CodeHS
Hour of Code: Teacher Guide

BEFORE THE HOUR OF CODE:

- Make sure student computers have an up-to-date browser (Chrome, Safari, or Firefox).
- Read through teacher notes in this document. Download notes to have exercise solutions ready.

DURING THE HOUR OF CODE:

1. Direct students to **codehs.com/hoc_modeling**
2. Allow students to work through Hour of Code at their own pace, providing encouragement and support when needed. See tips below for handling student questions.
3. Tweet pictures or stories at @CodeHS #HourOfCode!
4. If time allows at the end of the period, facilitate a discussion around the Hour of Code using the following guiding questions:
    - Before today, what did you think about programming or coding?
    - Did any of these ideas change during the Hour of Code?
    - What was your favorite part of the Hour of Code?
    - Did any parts of the Hour of Code challenge you? How?

HOUR OF CODE TIPS:

If students get stuck or have questions, it is okay if you don't have the answer! Ask questions to activate their problem-solving skills such as:

- What can we try differently?
- What do you want the program to do? What are you telling the program to do?
- How can we break this problem into smaller steps?

Thank you for your dedication to Computer Science Education!

Interested in going beyond the Hour of Code?
Reach out to us at hello@codehs.com!

CodeHS
Mathematical Models Teacher Notes

In this Hour of Code, students are introduced to Tracy the Turtle and learn how to code different mathematical models in Python. No coding experience is necessary, but students should have completed Algebra I or higher.

Objective
Students will be able to ...

- Create basic Python turtle graphics programs
- Build linear and exponential mathematical models in Python turtle graphics

Common Core Math Standards
CCSS.MATH.CONTENT.HSA.CED.A.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
CCSS.MATH.CONTENT.HSF.LE.A.2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
CCSS.MATH.CONTENT.HSF.LE.B.5: Interpret the parameters in a linear or exponential function in terms of a context.

Link to Activity: codehs.com/hoc_modeling

Discussion Questions

- What is programming?
- What is modeling? Why do people build models?
- What is something that a person might want to model? Why?

Exercise Solutions

Fixing the View	
Description	This program graphs a sinusoidal wave, but half of the wave isn't in view! Your job is to fix the viewing window so the full wave (highest and lowest points) can be seen on the canvas.
Motivation	Students practice using the **`setworldcoordinates`** command to set the viewing window of their models.
Solution	`import math`

	`# Change the coordinates so the full wave is in the viewing window!`
	`setworldcoordinates(0, 0, 100, 10)`
	
	`# Calculates the y value and moves the turtle to (x, y) coordinate`
	`for x in range(100):`
	`    y = 4 * math.sin(x / 3.0) + 5`
	`    setposition(x, y)`

Graphing!	
Description	This program creates a graph of the line y = 2. Change the equation so it plots a linear graph with a slope of 1/2 and a y-intercept of 5. Bonus: Change the color of the graph! Look at the “docs” tab to learn how to do this.
Motivation	Students practice creating a graph in turtle graphics.

Solution	`# Sets the coordinates of the screen`
	`# Bottom left corner is located at (0, 0)`
	`# Top right corner is located at (100, 100)`
	`setworldcoordinates(0, 0, 100, 100)`
	
	`# Calculates the y value and moves the turtle`
	`# to (x, y) coordinate`
	`# Change the equation so it plots a linear graph with a`
	`# slope of 1/2 and a y-intercept of -1`
	`for x in range(100):`
	`    y = .5 * x + 5`
	`    setposition(x, y)`

Electricity Bill	
Description	Every month, your electric company charges you 11.4 cents for every kilowatt-hour (kWh) used. Write a model to create a graph of the relationship between the amount of electricity used (in kWh) and your electricity bill.

CodeHS
Mathematical Models Teacher Notes

	Your graph should show calculations from 0 kWh to 1,500 kWh.
Motivation	Students will create a mathematical model of a two-variable linear relationship.

Solution	`# set world coordinates`
	`# graph should show kwh values between 0 and 1500`
	`setworldcoordinates(0, 0, 1500, 175)`
	
	`for kwh_used in range(1500):`
	`    # calculate bill (in dollars) for the kwh value`
	`    bill = 11.4 * kwh_used / 100`
	`    # draw plot`
	`    setposition(kwh_used, bill)`

Savings Account	
Description	You invest $200 in an account that has a 2% annual interest rate compounded continuously. How will your savings grow over 10 years? Remember to start by setting your world coordinates!
Motivation	This exercise requires students to set world coordinates and then create an exponential model. Students should be careful to use Python math syntax for exponents and the constant e.

Solution	`import math`
	`# set coordinates to graph 10 years`
	`setworldcoordinates(0, 0, 10, 250)`
	
	`# set principal balance, interest rates`
	`principal = 200`
	`interest = .02`
	`# plot balance over 10 years`
	`for year in range(10):`
	`    savings = principal * math.e ** (interest * year)`
	`    setposition(year, savings)`