

## Questions

1. Let  $\mathbf{F}$  be the vector field  $\mathbf{F}(x, y, z) = z\hat{\mathbf{i}} + \hat{\mathbf{j}} + x^2y\hat{\mathbf{k}}$  and  $C$  the curve given by  $\mathbf{r}(t) = 2t\hat{\mathbf{i}} + 2t(t+1)\hat{\mathbf{j}} + t^2\hat{\mathbf{k}}$  for  $0 \leq t \leq 1$ . Calculate  $\int_C \mathbf{F} \cdot d\mathbf{r}$ .
2. Let  $\mathbf{F}$  be the vector field  $\mathbf{F}(x, y, z) = -2y\hat{\mathbf{i}} + 2yz^2\hat{\mathbf{j}} + 4\hat{\mathbf{k}}$  and  $C$  the curve given by  $\mathbf{r}(t) = -2\hat{\mathbf{i}} + (2t+1)\hat{\mathbf{j}} + \hat{\mathbf{k}}$  for  $0 \leq t \leq 3$ . Calculate  $\int_C \mathbf{F} \cdot d\mathbf{r}$ .
3. Let  $\mathbf{F}$  be the vector field  $\mathbf{F}(x, y, z) = -x(y+2)\hat{\mathbf{i}} + x\hat{\mathbf{j}} - 3\hat{\mathbf{k}}$  and  $C$  the curve given by  $\mathbf{r}(t) = -\hat{\mathbf{i}} + t\hat{\mathbf{j}} + (3t^3+1)\hat{\mathbf{k}}$  for  $-2 \leq t \leq 0$ . Calculate  $\int_C \mathbf{F} \cdot d\mathbf{r}$ .
4. Let  $\mathbf{F}$  be the vector field  $\mathbf{F}(x, y, z) = y\hat{\mathbf{i}} + 3(1-x)\hat{\mathbf{j}} + \hat{\mathbf{k}}$  and  $C$  the curve given by  $\mathbf{r}(t) = t^2(t+3)\hat{\mathbf{i}} + 2\hat{\mathbf{j}} - t\hat{\mathbf{k}}$  for  $-1 \leq t \leq 1$ . Calculate  $\int_C \mathbf{F} \cdot d\mathbf{r}$ .