

# Meet the TI-Rover with Geometry Challenges

TI-Nspire CXII

Python

Texas Instruments

@ticalculators



[www.TIstemProjects.com](http://www.TIstemProjects.com)

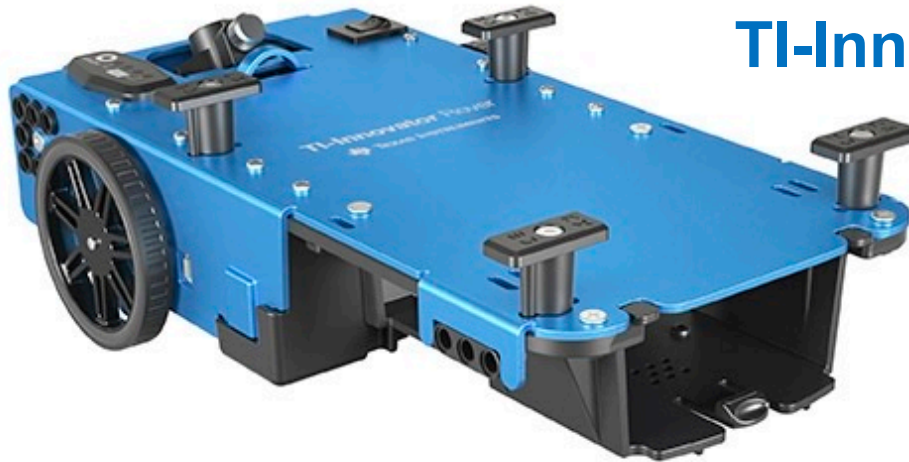
# Meet the TI-Innovator Rover



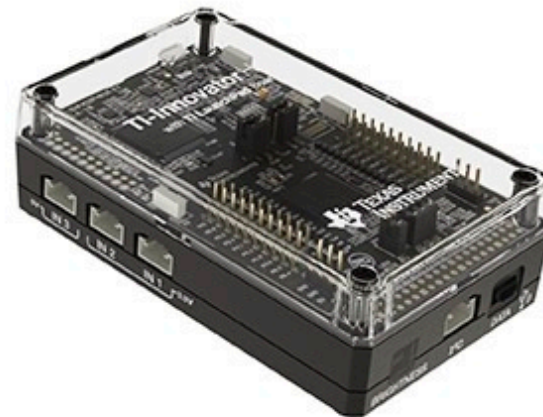
## TI Graphing Calculator



## TI-Innovator™ Rover



## TI-Innovator™ Hub



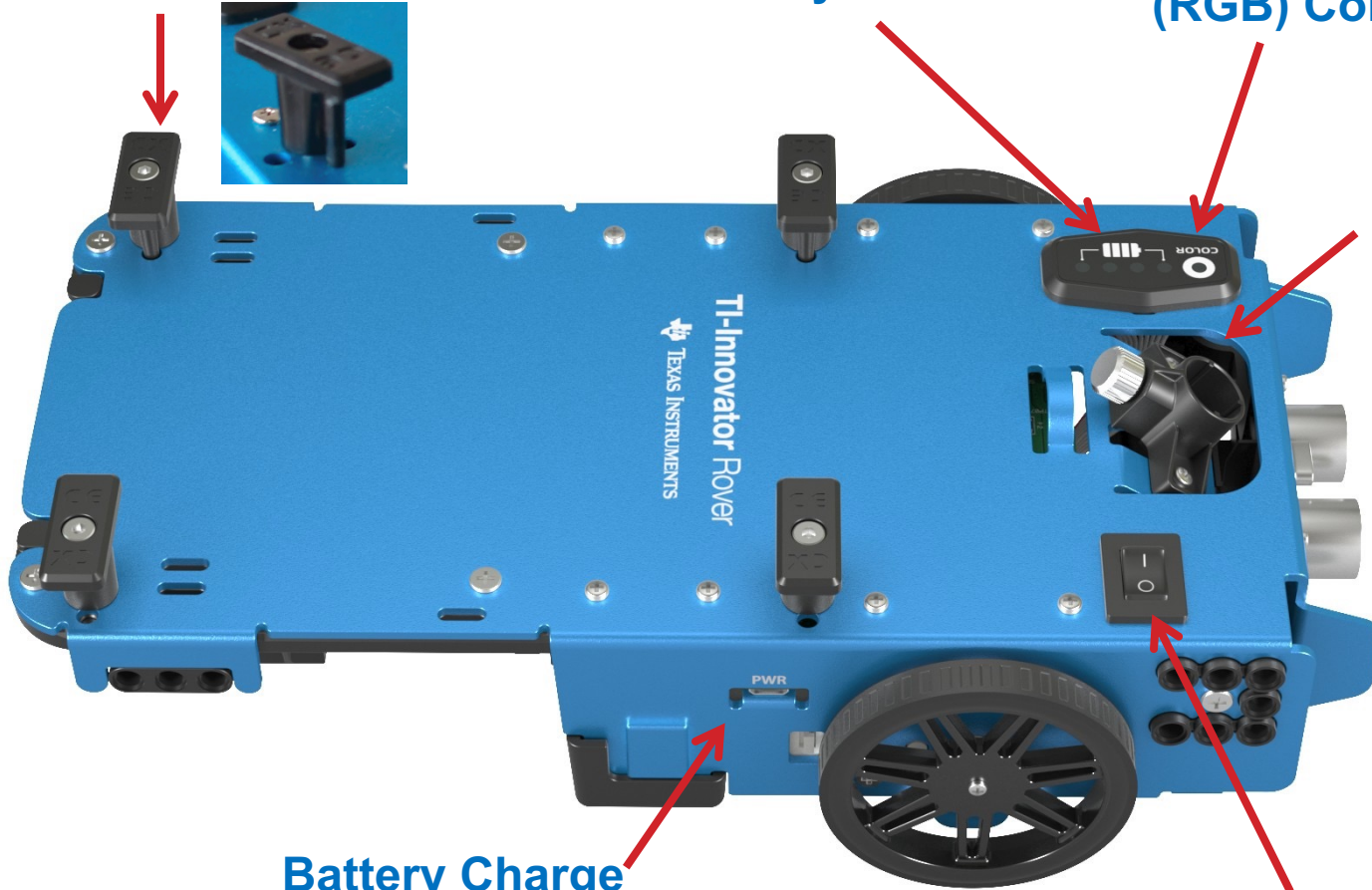
# Rover from the top

Calculator holder posts.  
Lift and twist to CE or CX side.

Battery indicator

Red-Green-Blue  
(RGB) Color LED

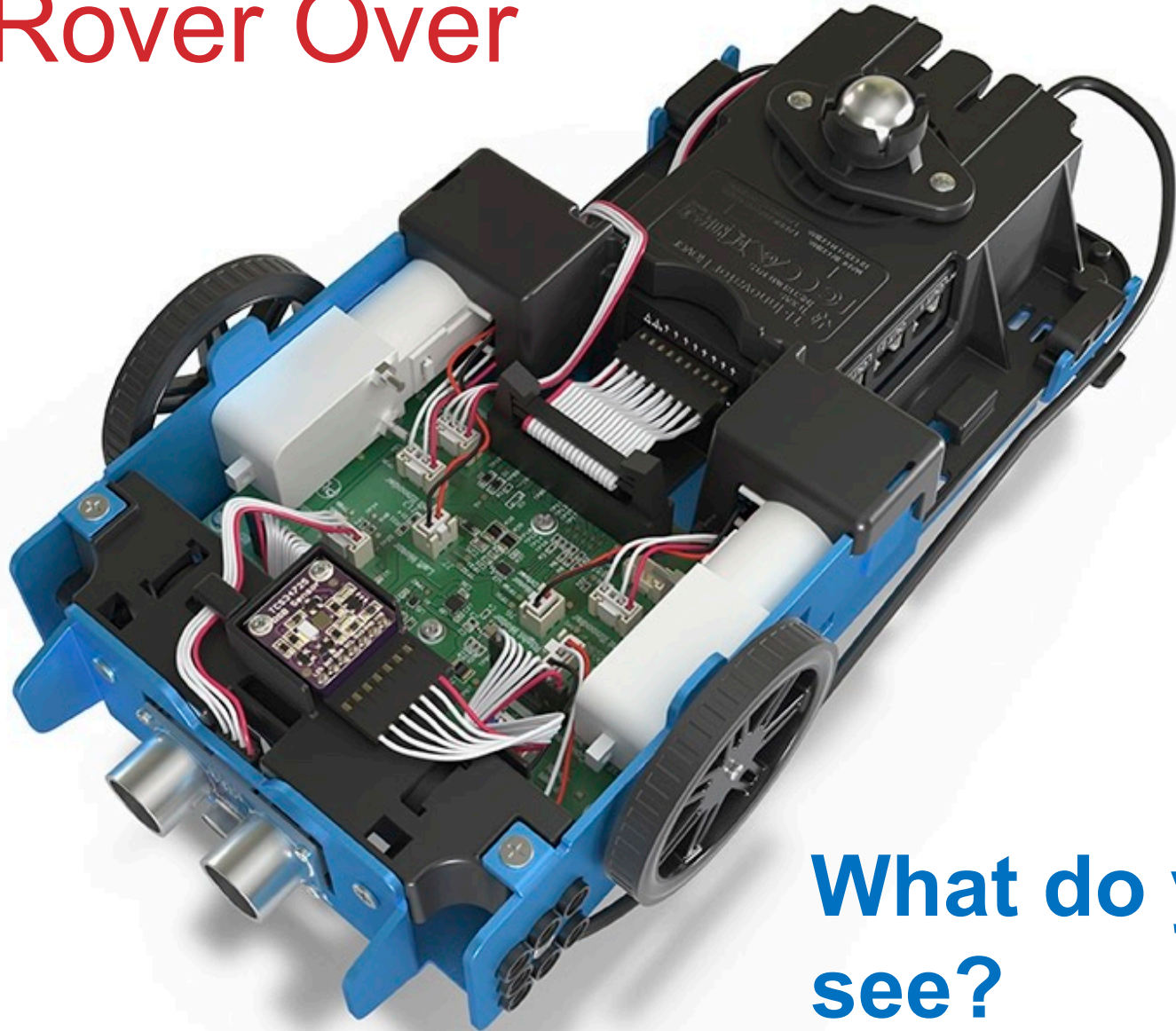
Marker holder  
(Expo Fine and  
Ultra Fine sizes)



