

# **Practice 2: GRAPHICS & COORDINATES**



# Drawing Lines and Shapes



Have fun with shapes and colors on your computer screen!

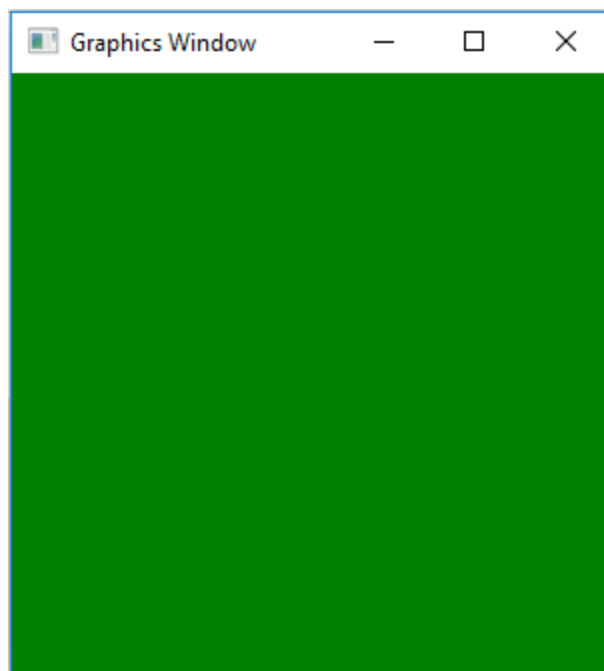
## What's a Graphic Window?

Imagine that the graphics window is the writing board or painting canvas on your computer screen. You can give it certain properties like your favorite color as a background, and you can draw a line and circles. You can also make it listen to you via your keyboard! 😊

Before moving to any of the activities in graphics window, let's bring it to life.

```
GraphicsWindow.BackgroundColor = "Green"  
GraphicsWindow.Width=300  
GraphicsWindow.Height=300  
GraphicsWindow.Title = "Graphics Window"
```

And when you run (F5) this program it will open a green-colored window with the width and height 300 and the title, "Graphics Window," as shown in the diagram below.



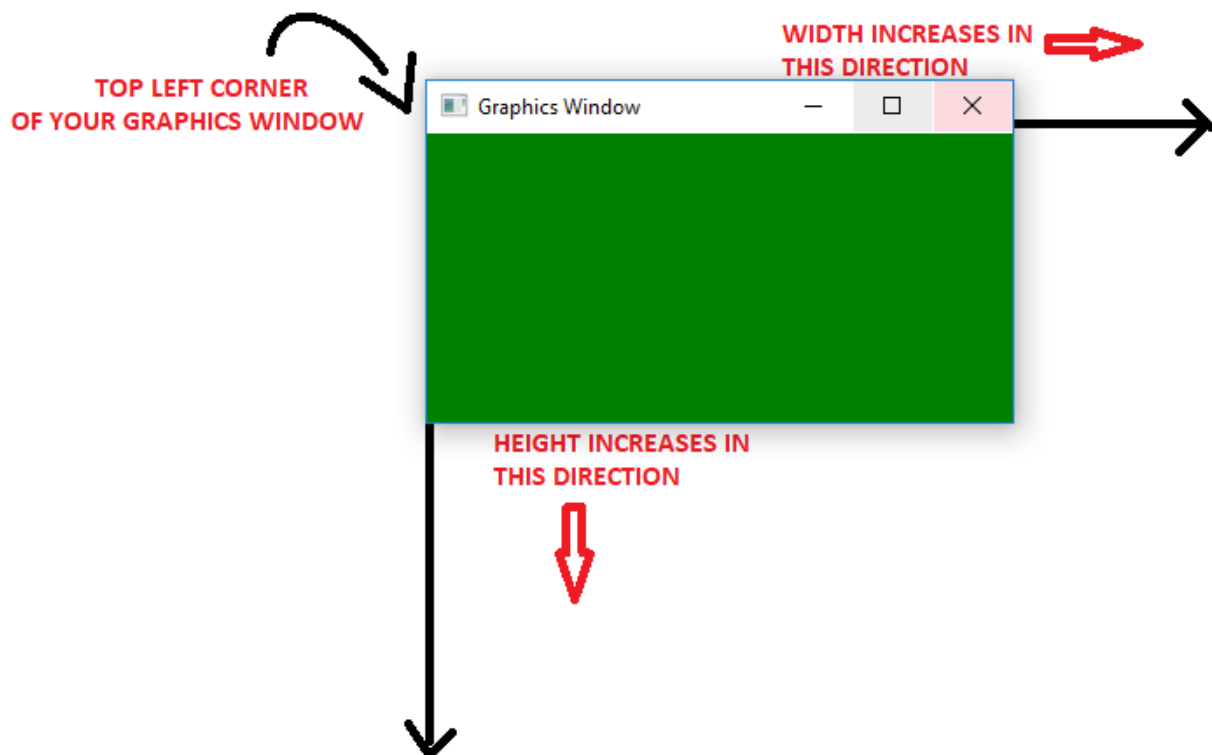
This is our graphics window! In the next sections, we will cover other aspects of the Graphics Window. But before moving ahead, let's discuss how coordinate geometry is related to what we will do in the graphics window!

