INSTRUCTIONS

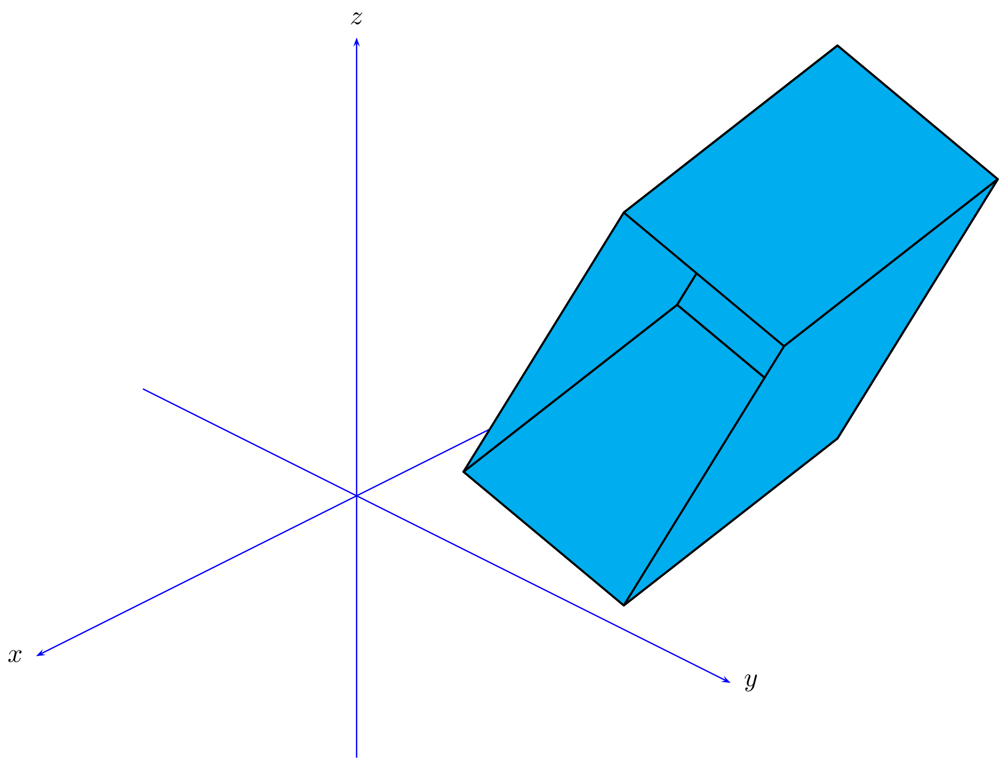
Full marks will be awarded for the correct solutions to ALL QUESTIONS. This paper will be marked out of a TOTAL MAXIMUM MARK OF 100. Credit will be given for clearly presented solutions.

BSc (Hons) in Computer Games Development

YEAR 1

CLASS TEST 3 (SAMPLE PAPER 2)

1.



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

$$A(1,3,2) \ , \ B(3,7,3) \ , \ C(4,5,1) \ , \ D(6,9,2)$$

$$E(1,4,7) \ , \ F(3,8,8) \ , \ G(4,6,6) \ , \ H(6,10,7)$$

Note that

$$\begin{aligned}\overrightarrow{AB} &= \overrightarrow{CD} = \overrightarrow{EF} = \overrightarrow{GH} = (2,4,1)\\ \overrightarrow{AC} &= \overrightarrow{BD} = \overrightarrow{EG} = \overrightarrow{FH} = (3,2,-1)\\ \overrightarrow{AE} &= \overrightarrow{BF} = \overrightarrow{CG} = \overrightarrow{DH} = (0,1,5)\end{aligned}$$

It follows that $A, B, C, D, E, F, G,$ and H are the vertices of a *parallelepiped* in $\mathbb{R}^3$.

Let $\vec{u} = (2,4,1)$, $\vec{v} = (3,2,-1)$ and $\vec{w} = (0,1,5)$.

(a) Calculate the magnitude of the vectors $\overrightarrow{BG}$ and $\overrightarrow{BH}$ and the angle θ between these two vectors at the point B.

20 marks

(b) Determine the equation of the plane passing through the points A, B and F, expressing in the form $ax + by + cz + d = 0$ where a, b, c and d are constants.

25 marks

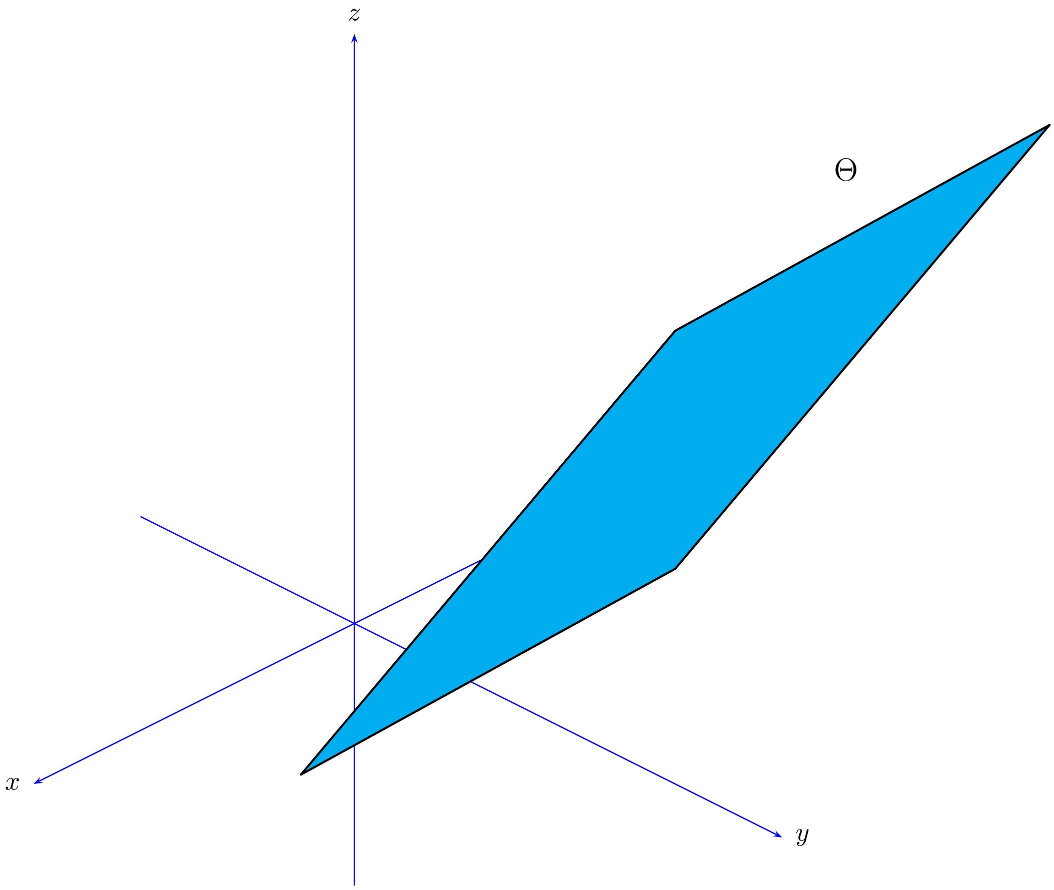
(c) The volume V of the *parallelepiped* is defined as $V = \vec{u}.(\vec{v} \times \vec{w})$. Evaluate V.

25 marks

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

$$P(1,1,-1) \quad , \quad Q(1,-2,4) \quad , \quad R(2,2,0)$$

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



30 marks