SAMPLE LESSON: MATHEMATICS

Class: Upper Sixth/ Further Mathematics

Module: Geometry II	**TOPIC:** Complex Numbers
Title of Lesson: Complex number and Plane Transformations	**Duration of Lesson:** 120mins

Name of Authors: Inspectorate of Pedagogy for the Far North Region

Module 4 : **GEOMETRY II**

Topic: Complex Numbers

Lesson: Complex number and Plane Transformations

Objectives: At the end of this lesson, the learners should be able to:

1) Determine the complex expression of some transformations: Translation, reflection, rotation and glide reflection ;
2) Find the image of points with given affixes under the transformations above.

Key question:

How to find and use the complex expression of some plane transformations?

Prerequisite knowledge:

- ✓ Verify whether students can give the characteristic elements of some transformations.

Motivation: The study of complex numbers comes to reinforce our knowledge and skills necessary to study plane geometry.

Didactic materials

Chalk, colour chalk, Chalkboard, ruler and set square.

REFERENCES

- EWANE ROLAND ALUNGE. Further Pure Mathematics Made Easy Third Edition.

-FURTHER Mathematics Teaching Syllabuses (January 2020)

Stages/ Duration	Teaching/Learning activities	Teacher's Activities	Learners' Activities	Learning Points	Observation
Introduction (5mins)	**<u>Verification of Pre-requisites</u>** **<u>Exercise</u>** what are the characteristic elements of the following transformations:Translation;reflection;rotation and glide symmetry.	-Copies questions on the board -Calls students to the board	-Solve on the board as called by the teacher, while the others follow up keenly	**<u>Verification of Pre-requisites</u>** **<u>Exercise</u>** what are the characteristic elements of the following transformations:Translation;reflection;rotation and glide symmetry.	
Lesson Development and Summary (100mins)	**<u>Activity1</u>** Given a vector $\vec{v}$ with affix $3-4i$. a)Find the complex expression of the translation $t_{\vec{v}}$ b)Find the image of the following points: $A(1+2i), B(-2+2i)$under the translation $t_{\vec{v}}$. **<u>Resolution</u>** a)For any point M(z) of the plane $\mathcal{P}$, $t_{\vec{v}}(M) = M' \leftrightarrow \overrightarrow{MM'} = \vec{v}$ $\leftrightarrow z_{\overrightarrow{MM'}} = z_{\vec{v}}$ $\leftrightarrow z_{M'} - z_M = z_{\vec{v}}$ $\leftrightarrow z' - z = 3-4i$ where z' is the affix of M' $\boldsymbol{\leftrightarrow z' = z + 3 - 4i}$ **is the complex expression of the translation** $t_{\vec{v}}$. b)let's find the images of A and B.	-Copies activity on the chalkboard -Instructs students to copy in their notebooks and allows them 10 minutes to research	-Follow the instructions and carry out the activity while interacting with each other -Copy notes in their books	**<u>Activity1</u>** Given a vector $\vec{v}$ with affix $3-4i$. a)Find the complex expression of the translation $t_{\vec{v}}$ b)Find the image of the following points: $A(1+2i), B(-2+2i)$under the translation $t_{\vec{v}}$. **<u>Resolution</u>** a)For any point M(z) of the plane $\mathcal{P}$, $t_{\vec{v}}(M) = M' \leftrightarrow \overrightarrow{MM'} = \vec{v}$ $\leftrightarrow z_{\overrightarrow{MM'}} = z_{\vec{v}}$ $\leftrightarrow z_{M'} - z_M = z_{\vec{v}}$ $\leftrightarrow z' - z = 3-4i$ where z' is the affix of M' $\boldsymbol{\leftrightarrow z' = z + 3 - 4i}$ **is the complex expression of the translation** $t_{\vec{v}}$. b)let's find the images of A and B.	

