

# Rover Geometry

## Student Activity

7 8 9 10 11 12



TI-Nspire™



Activity



Student



20 min

## Problem to Solve

In this activity you will get Rover to draw some simple shapes:

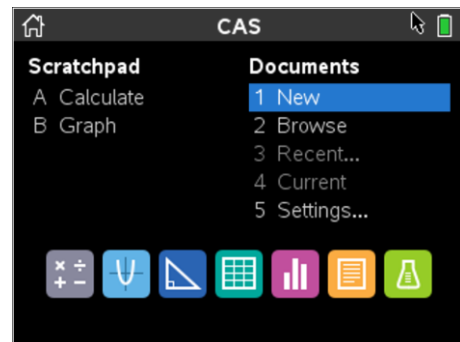
- Square
- Triangle
- Polygon
- 6 Pointed Star
- 5 Pointed Star
- House Drawing

## Programming

Press the HOME key:  on

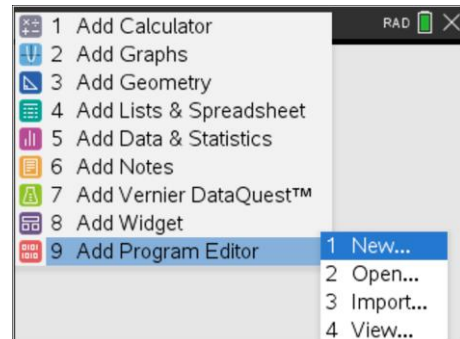
Start a new document.

If you are prompted to save your existing document, select NO.



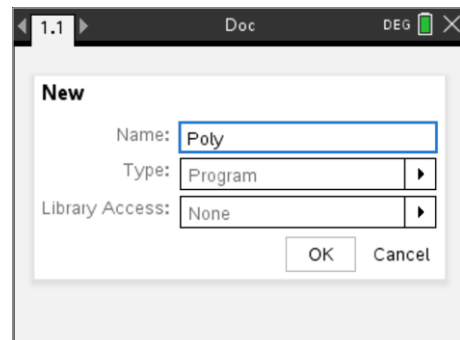
There are many applications to choose from on the TI-Nspire calculator. We will be starting with the Programming application.

Select option 9: **Add Program Editor > New**



When prompted, type the name of the program.

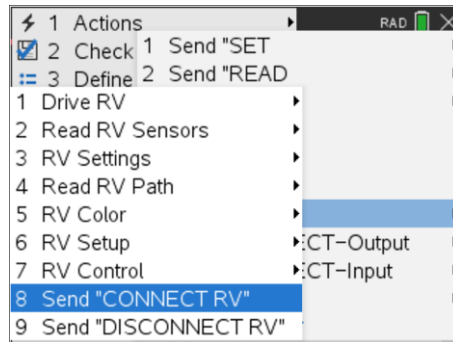
Program Name: Poly



The first task for the program is to alert Rover that the calculator is attached so that the communication lines are open. This is a built in programming instruction.

Press: **menu** > **Hub** > **Rover** > **Send "CONNECT RV"**

Press: **enter** [This accepts the command and inserts a new line]



The next step is to send a driving command to Rover.

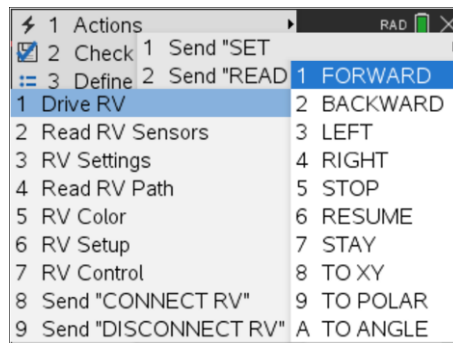
Press: **menu** > **Hub** > **Rover** > **Drive RV** > **Forward**

Before pressing the Enter key, insert a number between 1 and 2.

Your command will look like:

Send "RV FORWARD 1.2"

Press **enter** to create another blank line.

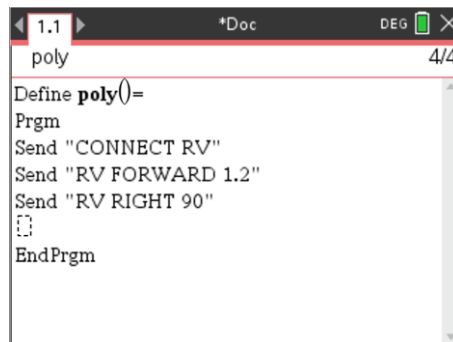


The next command will instruct Rover to turn right or left.

Press: **menu** > **Hub** > **Rover** > **Drive RV** > **RIGHT**

An angle needs to be entered after the "RIGHT" command.

To draw a square use: 90



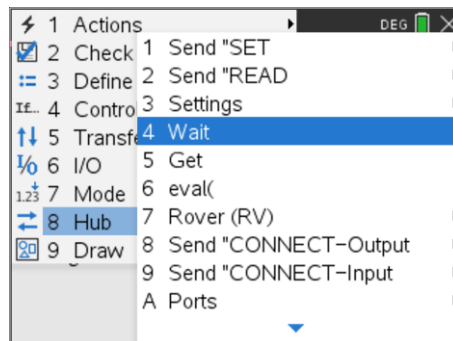
The brain behind Rover is the TI-Innovator. The TI-Innovator can only hold a relatively small number of commands in its buffer. To prevent loss of commands insert an occasional 'wait' command and specify an amount of time (seconds). The calculator will stop sending commands during this time allowing Rover to catch up.

A range of commands are available to detect what Rover is up to, however a simple solution is to measure or estimate how long the current commands will take to physically execute and have the calculator program 'wait' before sending additional commands.

The time taken to drive forwards a short distance and then turn takes approximately 3 seconds.

