Marked example 3

Paper 2 style · Graphic display calculator

3 6 marks AHL 3.12 · 3.13 ●●○ Typical

The points $P(1, 0, 2)$, $Q(4, 1, -1)$ and $R(2, 5, 3)$ are the vertices of a triangle.

(a) Find $\overrightarrow{QP}$ and $\overrightarrow{QR}$. **[2]**

(b) Find the size of the angle $P\hat{Q}R$, in degrees. **[2]**

(c) Find the area of the triangle PQR. **[2]**

MARKSCHEME (a)

$\overrightarrow{QP} = \begin{pmatrix} -3 \\ -1 \\ 3 \end{pmatrix}$ **A1**

$\overrightarrow{QR} = \begin{pmatrix} -2 \\ 4 \\ 4 \end{pmatrix}$ **A1**

Total 2 marks

MARKSCHEME (b)

$\cos\theta = \dfrac{6 - 4 + 12}{\sqrt{19} \times 6} = \dfrac{14}{6\sqrt{19}}$ **M1**

$P\hat{Q}R = 57.6°$ $(57.6355\ldots)$ **A1**

Total 2 marks

MARKSCHEME (c)

$\dfrac{1}{2} \times \sqrt{19} \times 6 \times \sin 57.6\ldots°$ **M1**

11.0 $(11.0453\ldots)$ **A1**

Total 2 marks

Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software.
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