Meet Wonder Workshop™ Dash with Geometry Challenges

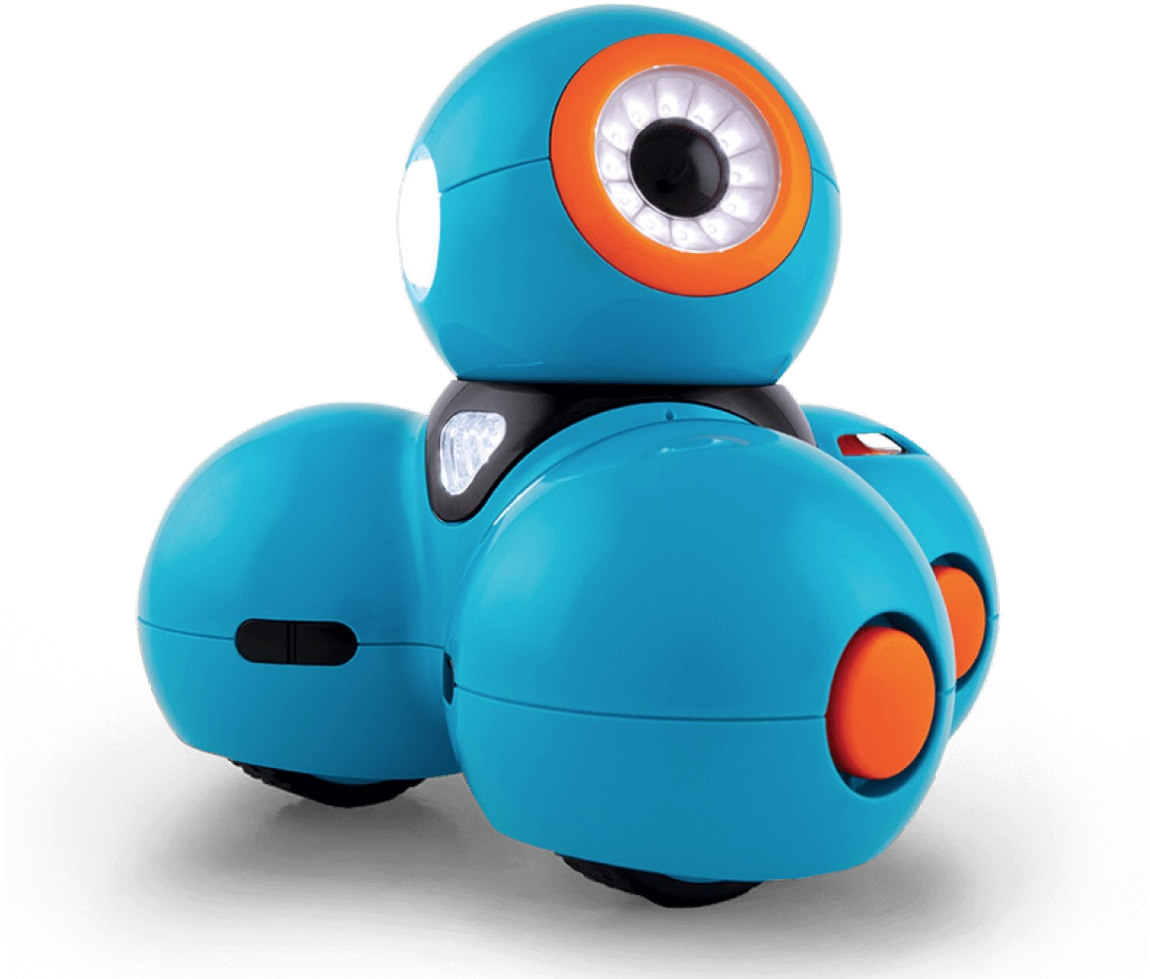
TI-Nspire CXII

Python

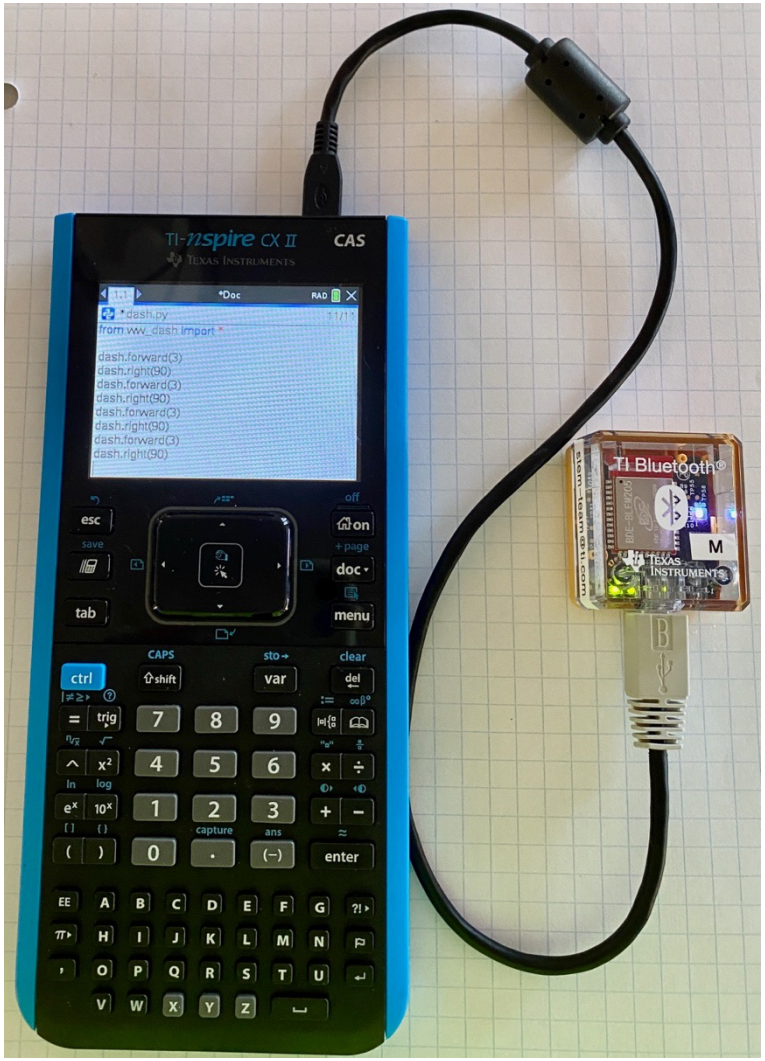
Texas Instruments

@ticalculators

Meet the Wonder Workshop™ Dash



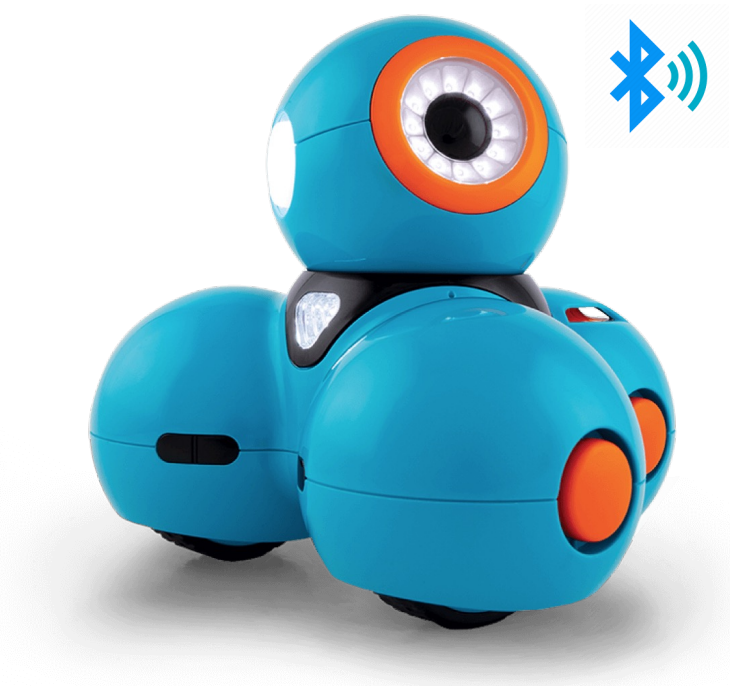
Control the Dash using Python from the TI-Nspire CXII over Bluetooth Wireless



