

$$1. F(x, y, z) = \langle \cos(\sqrt{1+x^2} + zy^9), \tan(x^7 + y^2 + \frac{1}{z}), \tan^{-1}(e^{xyz} + \cos^6(x^8 - y + 3z)) \rangle$$

$$\langle P, Q, R \rangle = \text{curl } F$$

$$\frac{dP}{dx} + \frac{dQ}{dy} + \frac{dR}{dz} = \text{div}(\text{curl } F) = 0$$

Divergence of curl is always 0.

$$2. \vec{F}(x, y, z) = \langle 2x + y + z, x + 2y + z, x + y + 2z \rangle$$

$$\text{div} = 2 + 2 + 2 = 6$$

$$\begin{aligned} \iint_S \vec{F} \cdot d\vec{S} &= \iiint_E \text{div } F \, dV \\ &= \int_0^1 \int_0^4 \int_0^5 6 \, dz \, dy \, dx \\ &= 120 \end{aligned}$$

