

### Homework/ Vectors, equations of lines and planes

**Q1/** Show that the line through the points  $(0,1,1)$  and  $(1,-1,6)$  is perpendicular to the line through the points  $(-4,2,1)$  and  $(-1,6,2)$ .

**Q2/** Find an equation of the plane that passes through the points  $(1,-2,-1)$  and  $(2, 5, 6)$  and is parallel to the x-axis.

**Q3/** Find an equation of the plane that contains the point  $(4,-1, 3)$  and is perpendicular to the vector  $\mathbf{n}=2\mathbf{i}+8\mathbf{j}-5\mathbf{k}$

**Q4/** Find the equation of the plane containing the point  $(1, 3,-1)$  and perpendicular to the planes  $\mathbf{x}+\mathbf{y}-2\mathbf{z}=1$  and  $2\mathbf{x}+\mathbf{y}+\mathbf{z}=2$ .

**Q5/** Find an equation of the plane containing the point  $(0, 1, 1)$  and perpendicular to the line passing through the points  $(2, 1, 0)$  and  $(1, -1, 0)$ . Also find the area of the triangle.

**Q6/** Given the points  $\mathbf{P}=(0, 1, 0)$ ,  $\mathbf{Q}=(-1,1, 2)$  and  $\mathbf{R}=(2, 1,-1)$

- 1- Find the angle between  $\overrightarrow{\mathbf{QP}}$  and  $\overrightarrow{\mathbf{QR}}$ .
- 2- Find the vector projection of  $\overrightarrow{\mathbf{PR}}$  in the direction of  $\overrightarrow{\mathbf{PQ}}$ .
- 3- Find parametric equations for the line containing  $\mathbf{P}$  and  $\mathbf{Q}$ .
- 4- Find the area of a triangle  $\mathbf{PQR}$ .
- 5- Find an equation for the plane containing  $\mathbf{P}$ ,  $\mathbf{Q}$ , and  $\mathbf{R}$ .

**Q7/** Let  $\mathbf{L}_1$  be the plane  $(\mathbf{x} + 3\mathbf{y} + \mathbf{z} = 0)$  and  $\mathbf{L}_2$  be the plane  $(2\mathbf{x} + \mathbf{y} - \mathbf{z} = 1)$ . Find:

- 1- The angle between the planes.
- 2- The parametric equations of the line of intersection between the two planes.
- 3- The distance from the plane  $\mathbf{L}_2$  to the **origin**.

**Q8/** given two lines:

$$L_1 \quad x = 1 + c$$

$$y = -2 + 3c$$

$$z = 4 - c$$

$$L_2 \quad x = 2s$$

$$y = 3 + s$$

$$z = -3 + 4s$$

1- Determine whether they intersect each other, or they are parallel, or neither (skew lines).

2- Find the distance from  $\mathbf{P}_1(1, -2, 1)$  to the line  $\mathbf{L}_1$ .