Answer all questions with full solutions. Make sure your work is legible.

1. The equation of a line can be determined using two points on the line.
   1. Find the vector, parametric and symmetric equations of the line through the points (-2, 6, 1) and (2, 1, 3)
   2. Explain the features of the equations of a line that is parallel to the *xy* plane, but does not lie on the plane, and is not parallel to any of the axes.
2. Two given lines are either parallel, skew or intersecting.
   1. Determine, if there is one, the point of intersection of the lines given by the equations

*x* 5 *y* 1 *z* 1 and *x* 6 *y* 7 *z* 2

1 2 4 3 2 5

* 1. Give the equations of two lines that meet at the point (3, 2, -4) and which meet at right angles, but do not use that point in either of the equations. Explain your reasoning.

1. The equation of a plane can be determined using three points on the plane.
   1. Find the vector, parametric and general equations of the plane through the points (3, 1, -2), (-2, 4, 3) and (5, -1, 4)
   2. Give the equation of a plane that crosses the axes at points equidistant from the origin. Explain your reasoning.
2. A line can either lie on a plane, lie parallel to it or intersect it.
   1. Determine, if there is one, the point of intersection between:

the line given by the equation

*x* 3

*y* 1 

*z* 10

# 3 2 4

and the plane given by the equation [*x*, *y*, *z*] = [-6, 3, 6] + *s*[1, 2, 3] + *t*[2, -1, 2]

* 1. Determine the angle between the line and the plane.
  2. Give the equation of a plane and three lines, one of which is parallel to the plane, one of which lies on the plane, and one of which intersects the plane. Explain your reasoning.

1. The angle between two planes can also be determined.
   1. Find the angle between the planes given by the equations [*x*, *y*, *z*] = [4, 3, -2] + *s*[2, 4, -2] + *t*[3, 5, 6] and

[*x*, *y*, *z*] = [1, 3, 4] + *s*[-4, -1, 3] + *t*[5, -1, -2]

* 1. Give the equations of two planes that meet at a 90° angle. Explain your reasoning.

1. A third plane can be found that passes through the line of intersection of two existing planes.
   1. Two planes are given by the equations 3*x* − 2*y* + 3*z* − 10 = 0 and 4*x* - 3*y* + 2*z* - 8 = 0. Find the scalar equation of the plane that passes through the line of intersection of these two planes, and also passes through the point (2, -3, 4).
   2. Give the equations of two planes. Create a third plane that passes through the line of intersection of the original two and which is parallel to the *y*-axis. Explain your reasoning.
2. Three planes can intersect in a number of different ways. For each of the combinations below, find the single point of intersection if there is one. If there isn't, explain how the planes do intersect.

a. 6*x* +2*y* + 3z -9 = 0

-2*x* - 5*y* + 3*z* - 4 = 0 5*x* - *y* + 2*z* + 3 = 0

b. 2*x* − 3*y* + 5*z* − 2 = 0

-5*x* + 2*y* + 2*z* + 5 = 0

-*x* - 4*y* + 12*z* + 1 = 0

1. Give the equations of three planes that meet in three lines. Explain your reasoning.