## Coordinates

Let's look at the code above and think more about how we gave the width and height values. We gave the value 300 for both the height and width, but where is the starting point of this height and width? In other words, 300 units from where?

The point of reference and measurement for all the tasks we will be doing in graphics window would be the top left corner of the window.

When we map this understanding to our graphics window it would look like this:



Go ahead and play around with giving different values to our width and height in the code above.



Imagine now in this graphics window, you want to draw a line segment. How do you know where the line segment starts (the starting point) and where it ends (the ending point)? We use the XY coordinate system to represent the starting and ending points. Consider 'x' as a moving point on your 'width' axis and 'y' as moving point on your 'height' axis. To represent any point on the graphics window, imagine where it is on the width axis (x) and on the height axis (y). Once you have established the XY coordinates, you can draw shapes on the graphics window.

For example, given the first graphics window example (whose width and height are 300), we want to draw a diagonal line from the top-left corner of the screen to the bottom-right corner of the screen. How would you represent both these points in the XY coordinate system?

The top-left corner is the first point on the width axis. Thus, its  $x$  value is 0. It is also the first point on the height axis. Thus, its  $y$  value is 0.

**Therefore, in the XY coordinate system, it can be represented as (0,0).**

Similarly, let us try to represent the bottom-right corner of the graphics window. Keep in mind that the width and height of the graphics window are both 300. The width axis is called the **X axis** and the height axis is called the **Y Axis**.

The bottom-right corner is the last point on the width axis. Thus, its  $x$  value is 300. It is also the last point on the height axis. Thus, its  $y$  value is 300.

**Therefore, in the XY coordinate system, it can be represented as (300, 300).**

In a similar manner, you can represent any point on the graphics



window in the XY coordinate system!

*Note: Remember, any point on the graphics window can be represented in the XY coordinate system.*

Can you think of how to represent the following in XY coordinate system?

- 1) The top-right corner of the graphics window
- 2) The bottom-left corner of the graphics window
- 3) The point at the center of the graphics window

You can assume that the width and height of the graphics window are both 300.

Once we have established how to determine the XY coordinates of the positions on the graphics window, we can instruct Small Basic to draw a line (and many other shapes). Let's look into the next section to draw some shapes!

## Shapes

We have some good news! We now understand the XY coordinate system, and so does Small Basic! Now we'll instruct it to draw shapes for us!

Let's draw a line from the top-left corner to the bottom-right corner, as we discussed in the last section:

```
GraphicsWindow.BackgroundColor = "Blue"
GraphicsWindow.Width=300
GraphicsWindow.Height=300
GraphicsWindow.Title = "Graphics Window with a Line"
GraphicsWindow.DrawLine(0,0,300,300)
```

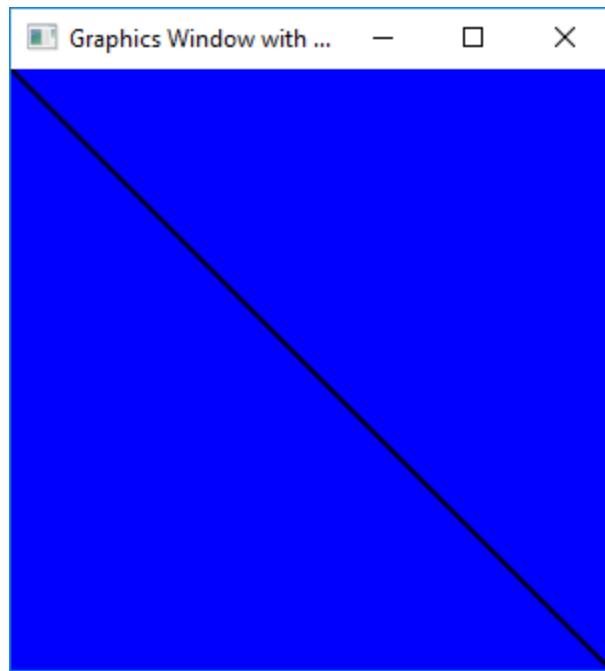
We have changed the background color to **Blue**, changed the title of the window, and we told **GraphicsWindow** to draw a line from a first point (0,0) to a second point (300,300).

