INSTRUCTIONS

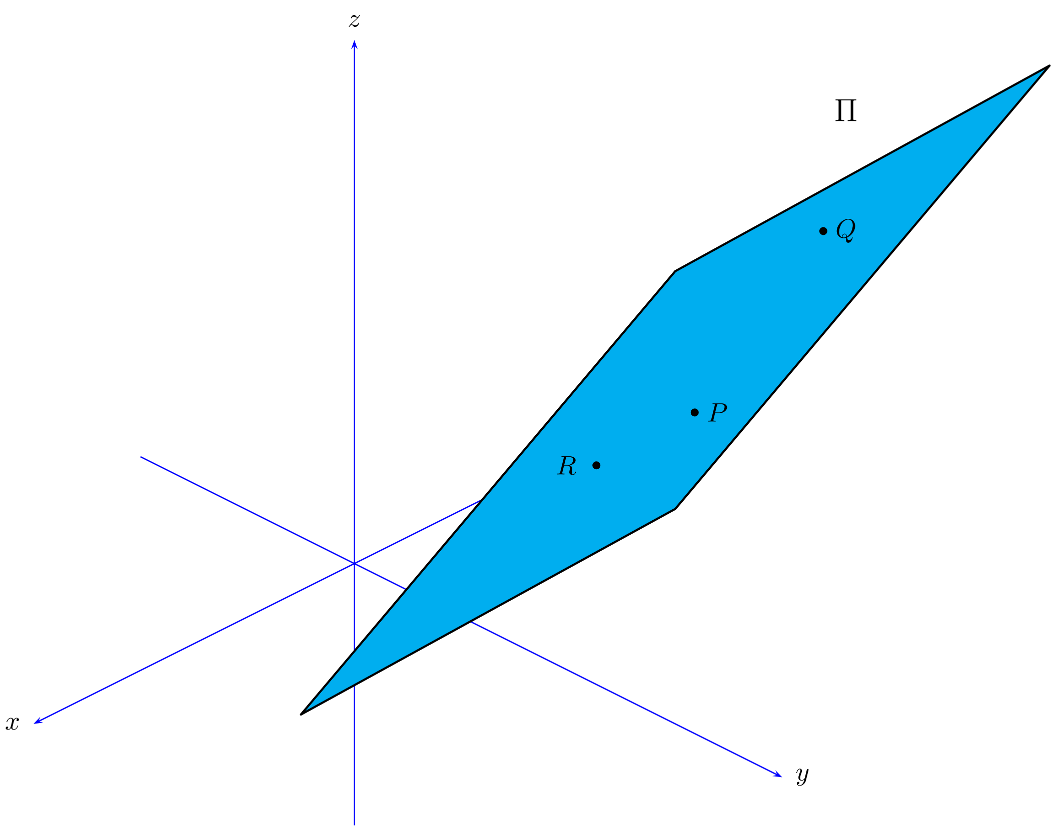
Full marks will be awarded for the correct solutions to **ALL QUESTIONS**. This paper will be marked out of a TOTAL MAXIMUM MARK OF 100. Credit will be given for clearly presented solutions.

BSc (Hons) in Computer Games Development
YEAR 1
CLASS TEST 3

1. Consider the following points in $\mathbb{R}^3$

$$P(1,1,-1) \quad , \quad Q(2,2,2) \quad , \quad R(3,2,0)$$

Find the equation of the plane Π that contain these points.



