6.7 A

2.(4) 直线段：
$$\begin{cases} x=1 \\ y=1+2t \\ z=1+3t \end{cases},\ t: 0\to 1$$

$$\therefore \int_{(C)} x\,dx + y\,dy + (x+y-1)\,dz$$
$$= \int_0^1 1\cdot 0\,dt + \int_0^1 (1+2t)\cdot 2\,dt + \int_0^1 (1+2t)\cdot 3\,dt$$
$$= 10$$

(6) (C):
$$\begin{cases} x=\cos\theta \\ y=\sin\theta \\ z=2-\cos\theta+\sin\theta \end{cases},\ \theta 从\ 0\to -2\pi$$

$$\therefore \oint_{(C)} (z-y)\,dx + (x-z)\,dy + (x-y)\,dz$$
$$= \int_0^{-2\pi} -(2-\cos\theta)\sin\theta\,d\theta + \int_0^{-2\pi} (2\cos\theta-2-\sin\theta)\cos\theta\,d\theta$$
$$+ \int_0^{-2\pi} (\cos\theta-\sin\theta)\cdot(\cos\theta+\sin\theta)\,d\theta$$
$$= -2\pi$$

11. $$\iint_{(S)} \vec{F}\,d\vec{S} = \iint_{(S)} y\,dy\wedge dz - x\,dz\wedge dx + z^2\,dx\wedge dy$$
$$= -\iint_{D_{yz}} y\,dy\,dz + \iint_{D_{xz}} x\,dx\,dz - \iint_{D_{xy}} (x^2+y^2)\,dx\,dy$$
$$= -\int_0^2 y\,dy\cdot\int_0^1 dz + \int_0^2 x\,dx\int_0^1 dz - \int_0^{\frac{\pi}{4}} d\theta\int_0^1 \rho^2\cdot\rho\,d\rho$$
$$= \frac{\pi}{16}$$

$\Sigma_1: x=0,\ \Sigma_2: y=0,\ \Sigma_3: z=0,\ \Sigma_4: x+y+z=1$

12.(2) $\iint\limits_{(S)} xy\, dy\wedge dz = \iint\limits_{\Sigma_1} xy\, dydz + \iint\limits_{\Sigma_4} xy\, dydz$

$= 0 + \cancel{\int_0^{1-z} dy} \int_0^1 dz \int_0^{1-z} (y - y^2 - zy)\, dy$

$= \frac{1}{24}$

同理，$\iint\limits_{(S)} yz\, dz\wedge dx = \frac{1}{24}$，$\iint\limits_{(S)} zx\, dx\wedge dy = \frac{1}{24}$

$\therefore \oiint\limits_{(S)} xy\, dy\wedge dz + yz\, dz\wedge dx + zx\, dx\wedge dy = \frac{1}{8}$

(6) $\cancel{\iint\limits_{(S)} z^2 dx\wedge dy =}$ 由 $x^2+y^2+z^2=2z$. $z=1\pm\sqrt{1-x^2-y^2}$

$\therefore \iint\limits_{(S)} z^2 dx\wedge dy = \iint\limits_{D_{xy}} \left(1\pm\sqrt{1-x^2-y^2}\right)^2 dxdy$

$= \iint\limits_{D_{xy}} \left(2 - x^2 - y^2 \pm 2\sqrt{1-x^2-y^2}\right) dxdy$

$D_{xy}: x^2+y^2 \le 1 \Rightarrow 0\le\rho\le 1,\ 0\le\theta\le 2\pi$

$\therefore$ 原积分 $= \iint\limits_{D_{xy}} \left(2 - x^2 - y^2 + 2\sqrt{1-x^2-y^2}\right) dxdy$

$- \iint\limits_{D_{xy}} \left(2 - x^2 - y^2 - 2\sqrt{1-x^2-y^2}\right) dxdy$

$= 4\iint\limits_{D_{xy}} \sqrt{1-x^2-y^2}\, dxdy$

$= 4\iint\limits_{D_{xy}} \sqrt{1-\rho^2}\, \rho\, d\rho\, d\theta$

$= 4\int_0^{2\pi} d\theta \int_0^1 \sqrt{1-\rho^2}\, \rho\, d\rho = \frac{8}{3}\pi$