Battery Charge  
with USB micro  
to wall adapter.

On/Off Switch

# Turn Rover Over



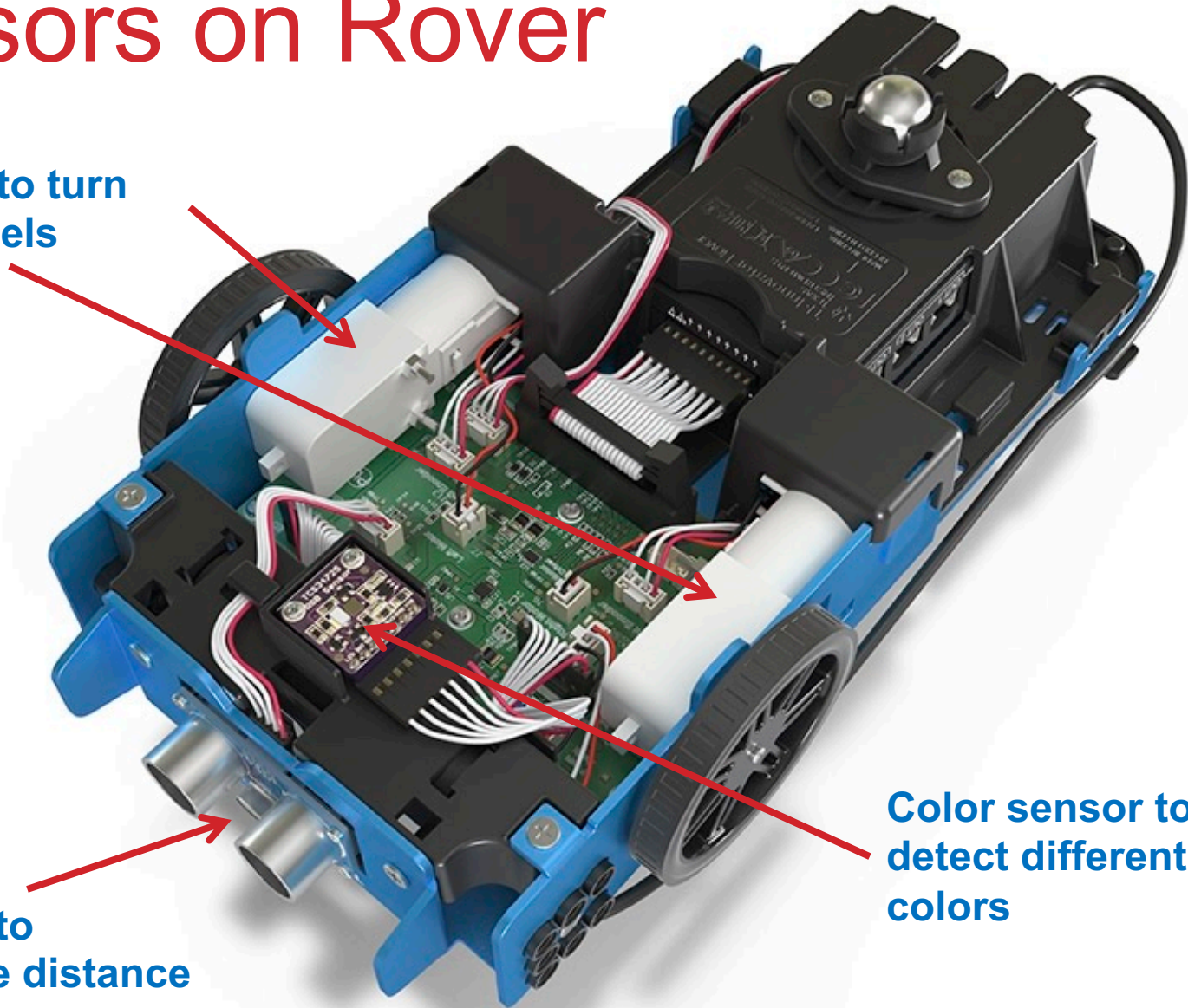
**What do you  
see?**

# Sensors on Rover

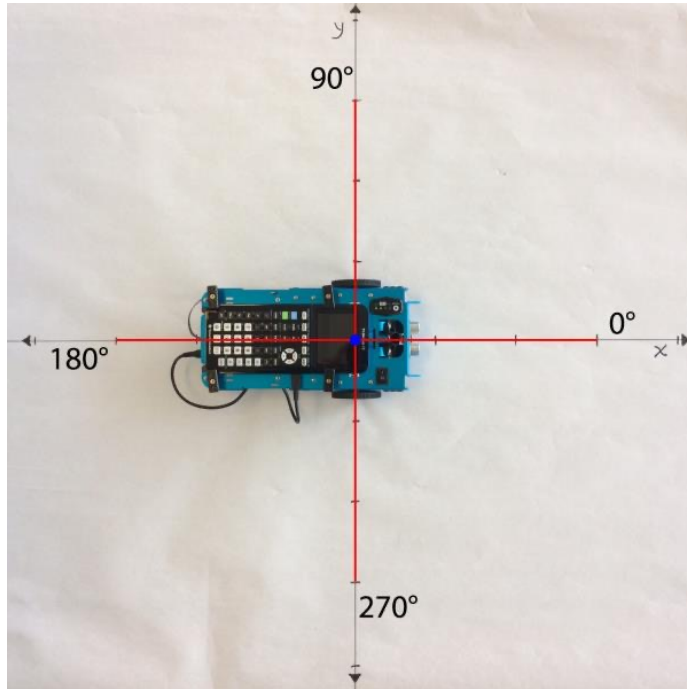
Motors to turn  
the wheels

Ranger to  
measure distance

Color sensor to  
detect different  
colors



# TI-Rover orientation and virtual grid



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

**Note:** The Rover 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(angle, "unit")` functions on the Rover Drive menu. The virtual grid also applies to Path menu functions.

# Connecting Rover to your calculator



1

Plug B side into USB B port of the Rover Hub.

2

Plug A side into port on calculator the Rover Hub.

3

Make sure that your Rover is switched on and on floor ready to roll before running the program.

