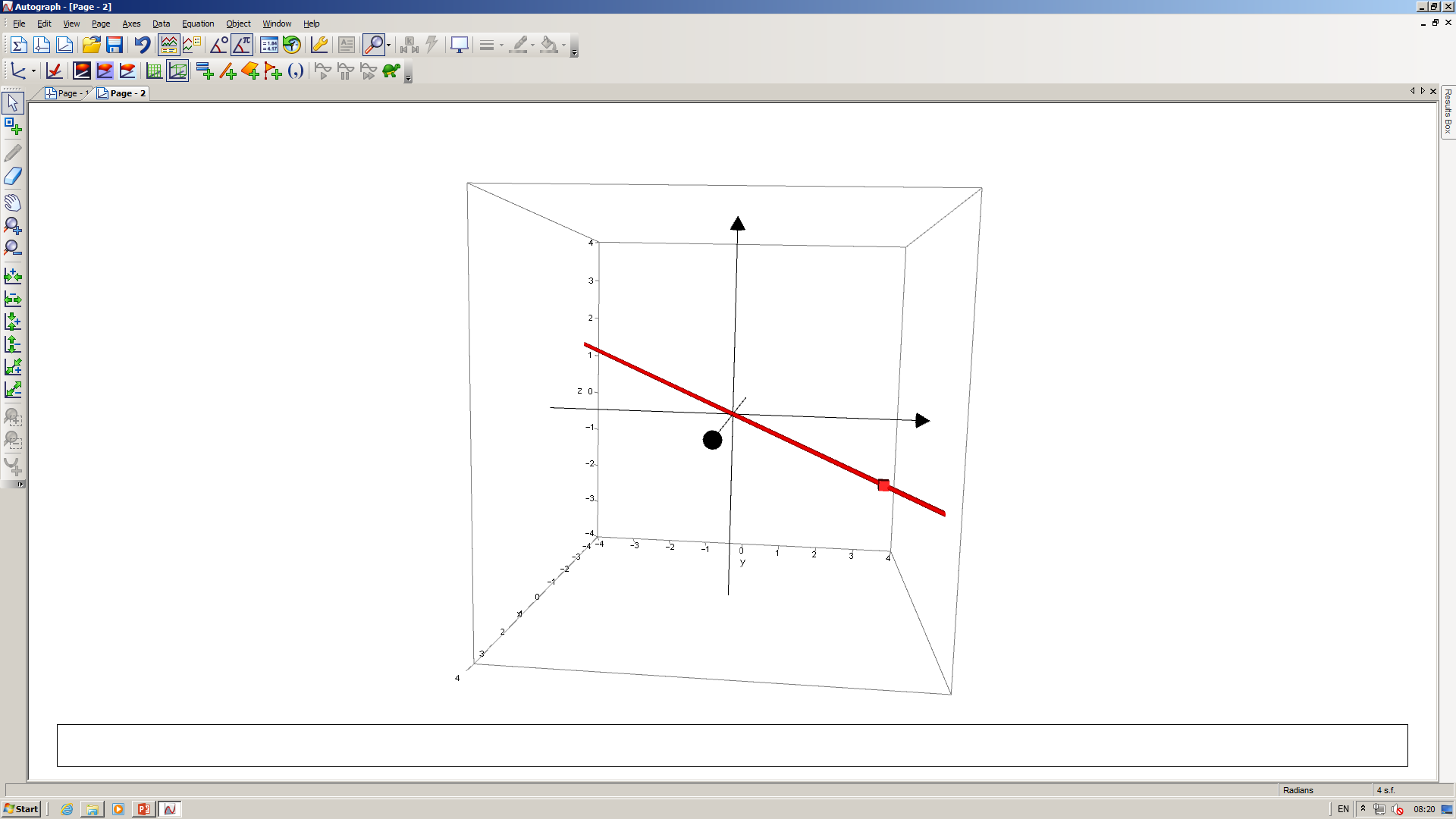
**9A Part 1 3D Lines Introduction**



1. Find the equation of the straight line that passes through the point A, which has position vector , and is parallel to the vector .
2. Find a vector equation of the straight line that passes through the points A and B, with coordinates and respectively.
3. The straight line has vector equation:

Given that the point lies on , find the value of and the value of .

