

## Python in Math | Strand: Coding + CS | Skill: Advanced

```
[print(' ',x, end='\t') for x in "Hello World"];print()
[print(ord(x), end='\t') for x in "Hello World"];print()

>>> H e l l o W o r l d
>>> 72 101 108 108 111 32 87 111 114 108 100
```



### STRAND:

Coding + Computer Science



### FUTURE READY SKILLS:

- Complex Problem Solving
- Critical Thinking
- Judgment and Decision Making
- Cognitive Flexibility



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Implementation shown: **High School**



**RESOURCE LIBRARY TOOL(S):** N/A  
**ADDITIONAL:** N/A

**OVERVIEW:** Students will write code to solve basic math equations using Python programming language and the repl.it website. The Pathway is written for students with no prior CS experience.

**ADAPTATION:** This project is applicable to all math classes with equations to be solved. The documents attached here relate to a Geometry class for coding distance formula and Pythagorean Theorem, but can be edited for other math settings.

### RATIONALE:

- Click [this link](#) to review Slides on the rationale behind incorporating CS into math class.
- Click [this link](#) for some introductory slides on using Python to code math equations.
- Click [this link](#) to see the skeleton of code in Python on the repl.it site used to setup the distance formula.

**PATHWAY FOLDER  
OF RESOURCES :**



## Python in Math | Strand: Coding + CS | Skill: Advanced



**1) HOUR OF CODE, 40-80 MINS**

Hour of Code

**2) INTRO TO CODING IN MATH CLASS, 20 MINS**

Introduction to Coding in Math Class



**3) SCRIPT A RECTANGLE, 40-80 MINS**

Creation of First Code as a Class -  
Area of a Rectangle



**4) PYTHAGOREAN THEOREM, 40-60 MINS**

Creation of Second Code as a Class -  
Pythagorean Theorem



**5) DISTANCE FORMULA, 40-60 MINS**



Creation of Third Code in Small  
Groups - Distance Formula



**6) ADVANCED PYTHAGOREAN THEOREM, 80 MINS**

Creation of Fourth Code in Small  
Groups - Advanced Pythagorean  
Theorem

## ACTIVITY 1: HOUR OF CODE

 <b>40-80 MINS</b>  <b>ONLINE</b>	<b>MATERIALS or RESOURCES:</b> <ul style="list-style-type: none"><li>Hour of Code website, Padlet (optional)</li></ul>	<b>LEARNING GOALS:</b> <p><b>Students will be able to...</b></p> <ul style="list-style-type: none"><li>Explore coding by coding an artistic creation in a user-friendly, unintimidating environment</li></ul>
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### ACTIVITIES:

1. Have students go to [www.hourofcode.com/art](http://www.hourofcode.com/art)
2. This Hour of Code activity steps students through using drag-and-drop coding to create an artistic creation.
3. The final screen (Bubble 10) gives the student the chance to use their new mad coding skills to create an artistic design.
4. (Optional) Students can post a link to their code on [Padlet](#), so everyone in the class can see their work.

### TEACHER SET-UP PRIOR TO LESSON:

- Work through the Hour of Code yourself prior to the lesson. This will allow you to be familiar with the website and the potential questions that students may have.
- This art project is an excellent fit for geometry as it involves angles and lines. It's also a great introduction to coding in general because drag-and-drop coding eliminates the struggle with "syntax" and lets students focus on easily telling the computer what it should do and in what order.
- Encourage students to really get creative with the final step, where they have free reign to create their own art with coding.
- An added incentive to encourage students to come up with a great artistic design through code is to have the students post their finished code on Padlet.
- Padlet is a free, virtual gallery walk. The teacher creates an account, and creates a Padlet for the activity. When students click Finish on the last screen ("Bubble 10"), they can click to get a link to their code. Then the student goes to the Padlet (via a link provided by the teacher on Google classroom or any other method), clicks the "+" sign to add a post, and adds their link. Instantly, everyone in the class can click on their Padlet post and see their creation.