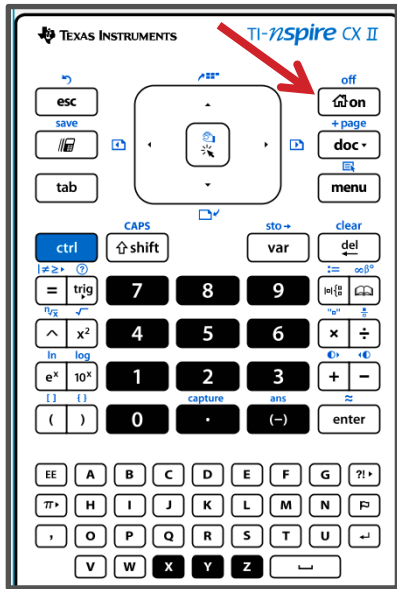


Unit-to-unit cable



# Creating a new TI-Nspire document

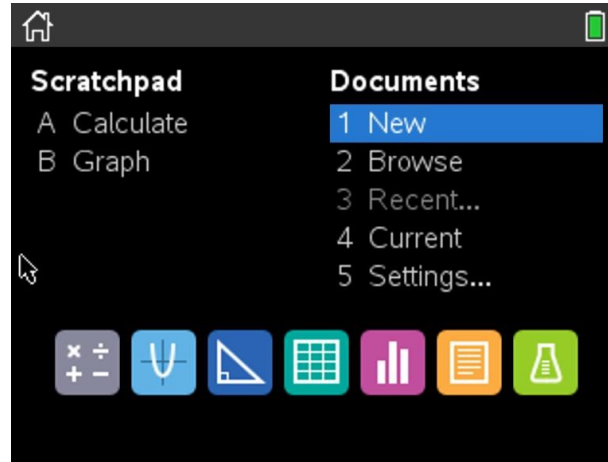
1



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.

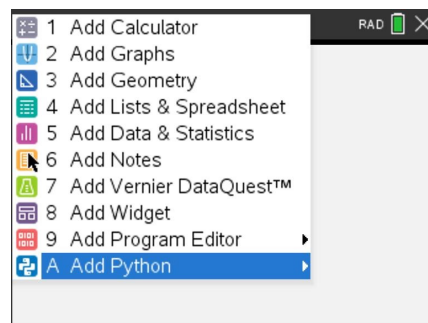
# Creating a Rover Program

1



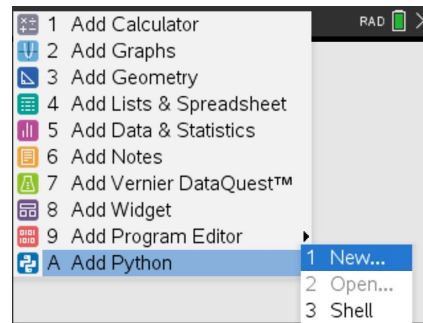
Press **[menu]** to bring up a menu of applications to add to the page.

2



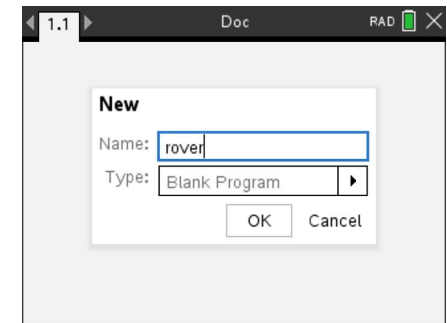
Press **down arrow** repeatedly then press **[enter]** or press **[A]** to select Add Python.

3



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

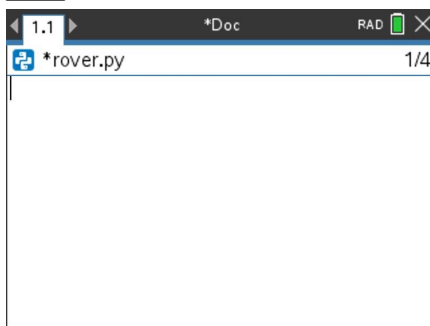
4



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

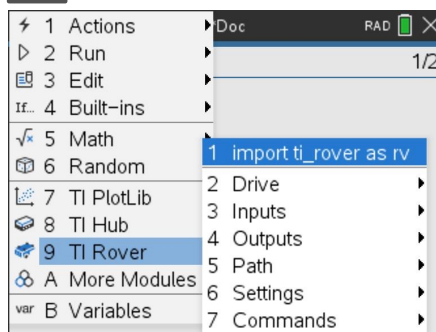
Note: You can also add a new page to the document by pressing **[ctrl] [doc] +page**.

5



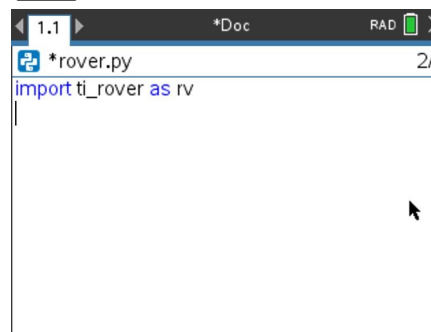
You begin at a blank edit screen.

6



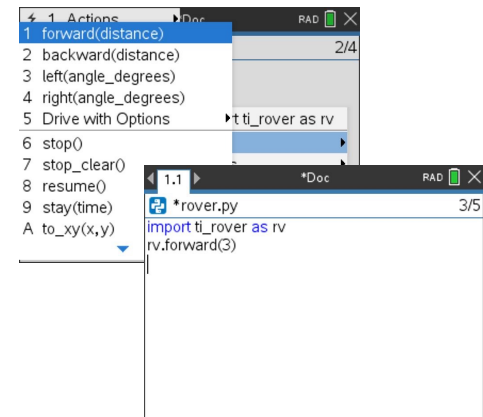
Press **[menu]** then **[9]** TI Rover **[1]** Import ti\_rover.

7



Importing the ti\_rover module is required at the beginning of every Rover program.

8

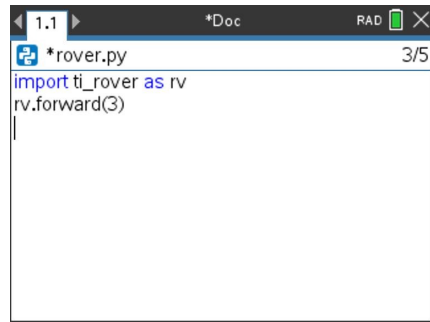


Press **[menu]** then **[9]** TI Rover **[2]** Drive **[1]** forward() to paste to the edit line. Type a value for units to drive. **Right arrow** to the end of the line and press **[enter]** to complete the statement.

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

# Running a Rover Program

1



```
*Doc RAD 1.1
*rover.py 3/5
import ti_rover as rv
rv.forward(3)
```

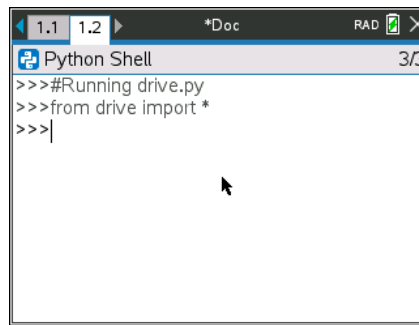
Press **[ctrl] [R]** to run the program from a Python shell on the next page.

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

- Rover is connected to the calculator
- Rover is switched on
- Rover is on a flat surface ready to roll

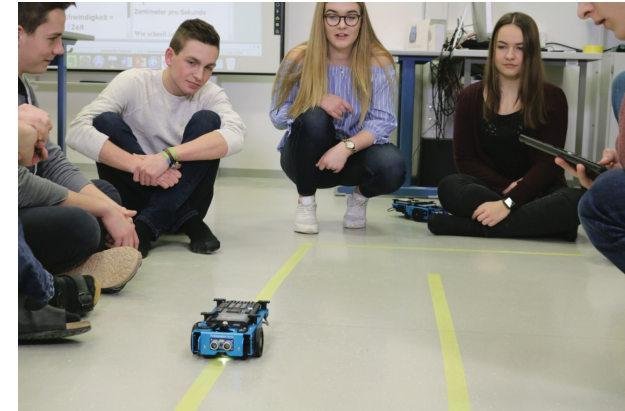
2



```
*Doc RAD 1.1 1.2
Python Shell 3/3
>>>#Running drive.py
>>>from drive import *
>>>|
```

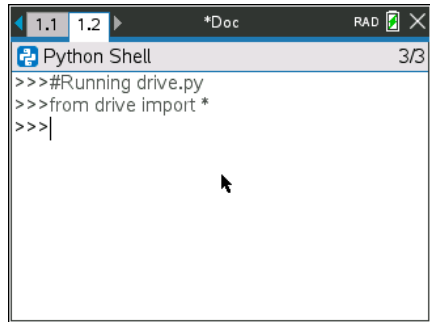
Your program runs in a Python shell.

