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Java Foundations

9-2
Colors and Shapes

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Guess What, Boys and Girls?!

- Today we're going to learn about colors and shapes!

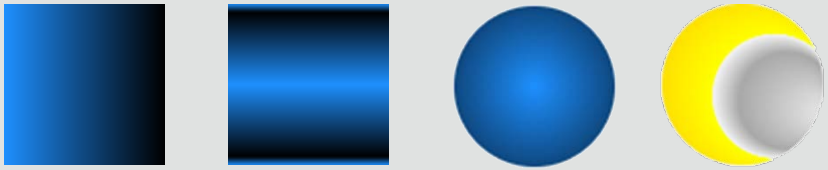
Objectives

- This lesson covers the following objectives:
  - Create and use custom colors
  - Create shapes and explain their properties and behaviors
  - Reference the JavaFX API Documentation

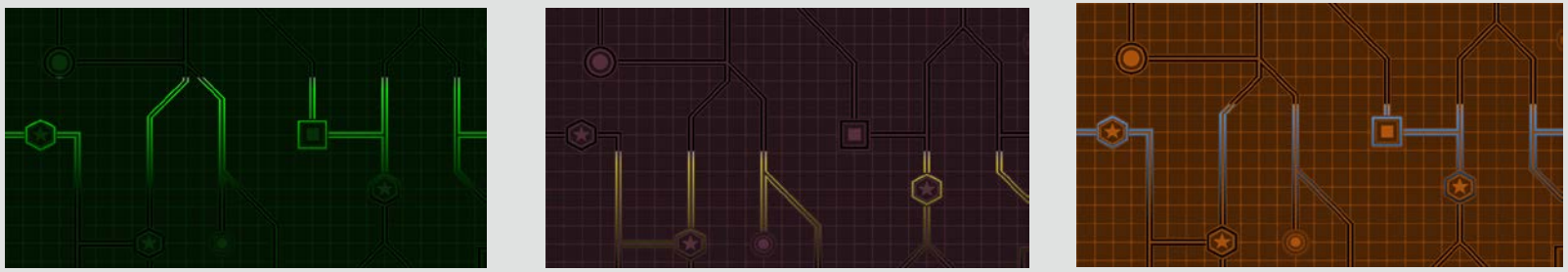
What Can I Do with Colors in JavaFX?

- Color shapes

- Create gradients



- Colorize images



JavaFX Contains a Color Class

- Colors can be stored as variables:

```
Color color = Color.BLUE;
```

- Colors can be passed in methods:

```
Scene scene = new Scene(root, 300, 250, Color.BLACK);
```

  - This example makes the scene's background black

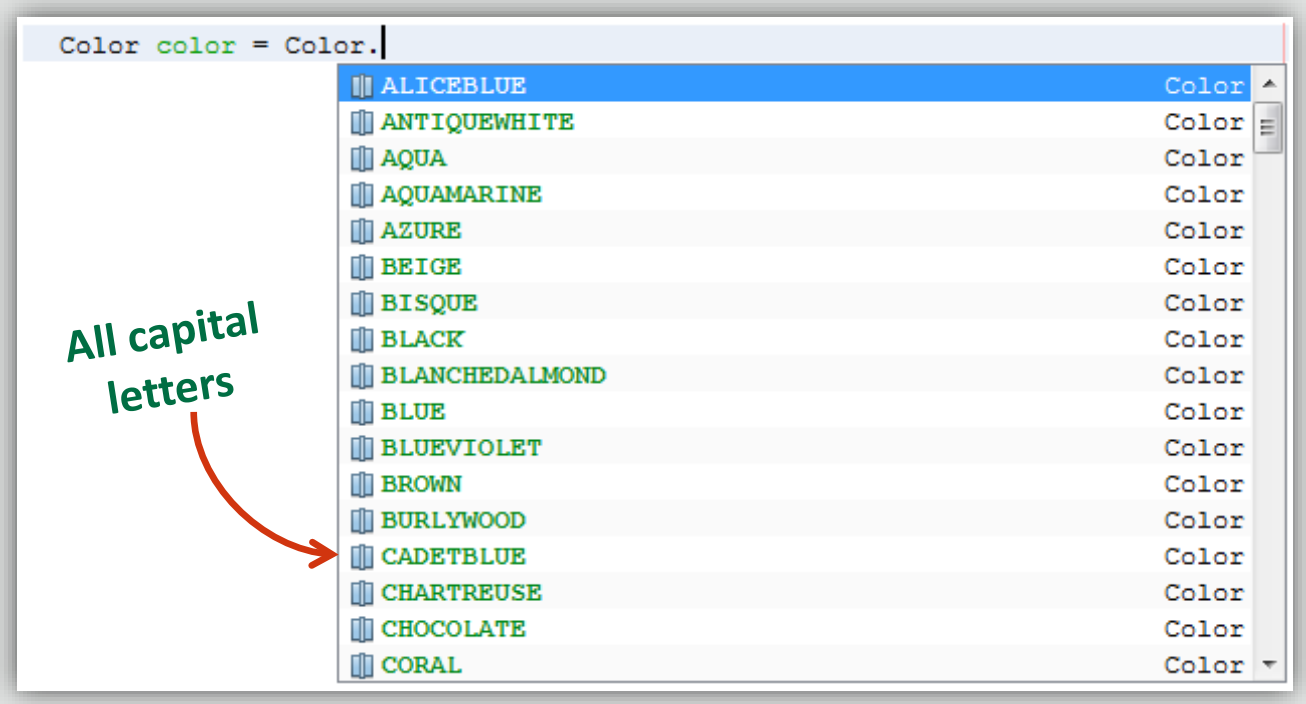
- But before using any Color …
  - You'll first need to make the following import:

```
import javafx.scene.paint.Color;
```