TI-Nspire CXII

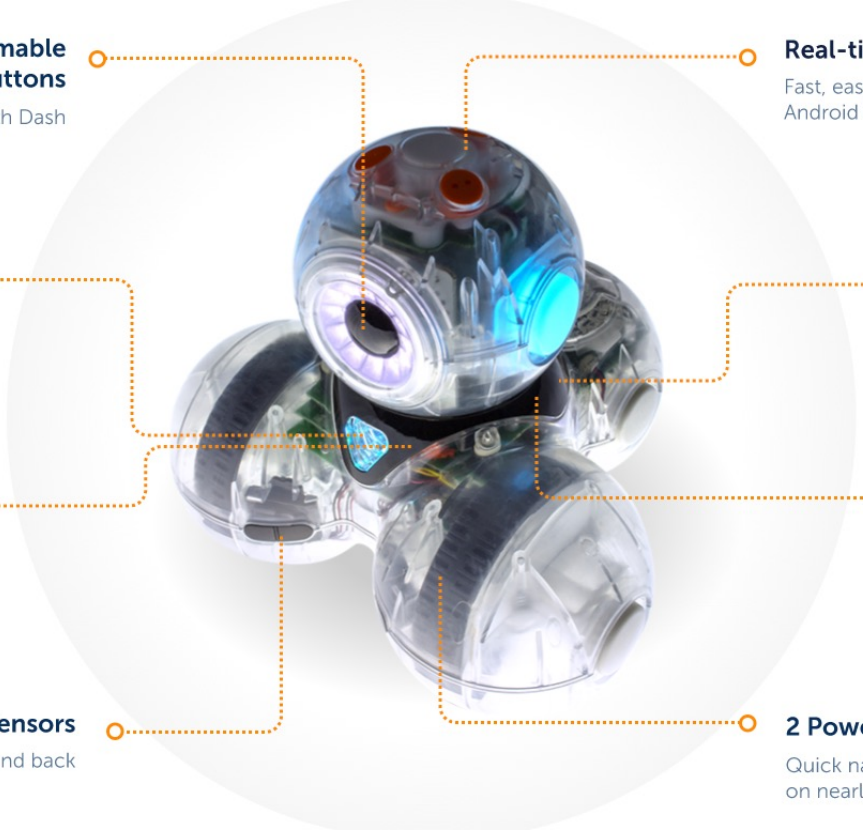
TI Bluetooth Adapter

Wonder Workshop™ Dash



TEXAS INSTRUMENTS

Meet the Wonder Workshop™ Dash



User Programmable LED's and Buttons

Customize your experience with Dash

IR Receivers & Transmitters

Enables Dash to find and interact with other robots

Potentiometers & Dual Motors

Supports head pan and tilt with accurate positioning

3 Proximity Sensors

Detects objects left, right, and back

Real-time Bluetooth

Fast, easy connections to Apple iOS, Android and Kindle mobile devices

3x Microphones & Speakers

Real-time voice triangulation and personalized recording and playback

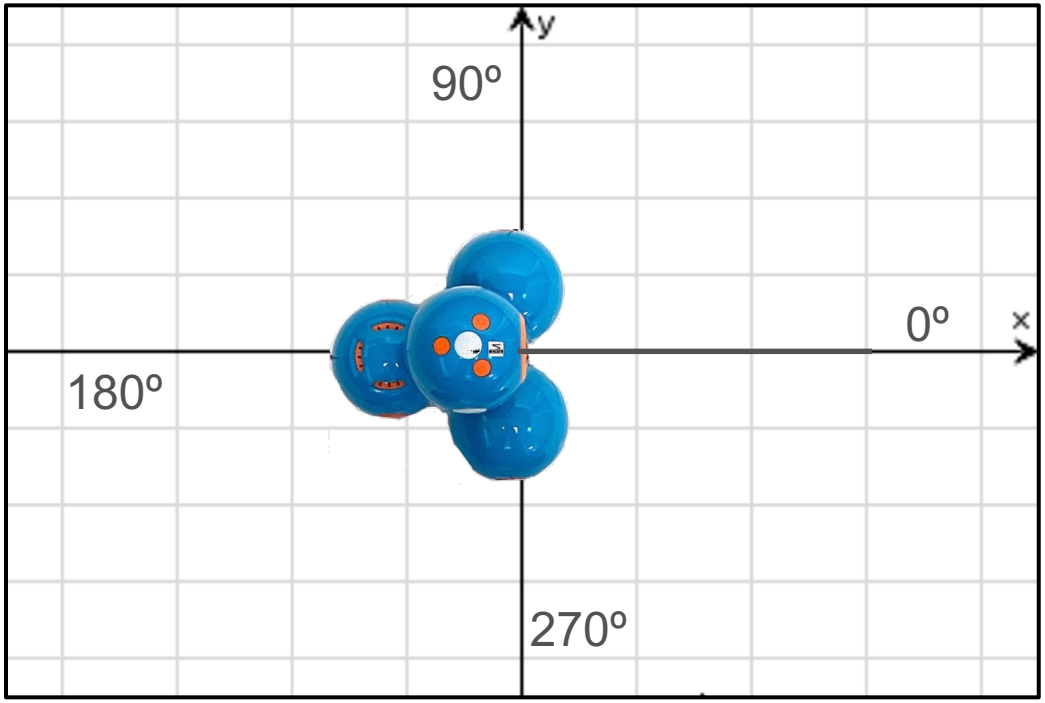
3 Processors & Sensor Fusion

Manages complex interactions among actuators & sensors - accelerometer, gyroscope and wheel encoders

2 Powered Wheels

Quick navigation and distance tracking on nearly any surface

Dash orientation and virtual grid



Dash programs set the initial position as the origin and the heading as 0 degrees measured from the x-axis.

Note: The Dash tracks its position on a virtual coordinate grid with a unit value of 10 cm. The coordinate grid position applies to the to_xy(x,y), to_polar(r,theta_degrees) and to_angle(heading angle, “unit”) functions on the Dash Drive menu. The virtual grid also applies to Path menu functions.

Draw with your Dash

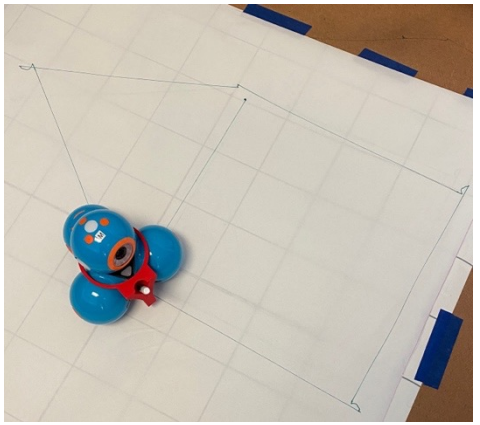
Optional

3D Print a snap-on attachment to hold Expo Fine dry erase markers for your Dash.

Step 1: Download .stl file at this link.

Step 2: 3D print following these recommendations.

1. Material PLA
2. Supports not recommended.
3. 20% infill
4. 3 to 4 shells
5. 0.2mm layer height



Setting up your calculator and TI Bluetooth adapter to run Dash

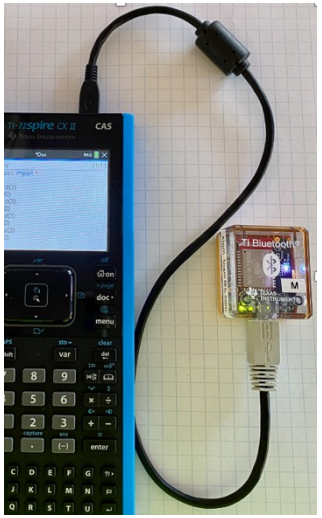
Find step-by-step directions in the Getting Started Guide at education.ti.com/dash

Follow the steps below to put the necessary files onto your calculator and to pair your TI Bluetooth Adapter with a Dash.

1. Download the ww_dash.tns Python module file and the SetDash.tns file to your calculator using your TI-Nspire computer software or by going to https://nspireconnect.ti.com/ on your Chrome browser.

2. Open the ww_dash.tns file and follow the directions to install the module into the PyLib folder.

3. Plug the TI Bluetooth Adapter into your calculator.

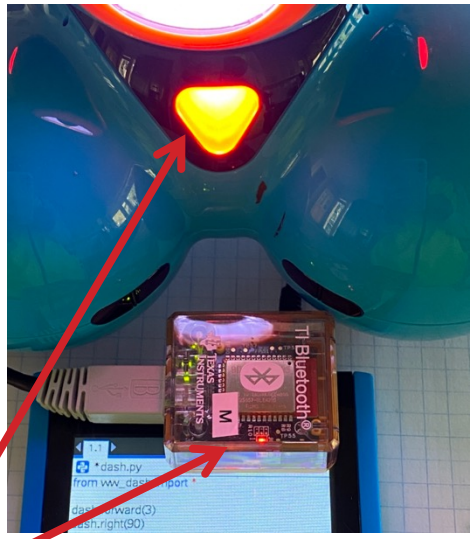


4. Turn on a Dash.
Open the SetDash.tns file and follow the directions to search for and select a Dash to pair with the TI Bluetooth Adapter.

The Adapter “remembers” the Dash that it is paired with until you use the SetDash.tns file to make a change.

Students can share a Dash by passing a paired Adapter to plug into their calculator.

Use stick-on letters or names to identify Dash/Adapter pairs (”M” is used in the photo.)



Note: The color of the adapter LED and the paired Dash LED’s match (Red in the Photo). Use the SetDash setup program to control the Dash color.

5. Quit the SetDash setup program.
You are now ready to write and run Python programs to control the Dash.

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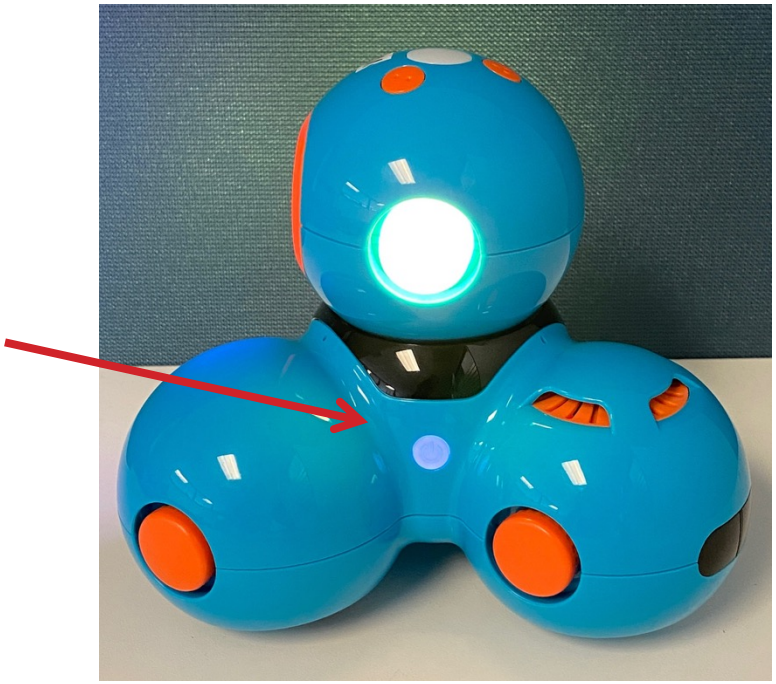
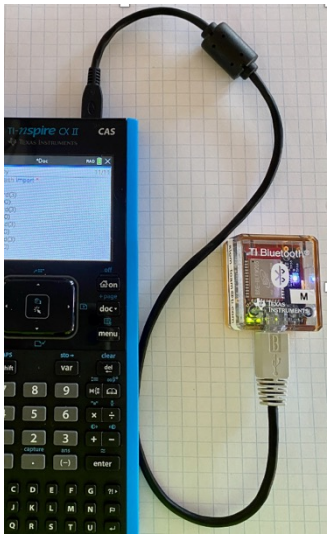
Getting ready to run a Dash program

1 **Make sure that your Dash is switched on.**



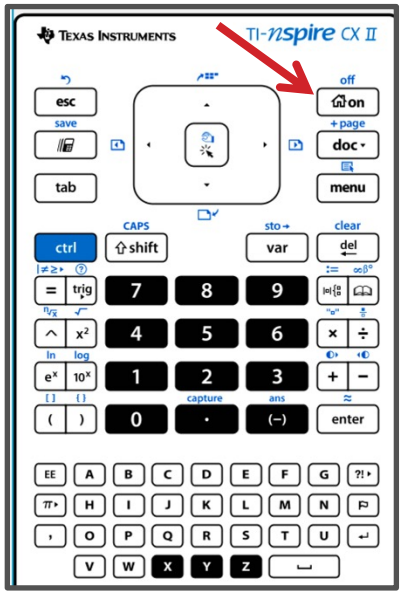
2 **Plug the Bluetooth Adapter that is paired with the Dash into the calculator.**



You are now ready to run Python programs that control the Dash.

Creating a new TI-Nspire document

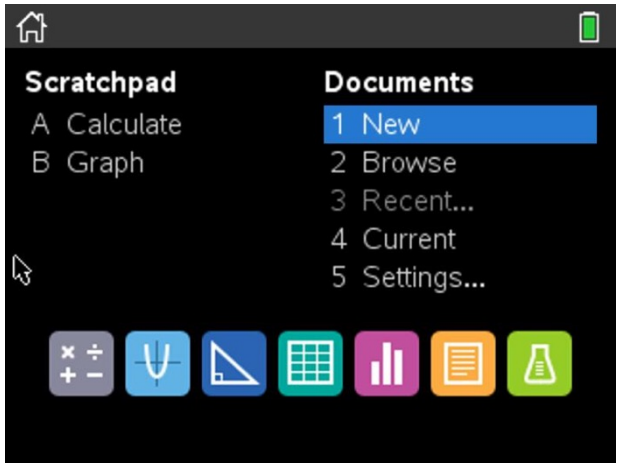
1



Press the **[home/on]** key to display the home screen.

