

- For each of the following planes containing the points A, B, C , write (i) a vector equation AND (ii) an equation in standard form for the plane.
 - $A(2, 1, -1), B(-3, 0, -5)$ and $C(5, 1, 3)$.
 - $A(3, 2, 1), B(-2, 0, -1)$ and $C(8, 1, 3)$.
- Define the vectors $\mathbf{u}, \mathbf{v}, \mathbf{w}$ as follows: $\mathbf{u} = (1, 2, -3), \mathbf{v} = (-3, 0, 1), \mathbf{w} = (0, 1, 2)$. Find the following:
 - $\mathbf{v} - \mathbf{u}$
 - The magnitude (norm) of \mathbf{v} .
 - The magnitude of $3\mathbf{w}$
 - The vector \mathbf{x} satisfying $2\mathbf{v} + 3\mathbf{u} - \mathbf{x} = \mathbf{w} - 2\mathbf{x}$.
 - A unit vector in the opposite direction of \mathbf{u} .
 - A unit vector perpendicular to \mathbf{u} .
- Do the trios of points below form the vertices of a right triangle in \mathbb{R}^3 ?
 - $A(1, 1, 1), B(2, 4, 1), C(-4, 6, 3)$
 - $A(1, 1, 1), B(2, 1, 1), C(0, 1, 2)$
- Find the vector equation for the line:
 - Through $P(2, 4, 1)$ and parallel to $\mathbf{u} = (3, 6, 6)$
 - Through $P(1, 3)$ and parallel to the line $L : 2x - 7y = 14$
 - Through $P(1, 2, 3)$ and orthogonal to both $\mathbf{u} = (1, 1, 1)$ and $\mathbf{v} = (2, 3, 1)$.
- Find the equation of the plane:
 - Through $(1, 2, 3)$ and parallel to both $\mathbf{u} = (1, 1, 1)$ and $\mathbf{v} = (2, 3, 1)$ (in vector form)
 - Through $(1, 2, 3)$ and orthogonal to $\mathbf{u} = (1, 1, 1)$ (in general form)
 - Through the points $P(1, 2, 3), Q(2, 2, 2)$, and $R(3, 2, 0)$ (in parametric form)

ANSWERS:

- (i) $(x, y, z) = (2, 1, -1) + s(5, 1, 4) + t(-3, 0, -4)$ (ii) $4x - 8y - 3z = 3$
 - (i) $(x, y, z) = (3, 2, 1) + s(5, 2, 2) + t(-5, 1, -2)$ (ii) $2x - 5z = 1$
- $(-4, -2, 4)$ (c) $3\sqrt{5}$ or $\sqrt{45}$ (e) $\frac{1}{\sqrt{14}}(-1, -2, 3)$
 - $\sqrt{10}$ (d) $\mathbf{x} = (3, -5, 9)$ (f) $\frac{1}{\sqrt{3}}(1, 1, 1)$
- Yes, The angle at vertex B is a right angle (i.e. \overrightarrow{AB} and \overrightarrow{BC} are orthogonal)
 - No. None of the vertices coincide with a right angle.
- $(x, y, z) = (2, 4, 1) + t(3, 6, 6)$
 - $(x, y) = (1, 3) + t(7, 2)$
 - $(x, y, z) = (1, 2, 3) + t(-2, 1, 1)$
- $(x, y, z) = (1, 2, 3) + s(1, 1, 1) + t(2, 3, 1)$
 - $x + y + z = 6$
 - $x = 1 + t + s, y = 2, z = 3 - t - 2s$