1. Find the most general anti-derivatives for the following functions:

(i) $xe^x$ 10 points

(ii) $\frac{3}{(x^2+4)}$ 10 points
2. (a) On what intervals is the function $f(x) = \frac{e^x}{x}$ increasing/decreasing. Classify any local minimima or maxima of $f$. 12 points

(b) Prove that the function $f(x) = (1 + x^3)^{\frac{1}{3}}$ is one-to-one on $(0, \infty)$. What is the inverse function of $f$? 8 points
3. (a) Sketch the region $A$ bounded by the curves $y = e^x$, $y = e^{-x}$, $x = -2$ and $x = 1$. 5 points

(b) What is the area of $A$. 10 points
4. Evaluate $\int_{e}^{e^2} \frac{dx}{x \ln x}$. 10 points
5. (a) Show that $t \ln t - t$ is an anti-derivative for $\ln t$.  6 points

(b) Use part (a) to evaluate $\int_1^{\sqrt{e}} x \ln x^2 \, dx$.  (Hint: Substitution)  9 points
6. (a) Sketch the region Ω bounded by the curves $x = y^2$, and $x = 2y$ marking carefully the points where these curves meet. **8 points**

(b) Find the volume of the solid obtained by revolving the region Ω (from part (a)) about the y-axis. **12 points**