22. In the diagram, **a** and **b** are two forces acting on an object that is initially at the spot Z. The bearings of **a** and **b** from Z are $010°$ and $060°$ respectively, $|\mathbf{a}| = 40$ N and $|\mathbf{b}| = 60$ N.
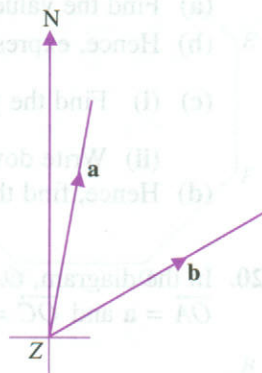
    (a) The resultant force of **a** and **b** is defined as $\mathbf{a} + \mathbf{b}$. Find
       (i) the magnitude of the resultant force,
       (ii) the bearing of the resultant force from Z.

    (b) Suppose that a force **c** is also applied to the object. The new resultant force, $\mathbf{a} + \mathbf{b} + \mathbf{c}$, equals **O** where **O** is the null vector.
       (i) Write down the magnitude of **c**.
       (ii) Find the direction of **c**.

23. In the diagram, $OABC$ is a square of area 36 units^2 and $BDEF$ is a rhombus of area 96 units^2. OD and CE are straight lines, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.
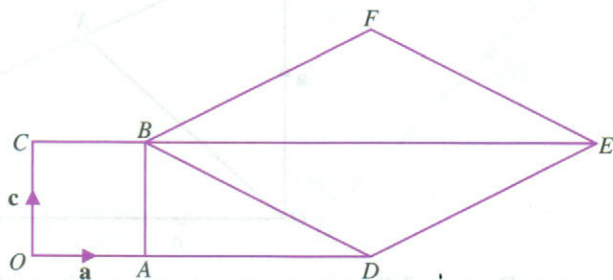
    (a) Find the magnitudes of $\overrightarrow{AD}$ and $\overrightarrow{BD}$.
    (b) Express each of the following vectors in terms of **a** and/or **c**.
       (i) $\overrightarrow{CE}$
       (ii) $\overrightarrow{BD}$
       (iii) $\overrightarrow{BF}$
       (iv) $\overrightarrow{CF}$

    (c) Suppose that FC and DO produced intersect at the point Z.
       (i) Express $\overrightarrow{OZ}$ in terms of **a**.
       (ii) Find the magnitude of $\overrightarrow{OZ}$.

24. (a) In the diagram, the diagonals of a parallelogram, $ABCD$, intersect at M. The position vectors of A, B, C and D with respect to the point O are **a**, **b**, **c** and **d** respectively.
    Show that $\mathbf{a} + \mathbf{c} = \mathbf{b} + \mathbf{d}$.
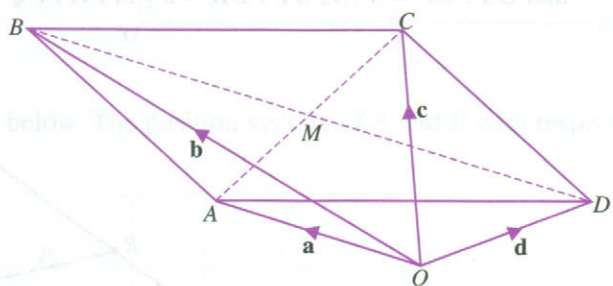
    (b) In the diagram, $OPXY$ is a straight line and $\triangle XYZ$ is an enlargement of $\triangle OPQ$ by a scale factor of 3. The area of $\triangle XYZ$ is 180 cm^2, $OP : OX = 1 : 3$, $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.
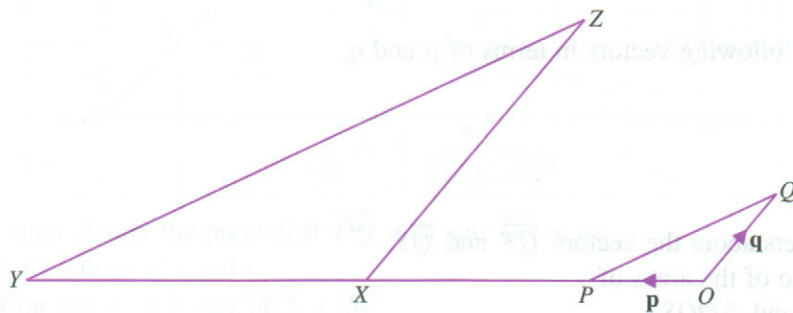
       (i) Express in terms of **p** and **q**, the vectors $\overrightarrow{PZ}$, $\overrightarrow{XQ}$ and $\overrightarrow{QZ}$.
       (ii) Find the areas of $\triangle OPQ$ and $\triangle PXZ$.