

# Unit 5: Python Turtle

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**Introduction to Computer Science**

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**Department of Curriculum and Instruction**



**Belleville Public Schools**

**Curriculum Guide**

**Introduction to Computer Science through Gaming and Design**

**Unit 5: Python Turtle, Grades 9-12**

**Belleville Board of Education**

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## **Unit Overview**

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- This unit introduces students to turtle, a Python module that contains drawing methods.
- Forward, backward, and goto are movement methods.
- Left and right are turning methods.
- When using these methods, the student must be careful, because they are done relative to the turtle's current position and angle of rotation.
- The student will find that placing the penup and pendown in the incorrect locations will either omit intended lines or draw unwanted lines.
- The student will have the opportunity to change the color of a shape and fill it with color by using the fillcolor, begin\_fill and end\_fill methods.
- Wrong placement of these methods will result in unintended results (ex: wrong color, not filled with color).
- It is possible to make simple drawings with the turtle module.

## **Enduring Understanding**

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- It is possible to draw polygons and circles in Python.

- To move a turtle, the forward, backward, and goto methods are used.
- The left and right methods only turn the turtle at a specific angle; it does not change location.
- To move to a location without dragging a line, the penup method is used.
- To draw a line from the current location, the pendown method must be called first.
- There is a circle method to draw a circle with a given radius.
- In order to fill a shape with the correct color, do the following - order matters.
  - Set the 'fillcolor'.
  - Make sure you are at the correct coordinates.
  - Use the begin\_fill method.
  - Draw the shape.
  - Use the end\_fill method.
- By using the penup method, it is possible to make simple drawings without having to attach the shapes.
- The hideturtle method is used so that the arrow (turtle) does not appear in the output.

## Essential Questions

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- What shapes can be used to make a picture with green grass, a blue sky, white clouds, and a yellow sun?
- Why is the turtle facing the wrong way? How can it go back to how it looked before?
- Why is there an extra line in this drawing? Where is the bug in the code?
- Can you explain an algorithm for drawing and filling a shape?
- Why is this circle an outline that is not filled with color?
- How can we get rid of the arrow in this drawing?
- What are the main turtle methods that we use in drawing shapes?

## Exit Skills

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At the end of Unit 5, the student should be able to:

- Use the forward, backward, left, right methods to move the turtle in the intended directions and turn it at the intended angle.
- Use the goto method to place the turtle at a specific location.
- Draw a simple polygon or circle that is filled with color.
- Debug code to find the source of an unwanted line, lack of 'fillcolor', etc.
- Draw at least 2 shapes filled with 2 different colors that are not connected to each other.

## **New Jersey Student Learning Standards (NJSL-S)**

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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.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.CS.4 | Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.   |
| CS.9-12.8.1.12.DA.1 | Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.   |
| CS.9-12.8.2.12.EC.3 | Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.                            |
| CS.9-12.8.2.12.ED.1 | Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.   |
| CS.9-12.8.2.12.ED.4 | Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience. |

## **Interdisciplinary Connections**

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|---------------|--|
| MA.K-12.1     | Make sense of problems and persevere in solving them.  |
| MA.K-12.2     | Reason abstractly and quantitatively.  |
| MA.K-12.4     | Model with mathematics.  |
| MA.N-Q.A      | Reason quantitatively and use units to solve problems.   |
| 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.   |
| LA.W.11-12.6  | Use technology, including the Internet, to produce, share, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. |
| LA.SL.11-12.4 | Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and     |

audience.

- LA.L.11-12.6 Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.
- SCI.HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
- SCI.HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

## Learning Objectives

- Determine the appropriate method necessary to perform a specific drawing function.
- Assess code to find the bug that causes an unnecessary line, a missing line, the wrong 'fillcolor', etc.
- Design a simple drawing consisting of filled circles and polygons that are not attached with lines.
- Construct a rainbow (LGBTQ) by using the turtle functions.
- Combine polygons and circles to produce a symbol or diagram related to climate change.

