

Unit 1

# Unit 1 TurtleLogo

## Student Handouts

# Unit 1

# TurtleLogo Guide

## Starting a new TurtleLogo project

Answer each question as shown below. If you do not see a black full screen window with questions, (1) click on the **black icon** at the bottom of your screen, (2) type **start** and (3) hit the **enter** key.

```
Would you like to load an existing experiment? (y/n)
```

```
> n
```

```
Would you like to create a new experiment (y/n)
```

```
> y
```

```
Please select an experiment by typing its complete name (eg BasicBoard.tar)
```

```
> TurtleLogo.tar
```

```
Provide a name for the new experiment folder (eg. MyBasicBoard)
```

```
> TurtleLogo
```

This will open three windows: The command center, the drawing field, and a text editor.

## Starting a previously created TurtleLogo project

Answer each question as shown below. If you do not see a black full screen window with questions, (1) click on the **black icon** at the bottom of your screen, (2) type **start** and (3) hit the **enter** key.

```
Would you like to load an existing experiment? (y/n)
```

```
> y
```

```
Which experiment would you like to load?
```

```
> TurtleLogo
```

This will open three windows: The command center, the drawing field, and a text editor.



# 1.1 Introducing TurtleLogo

## Getting Started

Imagine a turtle walking around on a sheet of paper with a pen in its mouth. Now imagine you could control that turtle's mind and drive it around. **TurtleLogo** is a computer program that does just that.



Type a command that the turtle *understands* and it will draw a picture on your screen.

Type in something the turtle *doesn't understand* and it will tell you what's wrong.

**What words does the turtle understand? What can you draw with TurtleLogo?**

## Learning Goals

- ✓ Drive the Turtle around the screen with the following basic commands:

clean

fd

bk

rt

lt

- ✓ Draw specific shapes using these commands.

## Instructions

1. Create your own personal TurtleLogo project following your teacher's instructions.
2. Launch the TurtleLogo program.  
*This will also open a file called `drawbox.txt`. Close this file for now.*

This is the screen setup for TurtleLogo.

Type your commands in the white **command center**.

Hit the **enter** key after each command.



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3. Create a TurtleLogo dictionary in your notebook. Copy the following table.

If I use the command ...	the turtle will...	Examples and Notes
clean	erase the drawing field and return to the center	This command is handy when I've driven the turtle somewhere off screen or when I make a mistake and want to start over.
fd 100	Move forward 100 steps	Change 100 to a different number to move the turtle forward by a different number of steps
bk 100		
lt 60		
rt 80		

4. Move the turtle forward 100 steps by typing **fd 100** and hitting the enter key.
5. Discover how to use the TurtleLogo words **bk**, **lt**, and **rt**.
6. Fill out your TurtleLogo dictionary based on your observations.
7. Complete each of the TurtleLogo challenges.

## Challenges

Credit	Task
◆	Draw a square with sides that are 75 steps long. In your notebook, record the list of commands that you used.
◆	Draw a rectangle. In your notebook, record the list of commands that you used.

## Helpful Hints

Embrace error messages. You cannot break the turtle. If something doesn't work, try typing a new line.

You can copy, paste, and delete any lines in the command center at any time.

If you mess up your drawing screen, type `clean` to start over.

If you get an error message, see if you can figure out what you did wrong by asking a classmate for help. If all else fails, ask your teacher.

## Going Further

Extra Credit	Task
◆	Draw any triangle
◆◆	Draw an <u>equilateral</u> triangle (all sides equal length)
◆◆	Draw an <u>isosceles</u> triangle (two sides equal length)
◆◆	Draw a <u>right</u> triangle (one 90° angle)
◆◆◆	Draw any polygon with more than 4 sides
◆◆◆	Draw any <u>regular</u> polygon with more than 4 sides (all sides equal, all angles equal)





## 1.2 TurtleLogo Words

### Getting Started

Wouldn't it be nice if you could shorten a long list of TurtleLogo commands for a complex drawing?