1. The straight line has vector equation:

Show that another vector equation of is:

**9A Part 2 Cartesian 3D Lines**

1. With respect to the fixed origin O, the line is given by the equation:

Prove that a Cartesian form of the equation of is:

1. Find a Cartesian equation of the line with equation:
2. The line has equation:

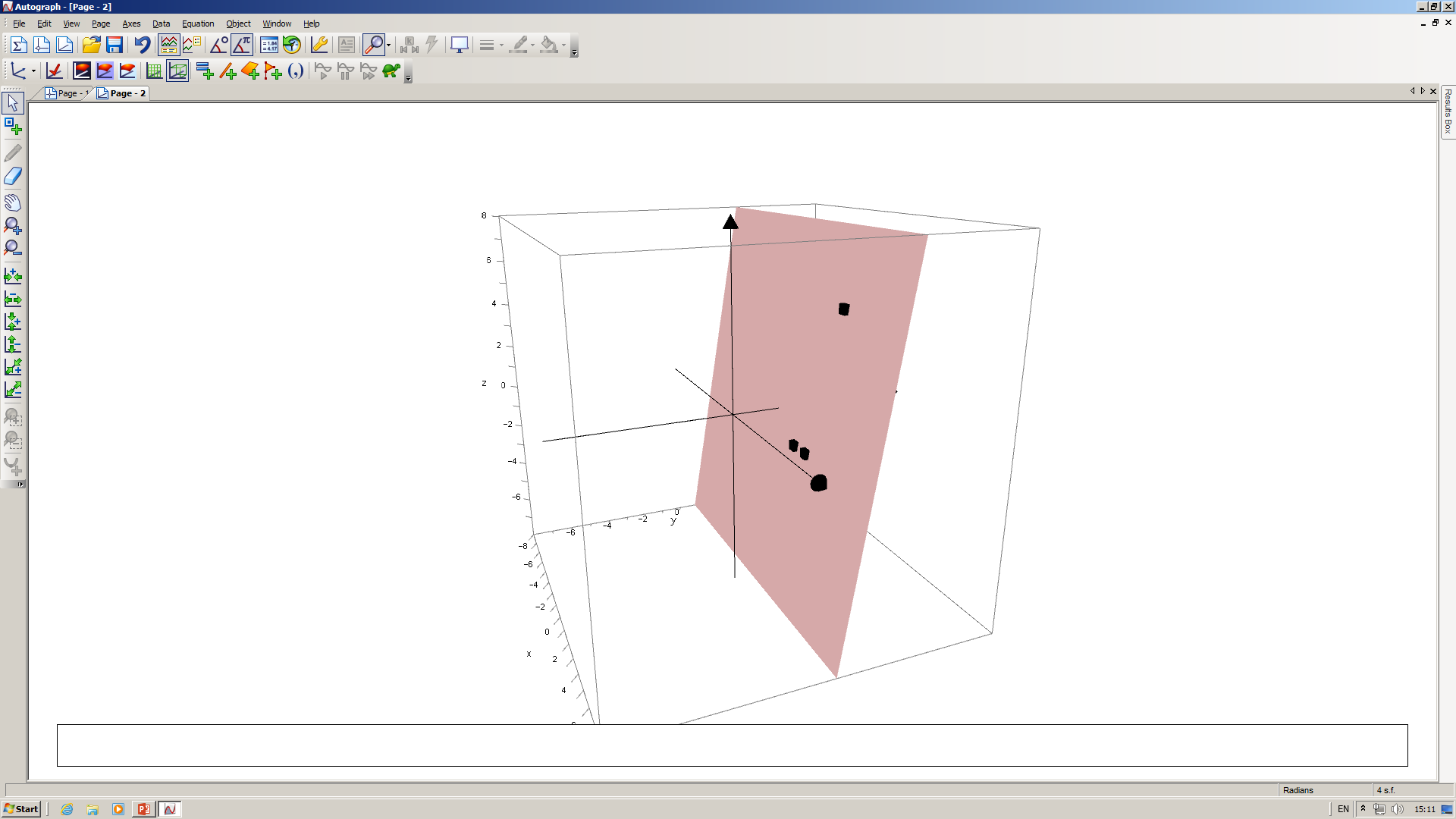
The point has position vector:

1. Show that does not line on
2. Given that a circle, centre , intersects at points and , and that has position vector:

Find the position vector of .

