Fayed Raza
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16, 4: 7, 13, 15, 19

$r = 2u + v\,i + (u - 4v)\,j + 3u\,k$

$T_u = 2i + 1j + 3k$

$\langle 2, 1, 3 \rangle$

$T_v = 1i - 4j + 0$

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

$$\begin{array}{ccc} i & j & k \\ 2 & 1 & 3 \\ 1 & -4 & 0 \end{array}$$

$0 - (-12)\,i - (0 - 3)\,j + (-8 - 1)\,k$

$\langle 12, 3, -9 \rangle$

$3\langle 4, 1, -3 \rangle$

$r(1,4) = \langle 6, -15, 3 \rangle$

$4(x - 6) + (y + 15) + 3(z + 3)$

$4x - 24 + y + 15 + 3z + 9$

$4x + y + 3z = 0$

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

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

$N(u,v) = 3\langle 4, 1, -3 \rangle$

$4x + y + 3z = 0$

$2x^2+2y^2$

13. $\langle 2zx, 2zy, x^2+y^2 \rangle$

$\langle 2u^2\cos v, 2u^2\sin v, u^2 \rangle$

$$\int_0^1\int_0^1 2u^2\cos v + 2u^2\sin v + u^2 \, du\, dv$$

$$2\frac{u^3}{3}\cos v + 2\frac{u^3}{3}\sin v + \frac{u^3}{3}$$

$$\int_0^1 \frac{2}{3}\cos v + \frac{2}{3}\sin v \; \frac{1}{3} \qquad + (1,0)$$

$$\frac{2\cos(1)}{3} + \frac{2\sin(1)}{3} + \cancel{\frac{1}{3}} - \frac{2}{3} - \cancel{\frac{1}{3}}$$

$$\frac{2\cos(1)+2\sin(1)-2}{3}$$

15. $\int_0^3 \int_0^3 \sqrt{9-y}\; dy\, dz$ $\qquad y-9=z^2$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad z^2=\sqrt{1-y}$

$-\frac{1}{(9-y)^{\frac{1}{2}}}\Big|_0^3$

$\int_0^2 -\frac{1}{\sqrt{6}}+\frac{1}{81}\,dz$

$-\frac{2}{\sqrt{6}},\frac{2}{8}$

19. $\int_0^4 2e^{-z}+2e^{-2}\;dz$

$-2e^{-z}+2e^{-2}\Big|_0^4$

$-2e^{-4}+2e^{-4}$

16.5. 5,7,9,11

5. $\int_0^{\pi}\int_0^{1} 3r\cos\theta - 4r\sin - 1 \, dr \, d\theta$

$\frac{3r^3\cos\theta}{3} - \frac{4r^2\sin\theta}{3} - r \Big|_0^1$

$\int_0^{\pi} \frac{3\cos\theta}{3} - \frac{4\sin\theta}{25} \, d\theta$ (1,0,1)

$\frac{3}{3}\sin\theta - \frac{4\cos\theta}{5}$

$-\frac{3}{\sqrt{13}} + \frac{4}{13} = \frac{\sqrt{3}}{8}$

7. $\int_0^{2\pi}\int_0^{3} e^{\cancel{-r^2}} (r^2 + 9) \, dr \, d\theta$

$\frac{r^3}{3} - 9r \Big|_0^3$

$9 - 27$

$\int_0^{2\pi} 18 \, d\theta$

$\frac{3\pi e}{12}$

9.

$$\int_0^{2\pi}\int_0^{3} \sqrt{3}\,9 - r^2 \, dr \, d\theta$$

$$9r - \frac{r^3}{3} \Big|_0^3$$

$$27 - 9$$

$$\int_0^{2\pi} 18 \, d\theta$$

$$\sqrt{3}\,36\pi$$

11.

$$\int_0^{2\pi}\int_0^{3} \sqrt{x^2+y^2+1}\,d\,r\,d\theta$$

$$\int_0^{2\pi} 3 \, d\theta$$

$$6\pi$$