

Question 9

Let L be the lattice $L(\mathbf{a}, \mathbf{b})$, where

$$\mathbf{a} = (1, 4) \quad \text{and} \quad \mathbf{b} = (2, 2).$$

- (a) Write down the coordinates of *all* the lattice points which lie inside the circle of radius 4 centred at the origin. (No explanation is required, but you may find it helpful to draw a diagram.) [3]
- (b) Write down a reduced basis for L . [2]

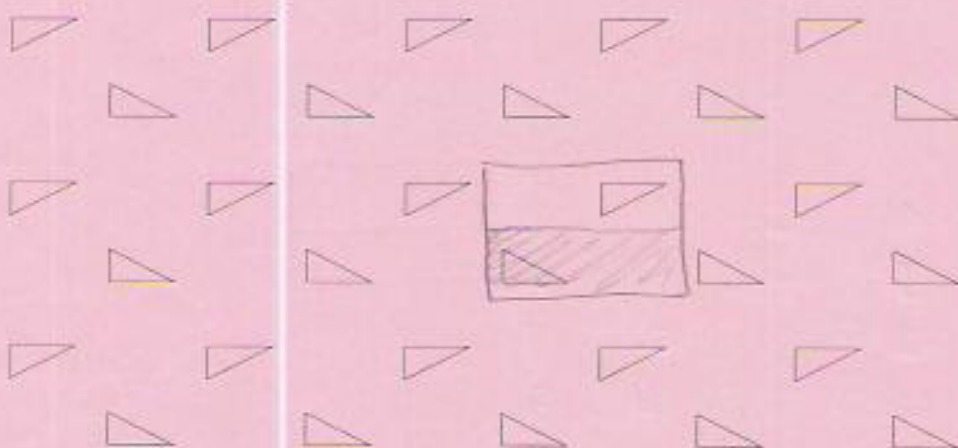
Question 10

Let G be a *non-Abelian* group of order 75. Show that the centre $Z(G)$ of G has order at most 5. [5]

Question 11

Figure 2 on the Figure Sheet is a copy of the figure below, which depicts a wallpaper pattern.

[NOTE: For this Specimen Paper *only* the Figure Sheet is attached to the rest of the paper. It would normally be a separate item to be handed in with your answer book(s).]



- (a) On Figure 2 on the Figure Sheet, draw a basic rectangle of the wallpaper pattern. [1]
- (b) Describe a symmetry of the wallpaper pattern which is *not* possessed by any associated lattice. *$t(a/2) \cdot (0)$* [2]
- (c) On Figure 2 on the Figure Sheet, shade, or otherwise indicate, a portion of your basic rectangle which is a generating region. [2]