**Action Verbs:** Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

| Remember  | Understand    | Apply       | Analyze       | Evaluate  | Create      |
|-----------|---------------|-------------|---------------|-----------|-------------|
| Choose    | Classify      | Choose      | Categorize    | Appraise  | Combine     |
| Describe  | Defend        | Dramatize   | Classify      | Judge     | Compose     |
| Define    | Demonstrate   | Explain     | Compare       | Criticize | Construct   |
| Label     | Distinguish   | Generalize  | Differentiate | Defend    | Design      |
| List      | Explain       | Judge       | Distinguish   | Compare   | Develop     |
| Locate    | Express       | Organize    | Identify      | Assess    | Formulate   |
| Match     | Extend        | Paint       | Infer         | Conclude  | Hypothesize |
| Memorize  | Give Examples | Prepare     | Point out     | Contrast  | Invent      |
| Name      | Illustrate    | Produce     | Select        | Critique  | Make        |
| Omit      | Indicate      | Select      | Subdivide     | Determine | Originate   |
| Recite    | Interrelate   | Show        | Survey        | Grade     | Organize    |
| Select    | Interpret     | Sketch      | Arrange       | Justify   | Plan        |
| State     | Infer         | Solve       | Breakdown     | Measure   | Produce     |
| Count     | Match         | Use         | Combine       | Rank      | Role Play   |
| Draw      | Paraphrase    | Add         | Detect        | Rate      | Drive       |
| Outline   | Represent     | Calculate   | Diagram       | Support   | Devise      |
| Point     | Restate       | Change      | Discriminate  | Test      | Generate    |
| Quote     | Rewrite       | Classify    | Illustrate    |           | Integrate   |
| Recall    | Select        | Complete    | Outline       |           | Prescribe   |
| Recognize | Show          | Compute     | Point out     |           | Propose     |
| Repeat    | Summarize     | Discover    | Separate      |           | Reconstruct |
| Reproduce | Tell          | Divide      |               |           | Revise      |
|           | Translate     | Examine     |               |           | Rewrite     |
|           | Associate     | Graph       |               |           | Transform   |
|           | Compute       | Interpolate |               |           |             |
|           | Convert       | Manipulate  |               |           |             |
|           | Discuss       | Modify      |               |           |             |
|           | Estimate      | Operate     |               |           |             |
|           | Extrapolate   | Subtract    |               |           |             |
|           | Generalize    |             |               |           |             |
|           | Predict       |             |               |           |             |



## Suggested Activities & Best Practices

### Best Practices:

- Short slideshow presentations for content, with questioning built into them.
- Use of multiple-choice questions to check for understanding.
- Repetition and review of concepts.
- Immediate feedback for assignments.
- Step by step visual instructions to make programs, especially at the beginning.
- The use of edublocks, where blocks appear in one panel, but the Python code appears in the other panel.
- Show model code for students to refer to.

- Provide example output for students to compare their results.
- Google Classroom and Schoology organized around units of study.

### Exemplars:

- Have examples of Python turtle code blocks and code available for students to use as a model.
- Use questioning activities about Python turtle where students get feedback after submission (Edulastic, Google Forms, quizizz.com).
- Use slideshow notes for instructions to use Python turtle, with illustrations of the blocks in English and Spanish.
- Have students continue to apply previous Scratch concepts when programming in Python turtle.

## **Assessment Evidence - Checking for Understanding (CFU)**

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- edulastic.com - for practice exercises and assessment (Formative and Summative)
- whiteboard.fi/ - to present notes and questions (Formative)
- Jamboard - for group work (Formative)
- Google Forms - for Do Nows, Exit Tickets and Assessment activities (Formative)
- Coding Rooms - for practice programs and projects (Formative)
- EduBlocks - for block-based python programming on one side and python code on the other (Formative/Summative)

### Performance Task Example (Alternate):

Review the suggested articles and websites about the climate change.

Make a brief program with Python turtle where images or symbols for climate change is shown.

You may choose any article or video that was not listed in the suggested articles/websites.

- Google Slides - for Notes and Drag and Drop activities (Formative)
- Google Classroom - for open-ended questions (Formative)
- quizizz.com - for content practice in a game format (Alternate)
- oncourse.com - for benchmarks (if applicable) (Summative/Benchmark)
- Admit Tickets
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define

- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Illustration
- Learning Center Activities
- Multimedia Reports
- Outline
- Quizzes
- Self- assessments
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

## Primary Resources & Materials

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- Creative Coding in Python
- Coding for Kids Python
- <https://edublocks.org/>

## Ancillary Resources

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Coding:

- <https://www.codingrooms.com/>
- <https://trinket.io/turtle>
- <https://realpython.com/beginners-guide-python-turtle/>
- <https://blockly.games/>
- <https://www.youtube.com/c/TechWithTim/search?query=turtle> (Tech with Tim Python Turtle Graphics Tutorials)
- <https://hourofpython.com/a-visual-introduction-to-python/index.html>

LGBTQ:

- <https://www.geeksforgeeks.org/draw-rainbow-using-turtle-graphics-in-python/>

- <https://dev.to/taarimalta/rainbow-and-clouds-with-python-turtle-pgh> (rainbow with clouds)

## Climate Change:

- <https://www.shutterstock.com/search/symbol-of-climate-change>
- <https://www.flaticon.com/free-icons/climate-change>

## Technology Infusion

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- use of the internet - for Python websites and articles about climate change and LGBTQ.
- edulastic.com - for practice exercises and assessment
- whiteboard.fi/ - to present notes and questions
- Jamboard - for group work
- Google Forms - for Do Nows, Exit Tickets and Assessment activities
- Google Slides - for Notes and Drag and Drop activities (Formative)
- Google Classroom - for open-ended questions (Formative)
- quizizz.com - for content practice in a game format (Alternate)
- edublocks.org - for programs and games (Formative/Summative)
- oncourse.com - for benchmarks (if applicable) (Summative/Benchmark)



