SAMPLE LESSON: MATHEMATICS

Class: Form 4

Title of Module: Plane Geometry

Title of Chapter: SIMPLE TRANSFORMATIONS

Title of Lesson: Translation

Duration of Lesson: 55mins

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CLASS: FORM 4 **Term:** **Date:**

ENROLMENT: **Boys:** **; Girls:** DURATION : 5**5MINS**

MODULE 16**:** Plane Geometry

TOPIC: SIMPLE TRANSFORMATIONS

LESSON : Translation

Rationale : Every day in real life especially in movements, designing and in decorations, we represent and displace self or shapes to come out with other forms that are more beautiful or that we want. In doing that we are carrying out a simple transformation that is called Translation.

Objectives: **At the end of the lesson, students should be able to:**

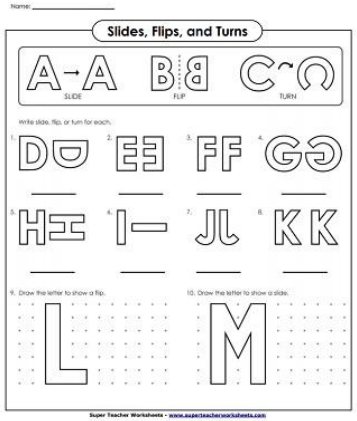
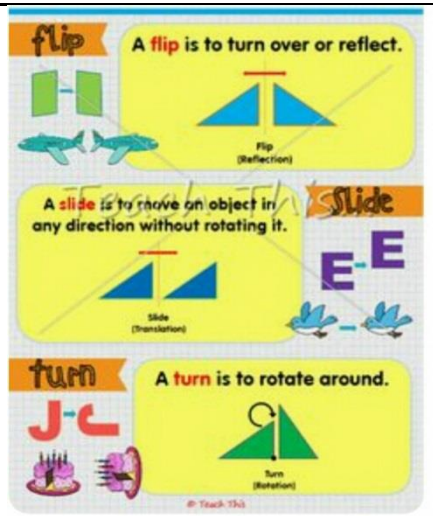
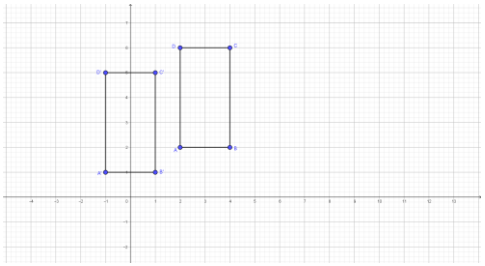
- **Define isometric transformations**
- **Translate plane shapes on the coordinate axes**
- **Determine the shift vector or matrix operator for a given translation**

Prerequisite knowledge: - plotting of points on the coordinate axes,
- identification of congruent figures,
- addition of matrices.

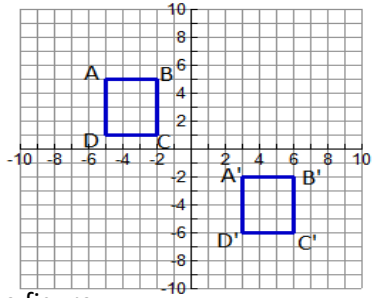
DIDACTIC MATERIALS: **Graph board, mathematical instruments and worksheets.**

REFERENCE: - August 2014 Mathematics teaching syllabus Form four. Ministry of Secondary Education, Cameroon
- Andrew T. Tamabang (2007) form 4 Mastering Mathematics, (1st edition) Cambridge university press.
-website: superteacher.com

