

1. If the density of dust collected by a single passage of a vacuum cleaner is given by $d(x, y) = 5 + x^2y$ (g/m), how much dust would be collected by a vacuum cleaner traveling counterclockwise along the upper semi-circle of radius 2 centered at the origin?

2. Compute

$$\int_C \vec{F} \cdot \frac{d\vec{r}}{dt} dt$$

where $\vec{F} = \langle e^y + \cos x, xe^y + 3xy \rangle$ and C is the boundary of the triangle with vertices $(0, 0)$, $(1, 0)$ and $(0, 2)$ oriented positively (counter-clockwise) parametrized with $\vec{r}(t)$. (Hint: You may split the given vector field into a conservative portion and a non-conservative portion, to save yourself some work.)

3. Find the work done by the force field $\vec{F} = 2\vec{i} + x^2\vec{j} + z\vec{k}$ on a particle traveling from $(0, 2, -1)$ to $(2, 1, 1)$ along a straight line.