

Calculus III, Mathematics 2210-90

Examination 1, Feb 5,7, 2004: Answers

You may use graphing calculators and a Table of Integrals. Each problem is worth 20 points. You MUST show your work. Just the correct answer is not sufficient for any points.

1. $\mathbf{V} = 3\mathbf{I} - \mathbf{J}$, $\mathbf{W} = 2\mathbf{I} + 5\mathbf{J}$ are two vectors in the plane.
 - a) Find the unit vector $\mathbf{X}$ which is orthogonal to $\mathbf{V}$ so that $\mathbf{W}$ lies between $\mathbf{V}$ and $\mathbf{X}$.
 - b) Find the area of the parallelogram spanned by $\mathbf{V}$ and $\mathbf{W}$.
2. A particle moves in the plane according to the equation

$$\mathbf{X}(t) = t^3\mathbf{I} + (3t^2 - t)\mathbf{J}$$

Find the velocity, speed, acceleration, tangent and normal vectors, and normal acceleration of the particle at time $t = 2$.

3. Find the symmetric equations of the line through the point (0,-1,3) which is perpendicular to the vectors $\mathbf{I} - 2\mathbf{J} + 2\mathbf{K}$ and $3\mathbf{I} - 2\mathbf{J} + \mathbf{K}$.
4. Find the distance of the point (2,0,1) from the plane with equation $2x - 3y + z = 1$.
5. A particle moves in space according to the formula $\mathbf{X}(t) = \ln t\mathbf{I} + t^2\mathbf{J} - t\mathbf{K}$.
 - a) Find the values of t at which the velocity and acceleration vectors are orthogonal.

- b) What is the tangential acceleration of the particle at these points?