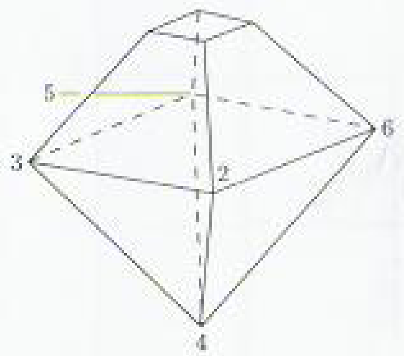
(c) Since σ_O is a symmetry of OCT which commutes with every element of $\Gamma^+(OCT)$, it follows from Theorem 4.1 that

$$\Gamma(OCT) \cong S_4 \times C_2.$$

However, if the vertex 1 is cut off (by a plane parallel to the plane through 2, 3, 5, 6), then σ_O is no longer a symmetry of the new solid OCT_1 thus created.



Explain carefully to which standard group (or product of two standard groups) $\Gamma(OCT_1)$ is isomorphic. [4]

(d) Now suppose that vertex 4 is also cut off OCT_1, forming a solid OCT_2 with two small square faces that can map to each other under a symmetry of OCT_2. Explain carefully to which standard group (or product of two standard groups) $\Gamma(OCT_2)$ is isomorphic. [4]

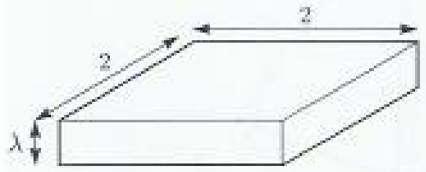
Question 4 (*Unit GE6*)

(a) For each of the following sets **a**, **b**, **c** of vectors in $\mathbb{R}^3$, write down the (plane) lattice type of $L(\mathbf{a}, \mathbf{b})$; find the offset of **c** relative to $\{\mathbf{a}, \mathbf{b}\}$; and hence determine the Bravais lattice type of $L(\mathbf{a}, \mathbf{b}, \mathbf{c})$.

(i) $\mathbf{a} = (5,3,0)$, $\mathbf{b} = (5,-3,0)$, $\mathbf{c} = (10,2,1)$. [4]

(ii) $\mathbf{a} = (8,6,0)$, $\mathbf{b} = (-3,4,0)$, $\mathbf{c} = (\frac{5}{2},5,3)$. [5]

(b) depth λ units, as shown in the figure below.



A crystal pattern C is constructed as follows. A layer of slabs is laid on the xy-plane so that, looking from above, the arrangement looks like the square tiling $\mathcal{R}_4$ as shown in the figure opposite.