

(* We compute the flux of F through a cone $z=\sqrt{x^2+y^2}$ oriented down *)

In[1]:= **F = {x, y, z^4}**

Out[1]= $\{x, y, z^4\}$

In[6]:= **(* parametrization *)**

q = {r Cos[t], r Sin[t], r}

qr = D[q, r]

qt = D[q, t]

n = Simplify[Cross[qt, qr]]

Out[6]= $\{r \cos[t], r \sin[t], r\}$

Out[7]= $\{\cos[t], \sin[t], 1\}$

Out[8]= $\{-r \sin[t], r \cos[t], 0\}$

Out[9]= $\{r \cos[t], r \sin[t], -r\}$

In[10]:= **g = F /. {x → q[[1]], y → q[[2]], z → q[[3]]}**

temp = Integrate[Dot[g, n], {r, 0, 1}]

Integrate[temp, {t, 0, 2 Pi}]

Out[10]= $\{r \cos[t], r \sin[t], r^4\}$

Out[11]= $-\frac{1}{6} + \frac{1}{3} (\cos[t]^2 + \sin[t]^2)$

Out[12]= $\frac{\pi}{3}$