**TurtleLogo can do that!**

In this lesson, instead of typing repetitive words, you will learn how to create loops and learn how to save and load TurtleLogo programs.

### Learning Goals

- ✓ Learn how to use the command **repeat** in TurtleLogo.
- ✓ Learn how to use the editor to store your turtle commands in a text file.

### Instructions

1. Reload your TurtleLogo project from *Lesson 1.1*. Follow your teacher's instructions.

*Note: You do not need to remake your personal TurtleLogo project from scratch as you did previously.*

2. Enter the following into the command center:

```
repeat 4 [ fd 100 rt 90 ]
```

*Note 1: The spaces are necessary.*

*Note 2: The square brackets are necessary.*

3. There is no difference between the following three TurtleLogo procedures. In your notebook, explain why this is true and update your TurtleLogo dictionary.

#### Option A

```
fd 100
rt 90
fd 100
rt 90
fd 100
rt 90
fd 100
rt 90
```

#### Option B

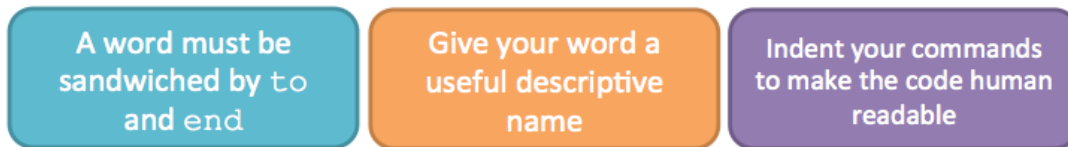
```
fd 100 rt 90
fd 100 rt 90
fd 100 rt 90
fd 100 rt 90
```

#### Option C

```
repeat 4 [ fd 100 rt 90 ]
```

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4. Load and run a TurtleLogo program called `drawbox.txt`.
  - a. Near the bottom of the command center, click on the icon with **three dots**. This will bring up a new window.
  - b. Choose the program `drawbox.txt` which is located in `lbym/TurtleLogo`.
  - c. Back in the command center, click the **load** icon and then the **go** icon. There won't be any output in the command center, but the turtle will move.
5. Record your observations in your notebook.
6. If it isn't already open, follow your teacher's instructions to open `drawbox.txt` in a text editor. This allows you to both view and change the TurtleLogo program.
7. Examine the block of text that defines a new TurtleLogo command called `box`. The proper name for a TurtleLogo command is a **word**. If you type `box` into the command center and hit enter, it will run the word. The following figure highlights the structure of a TurtleLogo word. Record this information in your notebook.



```
to box
  repeat 4 [fd 100 rt 90]
end
```

8. Add the follow piece of code to `drawbox.txt`. The word **wait** tell the turtle how many tenths of a second it should pause. The command, `wait 10`, means pause for 1 second (10 tenths of a second). Save, load, and run this file. Record your observations in your notebook. Add `wait` to your dictionary.

```
to turtle-wait
  repeat 10 [ fd 20 wait 10]
end
```

9. Complete the TurtleLogo challenges.

## Challenges

Credit	Task
◆	Draw a square with sides that are 200 steps long using the <code>repeat</code> command.
◆	Draw a triangle using the <code>repeat</code> command.
◆	Draw a geometric shape using <code>repeat</code> and <code>wait</code> .
◆◆	Run each of the <code>TurtleLogo</code> words in the <code>drawbox.txt</code> file by typing them in the command center and hitting the enter key. Add new <code>TurtleLogo</code> words to your dictionary. <i>Show your dictionary to your teacher before moving on to the next challenge.</i>
◆◆◆	Change the size of the square drawn by <code>box</code> . <ol style="list-style-type: none"> <li>1) Edit the code in the text editor window</li> <li>2) Click <b>save</b> at the top of the text editor window</li> <li>3) From the command center click the <b>load</b> icon to reload your new code</li> <li>4) From the command center click the <b>go</b> icon to run your word</li> <li>5) Add comments to each line of code that you understand</li> </ol>

## Helpful Hints

Embrace error messages. You cannot break the turtle. If something doesn't work, try typing a new line.