  - Ignore your IDE's other Color import suggestions

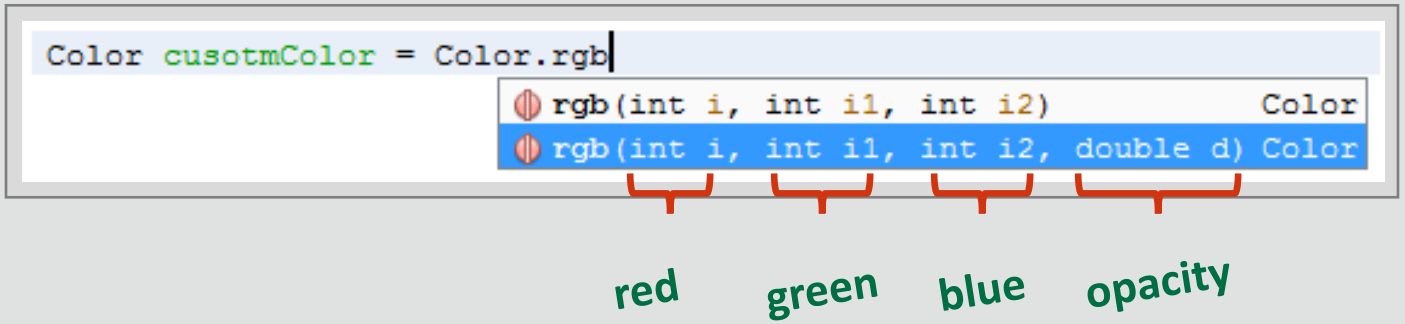
Referencing a Color

- There are many colors in JavaFX
- Typing `Color.` in your IDE reveals the entire list of possible colors



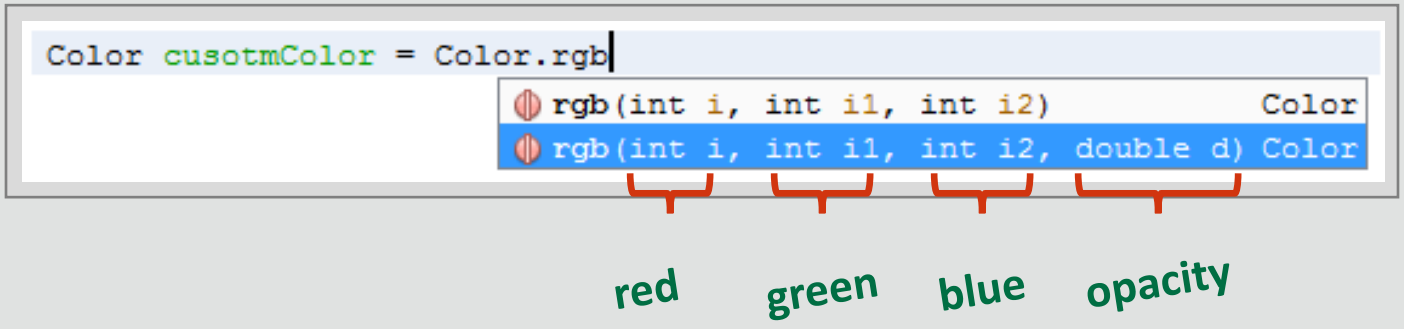
Customizing a Color

- If you're unhappy with the colors that JavaFX provides, there are ways to customize your own color
- The Color class contains methods to do this:



  - Customize a color by mixing red, green, and blue components
  - Opacity can also be controlled

The Range of Color Components



Component	Range of values
Red	0–255
Green	0–255
Blue	0–255
Opacity	0.0–1.0

Color Example

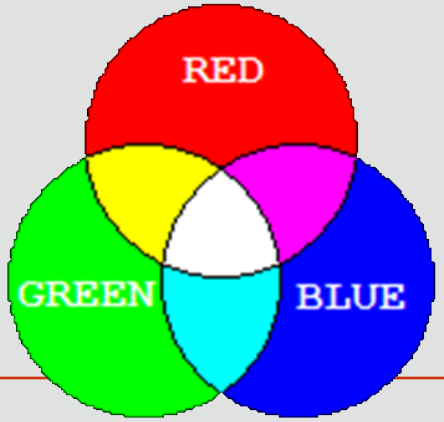
- In this example, the resulting color contains …

```
Color color = Color.rgb(255, 255, 20);
```