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	$z_{B'} = z_B + 3 - 4i$ then $z_{B'}=1-2i$ $z_{A'} = z_A + 3 - 4i$ then $z_{A'}=4-2i$ **Activity2** Given a point A with affix $3-4i$ a)Find the complex expression of the central symetry S with center A. b)Find the image of the following points: $k(1-i), B(-4+2i)$ under the translation S. **Resolution** a)For any point M (z) of the plane $\mathcal{P}$ S(M)=M'$\leftrightarrow \overrightarrow{AM'} = -\overrightarrow{AM}$ $\leftrightarrow z_{\overrightarrow{AM'}} = -z_{\overrightarrow{AM}}$ $\leftrightarrow z_{M'} - z_A = -(z_M - z_A)$ $\leftrightarrow z_{M'} = 2z_A - z_M$ $\leftrightarrow z' = -z + 2z_A$ where z' is the affix of M' b)let's find the images of A and B. $z_{K'} = 2z_A - z_K = 2(3-4i) - (1-i) =$ 5-7i $z_{B'} = 2z_A - z_B =$ $2(3-4i) - (-4+2i) = 10 - 10i$	-Copies notes on the board -Explains concepts -Dictates notes **-Carries out the proves to obtain the various complex expression**	Copy notes in their notebooks	$z_{B'} = z_B + 3 - 4i$ then $z_{B'}=1-2i$ $z_{A'} = z_A + 3 - 4i$ then $z_{A'}=4-2i$ **Activity2** Given a point A with affix $3-4i$ a)Find the complex expression of the central symetry S with center A. b)Find the image of the following points: $k(1-i), B(-4+2i)$ under the translation S. **Resolution** a)For any point M (z) of the plane $\mathcal{P}$ S(M)=M'$\leftrightarrow \overrightarrow{AM'} = -\overrightarrow{AM}$ $\leftrightarrow z_{\overrightarrow{AM'}} = -z_{\overrightarrow{AM}}$ $\leftrightarrow z_{M'} - z_A = -(z_M - z_A)$ $\leftrightarrow z_{M'} = 2z_A - z_M$ $\leftrightarrow z' = -z + 2z_A$ where z' is the affix of M' b)let's find the images of A and B. $z_{K'} = 2z_A - z_K = 2(3-4i) - (1-i) =$ 5-7i $z_{B'} = 2z_A - z_B =$ $2(3-4i) - (-4+2i) = 10 - 10i$	

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	<u>Properties</u> →)If $t_{\vec{v}}$ is a translation ,the complex expression of $t_{\vec{v}}$ is given by: $\boldsymbol{z' = z + z_{\vec{v}}}$ →)If S is a central symmetry with center Ω, the complex expression of S is given by: $\boldsymbol{z' = -z + 2z_{\Omega}}$ →) If S is a reflection about the X-axis the complex expression of S is given by: $\boldsymbol{z' = \bar{z}}$ →) If S is a reflection about the Y-axis the complex expression of S is given by: $\boldsymbol{z' = -\bar{z}}$ →) If S is a reflection about the line(Δ) with equation $y = b$,the complex expression of S is given by: $\boldsymbol{z' = \bar{z} + 2bi}$ →)If r(Ω;θ) is a rotation with center Ω and angle θ. the complex expression of r is given by: $\boldsymbol{z' = e^{i\theta}z + (1 - e^{i\theta})z_{\Omega}}$ →) If $h(\Omega, k)$ is a homothethy , the complex expression of h is given by: $\boldsymbol{z' = kz + (1 - k)z_{\Omega}}$ **<u>Definition</u>**		Follow up as the teacher explains, asking and answering questions where necessary	**<u>Properties</u>** →)If $t_{\vec{v}}$ is a translation ,the complex expression of $t_{\vec{v}}$ is given by: $\boldsymbol{z' = z + z_{\vec{v}}}$ →)If S is a central symmetry with center Ω, the complex expression of S is given by: $\boldsymbol{z' = -z + 2z_{\Omega}}$ →) If S is a reflection about the X-axis the complex expression of S is given by: $\boldsymbol{z' = \bar{z}}$ →) If S is a reflection about the Y-axis the complex expression of S is given by: $\boldsymbol{z' = -\bar{z}}$ →) If S is a reflection about the line(Δ) with equation $y = b$,the complex expression of S is given by: $\boldsymbol{z' = \bar{z} + 2bi}$ →)If r(Ω;θ) is a rotation with center Ω and angle θ. the complex expression of r is given by: $\boldsymbol{z' = e^{i\theta}z + (1 - e^{i\theta})z_{\Omega}}$ →) If $h(\Omega, k)$ is a homothethy , the complex expression of h is given by: $\boldsymbol{z' = kz + (1 - k)z_{\Omega}}$ **<u>Definition</u>**	

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	Glide symmetry is a composition of a translation and a orthogonal symmetry where the vector of translation is a direction vector of the axis of symmetry. $f = t_{\vec{v}} 0 S_{\Delta}$ →If $f = t_{\vec{v}} 0 S_{\Delta}$ is a glide symmetry Where (Δ) has as equation $y = b$ **and** $\vec{v}$ a direction vector of (Δ),the complex expression of f is given by: $\boldsymbol{z' = \bar{z} + 2bi + Z_{\vec{v}}}$			Glide symmetry is a composition of a translation and a orthogonal symmetry where the vector of translation is a direction vector of the axis of symmetry. $f = t_{\vec{v}} 0 S_{\Delta}$ →If $f = t_{\vec{v}} 0 S_{\Delta}$ is a glide symmetry Where (Δ) has as equation $y = b$ **and** $\vec{v}$ a direction vector of (Δ),the complex expression of f is given by: $\boldsymbol{z' = \bar{z} + 2bi + Z_{\vec{v}}}$	
Conclusion (5mins)	**Bilingual game** Give the equivalence of the word complex expression in French. **Home work** **Announcement of the next lesson**. The next lesson will be on Complex number and similarity	Copies questions on the board	Copy questions in their note books	**Bilingual game** Give the equivalence of the word complex expression in French_ **Assignments** **Announcement of the next lesson**. The next lesson will be on Complex number and similarity	