**9B Part 1 3D Planes Introduction**

1. Find, in the form , an equation of the plane that passes through the points , and



1. Verify that the point with position vector lies in the plane with vector equation:

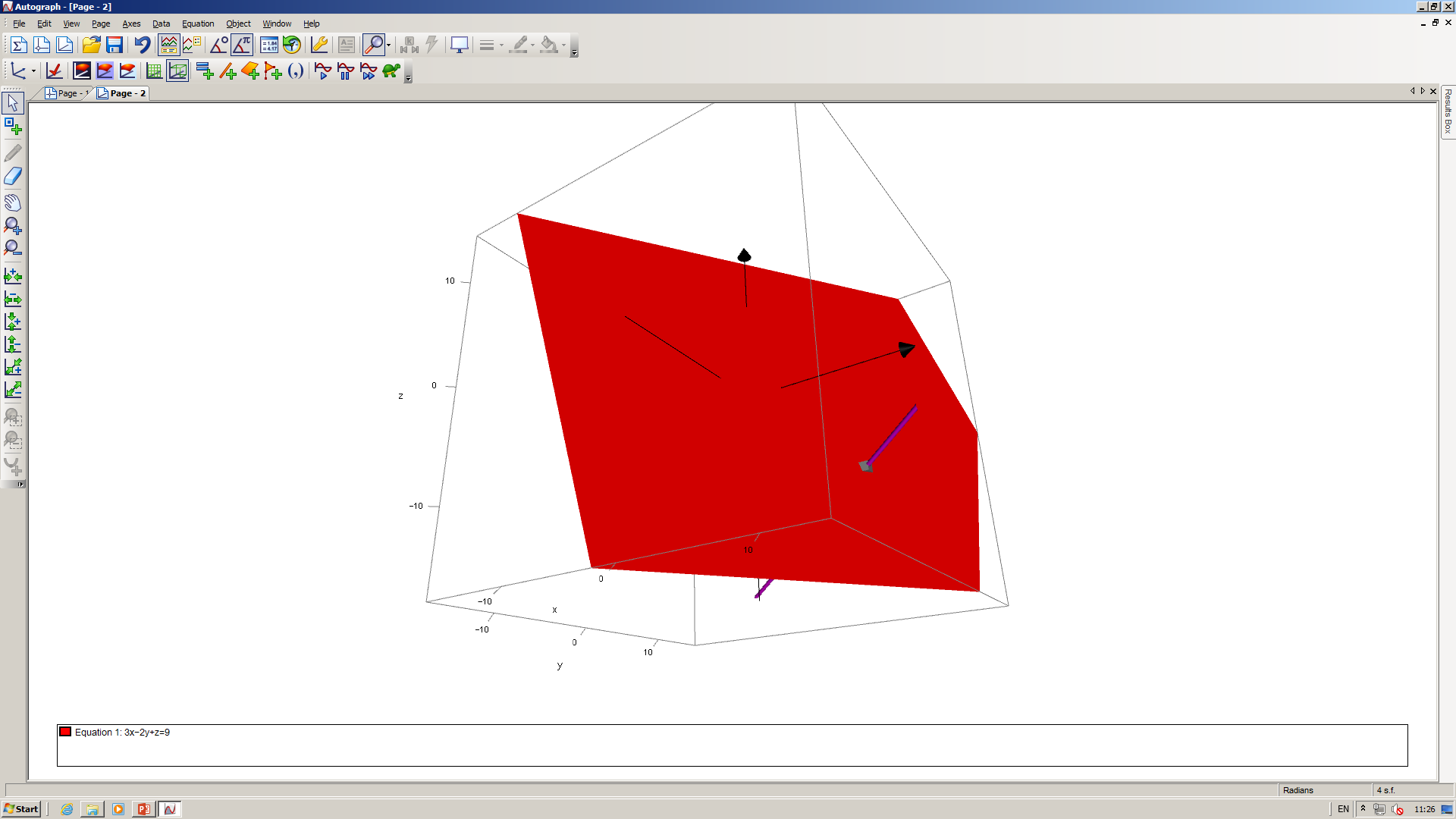
**9B Part 2 Cartesian 3D Planes**

2D notes:

