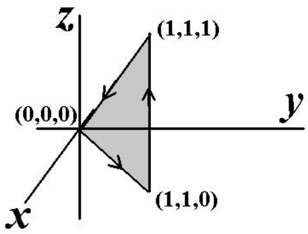
1. The following three points all lie in the plane $y = x$:

$$(0,\ 0,\ 0) \qquad (1,\ 1,\ 0) \qquad (1,\ 1,\ 1)$$

Let C be the closed triangular loop consisting of the straight line segments from $(0,\ 0,\ 0)$ to $(1,\ 1,\ 0)$ and then from $(1,\ 1,\ 0)$ to $(1,\ 1,\ 1)$ and finally from $(1,\ 1,\ 1)$ back to $(0,\ 0,\ 0)$.



Let $\vec{\mathbf{F}} = \left\langle x,\ -yz,\ y^2 \right\rangle$.

a. Calculate $\oint_C \vec{\mathbf{F}} \bullet d\vec{\mathbf{r}}$ by calculating the integrals over all three sides of the triangle and combining them.

b. Use Stokes' Theorem to calculate $\oint_C \vec{\mathbf{F}} \bullet d\vec{\mathbf{r}}$.

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2. Let $\vec{\mathbf{F}} = \left\langle 2xy^2 + z^2,\ 2x^2y,\ 2xz \right\rangle$

a. Show that $\vec{\mathbf{F}}$ is a conservative vector field

b. Find a scalar-valued function ϕ so that $\vec{\mathbf{F}} = \nabla\phi$

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3. Again, let $\vec{\mathbf{F}} = \left\langle 2xy^2 + z^2,\ 2x^2y,\ 2xz \right\rangle$.

Use the Fundamental Theorem for Line Integrals to calculate $\int_{(0,0,0)}^{(2,1,1)} \vec{\mathbf{F}} \bullet d\vec{\mathbf{r}}$.

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4. Let R be the region in the xy plane below $y = 1 - x^2$ but above the x-axis. Let C be the closed loop surrounding R. Let $\vec{\mathbf{F}} = \left\langle 6xy,\ 6x + 3x^2 \right\rangle$. Use Green's Theorem to calculate $\oint_C \vec{\mathbf{F}} \bullet d\vec{\mathbf{r}}$

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5. Find the Fourier series for the following function for $-1 \le x \le 1$:

$$f(x) = \begin{cases} 1 + x & \text{for } \quad 0 \le x \le 1 \\ -1 + x & \text{for } -1 \le x < 0 \end{cases}$$

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6. Find the Fourier series for the function $f(x) = \pi - |x|$ on the interval $-\pi \le x \le \pi$