Group A

(1) Evaluate the following integral by first switching the order of integration from $dy\,dx$ to $dx\,dy$ and then integrating.

$$\int_0^3 \int_{x^2}^9 x^3 e^{y^3} \, dy \, dx$$

(2) Evaluate whether the following series coverge or diverge:

    a) $\sum_{n=1}^{\infty} \frac{1+2^n}{1+3^n}$

    b) $\sum_{n=2}^{\infty} \frac{1}{n^2-1}$

Group B

(1) Evaluate the following integral over the unit circle by first transforming to polar coordinates and then integrating.

$$\iint\limits_{R} (x^2 + y^2)e^{\sqrt{x^2+y^2}} dA \text{ where } R = \{(x,y)|x^2 + y^2 \leqslant 1\}$$

(2) Using Lagrange multipliers, find two points which solve the following minimization problem:

$$f(x,y) = \sqrt{x^2 + y^2 + 1} \text{ subject to } g(x,y) = xy - 1$$