

On the front of your bluebook write: (1) your name, (2) your student ID number, (3) your instructor's name, and (4) a grading table. You must work all of the problems on the exam. Show ALL of your work in your bluebook and BOX in your final answers. A correct answer with no relevant work may receive no credit, while an incorrect answer accompanied by some correct work may receive partial credit. Text books, class notes, calculators and crib sheets are NOT permitted. Please start each new problem on a new page of the bluebook.

1. (20 pts)
 - a. Is the line $\langle 2t + 3, t - 1, -2t \rangle$, for $t \in \mathbb{R}$, parallel to the plane $3x - 4y + z = 2$?
 - b. What is the area of the parallelogram with vertices $(3, 4, 1)$, $(-1, 2, 1)$, $(2, -1, 0)$, $(6, 1, 0)$?
 - c. Do the lines parameterized as $\langle -3t + 6, 2t - 1, 5t - 3 \rangle$ and $\langle 6t - 2, -4t, -10t + 1 \rangle$, for $t \in \mathbb{R}$, intersect?
 - d. TRUE or FALSE: $\vec{A} \times \vec{A} = 0$
2. (30 pts) Suppose that an ant is walking along the parabolic path described by the equation $y = 2x^2$. It takes the ant 2 seconds to walk from the origin to the point $(2, 8)$.
 - a. Provide a parameterization, in terms of time, for the path that the ant follows.
 - b. What is the unit tangent vector, \mathbf{T} , at $(1, 2)$?
 - c. What is the unit normal vector, \mathbf{N} , at $(1, 2)$?
 - d. What is the tangential acceleration at $(1, 2)$?
 - e. What is the normal acceleration at $(1, 2)$?
3. (20 pts) Match each of the following plots on the left with the correct contour plot on the right (Note: There are more plots to choose from on next page).



