

Math 253 Practice Exam (2005/12/07)

1. Let $\vec{v} = 2\vec{i} - 2\vec{k}$ and $\vec{w} = \vec{i} - \vec{j}$. Find the angle θ between \vec{v} and \vec{w} .
2. The total amount of money you have left to pay off on a loan is a function of principle P , monthly payments m , interest rate r , and time elapsed so far t , so $A = f(P, m, r, t)$. Is f_m positive or negative? Why? Is f_t positive or negative? Why?
3. Let $f(x, y) = x^2y$, and $\vec{v} = \vec{i} - \vec{j}$. Find the directional derivative of f in the direction of \vec{v} . Also, find an equation of the tangent plane to f at $(-1, 3)$.
4. Find and classify all extrema of the function $g(x, y) = x^2 - 6xy + y^3$.
5. Rewrite $\int_0^1 \int_{x^2}^x (x^2 + y^2) dy dx$ in polar coordinates.
6. Let $\vec{F} = \vec{i} + x\vec{j}$, and C be the curve parameterized by $\vec{r}(t) = t\vec{i} + \frac{t^2}{2}\vec{j}$, $0 \leq t \leq 1$.
 - a. Sketch the vector field and the curve C . Based on your sketch, predict whether the value of $\int_C \vec{F} \cdot d\vec{r}$ is positive, negative, or zero. Explain.
 - b. Calculate $\int_C \vec{F} \cdot d\vec{r}$.
 - c. Can we apply the FTCLI to $\int_C \vec{F} \cdot d\vec{r}$? Why or why not?

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