## Alignment to 21st Century Skills & Technology

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- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Technology;
- Visual and Performing Arts.

|                   |   |
|-------------------|---|
| WRK.9.2.12.CAP.2  | Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.   |
| WRK.9.2.12.CAP.6  | Identify transferable skills in career choices and design alternative career plans based on those skills.   |
| TECH.9.4.12.CI.1  | Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12.prof.CR3a).  |
| TECH.9.4.12.CI.3  | Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).   |
| TECH.9.4.12.GCA.1 | Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.II.IPERS.7, 8.2.12.ETW.3). |
| TECH.9.4.12.IML.5 | Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).   |

## 21st Century Skills/Interdisciplinary Themes

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- Students search the internet for climate change related symbols and images.
- Students associate turtle functions with movements necessary to make a design.

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

## 21st Century Skills

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- Students read and communicate about climate change and pollution.

- Students learn how to add graphics to make their applications more engaging.
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness

## Differentiation

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### Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Small group setting

### Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Learning contracts
- Leveled rubrics
- Multiple intelligence options
- Multiple texts
- Project-based learning
- Problem-based learning
- Stations/centers
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

## Lo-Prep Differentiations

- Choice of books or activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied supplemental materials

## Special Education Learning (IEP's & 504's)

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### Exemplars:

- Allow multiple-choice assignments, written assignments, and quizzes to be submitted late.
- Convert articles to PDF and highlight important ideas for students.
- Make visual instructions.
- Give students the opportunity to unscramble computer commands instead of generating their own.

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions

- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

## **English Language Learning (ELL)**

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Exemplars:

- Have all notes, activity directions, and assessment items translated into Spanish.
- Place students next to Spanish-speaking peers.
- Make visual instructions.
- Have individual interaction with students to make sure that they understand the content and expectations.
- Allow students to use the drop-down menu to choose their native language on software, when applicable.

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

## **At Risk**

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## Exemplars:

- Minimize the amount of reading that needs to be done.
  - Minimize the amount of information that students need to write/type.
  - Make visual instructions.
  - When asking questions, give students possible answers to choose from.
  - Give students the opportunity to unscramble commands instead of having to generate them by themselves.
- 
- allowing students to correct errors (looking for understanding)
  - teaching key aspects of a topic. Eliminate nonessential information
  - allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
  - allowing students to select from given choices
  - allowing the use of note cards or open-book during testing
  - collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
  - decreasing the amount of work presented or required
  - having peers take notes or providing a copy of the teacher's notes
  - marking students' correct and acceptable work, not the mistakes
  - modifying tests to reflect selected objectives
  - providing study guides
  - reducing or omitting lengthy outside reading assignments
  - reducing the number of answer choices on a multiple choice test
  - tutoring by peers
  - using authentic assessments with real-life problem-solving
  - using true/false, matching, or fill in the blank tests in lieu of essay tests
  - using videos, illustrations, pictures, and drawings to explain or clarify

## **Talented and Gifted Learning (T&G)**

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### Exemplars:

- Have students do further research on climate change and the LGBTQ.
  - Allow students to use turtle methods beyond the classroom assignments.
  - Let students see their Python program with blocks converted to actual Python code.
  - Encourage students to try typing their own Python code.
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- Above grade level placement option for qualified students
  - Advanced problem-solving
  - Allow students to work at a faster pace
  - Complete activities aligned with above grade level text using Benchmark results
  - Create a plan to solve an issue presented in the class or in a text
  - Debate issues with research to support arguments

- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

## Sample Lesson

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**Unit Name:** Climate Change and Python Turtle

**NJSLS:**

**Interdisciplinary Connection:** Art Connection - Students try to draw climate change scenes and symbols.

**Statement of Objective:** The student should be able to:

- Identify climate change symbols.
- Use Python turtle functions to draw climate change scenes and symbols.

**Anticipatory Set/Do Now:** Ask if students know the symbols for climate change and how they can be found.

**Learning Activity:**

Do Now.

Have students review climate change symbols individually or in pairs.

Students discuss what shapes can be used to make the symbols.

Students use Python turtle functions to attempt to make the climate change symbols.

**Student Assessment/CFU's:** observation, questioning

**Materials:** internet access, computers/Chromebooks, websites with climate change symbols

**21st Century Themes and Skills:** communication, critical thinking, information literacy

**Differentiation/Modifications:** provide diagrams of the code blocks for students who are lost, try to include blocks in Spanish, peer tutoring

**Integration of Technology:** use of the websites with climate change symbols, use of EduBlocks/trinket.io, use of computers/Chromebooks

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|---------------------|--|
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| CS.9-12.8.1.12.CS.4 | Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.   |
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| TECH.9.4.12.CI.1    | Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).  |