Name: _____ **Section Number:** _____

TA Name: _____ **Section Time:** _____

Math 20C.
Midterm Exam 1
April 28, 2006

No calculators or any other devices are allowed on this exam.
Write your solutions clearly and legibly; no credit will be given for illegible solutions.
Read each question carefully. If any question is not clear, ask for clarification.
Answer each question completely, and show all of your work.

1. (a) (5 points) Find all constants c such that the vectors $\mathbf{v} = \langle 1, c, 2\rangle$ and $\mathbf{w} = \langle c^2, c, -4\rangle$ are perpendicular to each other.

   (b) (5 points) Set $c = 1$ in vectors $\mathbf{v}$ and $\mathbf{w}$ above. In this case, find a unit vector perpendicular to both $\mathbf{v}$ and $\mathbf{w}$.

   (c) (5 points) Keep $c = 1$. Find the scalar projection of $\mathbf{v}$ onto $\mathbf{w}$.

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2. (10 points) Find the equation for the plane that contains the point $P_0 = (1, 2, 3)$ and the line $x = -2 + t$, $y = t$, $z = -1 + 2t$.

3. (a) (10 points) Find the position and velocity vector functions of a particle that moves with an acceleration function $\mathbf{a}(t) = \langle 0, 0, -10 \rangle \ m/sec^2$, knowing that the initial velocity and position are given by, respectively, $\mathbf{v}(0) = \langle 0, 1, 2 \rangle \ m/sec$ and $\mathbf{r}(0) = \langle 0, 0, 3 \rangle \ m$.

   (b) (5 points) Draw an approximate picture of the graph of $\mathbf{r}(t)$ for $t \geq 0$.

4. (10 points) Reparametrize the curve $\mathbf{r}(t) = \left\langle \frac{3}{2}\sin(t^2), 2t^2, \frac{3}{2}\cos(t^2) \right\rangle$ with respect to its arc length measured from $t = 1$ in the direction of increasing t.
(Just in case you read it too fast, we repeat: starting at $t = 1$.)