1. For \( A(-1, 2, 3) \), \( B(2, 0, -1) \) and \( C(-3, 2, -4) \) find:
   a. the equation of the plane defined by \( A \), \( B \) and \( C \)
   b. the measure of angle \( CAB \)
   c. \( r \), given that \( D(r, 1, -r) \) is a point such that angle \( BDC \) is a right angle.

2. a. Find where the line through \( L(1, 0, 1) \) and \( M(-1, 2, -1) \) meets the plane with equation \( x - 2y - 3z = 14 \).
   b. Find the shortest distance from \( L \) to the plane.

3. Given \( A(-1, 2, 3) \), \( B(1, 0, -1) \) and \( C(1, 3, 0) \), find:
   a. the normal vector to the plane containing \( A \), \( B \) and \( C \)
   b. \( D \), the fourth vertex of parallelogram \( ACBD \)
   c. the coordinates of the foot of the perpendicular from \( C \) to the line \( AB \).

4. Show that the line \( x - 1 = \frac{y + 2}{2} = \frac{z - 3}{4} \) is parallel to the plane \( 6x + 7y - 5z = 8 \) and find the distance between them.

5. Consider the lines with equations \( \frac{x - 3}{2} = \frac{y - 4}{-2} = \frac{z + 1}{-2} \) and \( x = -1 + 3t \).
   a. Are the lines parallel, intersecting or skew? Justify each answer.
   b. Determine the cosine of the acute angle between the lines.

6. For \( A(2, -1, 3) \) and \( B(0, 1, -1) \), find:
   a. the vector equation of the line through \( A \) and \( B \), and hence
   b. the coordinates of \( C \) on \( AB \) which is 2 units from \( A \).

7. Find the equation of the plane through \( A(-1, 2, 3) \), \( B(1, 0, -1) \) and \( C(0, -1, 5) \). If \( X \) is \( (3, 2, 4) \), find the angle that \( AX \) makes with this plane.

8. a. Find all vectors of length 3 units which are normal to the plane \( x - y + z = 6 \).
   b. Find a unit vector parallel to \( \mathbf{i} + \mathbf{r} \mathbf{j} + 3\mathbf{k} \) and perpendicular to \( 2\mathbf{i} - \mathbf{j} + 2\mathbf{k} \).
   c. The distance from \( A(-1, 2, 3) \) to the plane with equation \( 2x - y + 2z = k \) is 3 units. Find \( k \).

9. Use vector methods to determine the measure of angle \( QDM \) given that \( M \) is the midpoint of \( PS \) of the rectangular prism.

10. \( P(-1, 2, 3) \) and \( Q(4, 0, -1) \) are two points in space. Find:
    a. \( \overline{PQ} \)    b. the angle that \( \overline{PQ} \) makes with the \( X \)-axis.
REVIEW SET 17C

1a  $14x + 29y - 4z = 32$
   b  $55.86^o$
   c  $r = \frac{2 \pm \sqrt{10}}{2}$

2a They do not meet, the line is parallel to the plane.
   b  $\frac{16}{\sqrt{14}}$ units

3a $\mathbf{n} = [5, -1, 3]$  
   b  D$(-1, -1, 2)$  
   c  $(\frac{1}{2}, \frac{5}{2}, \frac{3}{2})$
4  $\frac{31}{\sqrt{170}}$ units

5a intersecting  
   b  $\frac{10}{3\sqrt{15}}$ units

6a $[x, y, z] = [2, -1, 3] + t[-2, 2, -4]$, $t \in \mathbb{R}$
   b  $\left(2 - \frac{2}{\sqrt{3}}, -1 + \frac{2}{\sqrt{3}}, 3 - \frac{4}{\sqrt{3}}\right)$ and
   $\left(2 + \frac{3}{\sqrt{3}}, -1 - \frac{2}{\sqrt{3}}, 3 + \frac{4}{\sqrt{3}}\right)$

7  $4x + 2y + z = 3$, $\approx 64.12^o$

8a $[\sqrt{3}, -\sqrt{3}, \sqrt{3}]$ and $[-\sqrt{3}, \sqrt{3}, -\sqrt{3}]$
   b  $\frac{1}{\sqrt{2}}i + \frac{6}{\sqrt{2}}j + \frac{1}{\sqrt{2}}k$ or $-\frac{1}{\sqrt{2}}i - \frac{6}{\sqrt{2}}j - \frac{1}{\sqrt{2}}k$
   c  $k = -7$ or 11

9  $\approx 26.4^o$

10a $\overrightarrow{PQ} = [5, -2, -4]$  
   b  $\approx 41.8^o$