

Question 5 (Unit 5) – 15 marks

In this question G is the group of matrices

$$\left\{ \begin{pmatrix} a & b \\ 0 & 1 \end{pmatrix} : a, b \in \mathbb{R}, a \neq 0 \right\}$$

under matrix multiplication.

The group G acts on \mathbb{R}^2 as follows: for $g = \begin{pmatrix} a & b \\ 0 & 1 \end{pmatrix} \in G$ and $(x, y) \in \mathbb{R}^2$ we define

$$g \wedge (x, y) = (ax, y).$$

You are NOT asked to prove either of the statements above.

(a) Find the orbit of

(i) $(1, 0)$;

(ii) $(0, 1)$;

(iii) $(1, 1)$.

Hence deduce the orbits of the action.

[8]

(b) Find the stabilizer of

(i) $(1, 0)$;

(ii) $(0, 1)$;

(iii) $(1, 1)$.

[5]

(c) Find $\text{Fix} \begin{pmatrix} 2 & 1 \\ 0 & 1 \end{pmatrix}$.

[2]

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(Geometry Block)

Question 1 (Unit 1) – 20 marks

This question concerns the point, X , where the medians of a triangle ABC meet. (X is called the centroid of the triangle.) P , Q and R are the midpoints of the sides BC , CA and AB , respectively.

