б) $\Sigma: z = x^2 - 3$

$p = \frac{\partial z}{\partial x} = 2x$, $q = \frac{\partial z}{\partial y} = 0$, $\vec{N}(\cos\alpha, \cos\beta, \cos\gamma)$ – орт спољне нормале

$$\underset{\text{знак}}{\cos\alpha} = \frac{-p}{\underset{\text{скалар}}{\ominus}\sqrt{1+p^2+q^2}} = \frac{2x}{\sqrt{1+4x^2}}, \quad \cos\beta = \frac{-q}{-\sqrt{1+p^2+q^2}} = 0, \quad \cos\gamma = \frac{1}{-\sqrt{1+p^2+q^2}} = \frac{-1}{\sqrt{1+4x^2}}$$

$$\Pi = \iint_\Sigma \vec{A}\cdot\vec{N}\,dS = \iint_\Sigma [x\cdot(y-z)\cos\alpha + y(z-x)\cos\beta + z\cdot(x-y)\cos\gamma]\,dS =$$

$$= \iint_\Sigma \left[\frac{x(y-z)\cdot 2x - z(x-y)}{\sqrt{1+4x^2}}\right] dS \quad \left(dS = \sqrt{1+p^2+q^2}\,dx\,dy \Rightarrow dS = \sqrt{1+4x^2}\,dx\,dy\right)$$

$$= \iint_{x^2+y^2\le 4} \frac{x\cdot(y-x^2+3)\cdot 2x - (x^2-3)\cdot(x-y)}{\cancel{\sqrt{1+4x^2}}}\cdot\cancel{\sqrt{1+4x^2}}\,dx\,dy = \iint_{x^2+y^2\le 4}(3x^2y - 2x^4 - x^3 + 6x^2 + 3x - 3y)\,dx\,dy$$

$$= \int_0^{2\pi} d\varphi \cdot \int_0^2 (3\rho^2\cos^2\varphi\,\rho\sin\varphi - 2\rho^4\cos^4\varphi - \rho^3\cos^3\varphi + 6\rho^2\cos^2\varphi + 3\rho\cos\varphi - 3\rho\sin\varphi)\rho\,d\rho$$

$$= \int_0^{2\pi} d\varphi \cdot \int_0^2 (3\sin\varphi\cos^2\varphi\cdot\rho^4 - 2\cos^4\varphi\cdot\rho^5 - \cos^3\varphi\cdot\rho^4 + 6\cos^2\varphi\,\rho^3 + 3\cos\varphi\,\rho^2 - 3\sin\varphi\,\rho^2)\,d\rho$$

$$= \int_0^{2\pi}\left(\frac{96}{5}\sin\varphi\cos^2\varphi - \frac{128}{6}\cos^4\varphi - \frac{16}{5}\cos^3\varphi + 24\cos^2\varphi + 4\cos\varphi - 4\sin\varphi\right) d\varphi = \ldots$$

$$\Rightarrow \boxed{\Pi = 8\pi}$$

в) (Применом Стоксове формуле):

$$I = \oint_C \vec{A}\cdot\vec{t}\,ds = \iint_\Sigma \operatorname{rot}\vec{A}\cdot\vec{N}\cdot dS = \iint_\Sigma [-(y+z)\cos\alpha - (z+x)\cos\beta - (x+y)\cos\gamma]\,dS =$$

$$= -\iint_\Sigma \left[(y+z)\cdot\frac{-2x}{\pm\sqrt{1+4x^2}} + (z+x)\cdot 0 + (x+y)\cdot\frac{1}{\pm\sqrt{1+4x^2}}\right] dS =$$

$$= \iint_{x^2+y^2\le 4} \frac{(y+x^2-3)\cdot(-2x) + (x+y)}{\pm\sqrt{1+4x^2}}\,\cancel{\sqrt{1+4x^2}}\,dx\,dy = \mp\iint_{x^2+y^2\le 4}(-2xy - 2x^3 + 7x + y)\,dx\,dy =$$

$$= \mp\iint_{\substack{0\le\varphi\le 2\pi\\ 0\le\rho\le 2}} [-2\rho^2\cos\varphi\sin\varphi - 2\rho^3\cos^3\varphi + 7\rho\cos\varphi + \rho\sin\varphi]\,\rho\,d\rho\,d\varphi =$$

$$= \mp\int_0^2 d\rho\left[-2\rho^3\int_0^{2\pi}\cos\varphi\sin\varphi\,d\varphi - 2\rho^4\int_0^{2\pi}\cos^3\varphi\,d\varphi + 7\rho\int_0^{2\pi}\cos\varphi\,d\varphi + \rho\int_0^{2\pi}\sin\varphi\,d\varphi\right] = 0$$