Math 241 Exam 1 Sample 4

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:

$$P = (-1, 0, 3)$$
$$Q = (2, 5, 5)$$
$$\bar{a} = 1\,\hat{\imath} + 2\,\hat{\jmath} + 0\,\hat{k}$$
$$\bar{b} = 3\,\hat{\imath} + 2\,\hat{\jmath} + 1\,\hat{k}$$

   (a) Find a vector of length 2 pointing from P toward Q. [7 pts]

   (b) Find the cosine of the angle between $\bar{a}$ and $\bar{b}$. [6 pts]

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

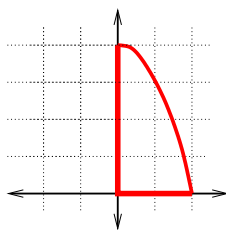**Please put problem 2 on answer sheet 2**

2. (a) Find the distance between the point $(3, 2, 1)$ and the line with symmetric equations [10 pts]

$$\frac{x+2}{3} = z - 3 \quad , \quad y = -2$$

   (b) Given $\bar{r}(t) = \cos(t)\,\hat{\imath} + 3\sin(t)\,\hat{\jmath}$ find and simplify $\bar{T}(\pi/4)$. [10 pts]

Please put problem 3 on answer sheet 3

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

   (b) Write down a piecewise parametrization of the curve shown below with clockwise orientation. [10 pts]
   The curved part is the parabola $y = 4 - x^2$.

Please put problem 4 on answer sheet 4

4. (a) Give the parametric equations of the line through $(1, 2, 3)$ and perpendicular to both vectors [10 pts]
   $2\,\hat{\imath} + 2\,\hat{\jmath} + 0\,\hat{k}$ and $3\,\hat{\imath} - 1\,\hat{\jmath} + 2\,\hat{k}$.

   (b) Find the point at which the line $\bar{r}(t) = (2t + 2)\,\hat{\imath} + (5 - t)\,\hat{\jmath} + (t + 10)\,\hat{k}$ passes through the [10 pts]
   plane $2x + y - z = 1$.

Please put problem 5 on answer sheet 5

5. (a) Sketch the plane $2x + y + 3z = 12$. Mark at least three points with their coordinates. [10 pts]

   (b) Set up (do not evaluate) the integral for the length of $\bar{r}(t) = t^2\,\hat{\imath} + t^3\,\hat{\jmath} - 1\,\hat{k}$ for $0 \le t \le 1$. [10 pts]