

PRINT Your Name: _____

There are 15 problems on 6 pages. Each problem is worth 10 points. SHOW your work. **CIRCLE** your answer. **NO CALCULATORS!** CHECK your answer, whenever possible.

1. Find the equations of the line which contains the points $(4, 2, -3)$ and $(4, -3, 0)$. The vector which connects the points is $5\vec{j} - 3\vec{k}$

line is

$$\begin{aligned} x &= 4 \\ y &= 5t - 3 \\ z &= -3t \end{aligned}$$

2. Find the equation of the plane which contains the points $P(4, 2, -3)$, $Q(4, -3, 0)$, and $R(2, 3, 4)$.

$$\vec{PQ} \times \vec{PR} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0 & -5 & 3 \\ -2 & 1 & 7 \end{vmatrix}$$

$$= -38\vec{i} - 6\vec{j} - 10\vec{k}$$

$$= -38(x-4) - 6(y+3) - 10z$$

$$0 = -38(x-4) - 6(y+3) - 10z$$

$$19x + 3y + 5z = 67$$

3. Let $\vec{a} = 4\vec{i} + 2\vec{k}$ and $\vec{b} = 2\vec{i} - \vec{j} + 3\vec{k}$. Find vectors \vec{u} and \vec{v} with $\vec{b} = \vec{u} + \vec{v}$, \vec{u} parallel to \vec{a} , and \vec{v} perpendicular to \vec{a} .



$$\vec{u} = \text{proj}_{\vec{a}} \vec{b} = \frac{\vec{a} \cdot \vec{b}}{\vec{a} \cdot \vec{a}} \vec{a} = \frac{8+6}{16+4} \vec{a} = \frac{14}{20} (4\vec{i} + 2\vec{k}) = \frac{7}{10} (4\vec{i} + 2\vec{k}) = \frac{7}{5} (2\vec{i} + \vec{k})$$

$$\vec{v} = \vec{b} - \vec{u} = \frac{1}{10} (20\vec{i} - 10\vec{j} + 30\vec{k} - 28\vec{i} - 14\vec{k})$$

$$\vec{v} = \frac{1}{10} (-8\vec{i} - 10\vec{j} + 16\vec{k})$$