

Starter Quiz

1. Find the area of the triangle with vertices $(0, 0, 0)$, $(1, 2, 0)$ and $(3, 1, 0)$.
- _____
2. Find the distance from $(1, 1, 1)$ to the plane $x + 2y + 2z = 14$.
- _____
3. The vector projection of $(2, 3)$ onto $(1, 1)$ is
- ☐ $(5, 5)$

☐ $(1, 1)$

☐ $(2, 3)$

☐ $(2.5, 2.5)$
4. $(1, 2, -1)$ and $(3, -1, 1)$ are perpendicular.
- ☐ True

☐ False
5. For $\mathbf{u}, \mathbf{v}, \mathbf{w} \in \mathbb{R}^3$, if $\mathbf{u} \cdot (\mathbf{v} \times \mathbf{w}) = 0$, the three vectors are linearly _____.
- _____
6. The zero vector makes a right angle with every nonzero vector because their dot product is zero.
- ☐ True

☐ False
7. Find the signed scalar component of $(-2, 1)$ in the direction $(1, 0)$.
- _____
8. Find the nearest point to $(4, 3)$ on the line $(1, 1) + t(1, 1)$.
- ☐ $(4, 3)$

☐ $(5/2, 5/2)$

☐ $(1, 1)$

☐ $(7/2, 7/2)$
9. If $\mathbf{u} \times \mathbf{v} = (2, -1, 4)$, what is $\mathbf{v} \times \mathbf{u}$?
- ☐ $\sqrt{21}$

☐ $(-2, -1, -4)$

☐ $(2, -1, 4)$

10. The equation $0x + 0y + 0z = 0$ describes one plane with normal $(0, 0, 0)$.

☐ True

☐ False

1. **2.5**

Use edges (1,2,0) and (3,1,0) from the origin. Their cross product is (0,0,-5); its length is 5, so the triangle area is $5/2$.

2. **3**

The nonzero normal is (1,2,2), of length 3. The signed numerator is $1+2+2\cdot 14=-9$; take its absolute value and divide by 3. The nearest point is (2,3,3).

3. **(2.5, 2.5)**

The coefficient is $(2+3)/(1+1)=5/2$. Multiply the target vector (1,1) by it to obtain (5/2,5/2); the remainder (-1/2,1/2) is perpendicular to (1,1).

4. **True**

Both vectors are nonzero and their dot product is $3\cdot 2-1=0$, so they are perpendicular.

5. **dependent**

The scalar triple product is the determinant of the three vectors. It vanishes exactly when they are linearly dependent; the spanned parallelepiped has zero volume.

6. **False**

The zero vector has no direction and no defined angle. The angle formula requires both lengths to be nonzero.

7. **-2**

Divide the dot product -2 by the target length 1. The signed component is -2; its absolute value 2 is the projection length.

8. **(7/2, 7/2)**

Project displacement (3,2) onto (1,1): coefficient 5/2. Add (1,1) back to obtain (7/2,7/2). The residual (1/2,-1/2) is perpendicular to the line.

9. **(−2, 1, −4)**

Swapping the order reverses every component of the vector; its length stays the same.

10. **False**

Every point in space satisfies this equation. A plane equation needs a nonzero normal.