5 marks   1. In each box mark T or F if the affirmation is true or false respectively. No justification is needed. Assume all functions below are continuous and that D is a bounded and closed fixed set.

☐ If $f(x, y) = g(x, y) - h(x, y)$ then

$$\iint_D f(x, y) \, \mathrm{d}A = \iint_D g(x, y) \, \mathrm{d}A - \iint_D h(x, y) \, \mathrm{d}A.$$

☐ If $\iint_D f(x, y) \, \mathrm{d}A = \iint_D g(x, y) \, \mathrm{d}A$ then $f(x, y) = g(x, y)$ for each $(x, y) \in D$.

☐ If $\iint_D f(x, y) \, \mathrm{d}A \geq 0$ then $f(x, y) \geq 0$ for each (x, y) in D.

☐ If $f(x, y) \geq 0$ in D then $\iint_D f(x, y) \, \mathrm{d}A \geq 0$.

☐ If $\iint_D f(x, y) \, \mathrm{d}A \leq 0$ then $f(x, y) \leq 0$ for some $(x, y) \in D$.

5 marks   2. Compute the volume of the solid on the first octant $(x, y, z \geq 0)$ bounded by the planes $y = x$, $x = 1$ and $z = x + y$.

5 marks   3. Compute the integral
$$I = \int_0^1 \int_y^1 e^{x^2} \, \mathrm{d}x \, \mathrm{d}y$$

5 marks 4. Find the area between the curve $r = 2 + \sin(\theta)$ and the circle of radius $r = 3$

2 marks 5. (Bonus marks) Find the volume enclosed by the cylinders $z = x^2 + y^2$, $y = x^2 + z^2$ and $x = y^2 + z^2$.

This page has been left blank for your rough work and calculations.