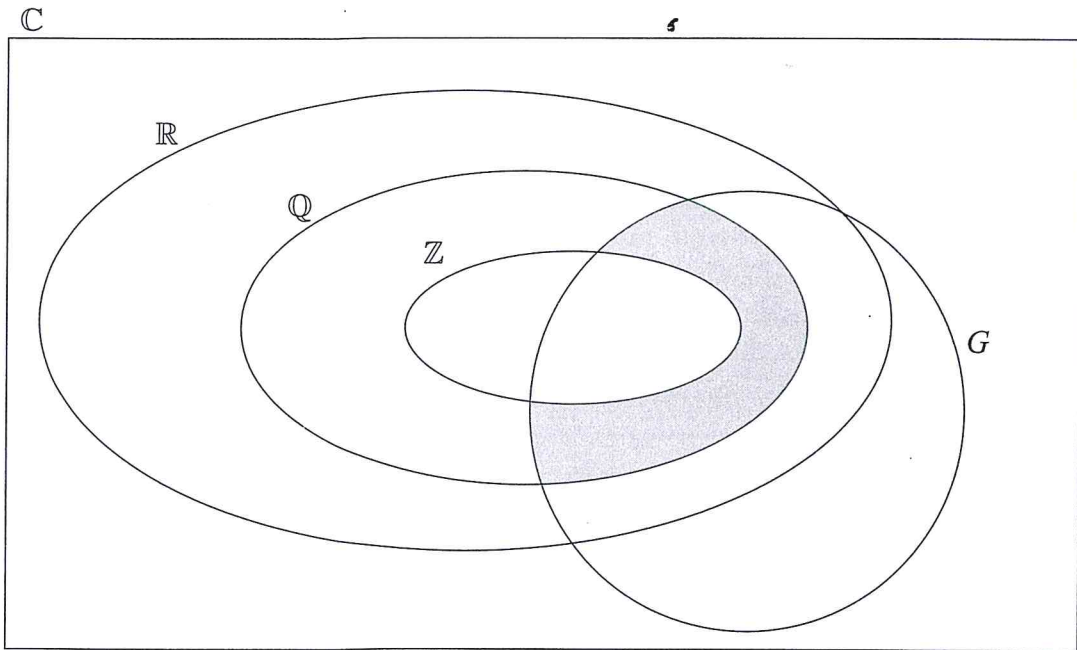Let G be the set $\{x+yi \mid x,y \in \mathbb{Z}, \ i^2 = -1\}$.

Consider the Venn diagram below.

(a) There are three regions in the diagram that represent empty sets. One of these is shaded. Shade in the other two.

(b) Insert each of the following numbers in its correct region on the diagram.
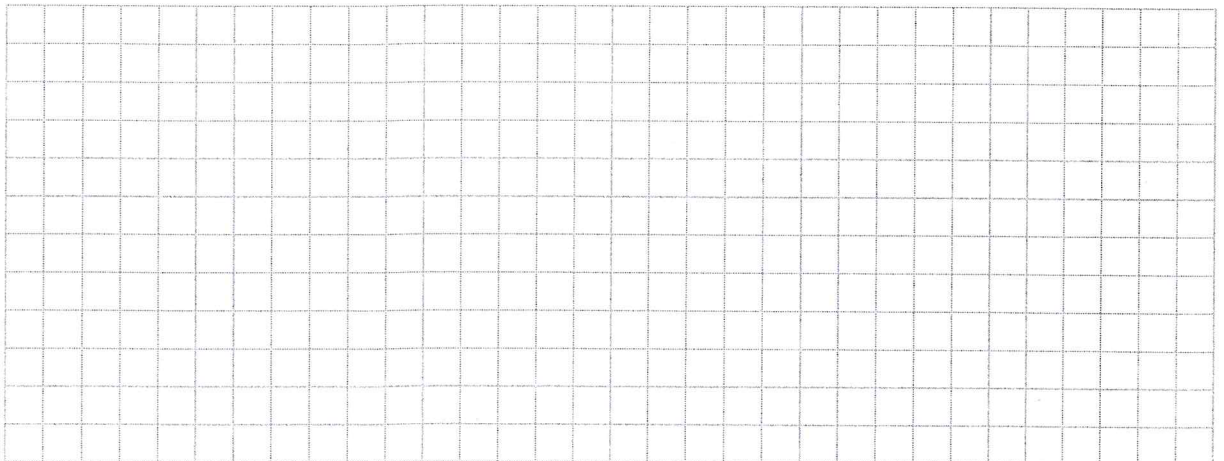
$\sqrt{2}$ 7 $\sqrt{3}-i$