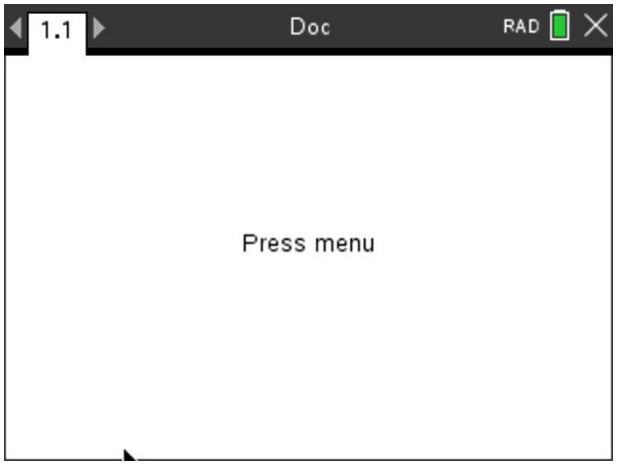
Note: If you have a document open, pressing the **[home/on]** key repeatedly toggles between the home screen and the document.

2



Use **arrow keys** and **[enter]** or Press **[1]** to select 1 New document.

3



See next slide for steps to add a program.

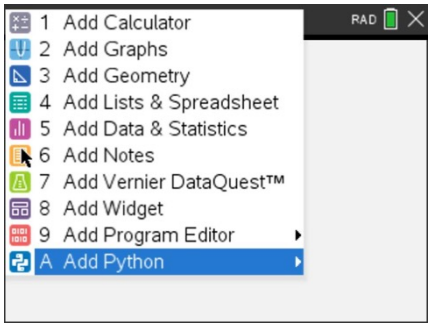
Creating a Dash Program

1

Press **[menu]** to bring up a menu of applications to add to the page.

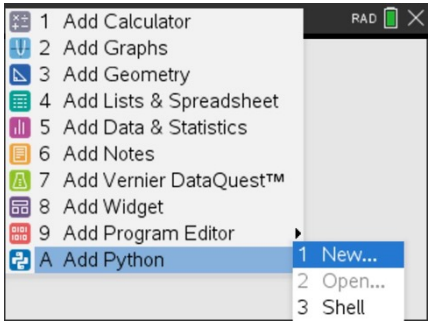
Note: You can also add a new page to the document by pressing **[ctlr] [doc] +page.**

2



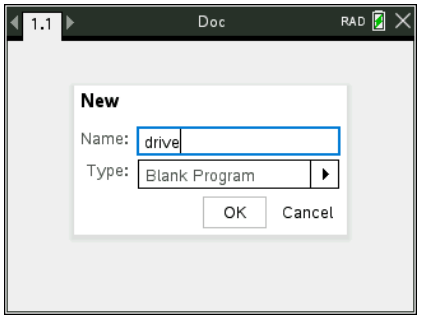
Press **down arrow** repeatedly then press **[enter]** or press **[A]** to select Add Python.

3



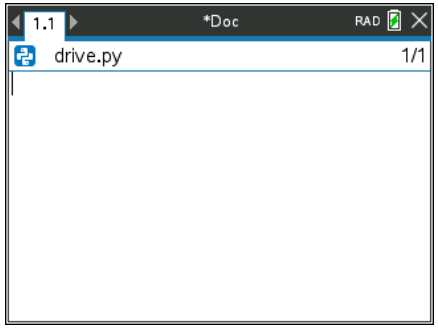
Select 1: New by pressing **[enter]** or **[1]**

4



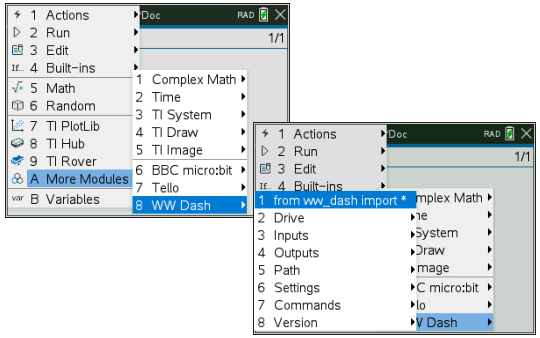
Enter your program name and press **[enter]**.

5



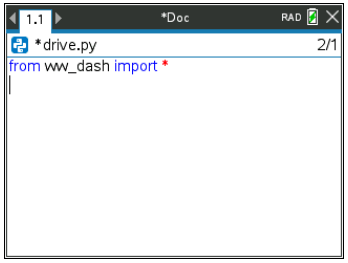
You begin at a blank edit screen.

6



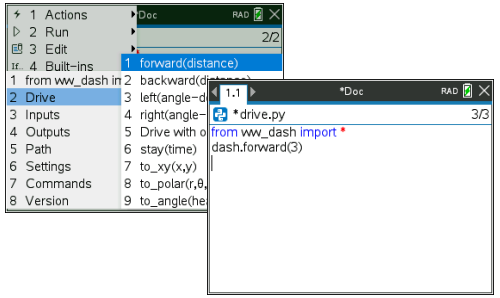
Press **[menu]** then **[A] More Modules** then select **WW Dash** from the More Modules menu. Then select [1] from **ww_dash import *** (Note: The More Modules menu selections depend on the modules that you have added to your calculator.)

7



Importing the ww_dash module is required at the beginning of every Dash program.

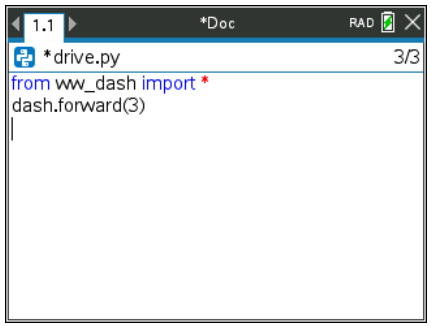
8



Press **[menu]** then **[A] More Modules** then select **WW Dash** then **[2] Drive [1] forward()** to paste to the edit line. Type a value for units to drive. **Right arrow** to the end of the line and press **[enter]** to complete the statement.
A faster approach is to use **[ctrl] [enter]** from any place on a line to complete the statement and move the cursor to the beginning of the line below. **Note:** It is important that each statement begin on a new line.

Running a Dash Program

1



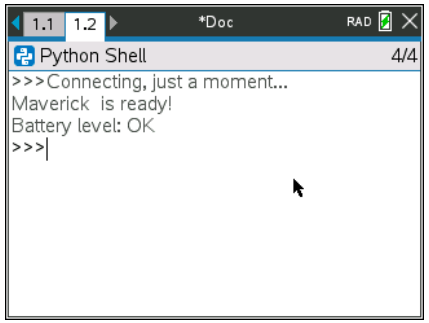
Press **[ctrl] [R]** to run the program from a Python shell on the next page.

Note: **[ctrl] [R]** also checks syntax and stores program changes. **[ctrl] [B] is another option for checking syntax and storing.**

* before the program name indicates that changes have not been stored.

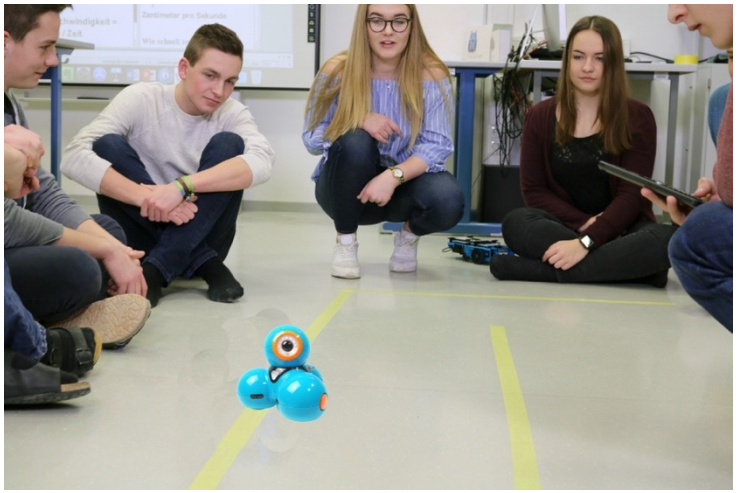
Before running the program make sure that
- Dash is switched on
- Bluetooth Adapter is connected to the calculator
- Dash is on a flat surface ready to roll

2



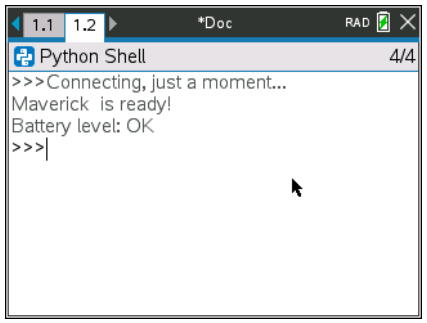
Your program runs in a Python shell.

You can re-run the program from the shell by pressing **[ctrl] [R]** again.



Editing a Dash Program

1

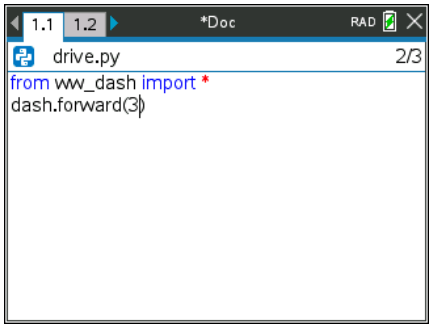


Press **[ctrl] left** to go back to your Python editor page.

2

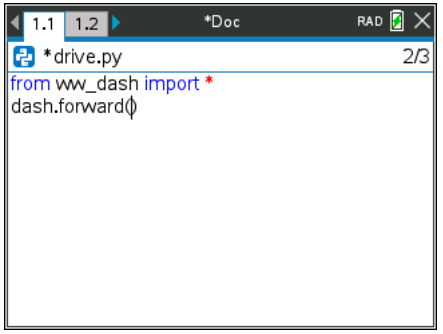
Use the arrow keys to position the cursor to change the value of the forward distance.

3



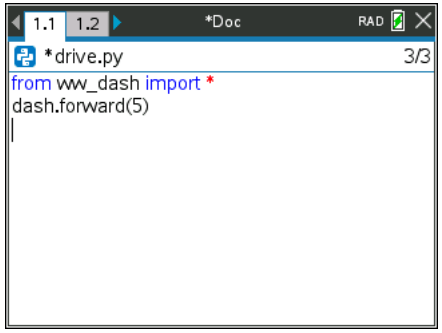
Press **[del]** to backspace over the 3.

4



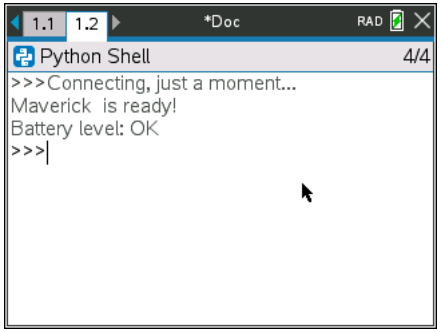
Type in a new value for distance, then **[ctrl] [enter]** to move to the next line.

5



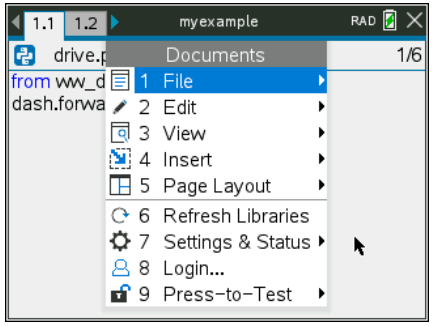
Press **[ctrl] [R]** to run the program again from a Python shell on the next page.

