

North Carolina State University
MA 242 Section 007 Exam 1 alt

Read all directions carefully. **A graphing calculator may NOT be used on this exam.** You must Show All Work for credit and clearly indicate your final answer; no work equals no credit. When you are finished fold your exam, write your name on the outside, turn it in, and then you may leave quietly. Good Luck!

True/False section

- a) (3 pts) The curvature of a line is zero.
- b) (3 pts) $\vec{r}(t) = \langle \ln(t^2), t^2 \rangle$ is a parametrization of the function $y = \ln(x)$.
- c) (3 pts) $\vec{v} \cdot (\vec{u} \times \vec{w})$ is a scalar.

Computations

- 1) (15 pts) Compute the dot product of the vectors $\vec{v} = \langle 1, 0, a \rangle$ and $\vec{u} = \langle 1, -\frac{2}{3}, \frac{1}{a} \rangle$. Are these vectors orthogonal?
- 2) (20 pts) Find the equation of the plane that contains the two parallel lines $\vec{r}(t) = \langle t, -2t, 3t \rangle$ and $\vec{r}(t) = \langle 2 + t, 3 - 2t, 1 + 3t \rangle$.
- 3) (15 pts) HW#16 Find the velocity vector of a particle that has acceleration $\vec{a}(t) = ti + e^tj + e^{-t}k$ and initial velocity $\vec{v}_0 = j + k$.
- 4) (20 pts) Calculate the curvature κ of the curve $\vec{r}(t) = \langle 2 \cos(t), 1, 2 \sin(t) \rangle$.
- 5) (10 pts) Given $\vec{u}_1, \vec{u}_2,$ and \vec{u}_3 are orthogonal unit vectors, $\vec{a} = a_1\vec{u}_1 + a_2\vec{u}_2 + a_3\vec{u}_3,$ and $\vec{b} = b_1\vec{u}_1 + b_2\vec{u}_2$ compute $\vec{a} \cdot \vec{b}$
- 6) HW #34 If $\vec{v}_1, \vec{v}_2,$ and \vec{v}_3 are non coplaner vectors and we define the vector

$$\vec{k} = \frac{\vec{v}_2 \times \vec{v}_3}{\vec{v}_1 \cdot (\vec{v}_2 \times \vec{v}_3)}$$

- a) (5 pts) Show that \vec{k} is orthogonal to \vec{v}_2 .
- b) (5 pts) Show that $\vec{k} \cdot \vec{v}_1 = 1$.

BONUS

(+5 pts) Show that the acceleration vector of a curve is orthogonal to the velocity vector if the speed is constant.