16.4.

7. $T_u = \langle 2,1,3 \rangle$

$T_v = \langle 1,-4,0 \rangle$

$N = T_u \times T_v = i(0+12) - j(0-3) + k(-8-1)$

$= 12i + 3j - 9k$

$= 3(4i + j - 3k)$

$4x + y - 3z = 4\times(2+4) + (-16 - 3\times 3 = 0$

$4x + y - 3z = 0$

13. $\cancel{T_u = \langle \cos v, \sin v, 1 \rangle}$

$\cancel{T_v = \langle -u\sin v, u\cos v, 0 \rangle}$

$\cancel{ds = |r_u \times T_v| du\,dv =}$

$(u\cos v)^2 + (u\sin v)^2 = u^2$

$x^2 + y^2 = z^2.$

$\cancel{0 \le r \le 1 \quad 0 \le \theta \le 2\pi}$

$\cancel{\iint \quad ds = \sqrt{2}\, r\, dr\, d\theta}$

$ds = \sqrt{(\cos v)^2 + (\sin v)^2 + 1}\sqrt{(-u\sin v)^2 + (u\cos v)^2}\, du\, dv$

$= \sqrt{2}\, u\, du\, dv$

$\int_0^1 \int_0^1 \sqrt{2} u^4\, du\, dv = \frac{\sqrt{2}}{5}.$

15. $G(u,v) = (u, 9-v^2, v)$

$r_u = (1,0,0)$

$r_v = (0,-2v,1)$

$ds = |r_u \times r_v|\, du\,dv = \sqrt{4v^2+1}\, du\,dv$

$\int_0^3 \int_0^3 av\sqrt{4v^2+1}\, du\,dv$

$= \int_0^3 \left[\frac{(4v^2+1)^{\frac{3}{2}}}{12}\right]_0^3 du$

$= \frac{37^{\frac{3}{2}} - 1}{4}$

19. $G(u,v) = (2\sin u, 2\cos u, v)$

$r_u = (2\cos u, -2\sin u, 0)$

$r_v = (0,0,1).$

$ds = \sqrt{4}\, du\,dv = 2\,du\,dv.$

$\int_0^4 \int_0^{2\pi} 2e^{-v}\, du\,dv$

$= \left[-4\pi e^{-v}\right]_0^4$

$= 4\pi(1 - e^{-4}).$

16.5.

5. $g = 1 - 3x + 4y$

$P = y \quad Q = 1-3x+4y \quad R = x.$

$\iint_S F\cdot ds = \cancel{\iint_D (3y - 4z + x)\,dA.}$

$= \iint_D (13x - 13y - 4)\,dA.$

$= \int_0^1 \int_0^1 (13x - 13y - 4)\,dx\,dy$

Inner: $\left[\frac{13}{2}x - 13xy - 4x\right]_0^1 = \frac{5}{2} - 13y$

Outer: $\left[\frac{5}{2}y - \frac{13}{2}y^2\right]_0^1 = -4.$

7. $g = \sqrt{9 - x^2 - y^2}$

$\iint_S F\cdot ds = \int_0^3 \int_0^{\sqrt{9-x^2}} (3y(9-x^2-y^2)^{-\frac{1}{2}} + x)\,dy\,dx$

$= \frac{27}{4}\pi + 9$

9. $g = 9 - x^2 - y^2$.

$P = z \quad Q = z \quad R = x$.

$$\int_0^3 \int_0^{\sqrt{9-x^2}} \left[2(x+y)(9-x^2-y^2)+x\right] dy\,dx = \frac{693}{5}$$

11. $\cancel{z=1}\ g = 1 - x - y$.

$P = y^2,\ Q = 2,\ R = -x$.

$$\int_0^1 \int_0^{1-x} (y^2+2-x)\, dy\,dx = \frac{11}{12}.$$