6



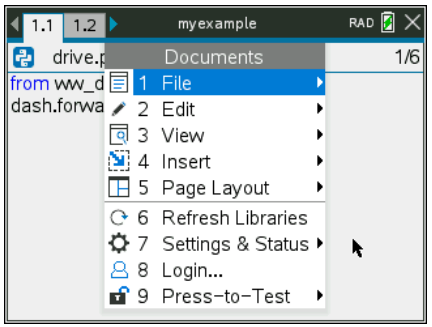
Saving a TI-Nspire document file

1



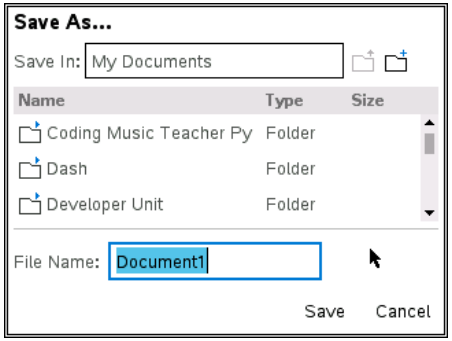
Press **[doc]** then select 1 File from the menu by pressing **[enter] or [1].**

2



Select 4 Save or 5 Save As… from the menu.

3

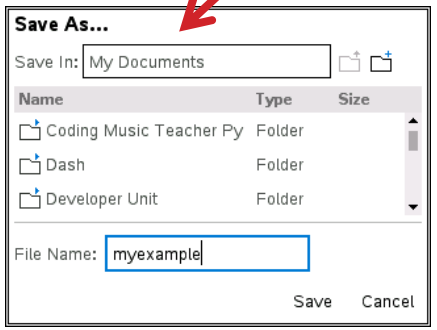


Type in your file name using alpha and numeric characters.

Note: The name must begin with an alpha character.

4

Folder where file will be saved.



Press **[enter]** to save the file to the folder indicated above.

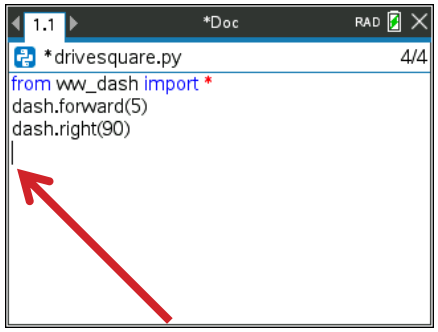
To change the folder press the **[UP]** arrow key and then use **arrows** and **[enter]** to select a folder before pressing **[enter]** to save the file.

Press **[esc]** to cancel the save dialogue.

You can use **[ctrl] [S]** as a shortcut to save the TI-Nspire document file.

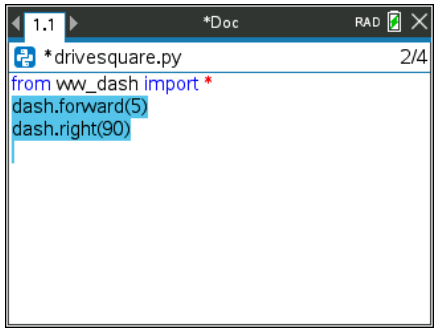
Copying and Pasting a Block of Code

1



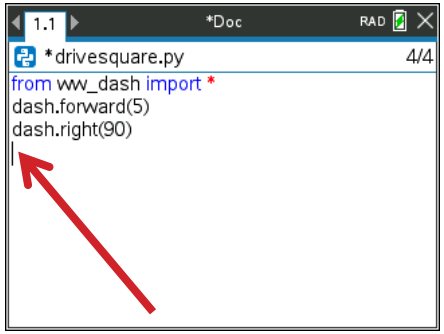
Use **arrow keys** to move the cursor to the beginning of row below the section of code that you want to copy.

2



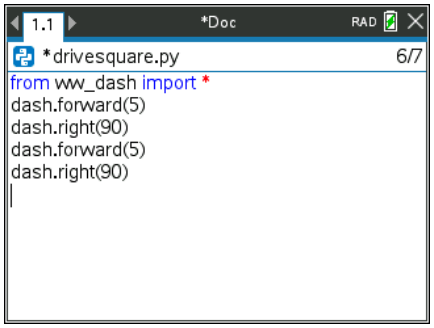
Press and hold **[shift]** then press **UP arrow** repeatedly to highlight the rows to be copied. Press **[ctrl] [C]** to copy the highlighted code.

3



Use **arrow keys** to move the cursor to the location that you want to paste from.

4

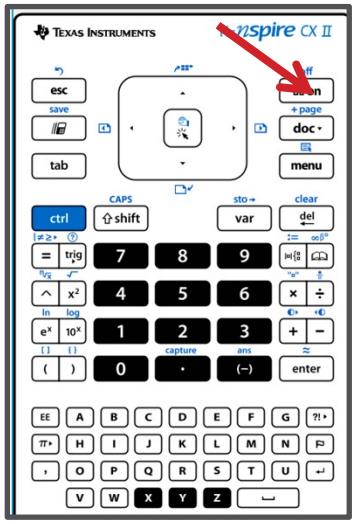


Press **[ctrl] [V]** to paste.

You can paste repeatedly.

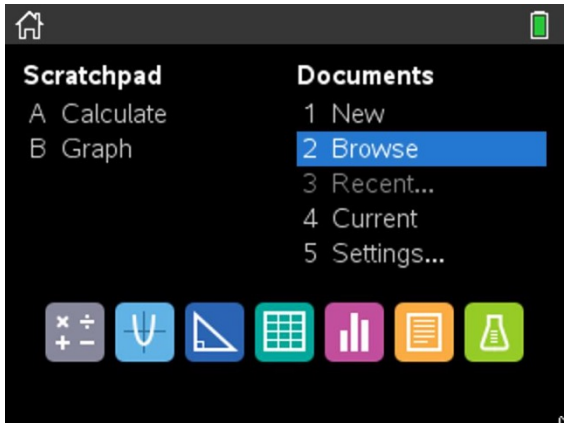
Opening an existing TI-Nspire document file

1



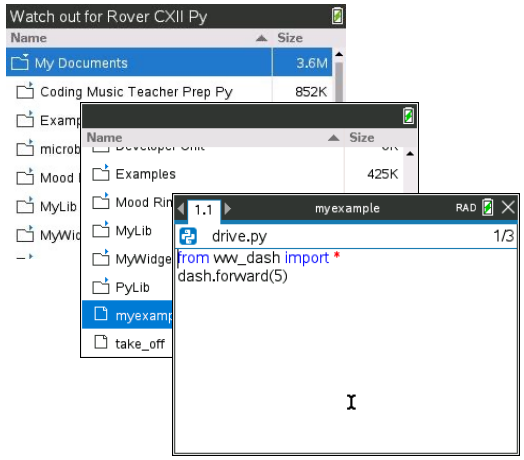
Press the **[home/on]** key to display the home screen.

2



Use **arrow keys** and **[enter]** or Press **[2]** to select 2 Browse files.

3

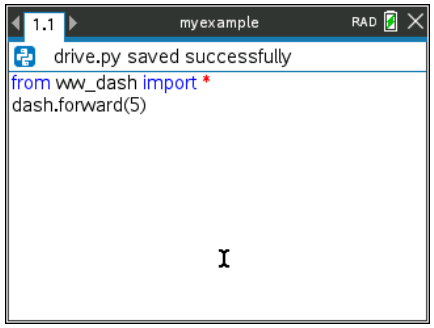


Use **arrow keys** and **[enter]** to select a folder and a file.

Note: Pressing the **[home/on]** key repeatedly toggles between the home screen and the current document.

Copying a Python Program

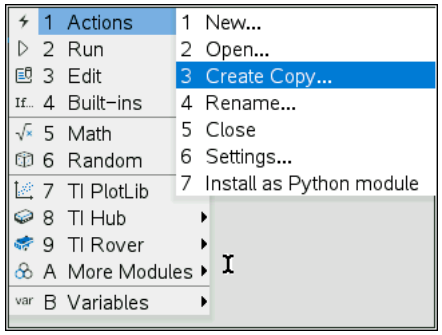
1



Press **[ctrl] [B]** to compile and save your program.

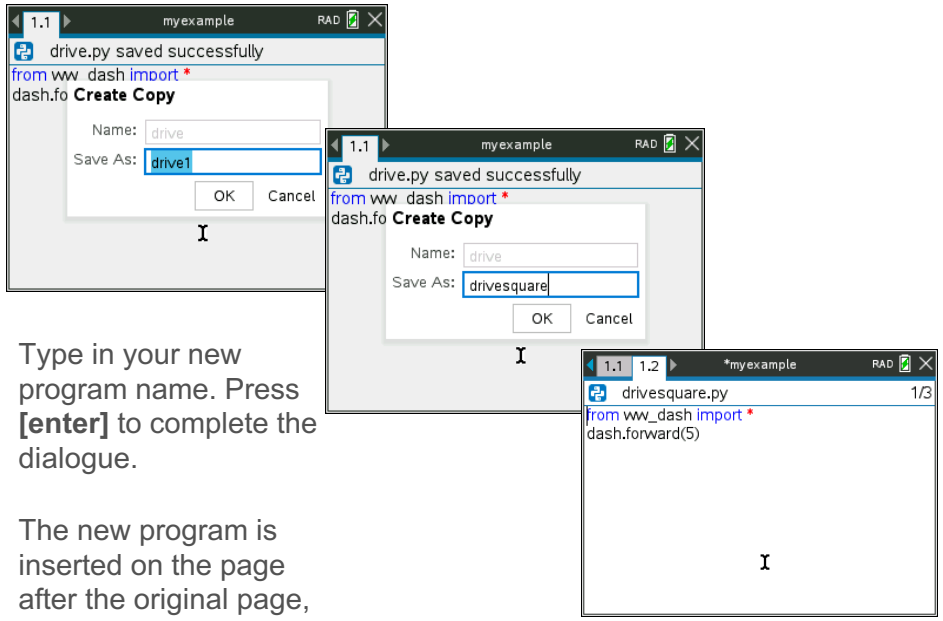
Note: You will not be able to copy the program if you have made changes since using **[ctrl] [R]** or **[ctrl] [B]**.