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



# Editing a Rover Program

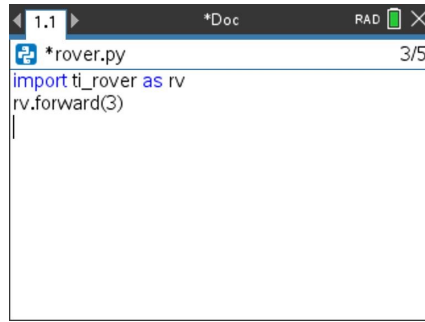
1



```
Python Shell 3/3
>>>#Running drive.py
>>>from drive import *
>>>|
```

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

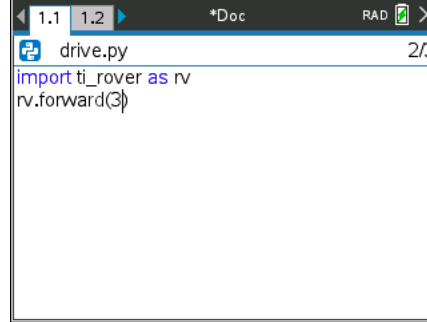
2



```
*rover.py 3/5
import ti_rover as rv
rv.forward(3)
|
```

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

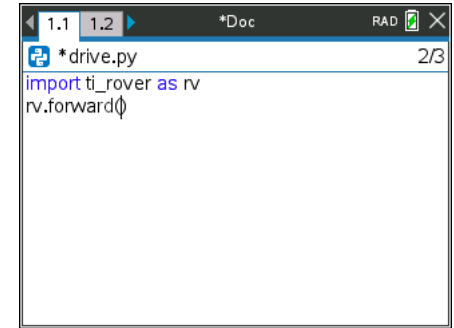
3



```
drive.py 2/3
import ti_rover as rv
rv.forward(3)
|
```

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

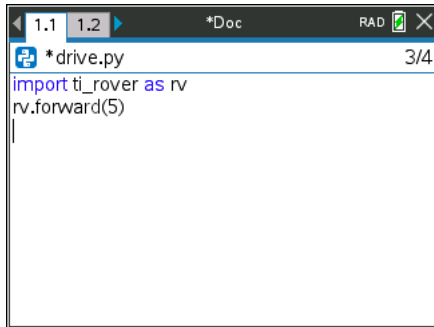
4



```
*drive.py 2/3
import ti_rover as rv
rv.forward(|
```

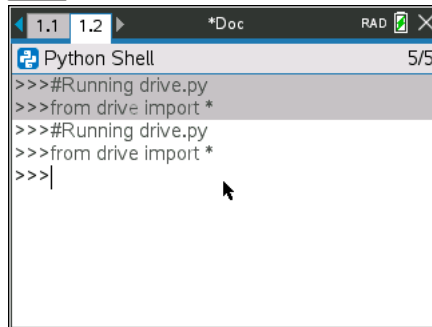
Type in a new value for distance, **right arrow** to the end of the line, then **[enter]** to move to the next line.

5



```
*drive.py 3/4
import ti_rover as rv
rv.forward(5)
|
```

6

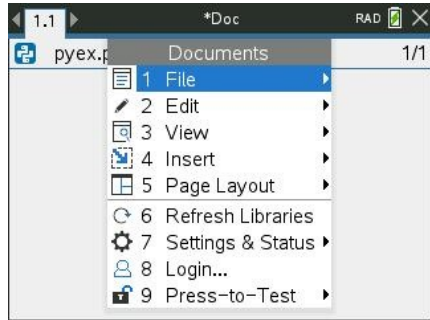


```
Python Shell 5/5
>>>#Running drive.py
>>>from drive import *
>>>#Running drive.py
>>>from drive import *
>>>|
```

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

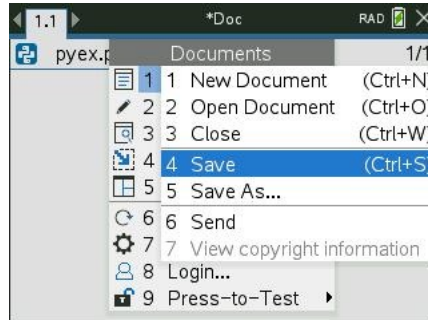
# Saving a TI-Nspire document file

1



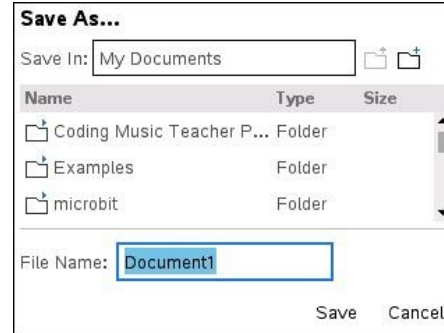
Press **[doc]** then select 1 File from the menu by pressing **[enter]** or **[1]**.

2



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

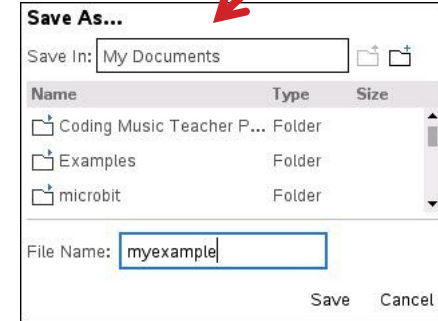
3



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.

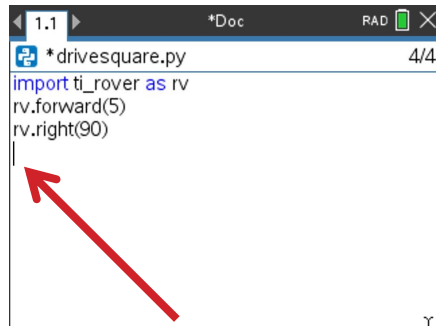
To change the folder press the **[UP]** arrow key and then use **arrows** and **[enter]** to select a folder before pressing **[enter]** to save the file.

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

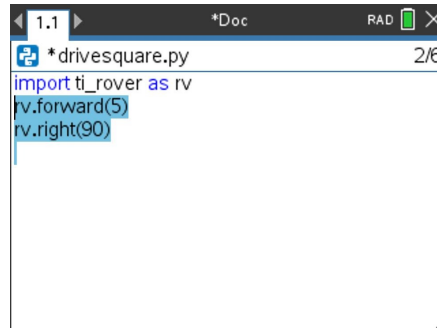


```
*drivesquare.py 4/4
import ti_rover as rv
rv.forward(5)
rv.right(90)
|
```

A red arrow points to the cursor at the beginning of the empty line below the code block.

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

2

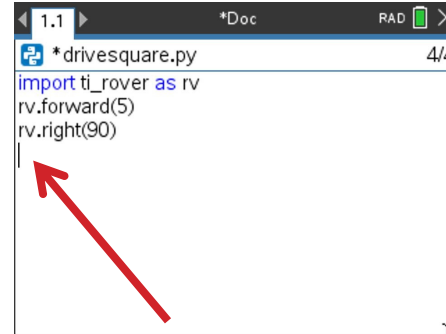


```
*drivesquare.py 2/6
import ti_rover as rv
rv.forward(5)
rv.right(90)
|
```

The code block is highlighted in blue.

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

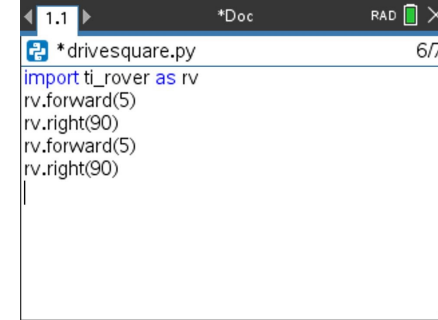


```
*drivesquare.py 4/4
import ti_rover as rv
rv.forward(5)
rv.right(90)
|
```

A red arrow points to the cursor at the beginning of the empty line below the code block.

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

4



```
*drivesquare.py 6/7
import ti_rover as rv
rv.forward(5)
rv.right(90)
rv.forward(5)
rv.right(90)
|
```

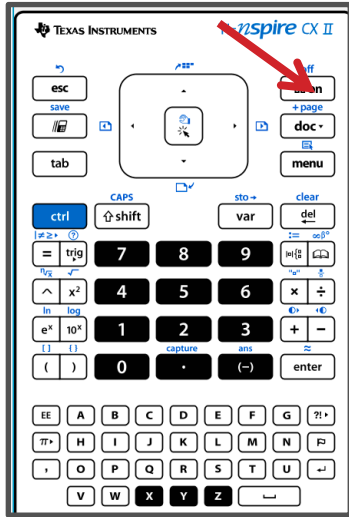
The code block is pasted, and the cursor is at the beginning of the empty line below it.

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

You can paste repeatedly.