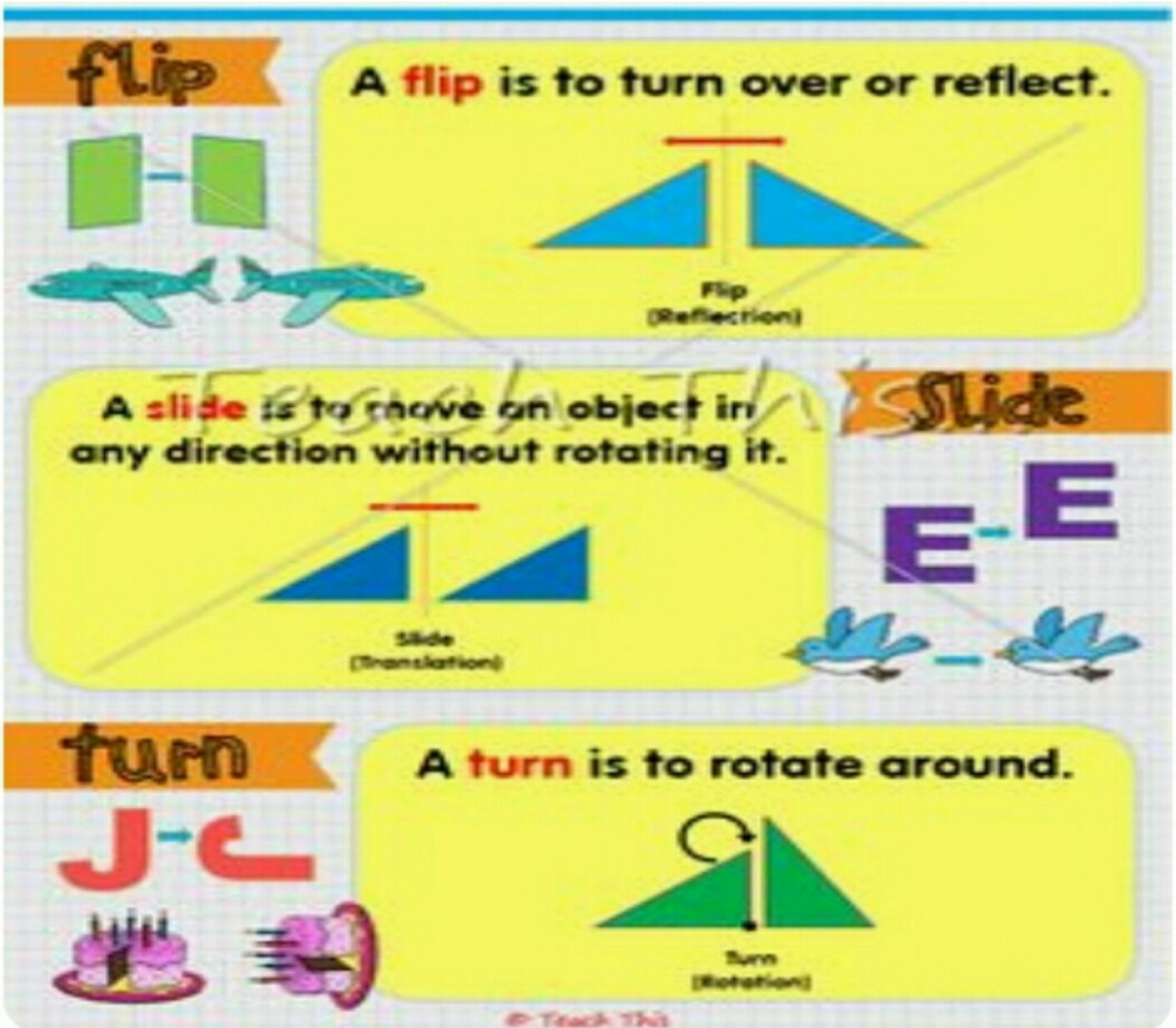
Stages /Duration	Teaching / learning ACTIVITIES	Teacher's Activities	Learner 's Activities	Learning Point	Observation
Introduction (7mins)	A/ - **Control of prerequisite knowledge** 1.On the Cartesian axes on the graph board, plot the following points : A(2,2),B(-2,-2), C(3,4), D(3,0), E(0,0) 2. What hand –on activity can you carry out to verify if 2 plane figures are congruent? **3.**Carry out the following addition of matrices **i)** $\begin{pmatrix}2\\3\end{pmatrix}+\begin{pmatrix}5\\-3\end{pmatrix}$; **ii)** $\begin{pmatrix}-2\\-2\end{pmatrix}+\begin{pmatrix}5\\-4\end{pmatrix}$	-Designates some students plot the points on the board, then use line segments to connect the points to have ABCD	Respond to the questions asked. Follow up the exercise on the board attentively to confirm the points plotted.	Plotting of points on the coordinate axes Connect points with line segments to form plane figures 2. two figures in the plane are congruent, if you can superpose one figure over the other so that they cover each other exactly. As such they have the same shape and size. 3. **i)** $\begin{pmatrix}2\\3\end{pmatrix}+\begin{pmatrix}5\\-3\end{pmatrix}=\begin{pmatrix}7\\0\end{pmatrix}$; **ii)** $\begin{pmatrix}-2\\-2\end{pmatrix}+\begin{pmatrix}5\\-4\end{pmatrix}=\begin{pmatrix}3\\-6\end{pmatrix}$	
	B/- **Problem situation** You are given the plane figure ABCD on the Cartesian axes on the graph board. 1) how do we move the shape ABCD to a new location, without changing its shape, size and orientation? 2) how do we move a shape from one location to another using a matrix.		Reflect on the problem Situation		

