1. Evaluate the line integral \( \int_C x e^y \, dx \) where \( C \) is the arc of the curve \( x = e^y \) from \((1, 0)\) to \((e, 1)\).

Parameterize \( C \) as \((e^t, t)\) for \(0 \leq t \leq 1\). Then \( dx = e^t \, dt \) so we get:

\[
\int_0^1 e^t e^t \, dt = \int_0^1 e^{3t} \, dt = \left[ \frac{1}{3} e^{3t} \right]_0^1 = \frac{e^3 - 1}{3}.
\]

2. Find the work done by the force \( F(x, y) = (2x, y) \) moving a particle along the curve \((t, t^2)\) from the point \((1, 1)\) to the point \((2, 4)\).

Work = \( \int_1^2 F(r(t)) \cdot r'(t) \, dt \) which is:

\[
\int_1^2 (2t, t^2) \cdot (1, 2t) \, dt = \int_1^2 2t + 2t^3 \, dt = \left[ t^2 + t^4/2 \right]_1^2 = (12 - 3/2) = 23/2.
\]