2



Press **[menu] [1]** Actions **[3]** Create Copy…

3

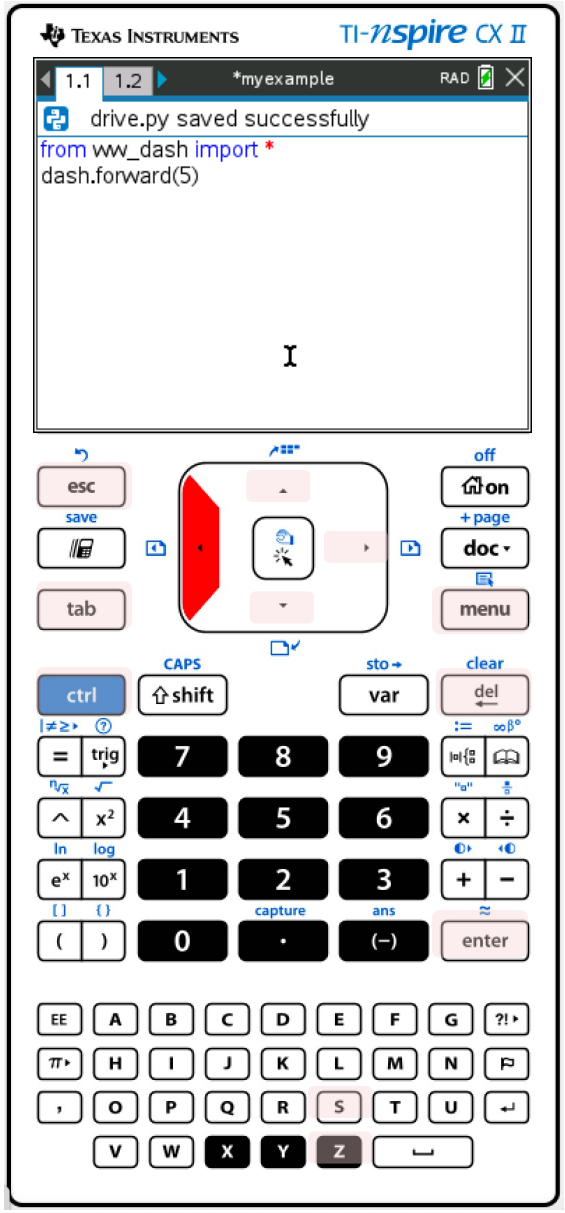


Type in your new program name. Press **[enter]** to complete the dialogue.

The new program is inserted on the page after the original page, in this case page 1.2.

Entry and Edit Tips

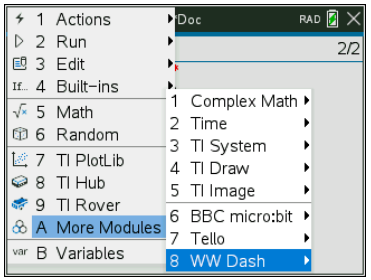
- Use **number key shortcuts** or **arrow keys** and **[enter]** to select from menus
- Use **[esc]** to back out of a menu or a dialogue.
- Use **[enter]** to complete a dialogue.
- Use **[tab]** to move to the next input when entering a function
- Use **arrow keys** to move the cursor around the screen
- Use **[del]** as a destructive backspace
- Use **[ctrl] [enter]** to complete a statement and move to the next line
- Use **[ctrl] [Z]** to undo an action
- Use **[ctrl] [S]** to save your file
- Use **[ctrl] [left arrow]** and **[ctrl] [right arrow]** to move from page to page
- Use **[menu]** to see options for the current application.

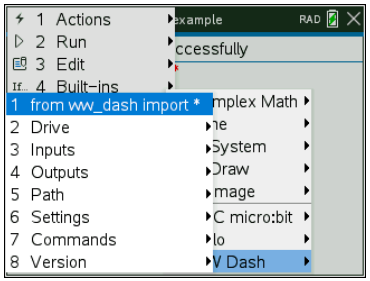


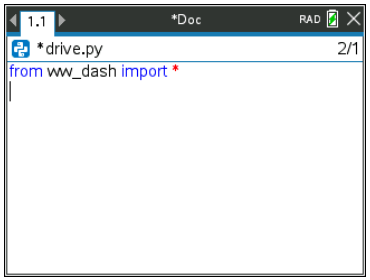
Texas Instruments

Dash Module Menus

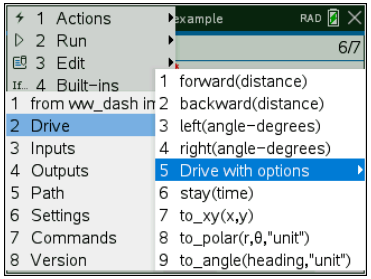
Find from ww_dash import * on the **A: More Modules WW Dash menu**. Every Dash program must include a ww_dash import statement. This statement imports Dash Python functions.



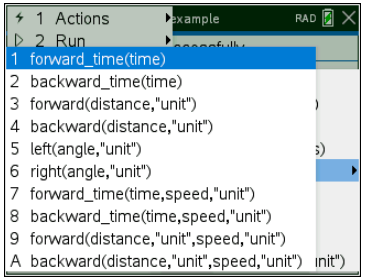




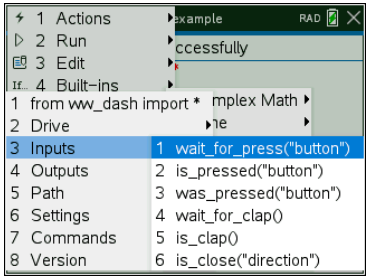
Drive



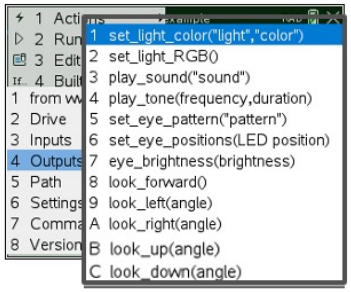
Drive with options



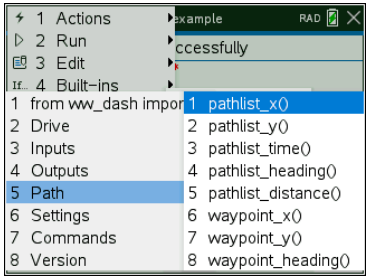
Inputs



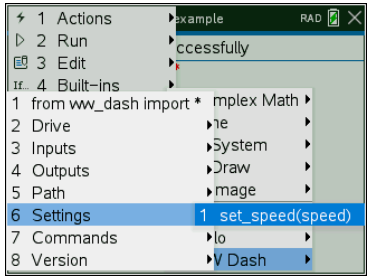
Outputs



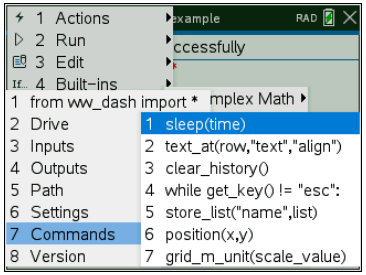
Path



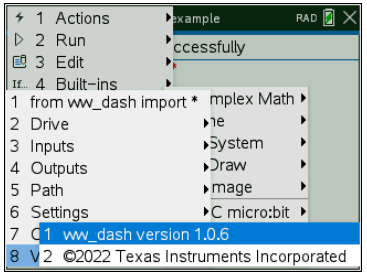
Settings



Commands

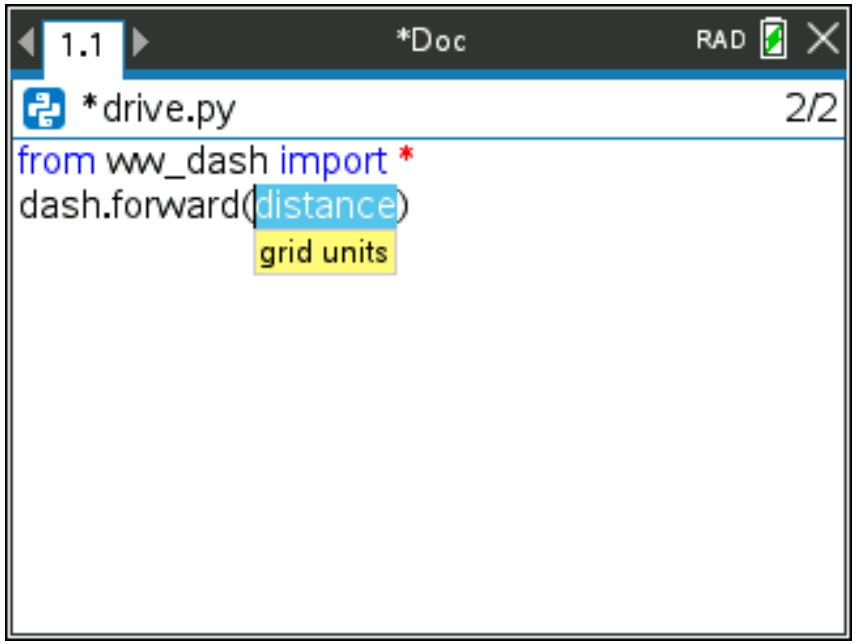


Version



MAKE IT MOVE!

New Program:

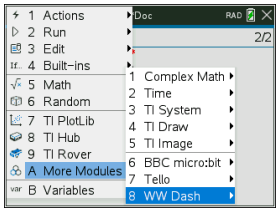


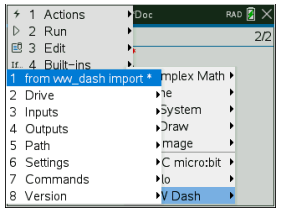
Task: Discover how far Dash drives per unit.

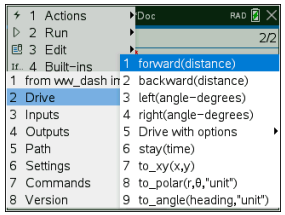
Use differing values (1-20) to determine what 1 Dash unit is.

Find from ww_dash import * on the A: More Modules WW Dash menu.

Find forward() and other drive functions on the WW Dash 2:Drive menu.







Press **[menu]** key to see Python Program Editor options.

Press **[ctrl] [R]** to run the program from a Python shell on the next page.

Use **[ctrl] left arrow** to move from the shell page back to the Python editor page.

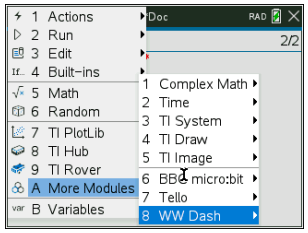
Have Dash make a sound

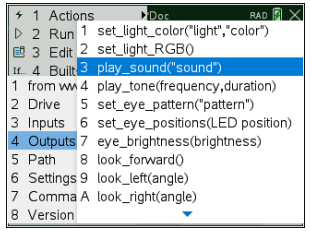
Edit Program:

Task: Have your Dash play a sound while driving.

Challenge Task: Have your Dash make a "Fire Siren" sound.

Find dash.play_sound() on the A: More Modules WW Dash 4:Outputs menu. After you paste the function to the editor you will be prompted to select a sound from a drop-down menu.





To insert a blank line for the play_sound() functon move the cursor to the ww_dash import line and then press **[ctrl] [enter]**

Press **[ctrl] [R]** to run the program from a Python shell on the next page.

Use **[ctrl] left arrow** to move from the shell page back to the Python editor page.

Set the Dash color

Task: Set the color output of the Red, Green, Blue (RGB) LED.

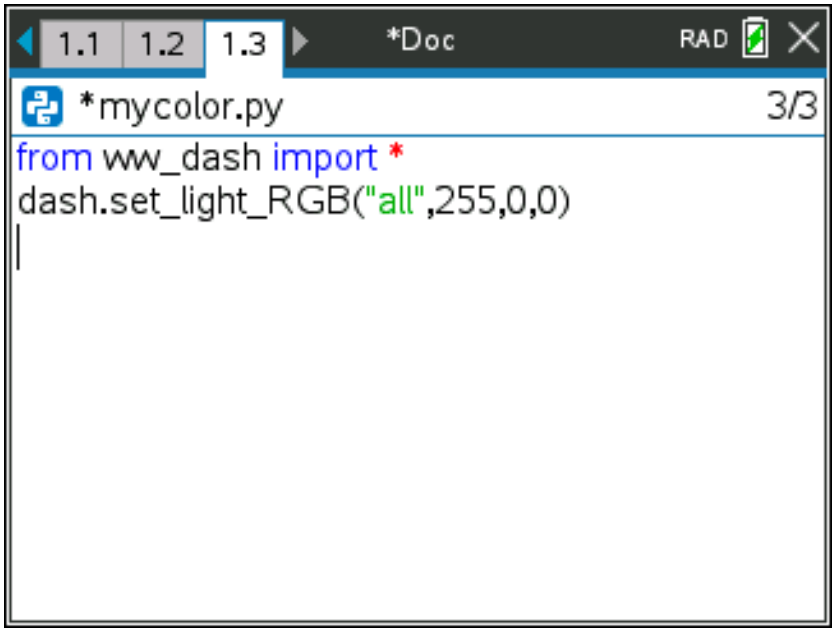
Each color takes a value of (0-255).