You can copy, paste, and delete any lines in the command center at any time.

If you mess up your drawing screen, type `clean` to start over.

If you get an error message that says I don't know how to \_\_\_\_\_, check your typing. You may have misspelled the command.

You can't define new words with the `to ... end` format within the command center. These must be in `TurtleLogo` files that you need to save, load, and run.

If you get an error message, see if you can figure out what you did wrong by asking a classmate for help. If all else fails, ask your teacher.

## Going Further

Extra Credit	Task
◆	Draw multiple squares using the <code>repeat</code> command.
◆◆	Create a drawing using the <code>repeat</code> command and at least two geometric shapes.
◆◆◆	Draw a 4-, 5-, or 6-sided star using the <code>repeat</code> command.



## 1.3 Words Within Words

### Getting Started

Wouldn't it be nice if you could combine TurtleLogo commands for a complex drawing so that you could pull them up with ease?

**TurtleLogo can do that!**

In this lesson, you will learn how to edit a file so that you can create more complicated commands based on previously defined words.

### Learning Goals

- ✓ Learn how to make new commands out of simpler ones.
- ✓ Learn how to use the editor to store your turtle commands in a text file.

### Instructions

1. Reload your TurtleLogo project from *Lesson 1.1*. Follow your teacher's instructions.
 

*Note: You do not need to remake your personal TurtleLogo project from scratch as you did previously.*
2. Load and run a TurtleLogo program called `drawbox.txt`.
  - a. Near the bottom of the command center, click on the icon with **three dots**. This will bring up a new window.
  - b. Choose the program `drawbox.txt` which is located in `lbym/TurtleLogo`.
  - c. Back in the command center, click the **load** icon and then the **go** icon. There won't be any output in the command center, but the turtle will move.
3. Compare the two words `box` and `box-stack` below. Once you create a word in a Logo program, it becomes a permanent part of that program. You can use your own words just as you use `fd` and `lt`. In your notebook, draw what you think the turtle will do if you run the word `box-stack`.

```
to box
  repeat 4 [ fd 100 rt 90 ]
end
```

```
to box-stack
  repeat 2 [ box fd 100 ]
end
```

4. Add `box-stack` to your `drawbox.txt` file. You can place this new definition at any location.
  - a. Edit the code in the text editor window
  - b. Click save at the top of the text editor window
  - c. From the command center, click the load icon to reload your new code
  - d. From the command center, type `draw-box` and hit the enter key.

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- Record your observations in your notebook. In 2-5 sentences, explain how `box-stack` works. Add `box-stack` to your dictionary.
- Complete the TurtleLogo challenges.

### Challenges

Credit	Task
◆	The word <code>go</code> in <code>drawbox.txt</code> is linked to the <b>go</b> icon in the command center. Edit this word so that clicking on the <b>go</b> icon make the turtle draw two stacked boxes.
◆◆	Edit the <code>go</code> word so that it runs all of the words in <code>drawbox.txt</code> , one after the other.
◆◆◆	Create a new TurtleLogo word that uses at least two words that <u>you</u> have previously defined.

### Hints

Embrace error messages. You cannot break the turtle. If something doesn't work, try typing a new line.

You can copy, paste, and delete any lines in the command center at any time.

If you mess up your drawing screen, type `clean` to start over.

If you get an error message that says `I don't know how to _____`, check your typing. You may have misspelled the command.

You can't define new words with the `to ... end` format within the command center. These must be in TurtleLogo files that you need to save, load, and run.

If you get an error message, see if you can figure out what you did wrong by asking a classmate for help. If all else fails, ask your teacher.

### Going Further

Extra Credit	Task
◆	Create a TurtleLogo word to draw any geometric pattern and includes <u>at least one</u> previously defined word.
◆◆	Create a word that uses <code>box</code> to draw squares in all four corners of the drawing field.
◆◆◆	Draw any object by creating a word that calls at least two other words <u>and</u> uses the <code>repeat</code> command.

