**Question 1:** Let $P$ be the point $(1, 3, 7)$. Determine the point $Q$ if the point $R(4, 0, -6)$ is $3/4$ of the distance from $P$ to $Q$.

**[3]**

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**Question 2:** Determine all values of $t$, if any, for which $\mathbf{u} = (4, -1)$ is parallel to $\mathbf{v} = (1, t^2)$.

**[3]**

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**Question 3:** Determine if the point $(-8, 8, 3, -1, 7)$ lies on the plane through the origin that is parallel to $\mathbf{u} = (2, 1, 0, 1, -1)$ and $\mathbf{v} = (-2, 3, 1, 0, 2)$.

**[4]**

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**Question 4:** Find a unit vector parallel to the $yz$-plane that is orthogonal to $\mathbf{v} = (2, 5, -3)$.

**[3]**

**Question 5:** Simplify $(\mathbf{u} - \text{proj}_{\mathbf{v}}\mathbf{u}) \bullet \text{proj}_{\mathbf{v}}\mathbf{u}$ (a sketch may help.)

**[3]**

**Question 6:** Determine the area of the triangle in $\mathbb{R}^3$ with vertices $P_1(4, 1, -1)$, $P_2(-2, 0, 1)$ and $P_3(-1, 0, 2)$.

**[4]**

**Question 7:** Find an equation of the plane containing the lines $\mathbf{x} = (5, 0, -2) + t(-1, 1, 3)$ and $\mathbf{x} = (4, 1, 1) + t(2, 1, -2)$. State your answer in the form $ax + by + cz = d$.

**[5]**

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**Question 8:** Find the distance from the point $Q(1, 8)$ to the line $3x + y = 5$ .

**[5]**

**Question 9:** Find an equation of the plane that contains the point $(7, 0, -2)$ and that is parallel to the plane $\mathbf{x} = (1, 2, 3) + r(-1, 1, 4) + t(0, 3, -2)$. State your answer in the form $ax + by + cz = d$.

**[5]**

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**Question 10:** Determine whether the points $P_1(4, 1, -1)$, $P_2(-2, 0, 1)$, $P_3(1, 1, 1)$ and $P_4(-1, 0, 2)$ all lie in the same plane.

**[5]**

**Question 11:** A box has length 3, width 2 and height 1. Consider the line segment joining the two corners of the box that are furthest apart. What angle does this line make with the bottom of the box? State your answer in degrees rounded to one decimal place.

**[5]**

**Question 12:** Let $\mathbf{u} = (c, 1, c)$, $\mathbf{v} = (1, c, 1)$, $\mathbf{w} = (c, 1, 1)$. Determine all values of $c$ for which $\text{span}\{\mathbf{u}, \mathbf{v}, \mathbf{w}\} = \mathbb{R}^3$ .

**[5]**