The values in between the parenthesis are called arguments. **GraphicsWindow.DrawLine** takes in arguments in the following format: (x coordinate of the first point, y coordinate of the first point, x coordinate of the second point, y coordinate of the second point).

This form is usually simplified to be written as  $(x_1, y_1, x_2, y_2)$ .



The above code would make a line on your graphics window, as shown in the picture below:



As we saw in the last example, we need 2 points to draw a line in the graphics window.



*Note: Don't forget the  $(x_1, y_1, x_2, y_2)$  form to represent the points*

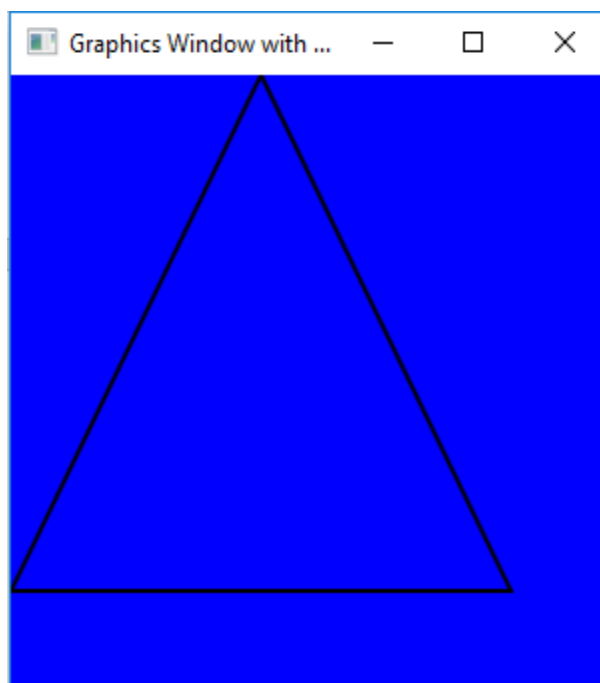
Similarly, we need 3 points to represent a triangle. As our dear graphics window understands the XY coordinate system so well, let's try to draw a triangle by giving the 3 points of the triangle in the XY coordinate system:

```
GraphicsWindow.BackgroundColor = "Blue"
GraphicsWindow.Width=300
GraphicsWindow.Height=300
GraphicsWindow.Title = "Graphics Window with a Triangle"
GraphicsWindow.DrawTriangle(0,250,125,0,250,250)
```

Once this code runs, we will see a blue graphics window with a triangle within it, as shown below:



*Hint: Think of how  
to represent any  
shape and then  
map it to the XY  
Coordinate system*



## Challenge: Build More Shapes in Graphics Window!

Using your knowledge of build a rectangle and then a triangle within this rectangle.

Here are some tips and reminders to help you start off your program: You will need to know how we represent a shape.





- A rectangle can be drawn by passing 4 arguments –  $x$  coordinate of a point,  $y$  coordinate of a point, width of the rectangle from this point, and the height of the rectangle from this point.
- As you learned, the width is calculated on the X axis and the height is calculated on the Y axis.
- Use **GraphicsWindow.DrawRectangle( $x$ ,  $y$ , width, height)**
- You also learned how to make a triangle. Now imagine what arguments need to be passed to draw the triangle so that fits in the rectangle!

## Discussion Questions

How would you draw a circle?



What happens when you give a negative value for the  $x$  and  $y$  coordinate?

*Hint: Think what happens if we go backwards on the width axis*

Imagine the shapes you see day to day, and try drawing them in the graphics window.

If coordinates go beyond my graphics window, what happens?

## Additional Resources

- [Small Basic GraphicsWindow Object](#)
  - <https://social.technet.microsoft.com/wiki/contents/articles/23618.small-basic-reference-documentation-graphicswindow-object.aspx>
- [Small Basic: Beginning Graphics](#)
- [Small Basic: Fun with Shapes](#)
- <https://www.mathopenref.com/coordintro.html>

