evaluate the integral $\int_0^4 \int_{\sqrt{y}}^2 e^{x^3}\ dx\ dy$. (15%)

6. Find all real numbers p for which the series $\displaystyle\sum_{n=2}^{\infty} \dfrac{1}{n\ (\ln n)^p}$ is convergent.

Explain your answer. (20%)