Lesson development (20 mins)	**Activity 1** **In the worksheet provided the first example has been done for you follow the example and complete the worksheet.**  	Provides worksheet to each group of 3 students. Paste the cardboard chart on transformation in a visible position in class. Dictates definitions for students to copy.	Read instructions and carry out the activity in groups. Students appreciate the chart and copy the definitions.	 A transformation is a general term for specific ways to manipulate the shape of a point, a line or a shape. The original shape of the object is called the pre-image and the final shape and position of the object is the image under transformation. If the pre-image and the image are congruent to each other, then the transformation is called an **isometry** or **rigid transformation.** The tree types of Isometric Transformation are: **Translation, Reflection and Rotation.**	
	Activity 2 1.Draw a vertical and horizontal line to intersect at the middle of your graph paper 2.Taking 1 cm to represent 1 unit on graph paper, label your pair of coordinate axes 3.Plot the points: A(2, 2); B(4, 2); C(4, 6); D(2,6) and connect them to produce the plane shape ABCD.	Puts students in groups of three. moves round to help students -sends students to the board to carry out activity on a graph board.	Students work in groups. Groups compare their answers with other groups.	Answers to 1. 2, 3 , 4 , 5 and 6 	

	4.Move each point 3 units to left and 1 unit downward 5.Mark the new points A',B',C',D' respectively. 6.Connect the new points A', B', C', D' using line segments to form figure A'B'C'D'. Write out the coordinates of A', B', C', D' 7.What do you observe between ABCD and A'B'C'D'? 8.i)Write the coordinate of point A, B, C and D as a column matrix. ii)To each column matrix add the matrix $\begin{pmatrix}-3\\-1\end{pmatrix}$. Iii) Call the respective results obtained as points A''; B'', C'', D''. 9. Compare the respective coordinates of A'B'C'D' with that of A''B''C''D'' ABCD and A'B'C'D' are congruent figures. 3units to the left and 1 unit downward can be represented by the column matrix $\begin{pmatrix}-3\\-1\end{pmatrix}$ called the translation matrix **TRANSLATION** When a plane shape moves or slides from one place to another, keeping its original shape and size and orientation, then the transformation is called Translation. The movement of points left(-x units) ,right (+x units) ,up (+y) or down (-y) on the coordinate axes is described by	Validates answer with students	Students copy solution to activity in their books after validation by the whole class	6. The coordinates are A' = (-1, 1); B' (1, 1); C' = (1, 5) and D' = (-1, 5) 7. The plane figures ABCD and A'B'C'D are the same shape, size and orientation. 8. i)Coordinates of A, B, C and D as column matrices are respectively $\begin{pmatrix}2\\2\end{pmatrix}$; $\begin{pmatrix}4\\2\end{pmatrix}$; $\begin{pmatrix}4\\6\end{pmatrix}$; $\begin{pmatrix}2\\6\end{pmatrix}$. ii) $\begin{pmatrix}2\\2\end{pmatrix}+\begin{pmatrix}-3\\-1\end{pmatrix}=\begin{pmatrix}-1\\1\end{pmatrix}$; $\begin{pmatrix}4\\2\end{pmatrix}+\begin{pmatrix}-3\\-1\end{pmatrix}=\begin{pmatrix}1\\1\end{pmatrix}$; $\begin{pmatrix}4\\6\end{pmatrix}+\begin{pmatrix}-3\\-1\end{pmatrix}=\begin{pmatrix}1\\5\end{pmatrix}$; $\begin{pmatrix}2\\6\end{pmatrix}+\begin{pmatrix}-3\\-1\end{pmatrix}=\begin{pmatrix}-1\\5\end{pmatrix}$ iii) A''= (-1, 1) B'' = (1, 1); C'' = (1, 5) D'' = (-1, 5) 9. The corresponding coordinates of A'B'C'D' and A''B''C''D'' are the same. ABCD and A'B'C'D' are congruent figures. 3units to the left and 1 unit downward can be represented by the column matrix $\begin{pmatrix}-3\\-1\end{pmatrix}$ called the translation matrix **TRANSLATION** When a plane shape moves or slides from one place to another, keeping its original shape and size and orientation, then the transformation is called Translation. The movement of points left(-x units) ,right (+x units) ,up (+y) or down (-y) on the coordinate axes is described by a column matrix $\begin{pmatrix}x\\y\end{pmatrix}$ called the matrix of translation or shift vector.	