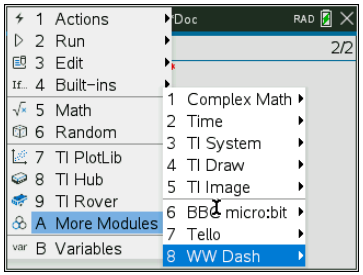
Challenge Tasks:

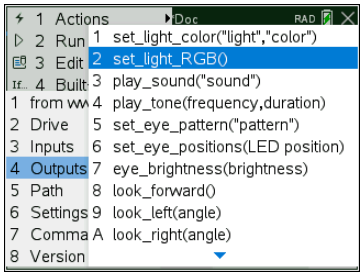
Try to make Yellow or Cyan or Magenta.

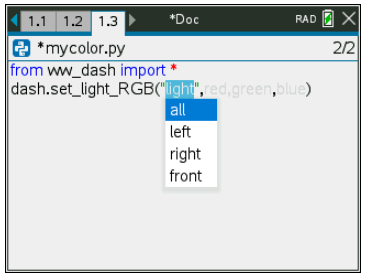
Extra Challenge: Make your own color and give the color a fun name.

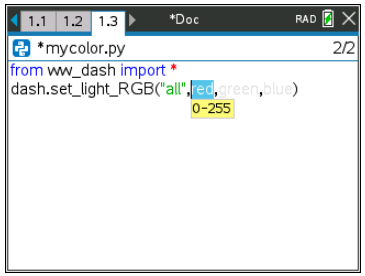
New Program:











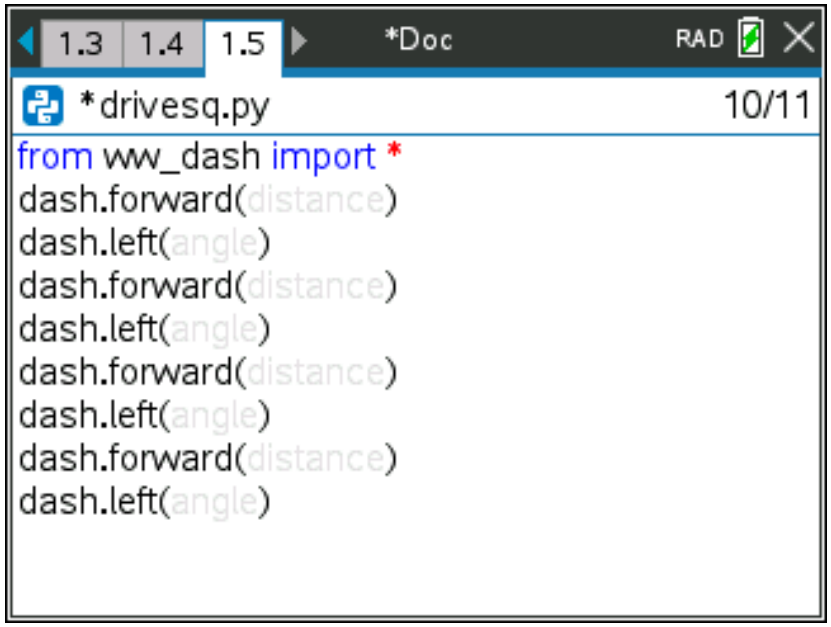
Find dash.set_light_RGB() on the WW Dash 4:Outputs menu. You will be prompted for the lights to set and then the values of the red, green and blue components of the LED, 0 is off and 255 is maximum. Press **[tab]** to move from input to input. Finally, press **[ctrl] [enter]** to complete the statement and move to the next line.

Press **[ctrl] [R]** to run the program from a Python shell on the next page.

Use **[ctrl] left arrow** to move from the shell page back to the Python editor page.

Explore angles

New Program:



The program above is a framework for driving a square.
Enter values for distance and turn angle.

Press **[menu]** key to see Python Program Editor options.

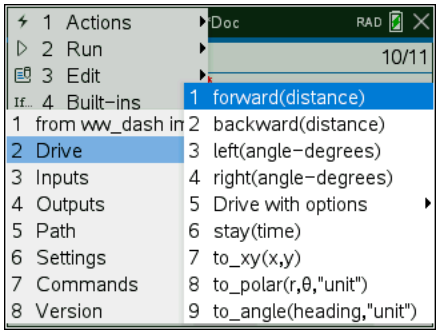
Press **[ctrl] [R]** to run the program from a Python shell on the next page.

Use **[ctrl] left arrow** to move from the shell page back to the Python editor page.

Task: Drive a square.

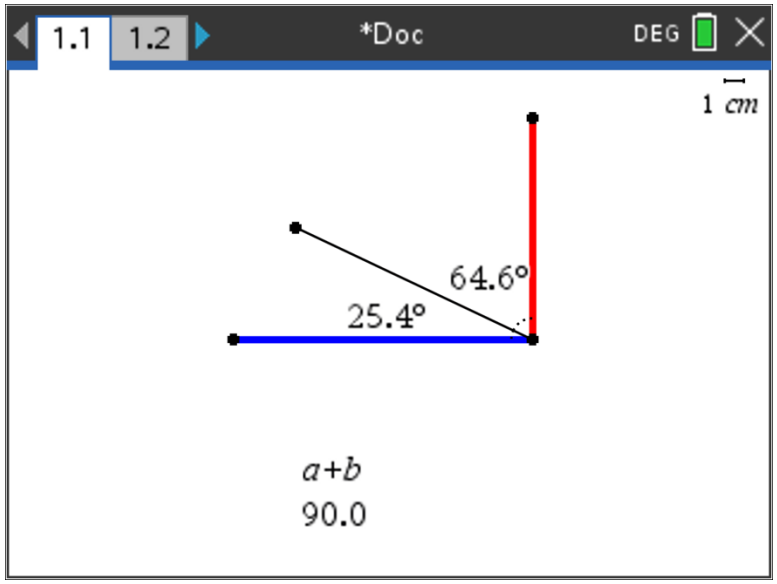
Challenge Task: Try to drive an equilateral triangle.

See the menu for the most common drive functions below.

