Evaluate the double integrals:

1) \( \int_0^1 \int_0^{x^2} (x + 2y) \, dy \, dx = \frac{9}{20} \)

The first integral is:

\[ \int_0^{x^2} (x + 2y) \, dy = [xy + y^2]_0^{x^2} = x^3 + x^4. \]

We therefore get:

\[ \int_0^1 \int_0^{x^2} (x + 2y) \, dy \, dx = \int_0^1 x^3 + x^4 \, dx = \frac{1}{4}x^4 + \frac{1}{5}x^5 \bigg|_0^1 = \frac{1}{4} + \frac{1}{5} = \frac{9}{20}. \]

2) \( \int \int_D e^{y^2} \, dA = \frac{1}{2}(e - 1) \), where \( D = \{(x, y) \mid 0 \leq y \leq 1 \; 0 \leq x \leq y\} \).

The integral can be written as \( \int_0^1 \int_0^y e^{y^2} \, dx \, dy \). The first integral is then

\[ \int_0^y e^{y^2} \, dy = x e^{y^2} \bigg|_0^y = ye^{y^2}. \]

The second integral is

\[ \int_0^1 ye^{y^2} \, dy = \frac{1}{2} \int_0^1 e^u \, du \quad (u = y^2, \; du = 2y \, dy) = \frac{1}{2} e^u \bigg|_0^1 = \frac{1}{2}(e - 1). \]

3) \( \int \int_D e^{-x^2-y^2} \, dA = \pi(1 - e^{-4}) \), where \( D \) is the region bounded by the semicircle \( x = \sqrt{4 - y^2} \) and the \( y \)-axis.

Using polar-coordinates this integral becomes

\[ \int_{-\pi/2}^{\pi/2} \int_0^2 e^{-r^2} \, r \, dr \, d\theta = \int_0^{\pi/2} \int_0^2 \pi e^{-r^2} \, r \, dr \, d\theta = \pi \int_0^2 e^{-r^2} \, r \, dr. \]

Making the change of variable \( u = -r^2, \; du = -2r \, dr \), the last integral becomes

\[ -\int_4^0 e^u \, du = \int_0^4 e^u \, du = 1 - e^{-4}. \]