

INSTRUCTIONS

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

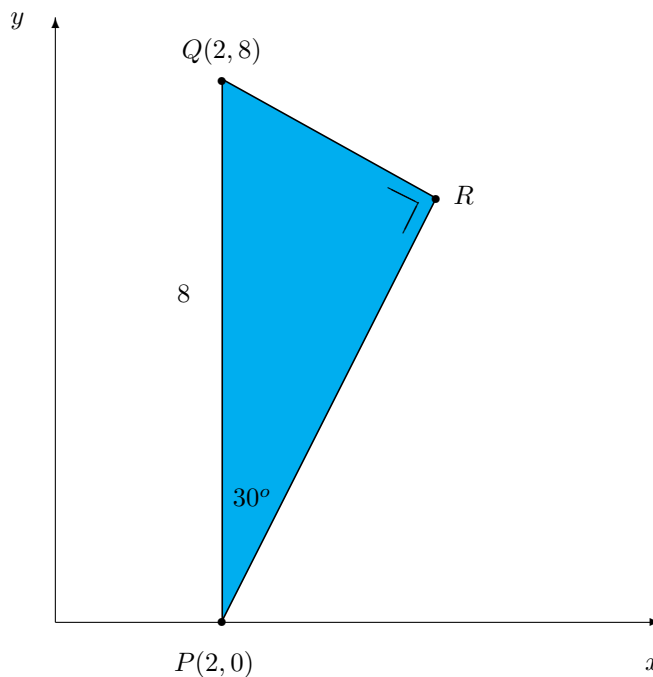
BSc (Hons) in Computer Games Development

Tuesday, October 23rd, 2018

YEAR 1

CLASS TEST 1

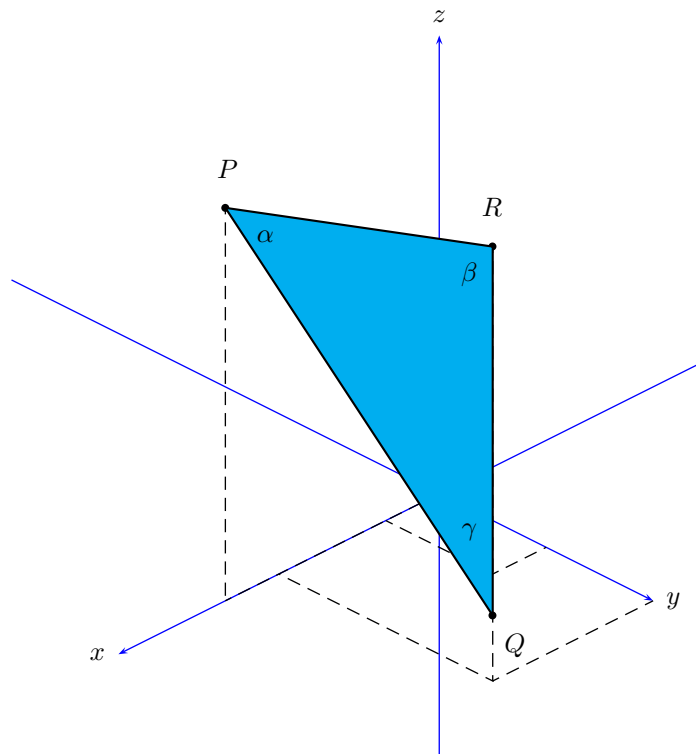
1. This coordinate diagrams in \mathbb{R}^2 shows a right-angled triangle PQR.
 Using *basic trigonometry*, determine the coordinate R .



20 marks

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

$$P(3, 2, -1) \quad , \quad Q(6, 6, 0) \quad , \quad R(4, 0, 5)$$



- i Evaluate $P - 2Q + 3R$.
- ii Determine $\|2P - 4Q\|$.
- iii Evaluate $P \cdot Q$, i.e., the *scalar product* of P with Q.
- iv Evaluate $P \times Q$.
- v Show that the vectors defining this triangle $\triangle PQR$ are *coplanar*.
- vi Determine all internal angles α, β, γ of the triangle $\triangle PQR$.
- vii Determine the area of the triangle $\triangle PQR$.

80 marks

USEFUL INFORMATION

VECTORS IN \mathbb{R}^3 :

For any vector $\vec{u} = (u_1, u_2, u_3)$ in \mathbb{R}^3 , we define the magnitude of \vec{u} to be the non-negative real number

$$\|\vec{u}\| = \sqrt{u_1^2 + u_2^2 + u_3^2}$$

○

Suppose that $\vec{u} = (u_1, u_2, u_3)$ and $\vec{v} = (v_1, v_2, v_3)$ are vectors in \mathbb{R}^3 and that $\theta \in [0, \pi]$ represents the angle between them. We define the scalar product $\vec{u} \cdot \vec{v}$ of \vec{u} and \vec{v} by $\vec{u} \cdot \vec{v} = \|\vec{u}\| \|\vec{v}\| \cos \theta$. Hence

$$\cos \theta = \frac{\vec{u} \cdot \vec{v}}{\|\vec{u}\| \|\vec{v}\|}$$

Note that the scalar product may also be defined as

$$\vec{u} \cdot \vec{v} = u_1 v_1 + u_2 v_2 + u_3 v_3$$

○**Theorem 1**

Suppose that $\vec{u}, \vec{v} \in \mathbb{R}^3$. Then the parallelogram with \vec{u} and \vec{v} as two of its sides has area $\|\vec{u} \times \vec{v}\|$.