Math 241 Exam 1 Sample 3

Directions: Do not simplify unless indicated. No calculators are permitted. Show all work as appropriate for the methods taught in this course. Partial credit will be given for any work, words or ideas which are relevant to the problem.

Please put problem 1 on answer sheet 1

1. Given the following data:
$$P = (3, 2, 1)$$
$$Q = (5, 0, 0)$$
$$\bar{a} = 2\,\hat{\imath} + 5\,\hat{\jmath}$$
$$\bar{b} = 1\,\hat{\imath} + 2\,\hat{\jmath} + 3\,\hat{k}$$

    (a) Find a vector of length 1 pointing from P toward Q.   [7 pts]

    (b) Find the value of α so that $\alpha\,\hat{\imath} - 2\,\hat{\jmath} + \alpha\,\hat{k}$ is perpendicular to $\bar{a}$.   [6 pts]

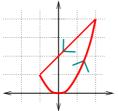   (c) Find $\mathrm{Pr}_{\bar{b}}\,\bar{a}$.   [7 pts]

Please put problem 2 on answer sheet 2

2. (a) Find the distance between the point $(3, 2, 1)$ and the plane $2x + 3y - z = 4$.   [8 pts]

    (b) Find the curvature of $\bar{r}(t) = t\,\hat{\imath} + \sin t\,\hat{\jmath}$ at $t = \frac{\pi}{2}$.   [12 pts]

Please put problem 3 on answer sheet 3

3. (a) Sketch the VVF $\bar{r}(t) = 3\cos t\,\hat{\imath} - 2\,\hat{\jmath} + 3\sin t\,\hat{k}$ for $0 \le t \le \pi$. Mark the start and end   [10 pts]
       points with their coordinates.

    (b) Write down a parametrization of the curve. The curved part is the parabola $y = x^2$.   [10 pts]

Please put problem 4 on answer sheet 4

4. (a) Give the symmetric equations of the line through $(1, 2, 3)$ and $(4, -2, 1)$.   [7 pts]

    (b) If $\bar{a}(t) = 2\,\hat{\imath}$, $\bar{v}(1) = 2\,\hat{\imath} + \hat{\jmath} + \hat{k}$ and $\bar{r}(1) = \bar{0}$, find $\bar{r}(t)$.   [13 pts]

Please put problem 5 on answer sheet 5

5. Find the point on the plane $2x + 3y + z = 8$ which is closest to the point $(1, 2, 3)$. There is more   [20 pts]
than one way to do this. Any remotely relevant pictures and/or calculations will be accepted for partial credit.