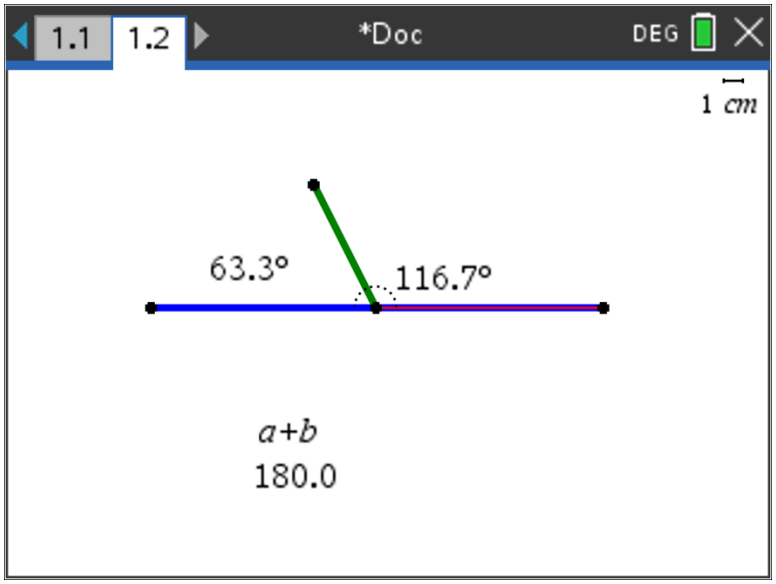


Quick Math Reminders

- Complementary Angles:
  - Sum to 90 degrees

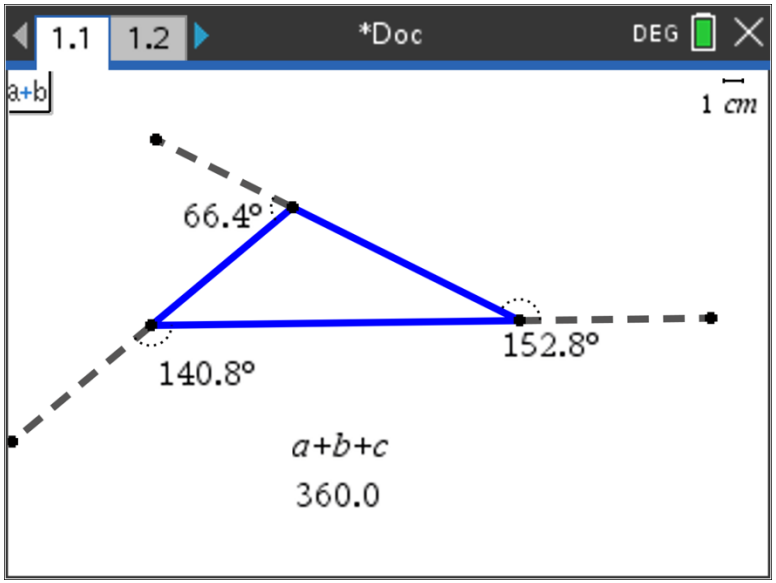


- Supplementary Angles:
  - Sum to 180 degrees

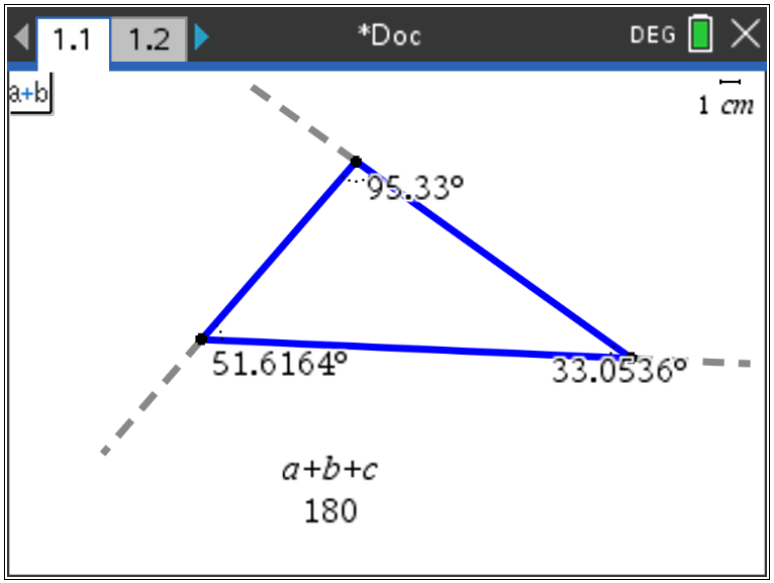


Quick Math Reminders

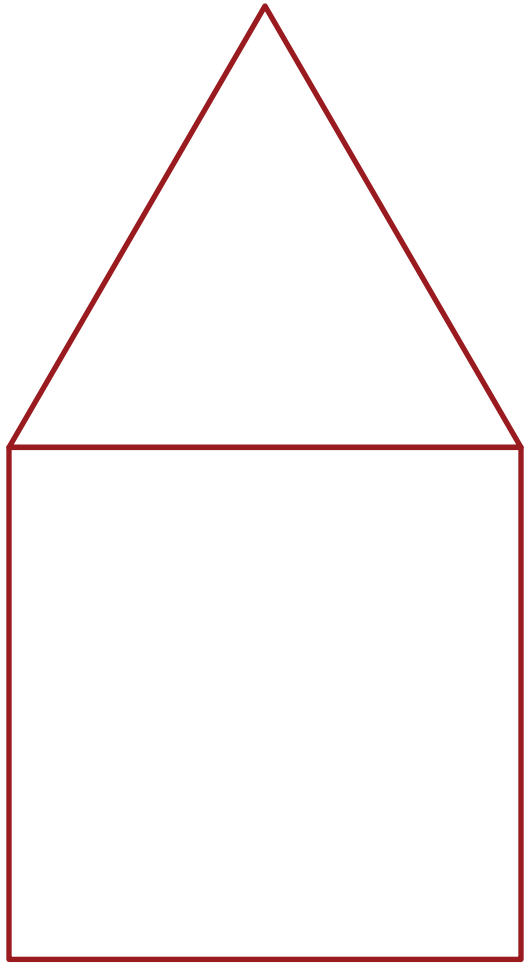
» Exterior angles:



» Interior Angles:



Logic Challenge



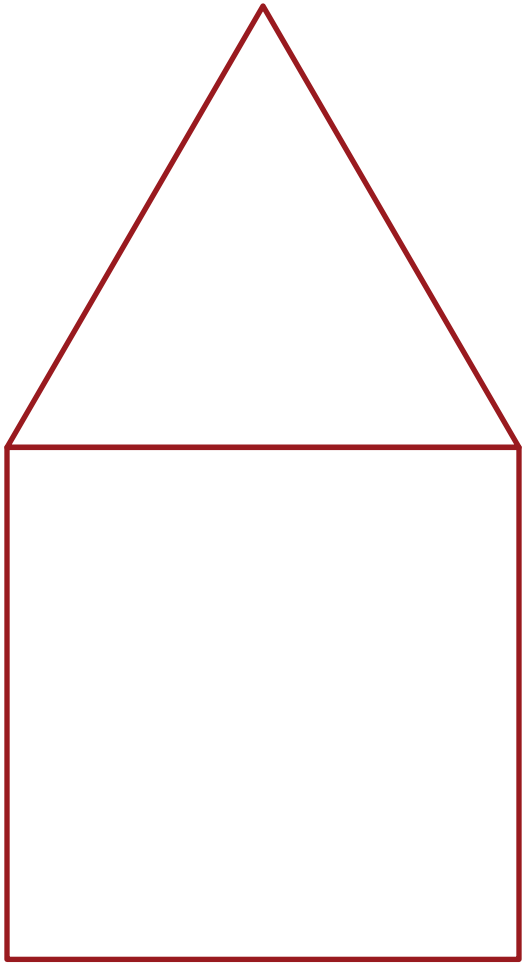
Task: Draw the figure shown large enough for Dash to drive.

Note: Try side lengths of 4 Dash units.

Write a program to have your Dash drive the figure without crossing any lines or going back over a line.

Marker version

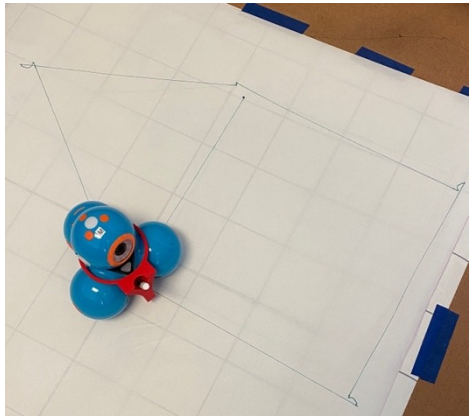
Logic Challenge



Task: Drive the figure shown without crossing any lines or going back over a line and without picking up the pen.

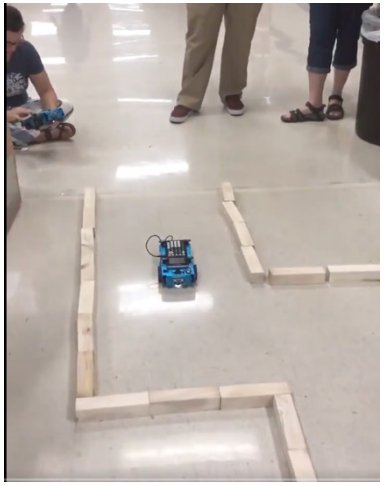
Note: Try side lengths of 4 Dash units.

When you are ready, put the pen in and trace your path.

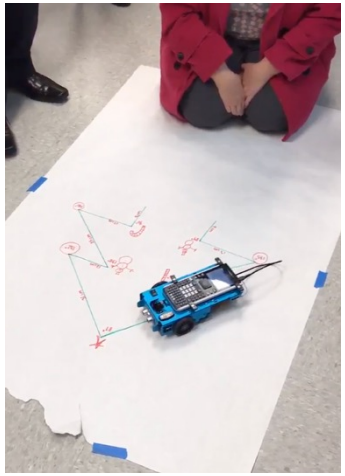


Note: For more information about marker holder 3D Print file see the earlier slide in this deck.

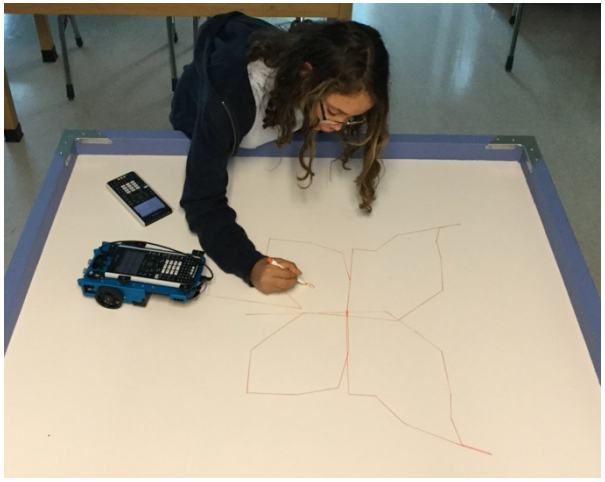
Where can you go next with TI-Rover and Dash?



