1. $\int_C 7ydx + 3xdy = \int 4dA = \int_0^{2\pi}\int_0^{10} 4rdr\,d\theta = 400\pi$

2. $z_x = 5\ z_y = 5$ *direction number is* $\begin{matrix} i & j & k \\ 1 & 0 & 5 \\ 0 & 1 & 5 \end{matrix} = -5i - 5j + k$

   plane is $5x + 5y - k - 5 = 0$

3. *on the side bottom side* $y = 0, 0 \le x \le 1$

   $f = 0$

   on the left side $x = 0, 0 \le y \le 1$

   $f = 0$

   on the upper side $y = 1 - x, 0 \le x \le 1$

   $f(x) = x^2(1-x)\ \ f'(x) = x(2-3x)\ \ f(0) = 0\ f\left(\frac{2}{3}\right) = \frac{4}{27}\ f(1) = 0$

   the absolute minimum is 0, *absolute maximum is* $\frac{4}{27}$

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

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

5. $x + x\frac{\partial z}{\partial y} + z + y\frac{\partial z}{\partial y} + 2x^2yz^2 + 2x^2y^2z\frac{\partial z}{\partial y} = 0$

   $4 + 4\frac{\partial z}{\partial y} = 0 \rightarrow \frac{\partial z}{\partial y} = -1$

6. $(0,1,2)$ *is the intersection of two line,* $n_1 = (1,1,1), n_2 = (-1,1,1)$
   the plane is $z - y - 1 = 0$

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

   $r\left(\frac{\pi}{4}\right) = \langle 1, 0, e^{\frac{3\pi}{4}}\rangle$

8. $\int (x + y + 2z)ds = \int_0^1 21tdt = \frac{21}{2}$

9. $\lim_{(x,y,z)\to(1,1,1)} \sin\left(\frac{\pi}{3}\right)\cos\left(\frac{\pi}{2}\right) = 0$

10. $\iint FdS = \iiint div(F)dV = \int_0^1\int_0^1\int_0^1 2(x + y + z)dx\,dy\,dz = 3$

11. $f = e^{2x+3y+4z}$

$$\int Fdr = f(1,2,1) - f(0,0,0) = e^{12} - 1$$

12. $\int Fdr = \iint curlFdS = \iint 0dS = 0$

13. $2\int_0^{\frac{\pi}{2}}\int_0^{\pi}\int_0^{10} \rho \sin(\varphi)\, d\rho\, d\theta\, d\varphi = 200\pi$

14. $\int_0^1\int_0^w\int_0^z\int_0^y 360x dx\, dy\, dz\, dw = 3$