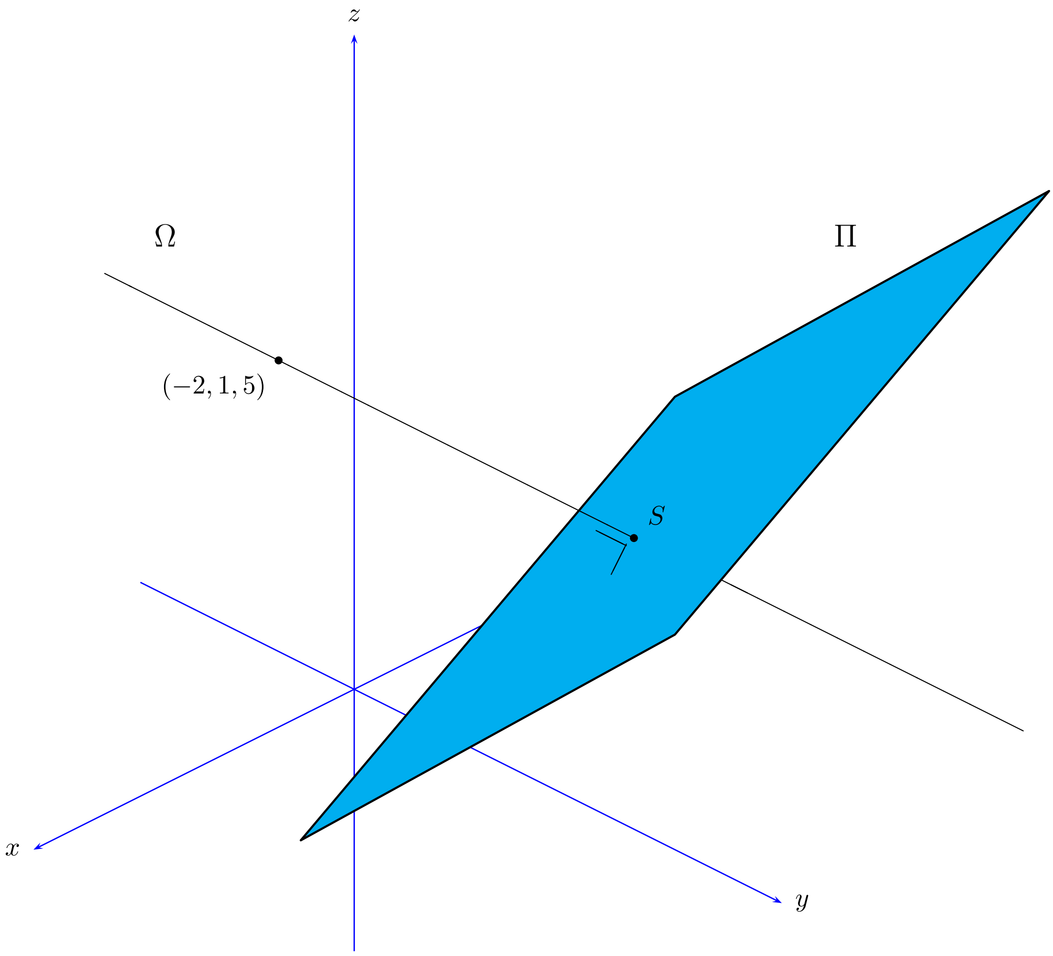
40 marks

2. Consider a line Ω through the point $(-2, 1, 5)$ that is *perpendicular* to the plane Π with equation $4x - 2y + 2z + 1 = 0$.

i Find the parametric equations of the line Ω.

ii Find the point S at which Ω meets Π.

iii Determine the perpendicular distance from the point $T(1, 2, 3)$ to the plane Π.



60 marks

LINES AND PLANES IN $\mathbb{R}^3$:

The perpendicular distance D of a point $P = (x_0, y_0, z_0)$ from the plane $ax + by + cz + d = 0$ is given by

$$D = \frac{|ax_0 + by_0 + cz_0 + d|}{\sqrt{a^2 + b^2 + c^2}}$$

Let Ω be a **line** in $\mathbb{R}^3$.

i Find a point $P_0 = (x_0, y_0, z_0)$ which is on Ω.

ii Find a vector $\vec{v} = (v_1, v_2, v_3)$ which is parallel to Ω.

Then $t\vec{v}$ is also parallel to Ω and the line is the set of all points $P = (x, y, z)$ for which the vector

$$\overrightarrow{P_0P} = (x - x_0, y - y_0, z - z_0)$$

is equal to $t\vec{v}$, or

$$\overrightarrow{P_0P} = t\vec{v}$$

for some $t \in \mathbb{R}$.

Let Π be a **plane** in $\mathbb{R}^3$.

i Find the co-ordinates of a point $P_0 = (x_0, y_0, z_0)$ which is in the plane.

ii Find a vector $\vec{n} = (a, b, c)$ perpendicular to the plane.

Then the plane Π consists of those points $P = (x, y, z)$ for which the vector

$$\overrightarrow{P_0P} = (x - x_0, y - y_0, z - z_0)$$

is orthogonal to $\vec{n}$, or

$$\overrightarrow{P_0P}.\vec{n} = 0$$

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