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1. Write the equation of the plane that passes through $A(1,2,-4)$, $B(2,-6,3)$, and $C(1,1,1)$.

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2. Let $\mathcal{P}$ be the plane $2x - 3y + z = 0$, and consider the points $A = (1,1,1)$, $B = (1,2,1)$ and $C = (1,0,1)$

   (a) Find the distances from A, B, and C to $\mathcal{P}$.

   (b) What can you say about the location of each point in relation to the plane?

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3. Find the angle between the planes $\mathcal{P}$, $2x + y - z = 3$, and $\mathcal{Q}$, $-x + 4y - z = 5$.

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4. Given any 4 points in 3-dimensional space, if we connect these points in pairs, we get a 3-dimensional "pyramid" with four triangular faces, called a *tetrahedron* (plural, *tetrahedra*).

   (a) Find the volume of the tetrahedron whose four vertices are $(0,0,0)$, $(1,0,0)$, $(0,1,0)$, and $(0,0,1)$.

   (b) Find the volume of the tetrahedron whose four vertices are $(1,-1,2)$, $(2,0,-1)$, $(1,1,3)$, and $(-2,1,1)$.

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5. Either show the statements are true or give a counterexample. In each case, $\vec{\mathbf{w}} \neq \vec{0}$.

   (a) If $\vec{\mathbf{u}} \cdot \vec{\mathbf{w}} = \vec{\mathbf{v}} \cdot \vec{\mathbf{w}}$, then $\vec{\mathbf{u}} = \vec{\mathbf{v}}$.

   (b) If $\vec{\mathbf{u}} \times \vec{\mathbf{w}} = \vec{\mathbf{v}} \times \vec{\mathbf{w}}$, then $\vec{\mathbf{u}} = \vec{\mathbf{v}}$.

   (c) If $\vec{\mathbf{u}} \cdot \vec{\mathbf{w}} = \vec{\mathbf{v}} \cdot \vec{\mathbf{w}}$ and $\vec{\mathbf{u}} \times \vec{\mathbf{w}} = \vec{\mathbf{v}} \times \vec{\mathbf{w}}$, then $\vec{\mathbf{u}} = \vec{\mathbf{v}}$.

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6. For each of the following, determine if the three points determine a unique plane. If so, give an equation for that plane.

   (a) $(0,1,0)$, $(0,2,0)$, $(0,3,0)$.

   (b) $(0,1,0)$, $(0,2,0)$, $(1,0,0)$.

   (c) $(1,-1,2)$, $(2,1,3)$, $(-1,2,-1)$.

   (d) $(1,-1,2)$, $(2,1,3)$, $(-5,-13,-4)$.
