1. Q — $\int_0^1 (x^2+9)e^{-x}dx$

A — Let $u = x^2+9$ and $v' = e^{-x} \implies u' = 2x$ and $v = -e^{-x}$

According to integration by parts:

$$\int uv' = uv - \int vu'$$

Therefore $\int (x^2+9)e^{-x}dx = -(x^2+9)e^{-x} + 2\int xe^{-x}dx$

To calculate $\int xe^{-x}dx$

Let $u = x$ and $v' = e^{-x} \implies u' = 1$ and $v = -e^{-x}$

Therefore $\int xe^{-x}dx = -xe^{-x} + \int e^{-x}dx = -xe^{-x} - e^{-x} = -(x+1)e^{-x}$

Therefore $\int (x^2+9)e^{-x}dx = -(x^2+9)e^{-x} + 2[-(x+1)e^{-x}]$

$= -(x^2+2x+11)e^{-x}$

Therefore $\int_0^1 (x^2+9)e^{-x}dx = \left[-(x^2+2x+11)e^{-x}\right]_0^1$

$= -\left[(x^2+2x+11)e^{-x}\right]_0^1$

$= -(14e^{-1} - 11e^{-0})$

$= 11 - \frac{14}{e}$