Exercise 3

Paper 2 style · Graphic display calculator

3 6 marks AHL 3.12 · 3.13 ●●○ Typical

The points $P(2, 1, 0)$, $Q(-1, 3, 2)$ and $R(3, -2, 4)$ 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]**

The markscheme is on the next page: try the question first. Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software. Not affiliated with or endorsed by the International Baccalaureate Organization.
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MARKSCHEME (a)

$\overrightarrow{QP} = \begin{pmatrix} 3 \\ -2 \\ -2 \end{pmatrix}$ **A1**

$\overrightarrow{QR} = \begin{pmatrix} 4 \\ -5 \\ 2 \end{pmatrix}$ **A1**

Total 2 marks

MARKSCHEME (b)

$\cos\theta = \dfrac{12 + 10 - 4}{\sqrt{17} \times \sqrt{45}}$ **M1**

$P\hat{Q}R = 49.4°$ $(49.3987\ldots)$ **A1**

Total 2 marks

MARKSCHEME (c)

$\dfrac{1}{2} \times \sqrt{17} \times \sqrt{45} \times \sin 49.39\ldots°$ **M1**

10.5 **A1**

Total 2 marks