17.3   Homework

① $F(x,y,z) = \langle z, x, y \rangle$; $[0,4] \times [0,2] \times [0,3]$

→ $P_x = 0$

→ $Q_y = 0$

→ $R_z = 0$

→ $div(F) = 0$

→ $\iiint_E div(F) dV = 0$

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③ $F(x,y,z) = \langle 2x, 3z, 3y \rangle$; $x^2 + y^2 \leq 1$, $0 \leq z \leq 2$

→ $P_x = 2$

→ $Q_y = 0$

→ $R_z = 0$

→ $div(F) = 2$

→ $\iiint_E 2 dV = 4\pi$

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⑤ $F(x,y,z) = \langle 0, 0, \frac{z^3}{3} \rangle$

→ S is the sphere $x^2 + y^2 + z^2 = 1$

→ $P_x = 0$

→ $Q_y = 0$

→ $R_z = z^2$

→ $div(F) = z^2$

→ $\int_0^{2\pi} \int_0^{\pi} \int_0^1 z^2 dV = \frac{4\pi}{15}$

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⑦ $F(x,y,z) = \langle xy^2, yz^2, zx^2 \rangle$; $x^2 + y^2 \leq 4$, $0 \leq z \leq 3$

→ $P_x = y^2$

→ $Q_y = z^2$

$\rightarrow R_z = z$

$\rightarrow div(F) = y^2 + z^2 + z$

$\rightarrow \iiint (y^2 + z^2 + z) \, dV = 60\pi$

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⑪ $F(x, y, z) = \langle x^3, 0, z^3 \rangle; \quad x^2 + y^2 + z^2 \leq 4, \quad x \geq 0, \quad y \geq 0, \quad z \geq 0$

$\rightarrow P_x = 3x^2$

$\rightarrow Q_y = 0$

$\rightarrow R_z = 3z^2$

$\rightarrow div(F) = 3x^2 + 3z^2$

$\rightarrow \iiint_E (3x^2 + 3z^2) \, dV = 64\pi$

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⑮ $F(x, y, z) = \langle x + y, z, z - x \rangle; \quad z = 9 - x^2 - y^2$

$\rightarrow P_x = 1$

$\rightarrow Q_y = 0$

$\rightarrow R_z = 1$

$\rightarrow div(F) = 2$

$\rightarrow \iiint_E 2 \, dV = 81\pi$