

3. Integrate the $f(x, y, z) = x - 3y^2 + z$ over the line segment C joining the origin to the point $(1, 1, 1)$.

4. Integrate $f(x, y, z) = x - 3y^2 + z$ over $C_1 \cup C_2$, where C_1 is the line segment joining the origin to $(1, 1, 0)$ and C_2 is the line segment joining $(1, 1, 0)$ and $(1, 1, 1)$.

5. A slender metal arch, denser at the bottom than top, lies along the semi-circle $y^2 + z^2 = 1, z \geq 0$, in the yz -plane. Find the center of the arch's mass if the density at the point (x, y, z) on the arch is $\mu(x, y, z) = 2 - z$.

Solutions:

1. $\frac{99}{5}$

2. $\frac{5}{24}$

3. 0

4. $-\frac{\sqrt{2}}{2} - \frac{3}{2}$

5. $\frac{8-\pi}{4\pi-4}$