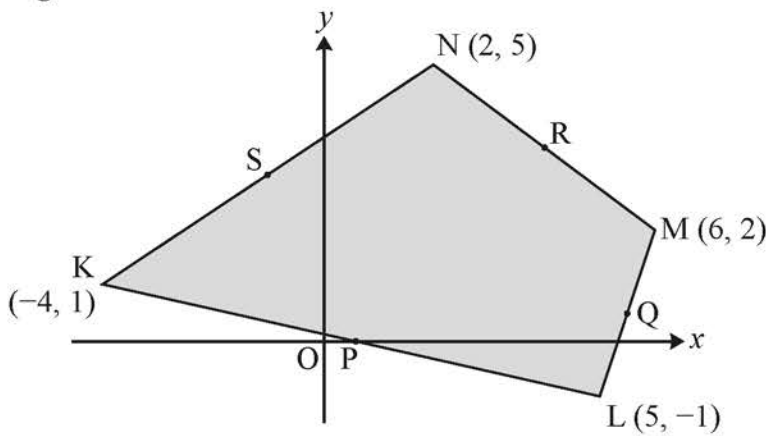**6** **(a)** Quadrilateral KLMN has vertices K $(-4, 1)$, L $(5, -1)$, M $(6, 2)$ and N $(2, 5)$, as shown in **Fig. 6.1**.

Fig. 6.1

(i) Find the coordinates of the following midpoints.

- P, the midpoint of KL
- Q, the midpoint of LM
- R, the midpoint of MN
- S, the midpoint of NK [2]

(ii) Verify that PQRS is a parallelogram. [3]

(b) TVWX is a quadrilateral as shown in **Fig. 6.2**.

Points A and B divide side TV into 3 equal parts. Points C and D divide side VW into 3 equal parts. Points E and F divide side WX into 3 equal parts. Points G and H divide side TX into 3 equal parts.

$\overrightarrow{TA} = \mathbf{a}$, $\quad \overrightarrow{TH} = \mathbf{b}$, $\quad \overrightarrow{VC} = \mathbf{c}$.

Fig. 6.2
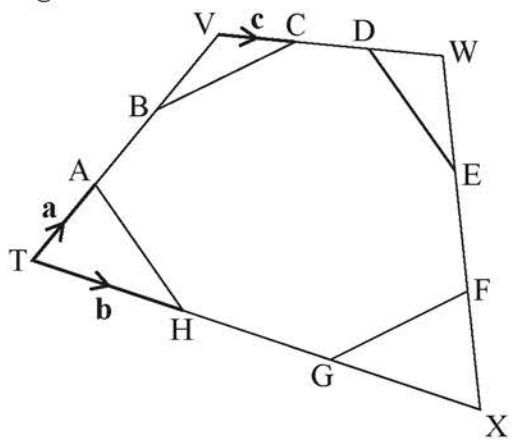
(i) Show that $\overrightarrow{WX} = k(-\mathbf{a} + \mathbf{b} - \mathbf{c})$, where k is a constant to be determined. [1]

(ii) Verify that AH is parallel to DE. [2]

(iii) Verify that BC is parallel to GF. [2]