

$\text{curl } \mathbf{F} = e^x \mathbf{k}$ and S is the portion of the plane $6x + y + 6z = 6$ over $D = \{(x, y) \mid 0 \leq x \leq 1, 0 \leq y \leq 6 - 6x\}$. We orient S upward and use Equation 17.7.10 [ET 16.7.10] with $z = g(x, y) = 1 - x - \frac{1}{6}y$:

$$\begin{aligned} \int_C \mathbf{F} \cdot d\mathbf{r} &= \iint_S \text{curl } \mathbf{F} \cdot d\mathbf{S} = \iint_D (0 + 0 + e^x) dA \\ &= \int_0^1 \int_0^{6-6x} e^x dy dx = \int_0^1 (6 - 6x)e^x dx \\ &= [(6 - 6x)e^x + 6e^x]_0^1 \quad [\text{integrating by parts}] = 6e - 12 \end{aligned}$$