

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. (a) Find the cosine of the angle between the vectors $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k}$ and $\mathbf{b} = 5\mathbf{i} - 1\mathbf{j} + 1\mathbf{k}$. [10 pts]
 - (b) Find the equation of the plane through the point $(1, 2, 3)$ and perpendicular to the line joining $(0, -1, 2)$ and $(5, 7, 3)$. [10 pts]
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Please put problem 2 on answer sheet 2

2. (a) Find a parametrization for the counterclockwise curve formed by the semicircle $x^2 + y^2 = 9$ for $x \geq 0$ along with the line segment joining the endpoints. [10 pts]
 - (b) If $\mathbf{a}(t) = 2t\mathbf{i} - 1\mathbf{j}$ and $\mathbf{v}(1) = 0\mathbf{i} + 1\mathbf{j} + 1\mathbf{k}$, find $\mathbf{v}(t)$. [10 pts]
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Please put problem 3 on answer sheet 3

3. (a) Sketch the VVF $\mathbf{r}(t) = \cos t\mathbf{i} + 2\sin t\mathbf{j} + 1\mathbf{k}$ for $0 \leq t \leq \frac{3\pi}{2}$. Mark the start and end points with their coordinates. [10 pts]
 - (b) Set up but do not evaluate the integral for the length of $\mathbf{r}(t) = 2t\mathbf{i} + 5t\mathbf{j} - t^2\mathbf{k}$ for $0 \leq t \leq 3$. [10 pts]
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Please put problem 4 on answer sheet 4

4. (a) Sketch the sphere $x^2 - 4x + y^2 + z^2 = 12$. Mark the center and two other points with their coordinates. [6 pts]
 - (b) Find all values of α so that $\alpha\mathbf{i} + 2\mathbf{j} + 3\alpha\mathbf{k}$ has length 7. [4 pts]
 - (c) If $\mathbf{r}(t) = 2t\mathbf{i} + (t^2 - 1)\mathbf{j} + (1 - t^2)\mathbf{k}$ find the tangential component of acceleration at $t = 2$. [10 pts]
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Please put problem 5 on answer sheet 5

5. (a) Find the distance between the origin and the line with parametric equations [10 pts]

$$\begin{aligned}x &= 2t + 1 \\y &= 3t \\z &= 3\end{aligned}$$

- (b) Find the point where the plane $2x - y + z = 25$ meets the line with symmetric equation [10 pts]

$$x + 1 = \frac{1-y}{3} = \frac{z}{2}$$

The End and the TA Section List

Kevin	0111 ↔ 8:00	0121 ↔ 9:30
Noah	0112 ↔ 8:00	0122 ↔ 9:30
Nathaniel	0131 ↔ 12:30	0141 ↔ 2:00
Tessa	0132 ↔ 12:30	0142 ↔ 2:00