

Name: _____

§14.1 VECTOR FIELDS

1. Sketch five vectors in the vector field $\mathbf{F}(x, y) = \frac{\langle 2y, x \rangle}{\sqrt{x^2 + y^2}}$.

2. Sketch five vectors in the vector field $\mathbf{F}(x, y) = \langle 0, 3y \rangle$.

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3. Find the gradient field corresponding to $f(x, y) = 5x^3 - 3y^4$.

4. Find the gradient field corresponding to $f(x, y) = \frac{1}{\sqrt{9x + 5y}}$.

5. Find the gradient field corresponding to $f(x, y, z) = x^2y^9 + yz^3$.

§14.2 LINE INTEGRALS

6. Evaluate the line integral $\int_C 3x - y \, ds$, where C is the quarter circle $x^2 + y^2 = 9$ from $(0, 3)$ to $(3, 0)$.

7. Evaluate the line integral $\int_C 3y^2 \, ds$, where C is the portion of $y = x^2$ from $(2, 4)$ to $(0, 0)$.

8. Evaluate the line integral $\int_C 4(x - z)z \, ds$, where C is the portion of $y = x^2$ in the plane $z = 2$ from $(1, 1, 2)$ to $(2, 4, 2)$.

9. Compute the work done by the force field $\mathbf{F} = \langle z, 0, 3x^2 \rangle$ along the curve C where C is the quarter ellipse $x = 2 \cos t$, $y = 3 \sin t$, $z = 1$ from $(2, 0, 1)$ to $(0, 3, 1)$.

§14.3 CONSERVATIVE VECTOR FIELDS

10. Determine whether or not the vector field $\mathbf{F} = \langle z^2 + 2xy, x^2 - z, 2xz - 1 \rangle$ is conservative. If it is, find a potential functions.

11. Show that $\frac{\mathbf{r}}{|\mathbf{r}|^n} = \frac{\langle x, y \rangle}{(x^2 + y^2)^{n/2}}$ is conservative for any integer n .