Press: **menu** > **Hub** > **Wait**

Enter a wait time of 3 seconds: Wait 3



The commands highlighted opposite need to be repeated 4 times to draw a square.

The commands could simply be copied (Copy =Ctrl + C) and pasted (Paste = Ctrl + V) repeatedly. There is however a programming alternative which is much more efficient.

**For  $i,1,4$**   
*Instructions*  
**Endfor**

In this example the 'i' is a counter that starts at 1 and finishes when the instructions have been executed 4 times.

Hold down the SHIFT key to highlight the commands to be repeated.

While the commands are highlighted:

Press: **menu** > **Control** > **For...EndFor**

The syntax in the For command is as follows:

**For  $variable, start, end$**

The variable can be given any name,  $i, j, n$  are all common.

The first time the commands are executed  $i = 1$ ; the second time the commands are executed  $i = 2$  ... the last time  $i = 4$

The program is now ready to be saved and Rover is ready to drive.

Press **ctrl** then **R**

Place Rover on the driving mat with a clear space in front for Rover to drive, then press **enter**.

```

1.1  *Doc  DEG  4/5
poly
Define poly()=
Prgm
Send "CONNECT RV"
Send "RV FORWARD 1.2"
Send "RV RIGHT 90"
Wait 3
EndPrgm

```

```

1.1  *Doc  DEG  2/7
* poly
Define poly()=
Prgm
Send "CONNECT RV"
For i,1,4
  Send "RV FORWARD 1.2"
  Send "RV RIGHT 90"
  Wait 3
EndFor
EndPrgm

```

```

1.1  1.2  *Doc  DEG
poly()

```

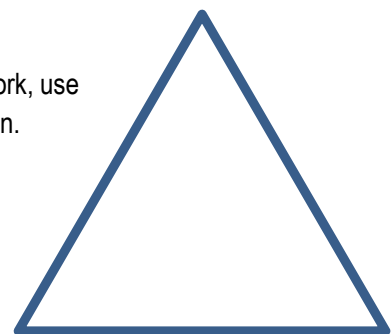
## Experimentation

It's now time to experiment. You can edit the program to change how far Rover travels forward. You can also put a piece of paper beneath Rover and a felt-tip pen in the holder to get Rover to draw whilst driving.

### Challenge 1

Edit the poly program so that Rover draws a triangle. If your first attempt doesn't work, use the result to think about what changes you may still need to make and then try again.

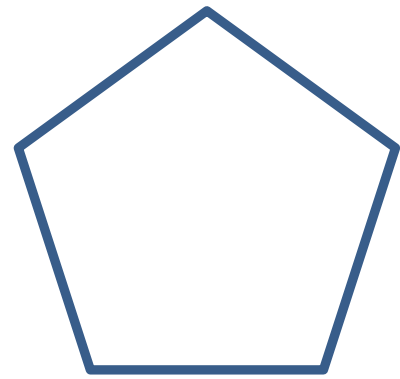
What type of triangle did Rover draw?



## Challenge 2

Edit the poly program so that Rover draws a pentagon.

Think about how the angles are calculated for the program and what Rover is actually doing when it turns. We are looking to generalise the program so that Rover can do any regular polygon.



## Challenge 2 - Extension

Rather than edit the program each time, it is much more convenient to simply enter the number of sides required. A Request command provides a text prompt (for the user) and expects a value to be entered.

Navigate to the CONNECT RV command and insert a line immediately below then add in the Request command.

Press: **[menu] > I / O > Request**

Inside the quotation marks (Press **[?]** or **Ctrl + x**) enter the text prompt. Outside the quotation marks use a comma (,) followed by the variable name. (n)

Change the number of loops in the **For** command to go up to n.

In the turn right command change the angle to `eval( expression )` where expression represents a mathematical formula, involving 'n' that determines the size of the angle that Rover needs to turn.

Once you are happy with your program, run it and see if it works! You know what to do if it doesn't.

```

1.1 1.2 *Doc DEG 5/8
* poly
Define poly()=
Prgm
Send "CONNECT RV"
Request "Sides",n
For i,1,n
Send "RV FORWARD 1.2"
Send "RV RIGHT eval( )|
Wait 3
EndFor

```

## Challenge 3

You can copy your program or start a new one. Your challenge this time is to write a program that draws a 6 pointed star. You should start by drawing a diagram; think about the angles and the collection of commands that need to be repeated to achieve the outcome.



The quick way to duplicate a program is to use the **[menu]** key and select **Actions** then **Create copy...**

You can simply type in the name for the new program 'star6' and start editing. The new program will appear alongside your existing program. Press **Ctrl + 6** to split these two applications onto two pages.

## Challenge 4

Your challenge this time is to write a program that draws a 5 pointed star. You should start by drawing a diagram. This one might take a bit more thinking!

Can you extend your program to create an 'n' pointed star?

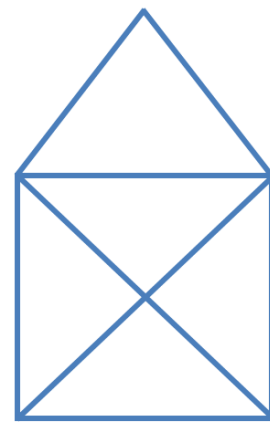


## Challenge 5

A popular challenge is to draw the shape shown opposite (house) so that each line is drawn just once and you are not allowed to take your pen of the page.

Try drawing it by hand first, then write the code so that Rover can also draw it.

What challenges do you face in trying to draw this object?



## Challenge 6

The Konigsberg bridge problem is very famous. The challenge is to visit each bank and each island and cross every bridge just once.

Think of Rover trying to navigate around the North and South bank, bridges and islands. Can you write a program that crosses each bridge just once?

Remember – Rover can't swim!

