

Name: _____

Score: _____ /20

Lines and Planes

Please staple your work and use this page as a cover page.

1. Find an equation of the line that passes through the points $(1, 3, -1)$ and $(-2, -1, 5)$.
2. Find all value(s) of the constant a that make the line through the points $(1, 0, 1)$ and $(a, 3, 2a^2)$ parallel to the line $\vec{r}(t) = \langle 4 - 3t, 5 + 3t, 2 + 7t \rangle$.
3. Show that the lines $\vec{r}_1(t) = \langle t, 2t, -3t \rangle$ and $\vec{r}_2(t) = \langle 1 - t, 2t, 3 - 2t \rangle$ are skew lines, meaning that they do not lie in the same plane.

Hint: Start by explaining why the given lines are not parallel. What else needs to be true for them to be skew?

4. Find all value(s) of t where the line $\vec{r}(t) = \langle 1 - t, t, t \rangle$ intersects the sphere $x^2 + y^2 + z^2 = 4$. Explain what is happening geometrically.
5. Find all value(s) of t where the line $\vec{r}(t) = \langle t, 2t, 3 - t \rangle$ intersects the sphere $x^2 + y^2 + z^2 = 4$. Explain what is happening geometrically.
6. Are the planes $2x - y - z = 3$ and $2x + 2y + z = 1$ parallel, orthogonal, or neither? Be sure to justify your answer.
7. Find an equation of the line that represents the intersection of the planes $x + y + z = 0$ and $2x - y + 3z = 1$.
8. Find an equation of the plane that contains the line $\vec{r}(t) = \langle 4 - 2t, t, 5 - 4t \rangle$ and the point $(1, 1, 1)$.
9. Determine the equation of two planes whose intersection is the y -axis. Neither plane that you use can be the xy -plane or yz -plane.

Hint: If the intersection of the two planes is the y -axis, then both planes must contain the point $(0, 0, 0)$.