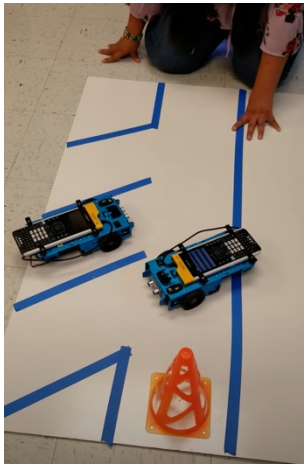
Drive an obstacle course



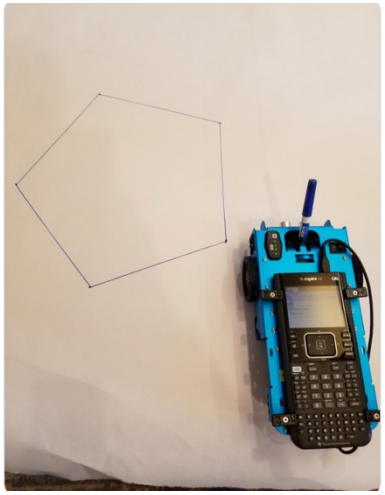
Drive a design



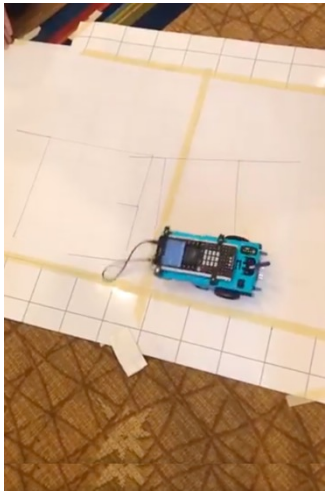
Draw artwork



Park your Rover



Use a For loop
to draw polygons

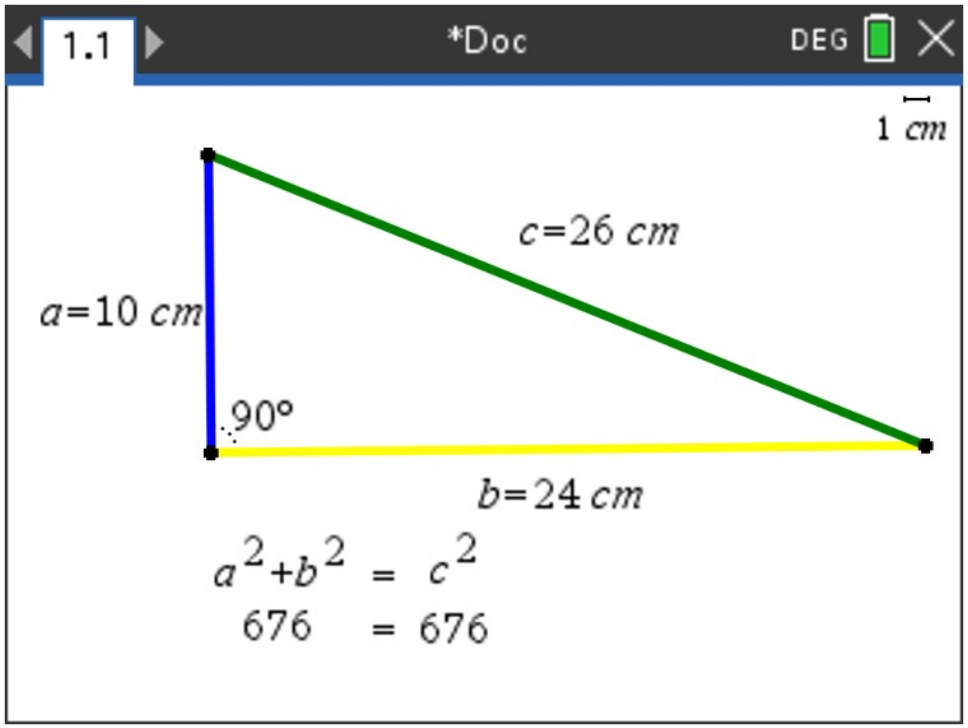


Write your name

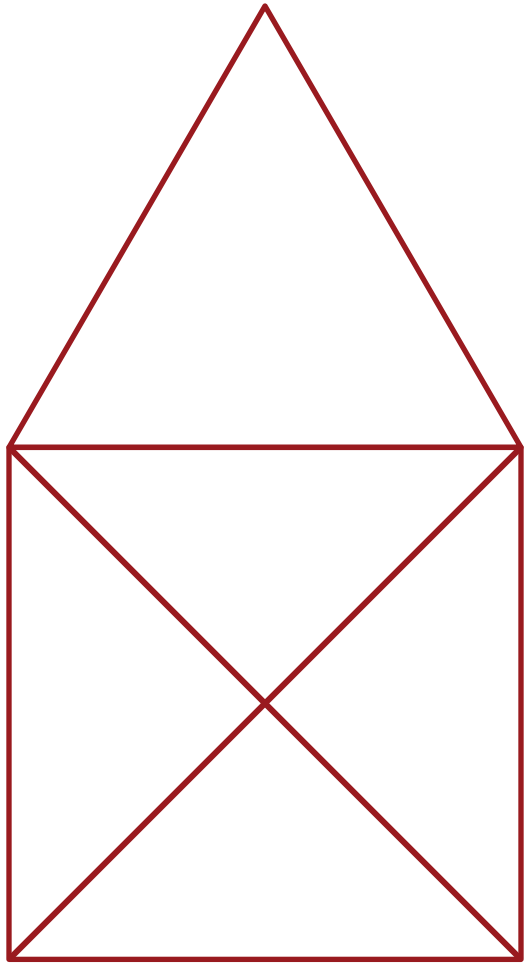
Navigate a map

Quick Math Reminders

» Pythagorean Theorem



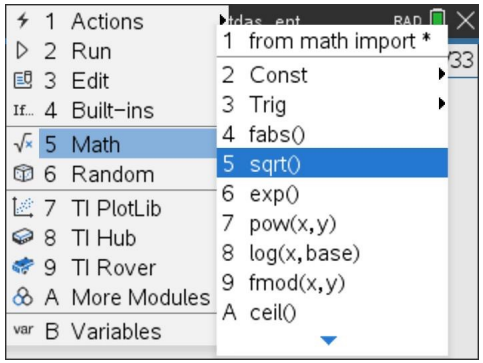
Logic Challenge 2

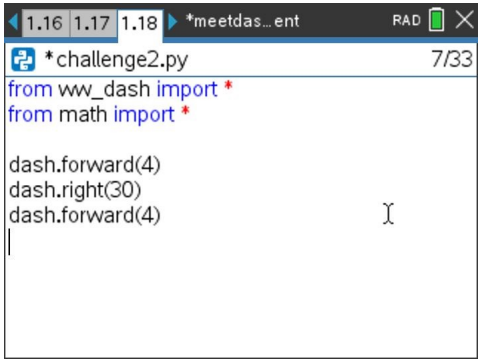


Task: Draw the figure shown large enough for Dash to drive.

Write a program to have your Dash drive the figure without crossing any lines.

The Math Module is needed for Square Root and other advanced functions.





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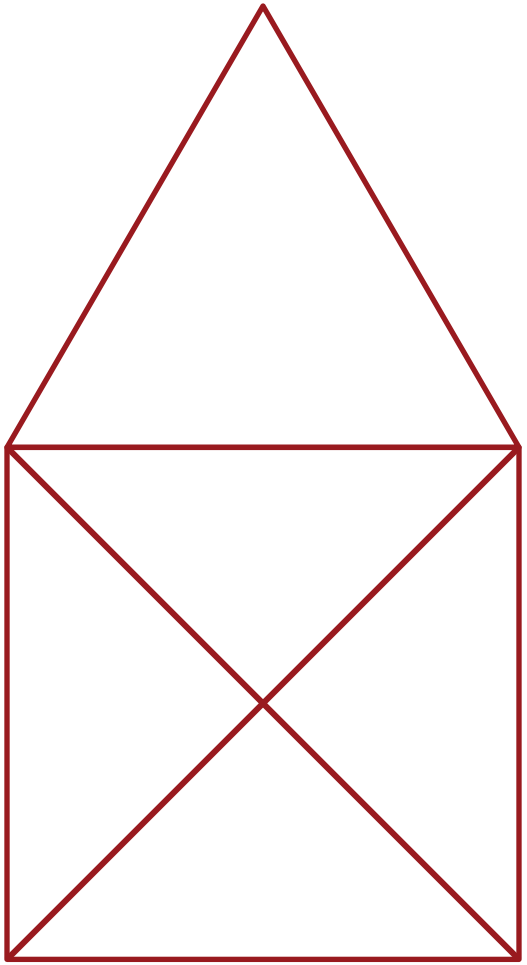
Marker version

Logic Challenge 2

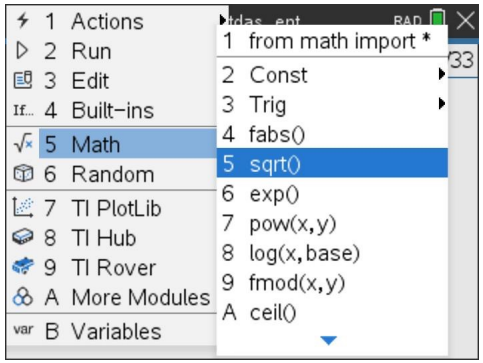


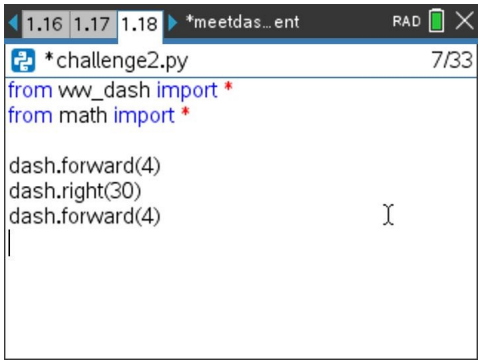
Task: Drive the figure shown without crossing any lines or going back over a line and without picking up the pen.

When you are ready, put the pen in and trace your path.

Note: For more information about marker holder 3D Print file see the earlier slide in this deck.

The Math Module is needed for Square Root and other advanced functions.





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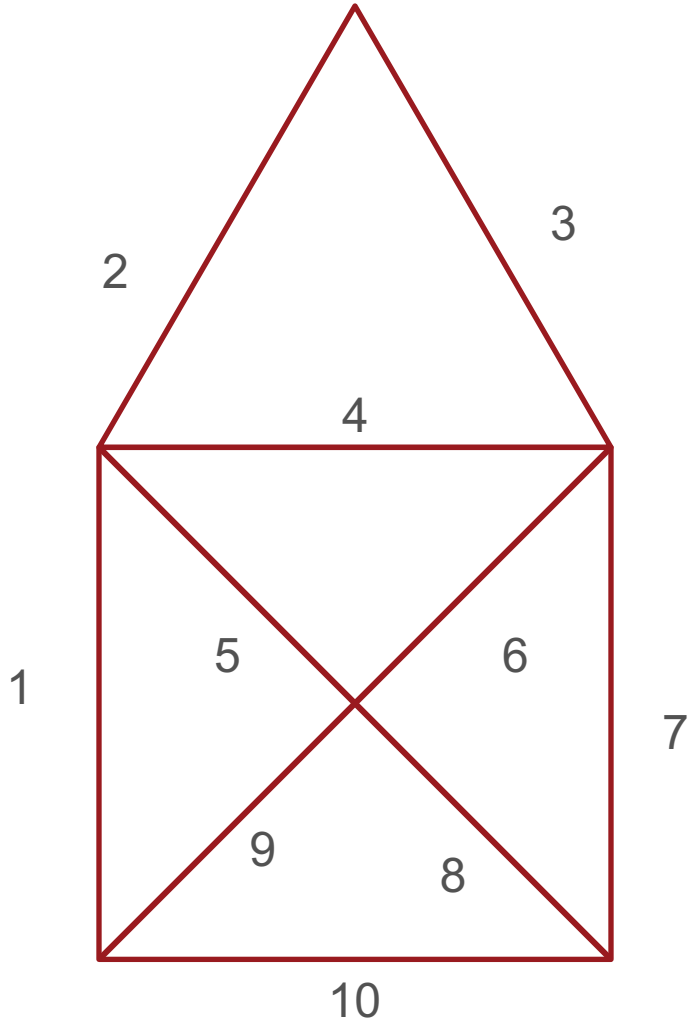
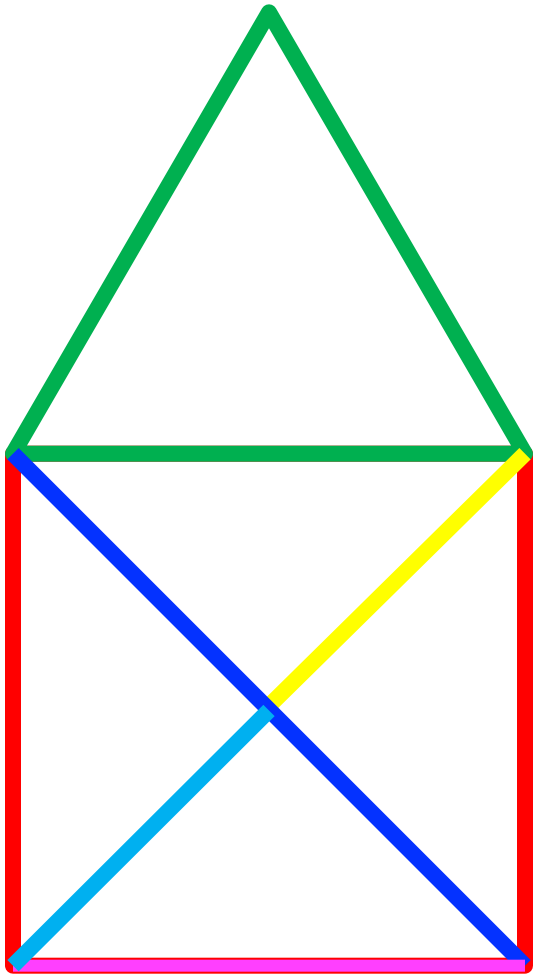
Logic Challenge 2 – example solution



Logic Challenge 3

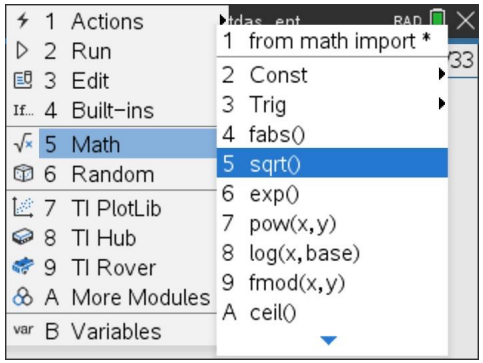


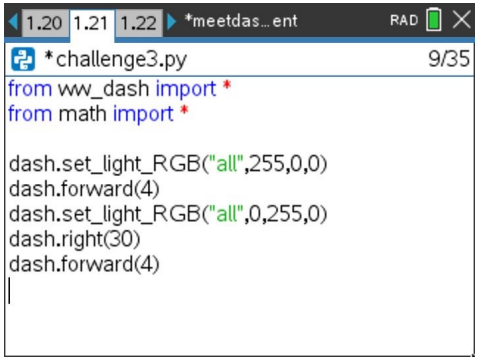
Task: Drive the figure shown without crossing any lines or going back over a line.

Now match the colors using the RGB LED. Don't worry about using a marker.

The Math Module is needed for the Square Root Function.

Put the set_light_RGB statement before the drive statement that you want to match.
Note: The LED's stay the same color until another set_light RGB statement is run.





Thank You

www.TIstemProjects.com

Contact stem-team@ti.com with questions

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