$4+3i$ $\dfrac{1}{2}$ $\dfrac{1}{2}+2i$

(c) Consider the product ab, where $a \in G$ and $b \in \mathbb{Q}$. There is a non-empty region in the diagram where ab cannot be. Write the word "here" in this region.
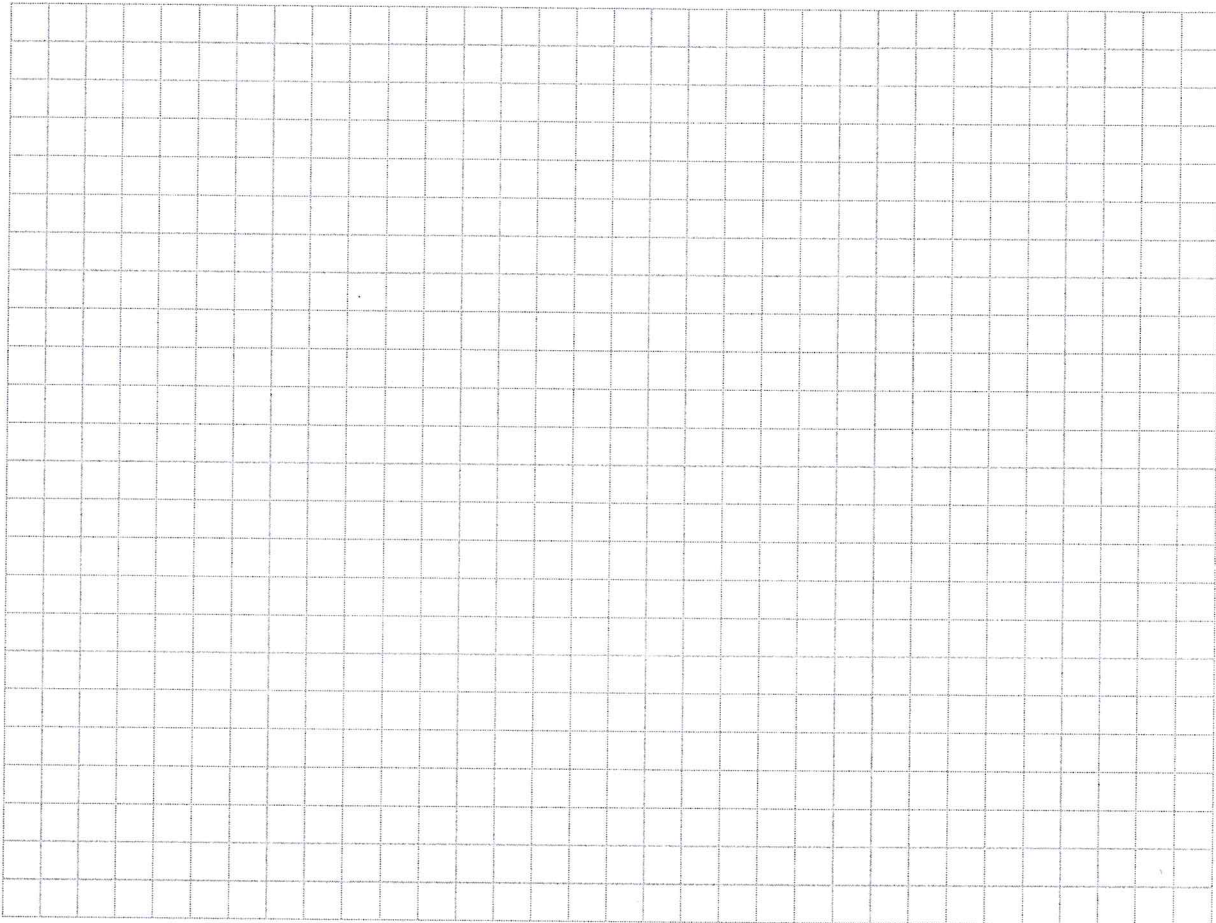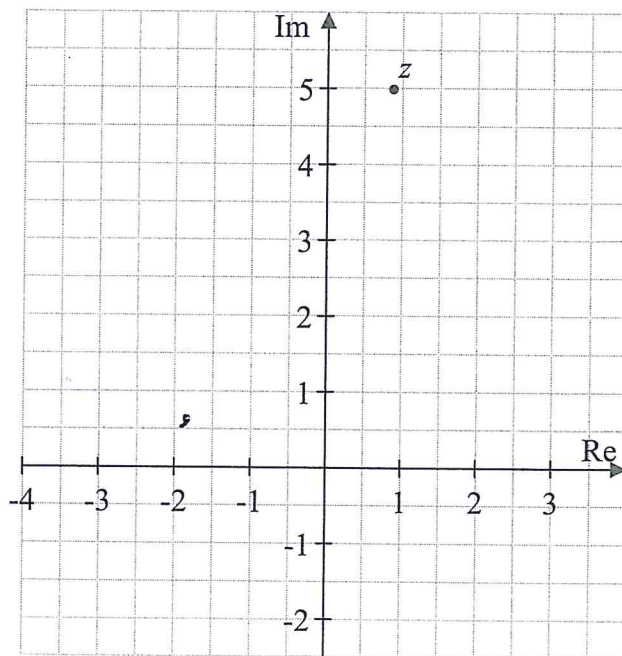
Question 3 (25 marks)

The complex number z has modulus $5\frac{1}{16}$ and argument $\dfrac{4\pi}{9}$.

(a) Find, in polar form, the four complex fourth roots of z.
(That is, find the four values of w for which $w^4 = z$.)

(b) z is marked on the Argand diagram below.
On the same diagram, show the four answers to part **(a)**.

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