Using Code to Transform   
 Triangles

**Algebra**

**Unit 3 Line Master 6a**

You will be creating new subprograms   
by writing code that will transform the   
vertices of a triangle.

If you have a Scratch login, save the project in your Scratch account by selecting **Remix** at the top of the screen.

A login is not required to work with the code, but you will not be able to save your changes without it.

Click on the link to open the Scratch   
application with subprograms that   
you used in Master 5.

<https://scratch.mit.edu/projects/741053989/editor/>

**Part 1: Translating the Triangle Horizontally**

Graphical user interface, application, website, Teams

Description automatically generated1. Let’s write code for a subprogram   
 that will translate the 3 vertices   
 horizontally by shifting the *x*-coordinate   
 of each point.   
 First, make a new block for the   
 subprogram by selecting **My Blocks**.   
 Name it **translateXShift*.*** It will appear in the code editing area.  
 Drag it to an area where there is room to place blocks below it.

Graphical user interface, application

Description automatically generated2. You will use**set** blocks to shift the *x*-coordinate of each point.   
 To do this, you will need a variable to hold the value by which   
 the *x*-coordinates will shift.

* Select Variables.  
  A picture containing shape

  Description automatically generated
* Select **Make a** **Variable**.  
  Graphical user interface, text

  Description automatically generated with medium confidence
* Name the variable **translateXBy**.

Using Code to Transform   
 Triangles (cont’d)

**Algebra**

**Unit 3 Line Master 6b**

Graphical user interface

Description automatically generated3. Drag four **set** blocks to beneath the   
 subprogram called **translateXshift**and adjust the pulldown menus as shown   
 on the right.

Look carefully to make sure you have   
 selected the *x*-coordinates of A, B, and C   
 in the **set** blocks and not the *y*-coordinates.

4. You will use **operator** blocks to add the value by which the   
 *x*-coordinates will shift to the original values of the *x*-coordinates.

* Graphical user interface

  Description automatically generatedFrom **Operators**, drag an **addition   
  operator** to inside each of the **set** blocks,   
  as shown on the right.
* Graphical user interface, chart

  Description automatically generatedFrom **Variables**, drag the *x*-coordinate   
  variables into the first part of each   
  **addition operator**.
* Drag the **translateXBy** variable to the   
  second part of the ***addition operator***   
  for each ***set*** block.

**Note:** This can be finicky—take your time. If things don’t snap   
into place as you expect, just pull them apart and try again!

Using Code to Transform   
 Triangles (cont’d)

**Algebra**

**Unit 3 Line Master 6c**

Graphical user interface, application

Description automatically generated

5. Let’s start by shifting the *x*-coordinates   
 by 100.   
 To do this, enter 100 in the **set** block   
 for the **translateXBy** variable, as shown   
 on the right.

6. Add a comment to let anyone who uses your code know   
 the range of values they can enter for the **translateXBy** variable.   
 To do this, right-click on the **set translateXBy** block, select **AddComment,** and type this statement:   
 **Input a number between -240 and 190.**  
 This will ensure that, based on the original triangle, the value   
 the person enters will result in a translation that can be displayed   
 on the stage. This range will need to be adjusted for different   
 starting triangles.

A picture containing graphical user interface

Description automatically generated

Text, application, chat or text message

Description automatically generated with medium confidence7. Finally, you need to add code to the main program to call   
 your new subprogram and draw a new triangle with vertices   
 that have shifted horizontally 100 units from the original vertices.

Adjust the code by adding the 4 blocks   
 shown here to the end of the main program.

Using Code to Transform   
 Triangles (cont’d)

**Algebra**

**Unit 3 Line Master 6d**

Here’s what these 4 blocks of code do:

* After the main program draws the blue triangle,   
  the **translateXShift**subprogram is called up to shift the   
  *x*-coordinates of the vertices by 100 units.
* Next, the pen is lifted up to avoid drawing a line while   
  the sprite moves to the new starting location.
* Then, the pen colour is changed to orange so that the translated triangle can be distinguished from the original triangle.
* Finally, the **drawTriangle** subprogram is called to action   
  once again!

8. Click on the green flag to test out the revised application.   
 Here’s what the stage should look like when the program   
 has executed. Describe how the triangle has moved.

Calendar

Description automatically generated

9. Alter the code to translate the original triangle 100 units   
 to the left instead of the right. What change did you make?

Using Code to Transform   
 Triangles (cont’d)

**Algebra**

**Unit 3 Line Master 6e**

**Part 2: Translating the Triangle Vertically**

Next, you’ll write code for a subprogram that translates the 3 vertices of the triangle up or down along the *y*-axis. Here are some tips:

* Start with your version of the application from Step 8   
  that includes the **translateXShift** subprogram.
* Text

  Description automatically generated with medium confidenceWrite similar code to your**translateXShift** subprogram,   
  but call it **translateYShift**.
* You will need a new variable called **translateYBy*.*** Start with a translation value of 100 units.
* Once you have written your subprogram,   
   add the following comment to your **set** block   
   for the variable **translateYBy**:   
   **Input a number between -180 and 130.**

Here’s what the main program might look like.   
Notice that it resets to the original points before   
translating vertically by calling the **originalPoints**subprogram. This means that the triangle will be   
shifted vertically from the original triangle and   
not from the triangle that you translated horizontally.   
It is possible to translate the second triangle instead.   
This is up to you as the programmer!   
If you choose to do this, your program will be   
missing the block that calls the **originalPoints**subprogram. Otherwise, it should look the same   
as what is shown here.  
If you think your **translateYShift** subprogram is not working  
properly or you get stuck, check with your teacher for a solution.

Using Code to Transform   
 Triangles (cont’d)

**Algebra**

**Unit 3 Line Master 6f**

**Additional Challenges**

* Write code for a subprogram that reflects the triangle points   
  in the *x*-axis. Call the subprogram **reflectXAxis**.  
  **Hint:** You will need a multiply operator.   
  Why will the subprogram shown here work?   
  Graphical user interface, application

  Description automatically generated
* Write code for a subprogram that reflects the triangle points

in the *y*-axis. Call the subprogram **reflectYAxis**.  
Think about how it will be similar to **reflectXAxis** and how   
it will be different.

* Prompt the user to enter values for the horizontal translation shift.

**Hint:** Use the **Ask and wait** block under **Sensing**.