## 1.4 Adding Inputs to TurtleLogo Words

### Getting Started

What if you can't decide how big of a box to draw?

What if you wanted to draw a box that is a different color but don't want to keep editing, saving, and loading your code?

TurtleLogo words in programs can accept various **input** options. This makes them **flexible**.

### Learning Goals

- ✓ Learn the new TurtleLogo words **setcolor** and **setpensize**.
  - ✓ Learn the new TurtleLogo words **penup** and **pendown**.
  - ✓ Write TurtleLogo words with one or more **input variables**.
- 

### Instructions

1. Reload your TurtleLogo project from *Lesson 1.2 Turtle Commands*.  
*Note: You do not need to remake your personal TurtleLogo project from scratch as you did previously.*
2. Load and run the TurtleLogo program called `drawbox.txt` as you did in *Lesson 1.2 Turtle Commands*.
  - a. Near the bottom of the command center, click on the icon with **three dots**. This will bring up a new window.
  - b. Choose the program `drawbox.txt` which is located in `lbym/TurtleLogo`.
  - c. Back in the command center, click the **load** icon and then the **go** icon. There won't be any output in the command center, but the turtle will move.
3. Search for the words `setcolor` and `setpensize` in the file `drawbox.txt`. Change the numbers following these words. Save, load, and run the `drawbox.txt` program to see how these numbers change the drawing.
4. Record your observations about `setcolor` and `setpensize` in your TurtleLogo dictionary.

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5. Compare the two words `box` and `draw-box` below. The new piece, `:n`, is called a **variable**. In the Logo computer language, variables always start with a colon (:). Add this new word, `draw-box`, to your TurtleLogo program, then **save** and **load** it.

*Note: a variable can be more than one letter. A word can also accept multiple variables. The following variable names are valid -*

*:size    :length    :width    :apple*

```
to box
repeat 4 [ fd 100 rt 90 ]
end
```

```
to draw-box :n
repeat 4 [ fd :n rt 90 ]
end
```

6. From the command center, type `draw-box 100` and hit enter. Type `draw-box 200` and hit enter. Type `draw-box 50` and hit enter.
7. Write 2-5 sentences that explain the difference between **box** and **draw-box**. Your explanation must include a discussion of how **variables** work.
8. Add at least two examples of variables to your TurtleLogo dictionary.
9. In the command center, type the following:
- ```
clean
penup
fd 100
pendown
fd 100
```
10. In your notebook, explain the function of the words **penup** and **pendown**. Add these to your dictionary.
11. Complete the TurtleLogo challenges.



## Challenges

| Credit | Task                                                                                                                                           |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------|
| ◆      | Create a <code>TurtleLogo</code> word that draws a triangle of any size without requiring you to edit, save, and reload the program each time. |
| ◆◆     | Add a <u>second</u> variable to <code>draw-box</code> that allows you to change the color directly from the command center.                    |

### Helpful Hints

Embrace error messages. You cannot break the turtle. If something doesn't work, try typing a new line.

You can copy, paste, and delete any lines in the command center at any time.

If you mess up your drawing screen, type `clean` to start over.

If you get an error message that says I don't know how to \_\_\_\_\_, check your typing. You may have misspelled the command.

You can't define new words with the `to ... end` format within the command center. These must be in `TurtleLogo` files that you need to save, load, and run.

If you get an error \_\_\_\_\_ needs more inputs, you have forgotten to provide the numerical value of your variable.

If you get an error message, see if you can figure out what you did wrong by asking a classmate for help. If all else fails, ask your teacher.

### Going Further

| Extra Credit | Task                                                                                                        |
|--------------|-------------------------------------------------------------------------------------------------------------|
| ◆            | Use <code>penup</code> and <code>pendown</code> to create multiple shapes on different parts of the screen. |
| ◆◆           | Create a word that can change the size, color, and pen size of a square using input variables.              |
| ◆◆◆          | Create a <code>TurtleLogo</code> word that draws your initials in multiple colors.                          |



## 1.5 Turtle Art

### Getting Started

In this final exercise, you will use a variety of `TurtleLogo` words to create a geometric art project.

