EL-STEM LESSON PLAN

Lesson Plan Information	
STEM Disciplines: *Mathematics, Computers, Robotics, Physics*	**Teachers:** A.Coudounaris A. Tsaousis
Topic: Transformations and Patterns in Geometry – Mathematics Building and Programming (Computers & Robotics) Mechanics: Kinematics & Dynamics (Physics)	**Duration:** Mathematics (4p) Computers & Robotics (4p) Physics (4 periods)
Age Range: Grade 9 (14-15)	**Language:** English

Prior Knowledge and Skills Needed

Basic programming skills

Basic geometry and coordinate geometry knowledge

Simple kinematics equations and dynamics

Learning Objectives

Mathematics: HSG-CO.A. Experiment with transformations in the plane

HSG-CO.A.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments

HSG-CO.A.5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

Computers & Programming:

2-CS-02 Design projects that combine hardware and software components to collect and

exchange data. (P5.1)

Use the basic steps in algorithmic problem solving to design solutions (e.g., problem statement and ex
design, implementing a solution, testing, evaluation).

Physics:

Representing forces as vectors

Sketching and interpreting free-body diagrams

Using Newton's second law quantitatively and qualitatively

Using kinematics equations to calculate distance and displacement

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Pedagogical Approaches
game-based learning, inquiry-based learning, problem-based learning, collaboration
Learning Activities
Activity 1: Define and apply the basic transformations of shapes and functions in the coordinate plane Activity 2: Design a Lego mindstrorms robot that can move in the x-y plane and program it using Scratch to verify translations given Activity 3: Use physics and circle geometry concepts to calculate the distances covered by the robot. Check and evaluate using the friction concept Activity 4: Use different shapes to verify your results
Assessment and Evaluation
Summative assessment Formative assessment in an on-going base according to in-class observations (see Rubric) Presentation of their work using power point or a tri-fold poster (rubric provided). Check if the project is working with different shapes and translations
Resources
Laptops (BYOD) Lego mindstrorms kit Coordinate geometry plane Use programming – Scratch (Internet access required) www.scratch.mit.edu Geometry kit (ruler, compass, protractor) Different shapes (laminated or tracing paper)
Additional Information/ Comments
The math, physics and Ed-tech teachers should collaborate for this interdisciplinary project, so it can be done in 1-2 weeks. The final assessment can be done in the Robotics Lab. An "expert" panel of teachers could be used for the final grade.

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