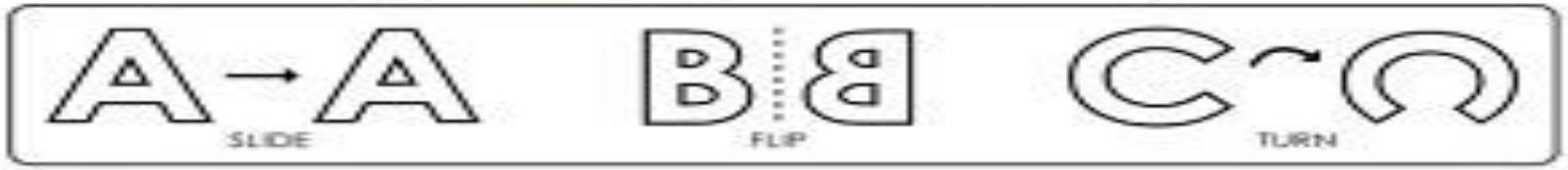
	a column matrix $\begin{pmatrix} x \\ y \end{pmatrix}$ called the matrix of translation or shift vector. Hence moving any point on a plane figure by translation , we just add the coordinates of each point separately to the translation matrix $\begin{pmatrix} x \\ y \end{pmatrix}$ **Example** Given the points A(2,2),B(3,3),C(4,4) ,and a translation matrix $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$,the translated points are then given by : $A' = \begin{pmatrix} 2 \\ 4 \end{pmatrix} + \begin{pmatrix} 2 \\ 2 \end{pmatrix} = \begin{pmatrix} 4 \\ 6 \end{pmatrix}$ $B' = \begin{pmatrix} 2 \\ 4 \end{pmatrix} + \begin{pmatrix} 3 \\ 3 \end{pmatrix} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$ $C' = \begin{pmatrix} 2 \\ 4 \end{pmatrix} + \begin{pmatrix} 4 \\ 4 \end{pmatrix} = \begin{pmatrix} 6 \\ 8 \end{pmatrix}$ Hence the translated shape will have cordinates; A'(4,6),B'(5,7) and C'(6,8).			Hence moving any point on a plane figure by translation , we just add the coordinates of each point separately to the translation matrix $\begin{pmatrix} x \\ y \end{pmatrix}$ Translation is an **ISOMETRIC** Transformation since the shape is preserved, **Example** Given the points A(2,2),B(3,3),C(4,4) ,and a translation matrix $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$,the translated points are then given by : $A' = \begin{pmatrix} 2 \\ 4 \end{pmatrix} + \begin{pmatrix} 2 \\ 2 \end{pmatrix} = \begin{pmatrix} 4 \\ 6 \end{pmatrix}$ $B' = \begin{pmatrix} 2 \\ 4 \end{pmatrix} + \begin{pmatrix} 3 \\ 3 \end{pmatrix} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$ $C' = \begin{pmatrix} 2 \\ 4 \end{pmatrix} + \begin{pmatrix} 4 \\ 4 \end{pmatrix} = \begin{pmatrix} 6 \\ 8 \end{pmatrix}$ Hence the translated shape will have coordinates; A'(4,6),B'(5,7) and C'(6,8).	
Application exercise (10 mins)	1) Given the points A(-1,1), B(-4,1),C(-4,6) and a translation matrix $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$,find points A' ,B' ,C' after ABC is translated . 2)  From the figure a) state the coordinates of ABCD and A'B'C'D'. b) find the matrix of translation.	Writes the exercise on the board. Move around and direct students with difficulties without solving for them	Solve individually and compare their solutions with peers.	**Solution to exercises** 1) Points are A(-1,1), B(-4,1) and C(-4,6) Translation Matrix is $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$. Therefore $\begin{pmatrix} -1 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ 2 \end{pmatrix} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$; ∴ A' = (1, 3) $\begin{pmatrix} -4 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ 2 \end{pmatrix} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$; $\therefore B' = (-2, 3)$ $\begin{pmatrix} -4 \\ 6 \end{pmatrix} + \begin{pmatrix} 2 \\ 2 \end{pmatrix} = \begin{pmatrix} -2 \\ 8 \end{pmatrix}$ ∴ C' = (-2, 8) 2)a) A(-5, 5); B = (-2 5); c = (-2 1); D = (-5 , 1) A'(3, -2); B'= (6, -2); C' = (6, -6); D' = (3, -6)	

				b) To move from one point to its image requires movement of 8 units to the Right and 7 units Down. The Translation matrix is therefore $\begin{pmatrix} 8 \\ -7 \end{pmatrix}$	
Conclusion (8 mins)	**Home work** Mastering maths page 160 Ex 20a nos. 1 and 3. Activity (reflection)	Teacher gives reference from textbook.	Students copy	A **translation** is moving all the points of the image the same distance in the same direction, or in other words, a slide.	


flip
A flip is to turn over or reflect.
Flip
(Reflection)
A slide is to move an object in any direction without rotating it.
Slide
(Translation)
Slide
E-E
turn
J-C
A turn is to rotate around.
Turn
(Rotation)
© Teach This

Name: _____

Slides, Flips, and Turns



Write slide, flip, or turn for each.

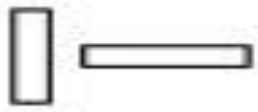
1.  _____

2.  _____

3.  _____

4.  _____

5.  _____

6.  _____

7.  _____

8.  _____

9. Draw the letter to show a flip.

10. Draw the letter to show a slide.