1. $\int_C 7y\,dx + 3x\,dy$, $x^2+y^2=100$

$x=10\cos t$, $y=10\sin t$

$\frac{dx}{dt} = -\sin t$, $\frac{dy}{dt} = \cos t$

$\cancel{r(t)}$ $r = \sqrt{(10\cos t)^2 + (10\sin t)^2} = 10$

$$\int_0^{2\pi}\int_0^{10} (70\sin t + 30\cos t)\cdot r\,dr\,dt$$

$= 20\pi^2 (14\sin^2(5) + 3\sin(10))$

2. $z = x^2+3xy+y^2$ at $(1,1,5)$

$f(x,y,z) = x^2+3xy+y^2-z$

$\nabla f(x,y,z) = (2x+3y)i + (3y+2y)j + (-1)k$

$\nabla f(1,1,5) = 5i + 5j - 5k$

$5x+5y-5z = 5+5-25$

$x+y-z=-3$

3. $f(x,y) = x^2y$ $\{(x,y) \mid 0 \le x \le 1,\ 0 \le y \le 1-x\}$

$f_x(x,y) = 2xy$, $f_y(x,y) = x^2$

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4. $f(x,y,z) = \sin(x^2+y+z)$

$f_x(x,y,z) = 2x\cos(x^2+y+z)$

$f_{xx}(x,y,z) = 2\cos(x^2+y+z) - 4x^2\sin(x^2+y+z)$

$f_{xxy}(x,y,z) = -2(\sin(x^2+y+z) + 2x^2\cos(x^2+y+z))$

$f_{xxyz}(x,y,z) = 4x^2\sin(x^2+y+z) - 2\cos(x^2+y+z)$

$f_{xxyz}(0,0,0) = 2$

5. $xy + xz + yz + \cancel{x^2y^2} x^2y^2z^2 = 4$

$\cancel{\text{当}}$ $x + x\frac{dz}{dy} + \frac{dz}{dy} + x^2 2yz^2 + x^2y^2 2z\frac{dz}{dy} = 0$

$\frac{dz}{dy}(x + 1 + 2zx^2y^2) = -x - x^2 2yz^2$

$\frac{dz}{dy} \cdot (4) = -3$

$\frac{dz}{dy} = -\frac{3}{4}$

6. $x = 1+t, \quad y = 2+t, \quad z = 3+t$

$x = -t, \quad y = 1+t, \quad z = 2+t$

7. $a(t) = \langle -4\sin 2t, -4\cos 2t, 9e^{3t} \rangle$

$v(t) = \int a(t)\,dt = \langle 2\cos(2t) + C, -2\sin(2t) + C, 3e^{3t} + C \rangle$

$v(t) = \cancel{v(t)}\ \cancel{v(0) =} \langle 2\cos(2t), -2\sin(2t), 3e^{3t} \rangle$

$P(t) = \int v(t)\,dt = \langle \sin(2t) + C, \cos(2t) + C, e^{3t} + C \rangle$

$P(0) = \langle 0, 1, 1 \rangle \Rightarrow P(t) = \langle \sin(2t), \cos(2t), e^{3t} \rangle$

$P(\frac{\pi}{4}) = \langle \frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}, e^{\frac{3\pi}{4}} \rangle$

9. $\lim_{(x,y,z)\to(1,1,1)} \sin(\frac{\pi}{3} f(x,y,z)) \cos(\frac{\pi}{4} g(x,y,z))$

$= \lim_{(x,y,z)\to(1,1,1)} \sin(\frac{\pi}{3}) \cdot \cos(\frac{\pi}{2})$

$= 0$