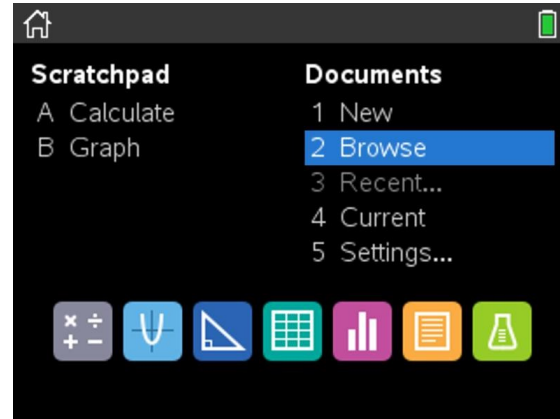
# Opening an existing TI-Nspire document file

1



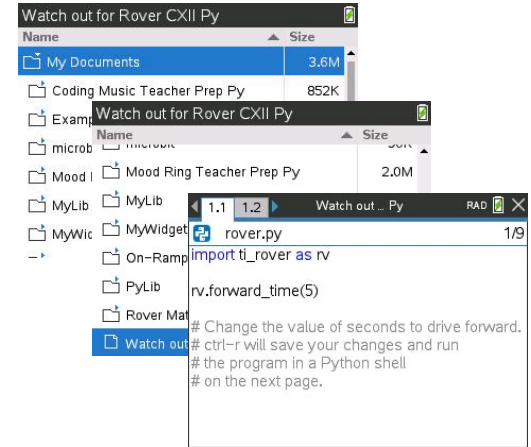
Press the **[home/on]** key to display the home screen.

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

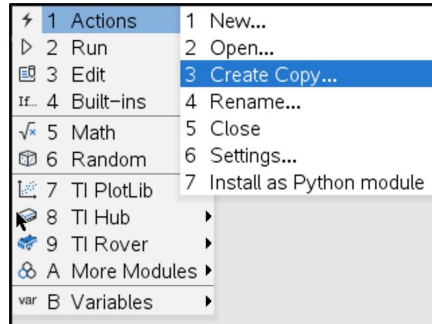
1

```
drive.py saved successfully
import ti_rover as rv
rv.forward(5)
```

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

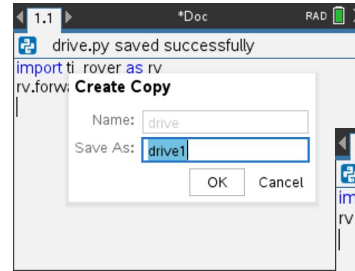
Note: You will not be able to copy the program if you have made changes since using **[ctrl] [R]** or **[ctrl] [B]**.

2



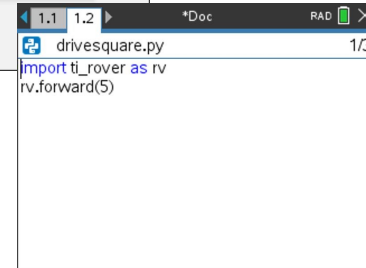
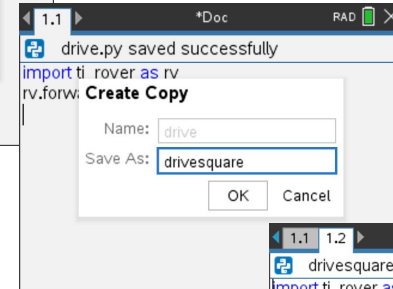
Press **[menu] [1]** Actions  
**[3]** Create Copy...

3



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

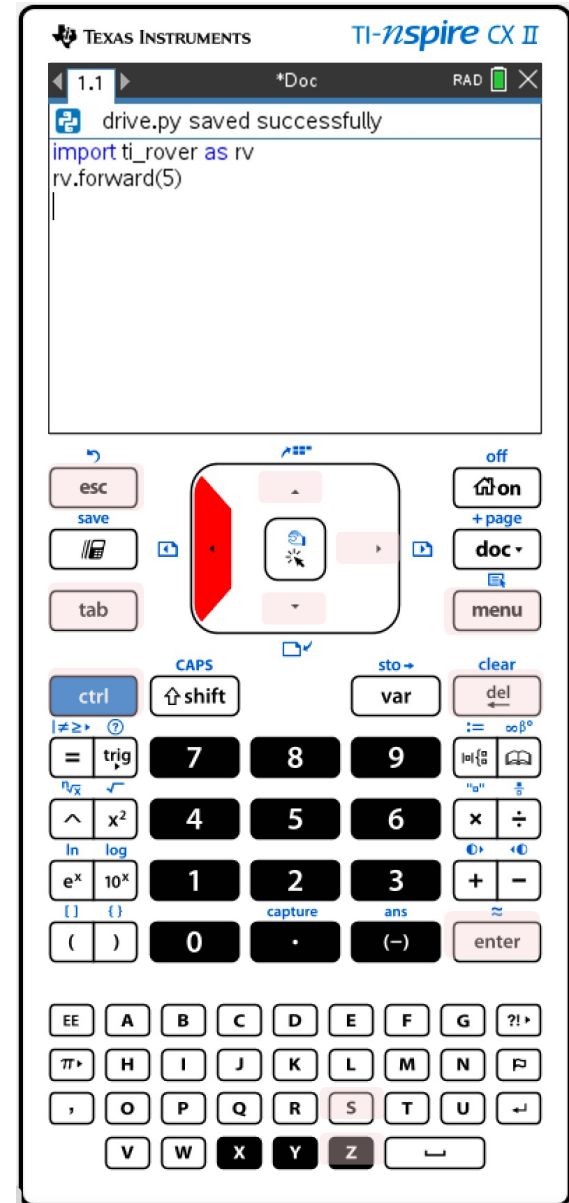
The new program is inserted on the page after the original page, in this case page 1.2.





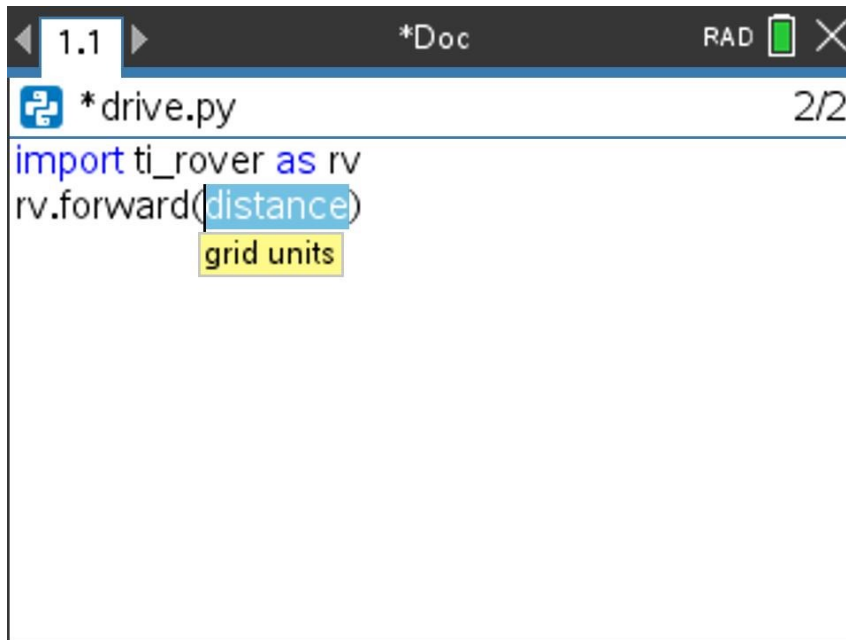
# Entry and Edit Tips

- » 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.



# MAKE IT MOVE!

## New Program:



```
1.1 *Doc RAD X
*drive.py 2/2
import ti_rover as rv
rv.forward(distance)
    grid units
```

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

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

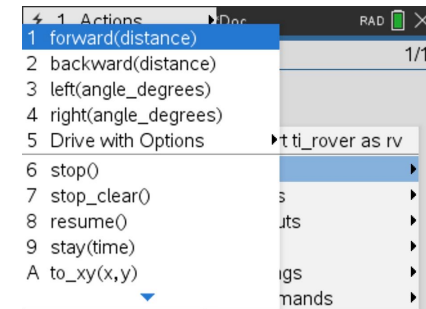
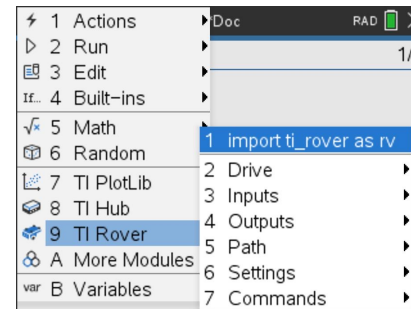
Use **[ctrl] left** to move from the shell page back to the Python editor page.

**Task: Discover how far Rover drives per unit.**

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


Find `import ti_rover` on the TI Rover menu.

Find `forward()` and other drive functions on the Rover 2:Drive menu.