### Learning Goals

- ✓ Explore the color choices available in `TurtleLogo`
- ✓ Learn how to use the words **`arc`**, **`fillscreen`**, and **`setxy`**
- ✓ Use a variety of `TurtleLogo` words to create a unique work of art with geometric shapes

### Instructions

1. Use the `setcolor` word in the command center to identify the range of `TurtleLogo` colors. Copy the table below into your notebook and then use your results to fill in the table.

| Color-code | Color |
|------------|-------|
| 0          | Red   |
| 10         |       |
| 20         |       |
| 30         |       |
| 40         |       |
| 50         |       |
| 60         |       |
| 70         |       |
| 80         |       |
| 90         |       |
| 100        |       |

2. Here are dictionary entries for three new `TurtleLogo` words. Try typing them into the command center to see how they work. Add these to your dictionary.

| If I use the command ...     | the turtle will...                                                                        | Examples and Notes                                                             |
|------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| <code>arc 90 100</code>      | Draw an arc of 90 degrees with a radius of 100 steps                                      |                                                                                |
| <code>fillscreen 70 3</code> | fill the entire screen with the color dark blue                                           | 70 is the color and 3 is the shade                                             |
| <code>setxy 20 40</code>     | move to the location that is 20 steps in the x-direction and 40 steps in the y direction. | The range of x-values is -340 to +340<br>The range of y values is -280 to +280 |

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3. Type each of the following sets of commands into the command center. In your notebook, write 2-5 sentences explaining the differences between each example.

| Example A                                      | Example B                                                     |
|------------------------------------------------|---------------------------------------------------------------|
| <pre>arc 360 100 setxy 180 100 ac 360 50</pre> | <pre>arc 360 100 penup setxy 180 100 pendown arc 360 50</pre> |

4. Complete the TurtleLogo art challenge.

## Challenges

| Credit | Task                                                                             |
|--------|----------------------------------------------------------------------------------|
| ◆◆◆    | Create a TurtleLogo art project including each of the requirements listed below. |
| ◆◆◆    | Present your TurtleLogo art project to the class.                                |

### Code Requirements:

- Your code must contain at least three unique words of your own creation. These can be anything that gives the turtle a series of directions to draw a shape, perform an action, or follow any kind of direction you choose.
- You must use at least one `repeat` somewhere in your code.
- You must include at least one geometric shape in your drawing.
- You must change either the color of the pen, the width of the pen or the color of the background at least once.
- You must have at least one word that requires a variable input.
- Your entire project should display when you type its name into the command center or when you click the **go** icon.

### Presentation Instructions:

1. Connect your HP Stream to the projector and demonstrate your final product to the class.
2. Display your code and point out the specific parts of code that fulfill the requirements listed above.
3. You will describe the parts of code and explain how they affect the outcome or actions of the turtle.
4. Answer questions from the class about your project.

## Helpful Hints

Embrace error messages. You cannot break the turtle. If something doesn't work, try typing a new line.

You can copy, paste, and delete any lines in the command center at any time.

If you mess up your drawing screen, type `clean` to start over.

If you get an error message that says I don't know how to \_\_\_\_\_, check your typing. You may have misspelled the command.

You can't define new words with the **to ... end** format within the command center. These must be in TurtleLogo files that you need to save, load, and run.

If you get an error \_\_\_\_\_ needs more inputs, you have forgotten to provide the numerical value of your variable.

If you get an error message, see if you can figure out what you did wrong by asking a classmate for help. If all else fails, ask your teacher.

## Going Further

| Extra Credit | Task                                                                                                            |
|--------------|-----------------------------------------------------------------------------------------------------------------|
| ◆            | Write a word that draws your name on the screen                                                                 |
| ◆◆           | Write a word that draws a dashed line where the number of dashes and the size of the dashes are both variables. |
| ◆◆◆          | Write a word that draws a smiley face on the screen                                                             |
| ◆◆◆          | Write a word that draws a spiral on the screen                                                                  |