## ACTIVITY 2: INTRO TO CODING IN MATH CLASS

 <b>20 MINS</b>  <b>OFFLINE</b>	<b>MATERIALS or RESOURCES:</b> <ul style="list-style-type: none"><li>• Geometry Coding in Python slides</li></ul>	<b>LEARNING GOALS:</b> <b>Students will be able to...</b> <ul style="list-style-type: none"><li>• Use equations to write a code telling the computer how to use the equations</li><li>• Learn introductory computer programming terms and concepts</li></ul>
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### ACTIVITIES:

1. Debrief with the class on the Hour of Code.
  - Is it “real coding” since it was drag and drop?
  - What did you learn about how to write a code?
  - What did you struggle with? What surprised you?
2. Launch the idea of *Coding in Math Class*, which will be a new concept to students. They know the math. They have written code in the code.org Hour of Code. This is the next logical step.
3. Teacher presents the [Geometry Coding in Python Slides](#), including reviewing basic CS info.

## ACTIVITY 3: SCRIPT A RECTANGLE

 <p><b>40-80 MINS</b></p>  <p><b>ONLINE</b></p>	<b>MATERIALS or RESOURCES:</b> <ul style="list-style-type: none"><li>• Python, repl.it teacher and student accounts, Instructions to Create a repl.it Teacher Account, Instructions to Invite Students to Your repl.it Classroom, Suggested Script to Review the Area of a Triangle Code, Overview of the Students' repl Screen, Code Solutions</li></ul>	<b>LEARNING GOALS:</b> <p><b>Students will be able to...</b></p> <ul style="list-style-type: none"><li>• Join a repl.it classroom, get familiar with the website, and create their first program in Python to calculate the area of a rectangle</li></ul>
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
### ACTIVITIES:

1. Ask students to click on their repl.it class. Use the following [Instructions to Invite Students to Your repl.it Classroom](#). They will now see the list of assignments. Have students click on the Area of Rectangle assignment.
  - In repl.it, there are assignments and projects. You will see duplicates for each program shell under each heading.
  - The differences between assignments and projects are as follows:
    - Projects do not include the instructional panel telling that students what code to write where
    - Projects create repl's of that particular program, which will remain in the students' accounts after the teacher removes them from the class at the end of the year - students can also invite collaborators to the repl's created through projects and collaborate in real time like a Google Doc
    - Assignments are only good for the time the student is enrolled in the course
2. Project the code and review each line with the students. See this [Suggested Script to Review the Area of a Triangle Code](#). For reference, see:
  - the [Overview of the Students' repl Screen](#)
  - the [Code Solutions](#).
3. When everyone has a running code, encourage the students to play around with it. Can they break it? What if they enter a negative number for length? Do decimals work? What if they type in "two" instead of the number 2? What if the length is 0?

### TEACHER SET-UP PRIOR TO LESSON:

1. Use the following instructions to [Create a repl.it Teacher Account](#).
2. Go to our repl.it class using this link, which will automatically clone the classroom to your account: <https://repl.it/data/classrooms/share/7c9979c330555df0231994a142158774>
3. Post link for students to join your repl.it classroom somewhere where students can reach it. Use the following instructions to [Invite Students to Your repl.it Classroom](#).

## ACTIVITY 4: PYTHAGOREAN THEOREM

 <b>40-80 MINS</b>  <b>ONLINE</b>	<b>MATERIALS or RESOURCES:</b> <ul style="list-style-type: none"><li>• Python, repl.it teacher and student accounts, Python Pythagorean Theorem and Distance Formula Packet, Suggested Script for Reviewing the Pythagorean Theorem Code, Code Solutions, Pythagorean Theorem Code Exit Pass</li></ul>	<b>LEARNING GOALS:</b> <b>Students will be able to...</b> <ul style="list-style-type: none"><li>• Create a Python code to find the hypotenuse of a right triangle, given the two legs as inputs using the Pythagorean Theorem and increase their comfort level and confidence with coding and debugging</li></ul>
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### ACTIVITIES:

