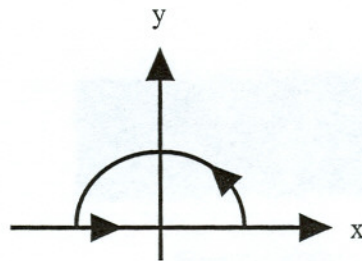


Show ALL your work.

1. Evaluate $\int_C (x + y) \, ds$ along the portions of the curves $x^2 + y^2 = 4$ and $y = 0$ as shown in the figure.



13 Points

2. Find the curl and divergence of $\mathbf{F} = xe^y\mathbf{i} - ze^{-y}\mathbf{j} + y \ln z \mathbf{k}$.

12 Points

25 Points

3. Evaluate $\int_C (7x - 5y)dx + (6x - 7y)dy$ where C is the circle $(x - 3)^2 + (y - 3)^2 = 9$.

12 Points

4. Find the flux of the vector field $\mathbf{F} = 8x\mathbf{i} + 8y\mathbf{j} + 4z\mathbf{k}$ outward through the surface cut from the bottom of $z = x^2 + y^2 + 5$ by $z = 7$.

13 Points

25 Points

5. Let $\mathbf{F} = (3 + 2xy)\mathbf{i} + (x^2 - 3y^2)\mathbf{j}$. Is \mathbf{F} conservative? Also evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$ where C is given by $\mathbf{r}(t) = (e^t \sin t)\mathbf{i} + (e^t \cos t)\mathbf{j}$, $0 \leq t \leq \pi$.

12 Points

6. Calculate the flux of $\mathbf{F} = \frac{1}{2}x^2\mathbf{i} + \sin(xz)\mathbf{j} + (xz + e^{x^2y})\mathbf{k}$ across the surface S where S is the surface of the region bounded by $x = 0$, $y = 0$, $z = 0$, $z = 1 - x^2$ and $y + z = 2$.

13 Points

25 Points

7. Find the vector components of $2\mathbf{i} + 3\mathbf{j}$ which are parallel and perpendicular to $-\mathbf{i} + 2\mathbf{j}$.

10 Points

8. Let V be the solid that lies above $z = 7$ and inside $x^2 + y^2 + z^2 = 64$. Let the density of this solid be given by xyz . SET UP BUT DO NOT EVALUATE INTEGRALS
- a) in spherical coordinates to find the mass of V .

8 Points

- b) in cylindrical coordinates to find the volume of V .

7 Points

25 Points

9. The point $P(2, 1, -1)$ lies on both $F(x, y, z) = -x + y^2 + z^2 = 0$ and $G(x, y, z) = x^2 + 2y^2 + 3z^2 - 9 = 0$. Find an equation of the line through P that is tangent to both surfaces F and G . Hint: The line is perpendicular to both normals at P .

13 Points

10. Let $w = f(x, y)$ where $x = u - 2v$ and $y = u + 2v$.

a) Find $\frac{\partial w}{\partial u}$ in terms of f_x and f_y .

4 Points

b) Find $\frac{\partial^2 w}{\partial v \partial u}$ in terms of f_{xx} , f_{yy} , and f_{xy} .

8 Points

25 Points

11. Find the rate of change of $f(x, y) = e^{x^2y} - 3xy$ at the point $(2, 3)$ in the direction of $-\mathbf{i} + 2\mathbf{j}$.

12 Points

12. Find the absolute maximum and minimum values obtained by the function $f(x, y) = 2xy - 2x - 2y + 1$ on the triangular region R in the xy -plane with vertices at the points $(0, 0)$, $(0, 3)$, and $(3, 0)$.

13 Points

25 Points