6. $\int_C \vec{F}\cdot d\vec{r}$ $\quad F(x,y) = \underbrace{3}_{M}\vec{i} + \underbrace{2z}_{N}\vec{j} + \underbrace{2y}_{P}\vec{k}$

$f_x \quad f_y \quad f_z$

$\vec{r}(t) = (\underbrace{\cos t}_{x(t)})\vec{i} + (\underbrace{\sin t}_{y(t)})\vec{j} + \underbrace{t^2}_{z(t)}\vec{k}$

$t=0$

$x(0) = \cos 0 = 1$

$y(0) = \sin 0 = 0$

$z(0) = 0^2 = 0$

$t=\pi$

$x(\pi) = \cos\pi = -1$

$y(\pi) = \sin\pi = 0$

$z(\pi) = \pi^2$

$(1,0,0)$ TO $(-1,0,\pi^2)$

$f_x = 3 \qquad f_y = 2z \qquad f_z = 2y$

$f = \int 3\,dx \qquad f = \int 2z\,dy \qquad f = \int 2y\,dz$

$= 3x \qquad = 2yz \qquad = 2yz$

$f(x,y) = 3x + 2yz$

$(-1, 0, \pi^2)$ (x, y, z) $\qquad (1,0,0)$ (x, y, z)

$3(-1) + 2(0)(\pi^2) - (3(1) + 2(0)(0))$

$= -3 - 3$

$= \boxed{-6}$

$\frac{\partial P}{\partial y} = 2$

$\frac{\partial N}{\partial z} = 2$

$\frac{\partial P}{\partial x} = 0$

$\frac{\partial M}{\partial z} = 0$

$\frac{\partial N}{\partial x} = 0$

$\frac{\partial M}{\partial y} = 0$

YES