

17.3 HW

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

$P_x = 0, Q_y = 0, R_z = 0$

$\text{div } F = P_x + Q_y + R_z = 0 \quad \iiint_E \text{div}(F) dV = 0$

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

$P_x = 2, Q_y = 0, R_z = 0 \quad \text{div}(F) = 2 \quad \iiint_E \text{div}(F) dV = \iiint_E 2 dV = 4\pi$

5. $F(x, y, z) = \langle 0, 0, z^3/3 \rangle$, S is sphere $x^2 + y^2 + z^2 = 1$

$P_x = 0, Q_y = 0, R_z = z^2 \quad \text{div } F = z^2 \quad \iiint_E \text{div}(F) dV = \int_0^{2\pi} \int_0^{2\pi} \int_0^1 z^2 dV = 4\pi/15$

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

$\text{div } F = y^2 + z^2 + 2 \quad \iiint (y^2 + z^2 + 2) dV = 60\pi$

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

$P_x = 3x^2, Q_y = 0, R_z = 3z^2 \quad \text{div}(F) = 3x^2 + 3z^2$

$\iiint_E \text{div}(F) dV = \iiint_E (3x^2 + 3z^2) dV = 64\pi$

15. $F(x, y, z) = \langle x+y, z, z-x \rangle$, $z = 9 - x^2 - y^2$ $P_x = 1, Q_y = 0, R_z = 1 \quad \text{div}(F) = 2$

$\iiint_E \text{div}(F) dV = \iiint_E 2 dV = 81\pi$