

# 03 Groups, Iteration, and Motion

Content Area: **Math**  
Course(s):  
Time Period: **Semester**  
Length: **4 Weeks**  
Status: **Published**

## General Overview, Course Description or Course Philosophy

The course is designed to give students an introduction to the programming language python and develop abstraction skills. Students will have the opportunity to foster their ability to develop and apply computational problem-solving skills. This course utilizes graphical problems that allow for multiple solutions and provides visual cues while debugging. Students will design creative solutions to address real-world problems. Students will engage not only independently but will work collaboratively to navigate the dynamic digital landscape.

In this unit, students will have the opportunity to explore not only how loops can simplify algorithms but can also be used to mimic motion, bouncing, and gravity. Students will use indefinite, infinite and finite loops combined with coordinate geometry to create realistic directional motion.

## OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

### Objectives

- Students will be able to group multiple shapes together to apply a method to each item in the group.
- Students will be able to compare and contrast how groups of shapes and individual shapes.
- Students will be able to generate and test code to apply methods to groups of shapes.
- Students will be able to explain onStep is used to create motion.
- Students will be able to generate and test code to simulate motion on the screen.
- Students will be able to display curved shapes on a canvas.
- Students will be able to display arrows on the canvas.
- Students will be able to determine the scope of a variable.
- Students will be able to compare and contrast helper functions and helper variables.
- Students will be able to compare and contrast for loop and onStep.
- Students will be able to compare and contrast /, //, and %.
- Students will be able to explain angleTo and PointInDir.
- Students will be able to generate and test code that creates a random number between two values.
- Students will be able to generate and test code that uses nested loops to create a 2D grid.

## Essential Questions

- How does a personal experience and strengths affect the development and testing of a program?
- Why are loops used in programming?
- How are nested loops used in daily life?
- Why do programs communicate responses to themselves?
- What are the advantages and disadvantages of using a for loop over a while loop?
- Why do we often purposely repeat tasks in our lives?
- Why are mathematical and logical concepts fundamental to computer programming?

## Enduring Understanding

- Python using repetitive code and step functions to simulate motion on a canvas.
- Python uses the concept of stop motion to simulate movement on the screen.
- Iteration is a layer of abstraction that simplifies code and makes it more readable
- Variables are only accessible within their scope
- The life and scope of different types of variables are important for efficiency in a computer program.
- Simple mathematical operations can represent complex cases in a program.

## **CONTENT AREA STANDARDS**

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CS.9-12.8.1.12.AP.1	Design algorithms to solve computational problems using a combination of original and existing algorithms.
CS.9-12.8.1.12.AP.2	Create generalized computational solutions using collections instead of repeatedly using simple variables.
CS.9-12.8.1.12.AP.3	Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.
CS.9-12.8.1.12.AP.4	Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
CS.9-12.8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
CS.9-12.8.1.12.AP.7	Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
CS.9-12.8.1.12.AP.8	Evaluate and refine computational artifacts to make them more usable and accessible.
CS.9-12.8.1.12.AP.9	Collaboratively document and present design decisions in the development of complex programs.

## **RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)**

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LA.K-12.NJSLSA.R7	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
LA.K-12.NJSLSA.W7	Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.
LA.K-12.NJSLSA.SL1	Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
LA.K-12.NJSLSA.SL2	Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
LA.K-12.NJSLSA.SL4	Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
LA.K-12.NJSLSA.SL5	Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
PFL.9.1.K12.P.4	Demonstrate creativity and innovation.
PFL.9.1.K12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
PFL.9.1.K12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
PFL.9.1.K12.P.9	Work productively in teams while using cultural/global competence.

## **STUDENT LEARNING TARGETS**

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### **Declarative Knowledge**

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Students will understand that:

- Grouping shapes allows programmers to code complex behaviors easier
- Altering a property or applying a method to a group applies it to every shape in that group
- Motion on a canvas is simulated through stop motion
- Altering the steps per second will alter the number of times a function is called per second
- Loops are an abstraction to simplify code

- Loops are iterations that run a predetermined amount of times
- Variable can only be accessed with their scope
- Parameters are used to pass local information into a function to

## **Procedural Knowledge**

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Students will be able to:

- Create a group of objects
- Alter the appearance of a group of shapes
- Simulate motion of a group or a specific shape
- Create a loop that runs  $n$  times
- Create a loop that performs tasks to every object in a group
- Determine the scope of a variable

## **EVIDENCE OF LEARNING**

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### **Formative Assessments**

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- Checkpoints in each section
- Guided Practice
- Independent Practice
- Checklists
- Class Discussion
- Exit Tickets
- Rubrics
- Teacher Observation
- Exit/Entrance Tickets

### **Summative Assessments**

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- End of Unit Assessment
- End of Unit Creative Task

## **RESOURCES (Instructional, Supplemental, Intervention Materials)**

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[Example Creative Tasks](#)

## **INTERDISCIPLINARY CONNECTIONS**

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Interdisciplinary connections are frequently addressed through examples and practice problems whereby creating solutions that draw from cultures around the world, athletics, mathematics and geography. Examples can be found in topic specific examples, practice exercises, guided projects and digital resources.

## **ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS**

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See link to Accommodations & Modifications document in course folder.