1. The straight line graph has normal vector and passes through . Find the equation of the line.

3D notes:

1. The plane is perpendicular to the normal vector and passes through the point P with position vector . Find a Cartesian equation of .



**9C Scalar Products & Angles Between Lines**

1. Given that and .
2. Find
3. Find the angle between and , giving your answer in degrees to 1 decimal place
4. Given that the vectors and are perpendicular, find the value of **.**
5. Given that and , find a vector which is perpendicular to both and .
6. The points , and have coordinates , and respectively.
7. Find
8. Hence, or otherwise, find the area of triangle

**9D Acute Angles Between Lines & Planes**

1. The lines and have vector equations:

and

Given that and intersect, find the size of the acute angle between the lines, to 1 decimal place.

r.n = k for equation of a plane notes

1. The plane passes through the point and is perpendicular to the vector .

Given that and , with O being the origin, find an equation of the plane:

1. In scalar product form
2. In Cartesian form
3. Find the acute angle between the line with equation:

and the plane with equation:

1. Find the acute angle between the planes with equations and .

**9E Points of Intersection**

1. The lines and have vector equations:

and

Show that the lines intersect, and find their point of intersection.

1. Find the coordinates of the point of intersection of the line and the plane where has equation:

And has equation:

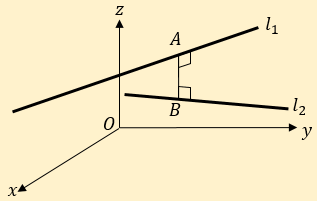
1. The lines and have equations:

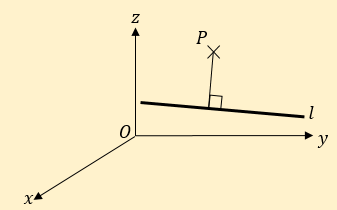
and

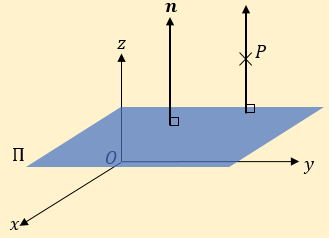
respectively.

Prove that and are skew.

**9F Part 1 Perpendicular Distances with Lines**







1. Show that the shortest distance between the parallel lines with equations:

and

is

1. The lines and have equations:

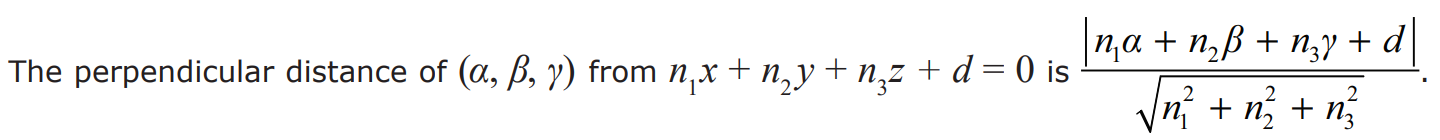
Find the shortest distance between these two lines.

1. The line has equation:

The point has coordinates

1. Find the shortest distance between and .
2. Find a Cartesian equation of the line that is perpendicular to , and passes through .

**9F Part 2 Perpendicular Distances with Lines & Planes**



1. Find the perpendicular distance from the point with coordinates to the plane with equation
2. The plane has equation:

The point has coordinates:

1. Find the shortest distance between and
2. The point is a reflection of in . Find the coordinates of .
3. The line has equation:

The plane has equation:

The line is a reflection of in the plane . Find a vector equation of the line .