EXAM 2 - MATH 251 Friday, March 2

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Find the decomposition $\mathbf{a} = \mathbf{a}_{\|} + \mathbf{a}_{\perp}$, for $\mathbf{a} = \langle 1, -1, 2 \rangle$, with respect to $\mathbf{b} = \langle 1, 1, 1 \rangle$.

2. Find the intersection of the plane $x - y + 5z = 10$ with the line $\mathbf{r}(t) = \langle 1, 0, 1 \rangle + t\langle -2, 1, 1 \rangle$.

3. Find an equation for the plane that contains the lines $\mathbf{r}_1(t) = \langle 2, 1, 0 \rangle + \langle t, 2t, 3t \rangle$ and $\mathbf{r}_2(t) = \langle 5, 2, 8 \rangle + \langle 3t, t, 8t \rangle$.

4. (a) Use the product rule to compute $\frac{d}{dt}(\mathbf{r}_1(t) \times \mathbf{r}_2(t))$, where $\mathbf{r}_1(t) = \langle t^2, t^3, t \rangle$ and $\mathbf{r}_2(t) = \langle e^{3t}, e^{2t}, e^t \rangle$.

(b) Evaluate the integral

$$\int_0^1 \mathbf{r}(t)dt, \text{ where } \mathbf{r}(t) = \langle te^{-t}, t\ln(t^2+1) \rangle.$$

5. Find an arc length parametrization of $\mathbf{r}(t) = \langle e^t \sin t, e^t \cos t, e^t \rangle$.