Line/plane intersections and angles

6 questions | 12 marks

Equivalent correct methods earn the corresponding marks.

1. Intersect $t(1, 1, 1)$ with $x + y + z = 6$. [2 marks]

The plane equation gives $3t = 6$.

Substitute $t = 2$.

Answer: $(2, 2, 2)$

2. Does $(0, 0, 1) + t(1, 0, 0)$ meet $z = 0$? [2 marks]

Its z coordinate remains 1.

It is a distinct parallel line.

Answer: No.

3. Find the smaller angle between $x = 0$ and $x + y = 0$. [2 marks]

Use normals $(1, 0, 0)$ and $(1, 1, 0)$.

Their smaller-angle cosine is $\frac{1}{\sqrt{2}}$.

Answer: 45°

4. Find the smaller angle of direction $(0, 0, 1)$ with $z = 2$. [2 marks]

The line direction is parallel to the plane normal.

It is perpendicular to the plane.

Answer: 90°

5. Find the intersection line of $x + y = 1$ and $z = 2$. [2 marks]

Set $y = t$.

Then $x = 1 - t$ and $z = 2$.

Answer: $\mathbf{r} = (1, 0, 2) + t(-1, 1, 0)$.

6. Find k so $(0, 0, k) + t(1, -1, 0)$ lies in $x + y + z = 3$. [2 marks]

The direction contributes zero to $x + y + z$.

The initial point must satisfy the plane.

Answer: $k = 3$