Please put problem 1 on answer sheet 1

1. Given the following data:
   \[ \vec{a} = 3 \hat{i} - 2 \hat{j} + 1 \hat{k} \]
   \[ \vec{b} = 1 \hat{i} + 2 \hat{j} + 3 \hat{k} \]
   (a) Show that \( \vec{a} \) and \( \vec{b} \) are not perpendicular. [3 pts]
   (b) Find a vector of length 1 perpendicular to both \( \vec{a} \) and \( \vec{b} \). [10 pts]
   (c) Find \( \text{Pr}_\vec{b} \vec{a} \). [7 pts]

Please put problem 2 on answer sheet 2

2. (a) Find the simplified equation of the plane containing \((1, 2, 3)\) and perpendicular to the line
   \[ \frac{x - 2}{3} = \frac{5 - y}{2}, \quad z = 3 \] [8 pts]
   (b) Find the tangential component of acceleration \( a_T \) at \( t = 2 \) for the curve parametrized by
   \[ \vec{r}(t) = t \hat{i} - t^2 \hat{j} + t^2 \hat{k} \]. [12 pts]

Please put problem 3 on answer sheet 3

3. (a) Sketch the VVF \( \vec{r}(t) = 3 \cos t \hat{i} + 2 \hat{j} + 2 \sin t \hat{k} \) for \( 0 \leq t \leq \pi \). Label three points with their coordinates. [10 pts]
   (b) Write down a parametrization of the semicircle \( x^2 + y^2 = 9 \) with \( x \geq 0 \) along with the line segment joining the endpoints, in a counterclockwise direction. [10 pts]

Please put problem 4 on answer sheet 4

4. (a) Sketch the plane \( 2x + 12y + 3z = 24 \) and label three points with their coordinates. [5 pts]
   (b) Sketch the plane \( 2x + 3y = 12 \) and label two points with their coordinates. [5 pts]
   (c) Find the length of the curve parametrized by \( \vec{r}(t) = \cos t \hat{i} + \sin t \hat{j} + 2 t^{3/2} \hat{k} \) with \( 0 \leq t \leq 2 \). If you’re careful the integral should be easy. [10 pts]

Please put problem 5 on answer sheet 5

5. (a) Find the two points where the curve \( \vec{r}(t) = t \hat{i} + t^2 \hat{j} - 3 \hat{k} \) meets the plane \(-2x + y + z = 0\). [10 pts]
   (b) Suppose \( \vec{a}(t) = 1 \hat{i} + 0 \hat{j} + 0 \hat{k}, \quad \vec{v}(0) = 0 \hat{i} + 0 \hat{j} + 1 \hat{k} \) and \( \vec{r}(1) = \vec{0} \). Find \( \vec{r}(t) \). [10 pts]

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