

YOUR NAME: _____

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Find an equation of the plane containing the point $P = (4, -1, 9)$ and the line $\mathbf{r}(t) = \langle 1, 4, -3 \rangle + t\langle 2, 1, 1 \rangle$.

2. Find the intersection of the planes $x + y + z = 1$ and $3x - 2y + z = 5$.

3. Find parametric equations for the tangent line to the curve

$$\mathbf{r}(t) = \langle e^{-t} \cos t, e^{-t} \sin t, e^{-t} \rangle \quad \text{at the point } (1, 0, 1).$$

4. Parameterize by arc length the curve

$$\mathbf{r}(t) = \langle t^2, \sin t - t \cos t, \cos t + t \sin t \rangle, \quad t \geq 0.$$

5. Find the curvature $\kappa(t)$ of the curve

$$\mathbf{r}(t) = \langle \sqrt{2}t, e^t, e^{-t} \rangle.$$

(Please, simplify your answer.)