1. Distribute the [Python Pythagorean Theorem and Distance Formula Packet](#). The packet includes problems involving Pythagorean Theorem for the students to solve on paper. This will refresh their memory on Pythagorean, plus give the students solved problems which they can use to check their code once it's running.
2. Instruct students to complete the Pythagorean Theorem pages of the packet using their calculator.
3. Instruct students to get into their repl.it account and click on Assignments, then click on Pythagorean Theorem.
4. The teacher projects the repl.it screen as well. Read through the instructions and the existing code together, just like was done for the Area of Rectangle code. See this [Suggested Script for Reviewing the Pythagorean Theorem Code](#). For reference, see the [Code Solutions](#).
5. Once the students all have their code running correctly, debrief with common errors.
6. Encourage the students to try to break their code. What if they put in negative numbers for the leg lengths? Zero? A word instead of a number? Discuss.
7. Distribute this [Pythagorean Theorem Code Exit Pass](#).

## ACTIVITY 5: DISTANCE FORMULA



40-80  
MINS



ONLINE

### MATERIALS or RESOURCES:

- Python, repl.it teacher and student accounts, Python Pythagorean Theorem and Distance Formula Packet, Code Solutions, Distance Formula Code Exit Pass

### LEARNING GOALS:



Students will be able to...

- Write a Python code to calculate the distance between two points using the Distance Formula and increase their comfort level and independence in writing code.

### ACTIVITIES:

1. Before the lesson:
  - review the exit passes
  - break students into groups appropriately. Perhaps - one group that is not yet comfortable and will need more help, one group that is ready to be let loose to try this on their own, and another group in the middle.
2. Instruct the students to complete the Distance Formula pages in their [Python Pythagorean Theorem and Distance Formula Packet](#) using their calculator.
3. Instruct the class that “today, we will be stepping up our coding game and writing a program to tell the computer to use Distance Formula to calculate the distance between two points.”
4. What input do you think the computer will need from the user? *The x and y coordinates for both points.*
5. With your group, read through the assignment together, like we’ve done as a class. Start with the instructions, and then review the code input and print statements.
6. Groups can start working, teacher circulates for assistance. For reference, see the [Code Solutions](#).
7. When student/group has a working code, remind them to test it out using the problems they solved by hand in the packet.
8. Distribute [Distance Formula Code Exit Pass](#).

## ACTIVITY 6: ADVANCE PYTHAGOREAN THEOREM

 <b>80 MINS</b>   <b>ONLINE</b>	<b>MATERIALS or RESOURCES:</b> <ul style="list-style-type: none"><li>• Python, repl.it teacher and student accounts, Python Pythagorean Theorem and Distance Formula Packet, Python If-Else Statement Slides, Advanced Pythagorean Theorem Code Planning Sheet, Code Solutions</li></ul>	<b>LEARNING GOALS:</b> <b>Students will be able to...</b> <ul style="list-style-type: none"><li>• Write a Python code to find the missing side of a right triangle, whether the missing side is the hypotenuse or leg using the Pythagorean Theorem and increase their confidence and competence in coding by introducing if-else statements.</li></ul>
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### ACTIVITIES:

1. Review the exit pass answers with students.
2. Place students in same groups as yesterday (or tweak the groups based on the exit pass).
3. Instruct students to complete the Advanced Pythagorean Theorem problems in their [Python Pythagorean Theorem and Distance Formula Packet](#).
4. Present the [Python If-Else Statements Slides](#).
5. Instruct students to go to repl.it, click on Assignments, click on Advanced Pythagorean Theorem.
6. Work with their groups and read the instructions. For this code, because it is a step-up in complexity, we need to plan out our code on paper first. Distribute the [Advanced Pythagorean Theorem Code Planning Sheet](#), one per group. Groups will plan out the code, writing pseudocode on the planner paper, and will get their plan approved by the teacher before actually jumping in to code.
7. Teacher circulates for assistance. For reference, see the [Code Solutions](#).
8. Once groups have the code done correctly, run test cases using the worksheet they completed.





## CONTACT INFORMATION

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**Feel free to contact us with any questions or suggestions, or to share how the unit went with your class! Help us make this better with your input. Thanks!**

**PATHWAY FOLDER  
OF RESOURCES :**

