

MULTIVARIABLE CALCULUS MATH 2D

(Sample) Midterm Exam II

Problem 1.

For the curve given by $\vec{r}(t) = \langle t^3, t^2, t \rangle$, find

- the unit tangent vector;
- the unit normal vector;
- the curvature.

Problem 2.

The position of a particle is given by

$$\vec{r}(t) = \langle t^2, 5t, t^2 - 16t \rangle .$$

When is the speed a minimum?

Problem 3.

Find the arc length of the space curve with parametric equations

$$x = \cos(2t), \quad y = \sin(2t), \quad z = 3t,$$

where $0 \leq t \leq \pi$.

Problem 4.

Find all the second partial derivatives of the function

$$f(x, y) = \sin^2(mx + ny).$$

Problem 5.

Find the partial derivatives $\frac{\partial u}{\partial \alpha}$, $\frac{\partial u}{\partial \beta}$, $\frac{\partial u}{\partial \gamma}$ when $\alpha = -1$, $\beta = 2$, $\gamma = 1$, if

$$u = xe^{ty}, \quad x = \alpha^2\beta, \quad y = \beta^2\gamma, \quad t = \gamma^2\alpha.$$