# Set the color

## New Program:



```
1.1 *Doc RAD X
*color.py 2/2
import ti_rover as rv
rv.color_rgb(red, green, blue)
0-255
```

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

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

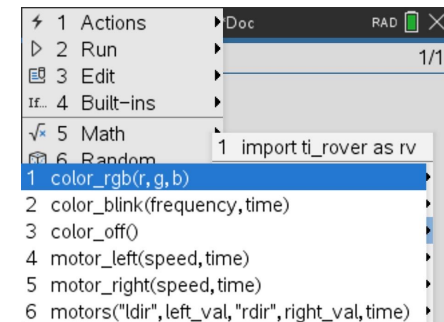
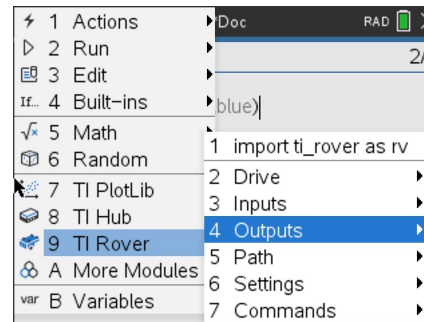
Use **[ctrl] left** to move from the shell page back to the Python editor page.

**Task: Set the color output of the RGB LED.**

Each color takes a value (0-255).

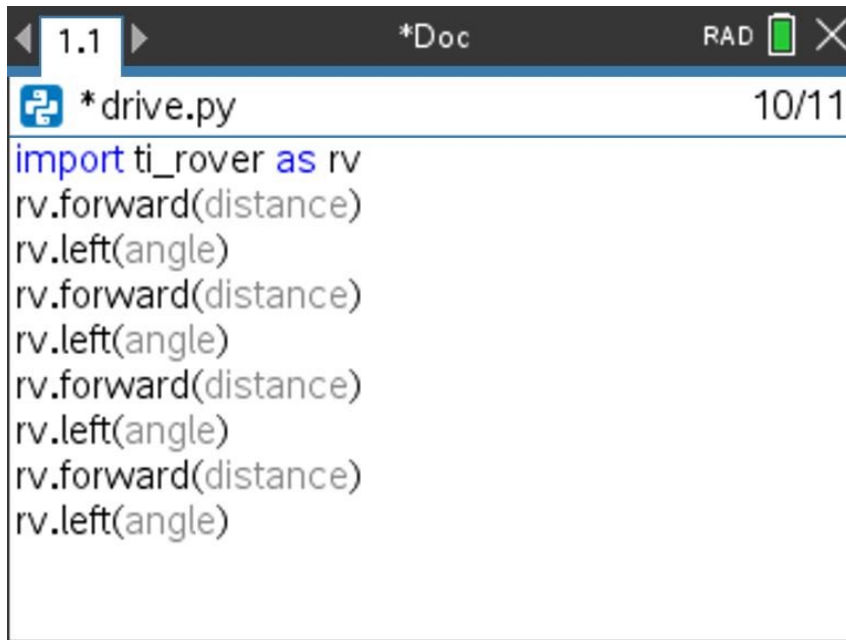
**Challenge Task: Try to make Yellow**

Find the `color_rgb()` function on the Rover Outputs menu.



# Explore angles

## New Program:



```
1.1 *Doc RAD 10/11
* drive.py
import ti_rover as rv
rv.forward(distance)
rv.left(angle)
rv.forward(distance)
rv.left(angle)
rv.forward(distance)
rv.left(angle)
rv.forward(distance)
rv.left(angle)
```

## Task: Drive a square.

**Challenge Task:** Try to drive an equilateral triangle.

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.

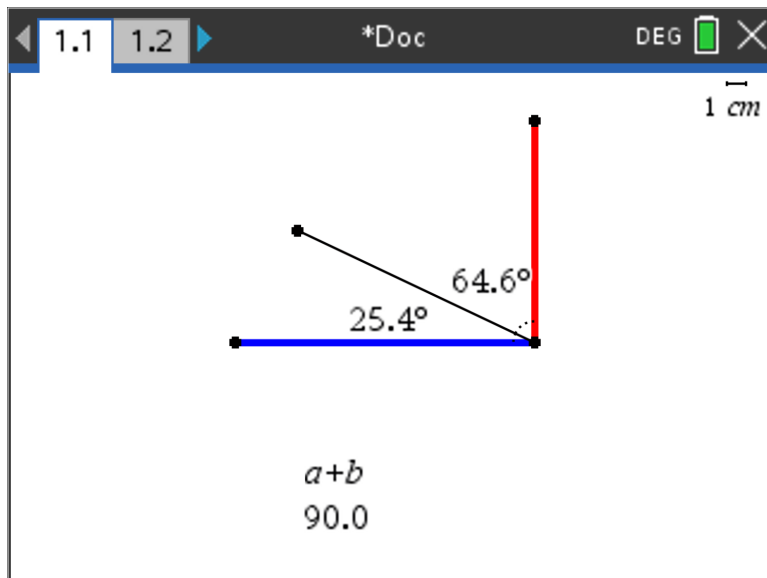
Press **[ctrl] [R]** to run the program from a Python shell on the next page.

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

# Quick Math Reminders

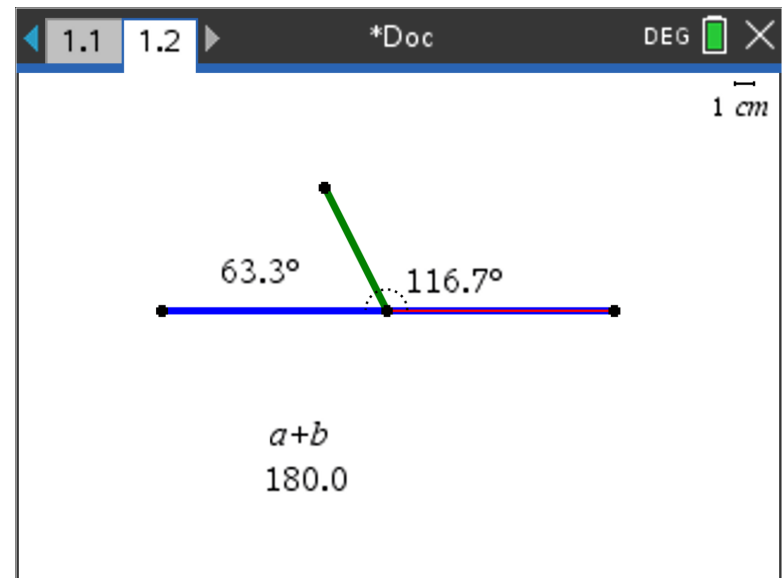
» Complementary Angles:

» Sum to 90 degrees



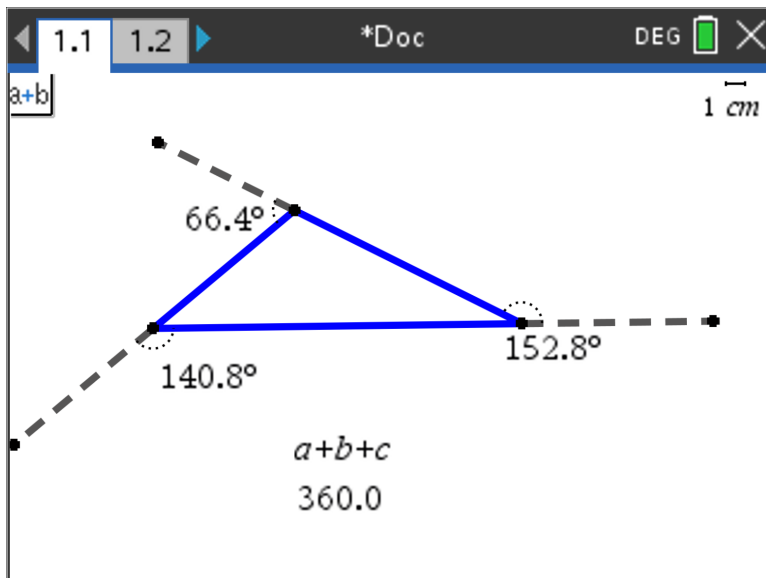
» Supplementary Angles:

» Sum to 180 degrees

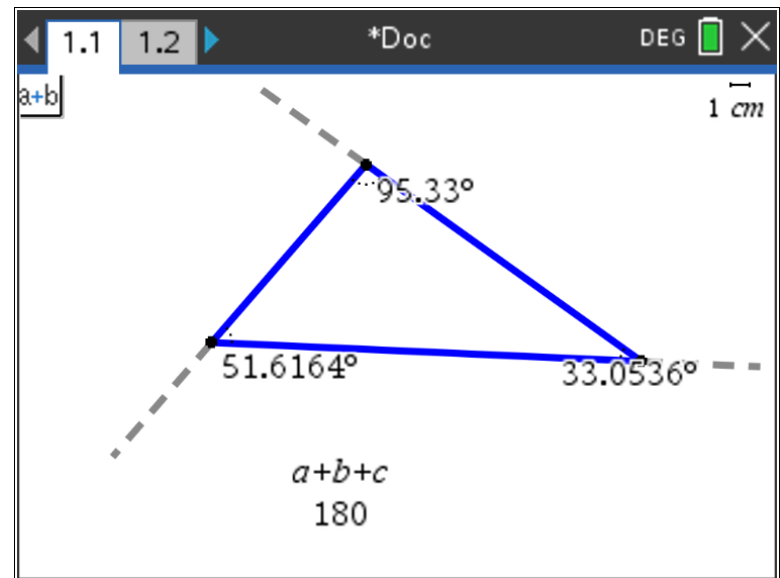


# Quick Math Reminders

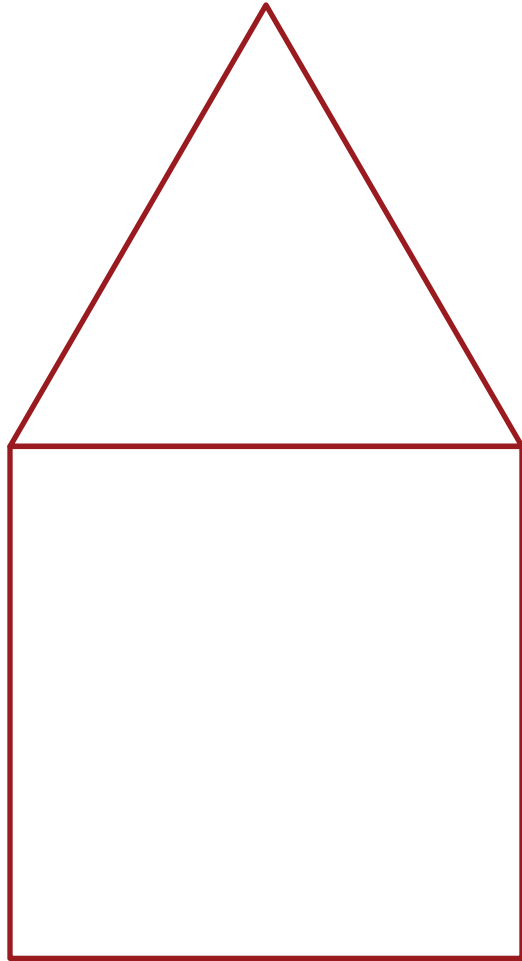
» Exterior angles:



» Interior Angles:



# Logic Challenge

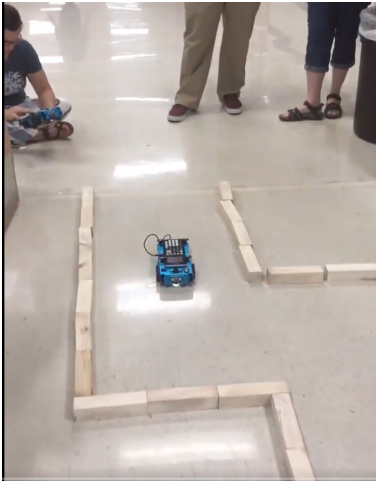


**Task: Drive the figure shown without crossing any lines or going back over a line and without picking up the pen.**

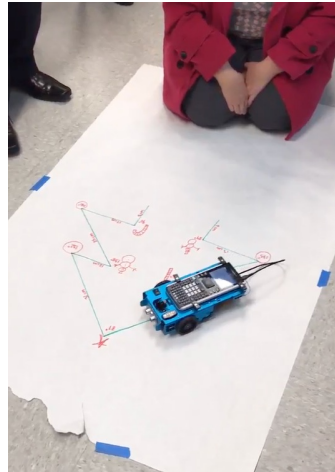
When you are ready put the pen in and trace your path



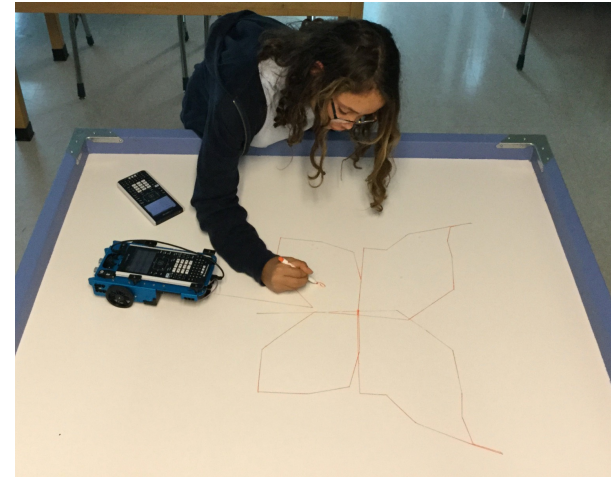
# Where can you go next with TI-Rover?



