3) $\int_C F \cdot d\alpha = \int_S dS \cdot (\vec{\nabla} \times \vec{F})$

$F(x,y,z) = (0, -z, y)$

$\alpha(u,v) = (u\cos(u), u\sin(u), v)$

$\vec{\nabla} \times \vec{F} = (1, 0, 0)$

$dS = \frac{d\alpha}{du} \times \frac{d\alpha}{dv} \cdot du\, dv$

$= (\sin(u) + u\cdot\cos(u), -\cos u + u\sin u, 0)$

$\int_0^{\pi/2} \int_0^{u} dS \cdot F = \frac{\pi^2}{2} - 2$