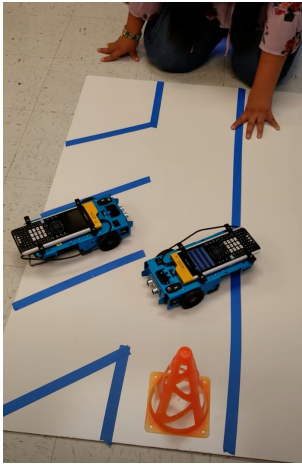
Drive an obstacle course



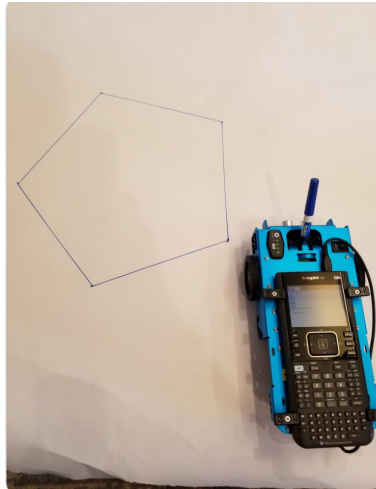
Drive a design



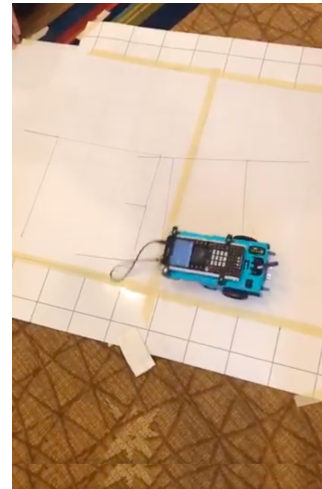
Draw artwork



Park your Rover



Use a For loop to draw polygons



Write your name

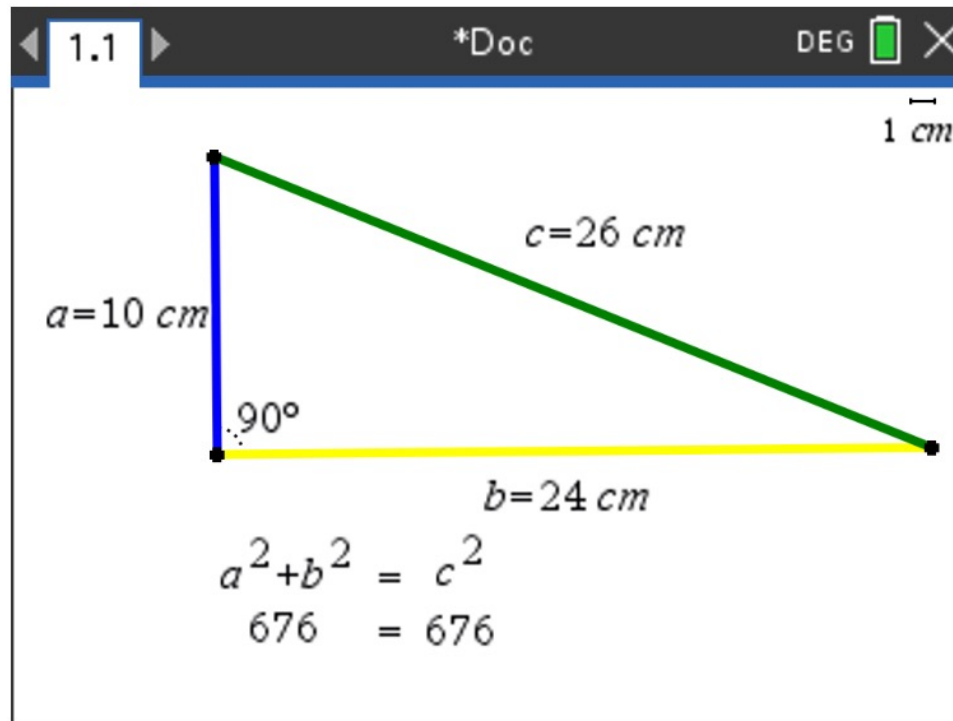


Navigate a map

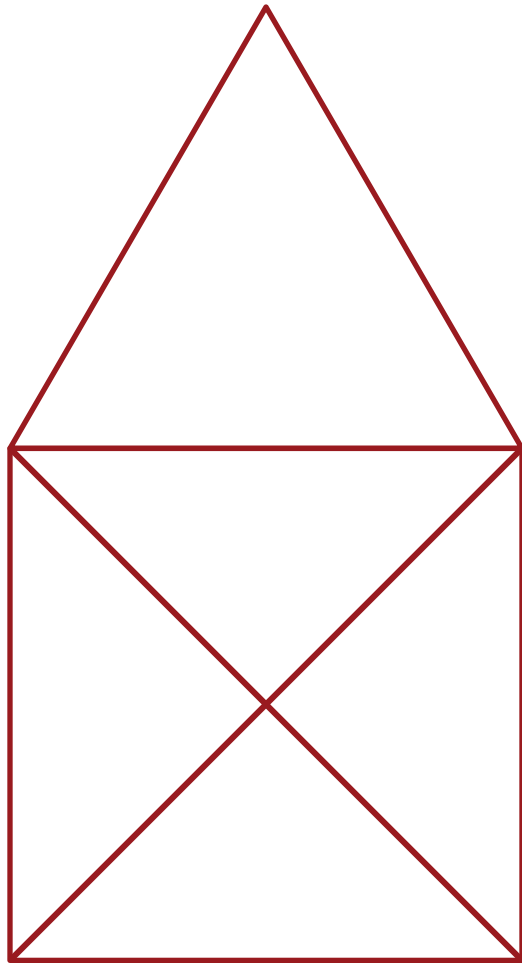


# Quick Math Reminders

## » Pythagorean Theorem



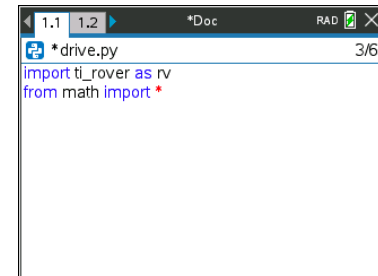
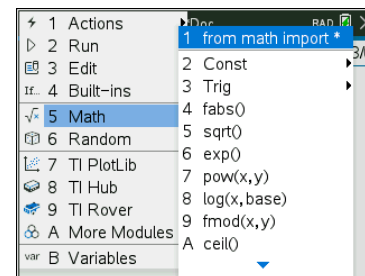
# Logic Challenge 2



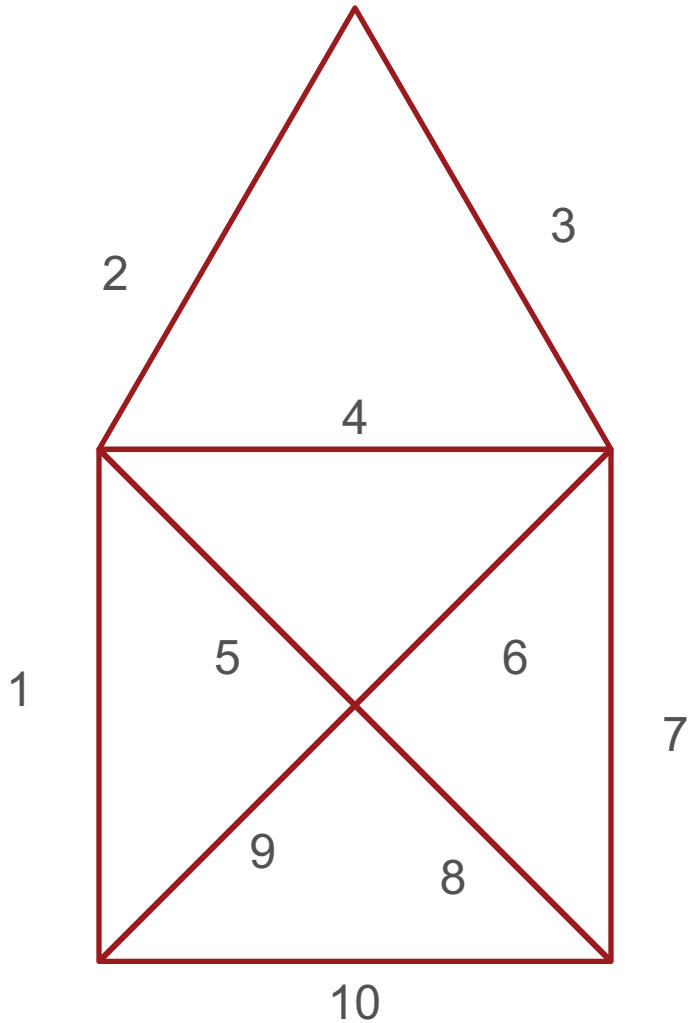
**Task: Drive the figure shown without crossing any lines or going back over a line and without picking up the pen.**

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

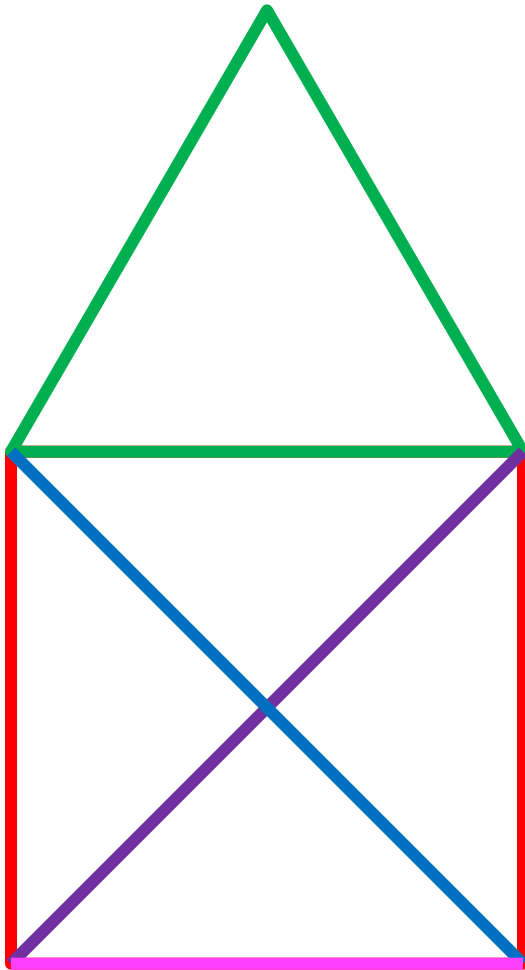
Import the Python Math module in addition to the Rover module for this challenge.



# Logic Challenge 2



# Logic Challenge 3

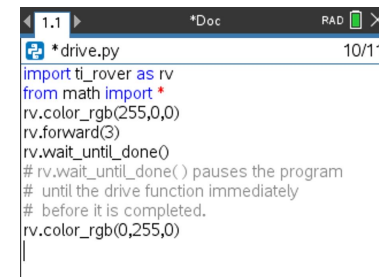
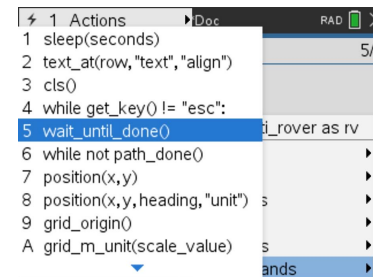
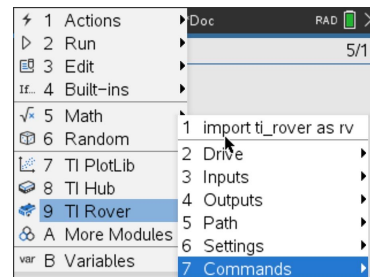


**Task: Drive the figure shown without crossing any lines or going back over a line and without picking up the pen.**

**Now match the colors using the RGB LED. Don't worry about using the pen.**

Import the Python Math module in addition to the Rover module for this challenge.

Use `wait_until_done()` from the Rover Commands menu to synchronize Rover drive functions with the RGB LED.



# Thank You



[www.TIstemProjects.com](http://www.TIstemProjects.com)

Contact [stem-team@ti.com](mailto:stem-team@ti.com) with questions