  - As much Red as possible
  - As much Green as possible
  - Only a little Blue

- The resulting color is very close to yellow
  - But how do we know this?
  - For the most part, finding the perfect color is “guess and check,” but there are guiding principles

Rules of Additive Color Mixing



Examples:

Code	Color	
`Color.rgb(255, 0, 0);`	red	Pure red
`Color.rgb(0, 255, 0);`	green	Pure green
`Color.rgb(0, 0, 255);`	blue	Pure blue
`Color.rgb(255, 255, 0);`	yellow	No blue
`Color.rgb(0, 0, 0);`	black	No color
`Color.rgb(255, 255, 255);`	white	All color

Exercise 1

- Create a new JavaFX project using `JavaFXMainEx1.java`
  - `JavaFXMainEX1.java` is a copy of `JavaFXMain.java`
  - Change the Root Node to a Group type
  - Remove the button and any other unnecessary code relating to the button
- Experiment with customizing colors
  - Create a few custom colors
  - Admire your custom colors through the scene's background by providing a Color argument when the Scene is instantiated

This Is a Rectangle

- This is how to instantiate a JavaFX Rectangle:

```
Rectangle rect = new Rectangle(20, 20, 100, 200);
```

x-position

y-position

width

height

- You'll first need to make the following import:

```
import javafx.scene.shape.Rectangle;
```

  - Ignore your IDE's other Rectangle import suggestions

Important Methods for Rectangles

- We can get a sense of a Rectangle's properties from the constructor and the following methods:
  - setX(double d)
  - setY(double d)
  - setWidth(double d)
  - setHeight(double d)
  - setFill(Paint paint)
  - setStroke(Paint paint)

  These can accept a color as an argument

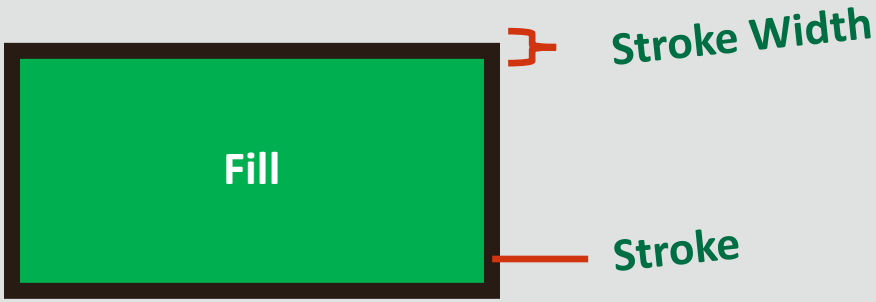
  - setStrokeWidth(double d)
    - (There are many more Rectangle methods besides these seven)
- But what exactly will these methods do?

Exercise 2

- Continue editing the JavaFX project that you created in the previous exercise
- Create a Rectangle and add it to the Root Node
- Call each method outlined in the previous slide
- Can you figure out what each method does?

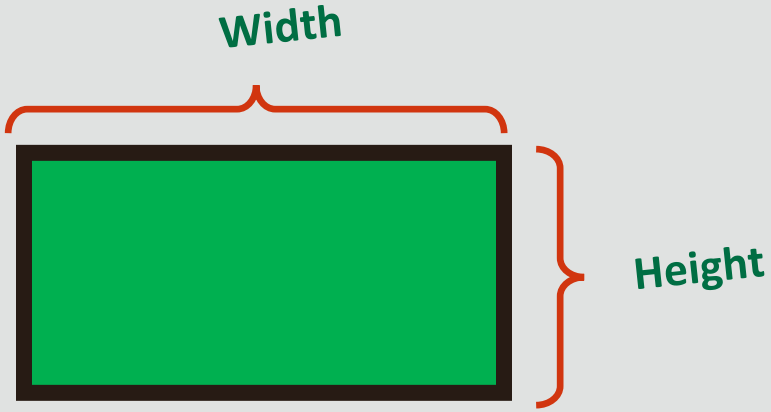
Method Descriptions, Part 1

- setFill(Paint paint)
  - Sets the color of the Rectangle
- setStroke(Paint paint)
  - Sets the color of the Rectangle's outline
- setStrokeWidth(double d)
  - Sets the width of the Rectangle's outline



Method Descriptions, Part 2

- setX(double d)
- setY(double d)
  - Sets the x or y position of the Rectangle
- setWidth(double d)
- setHeight(double d)
  - Sets the width or height of the Rectangle



Changing a Node's Position

- We've seen a couple ways to change a node's position … but which way is preferable?

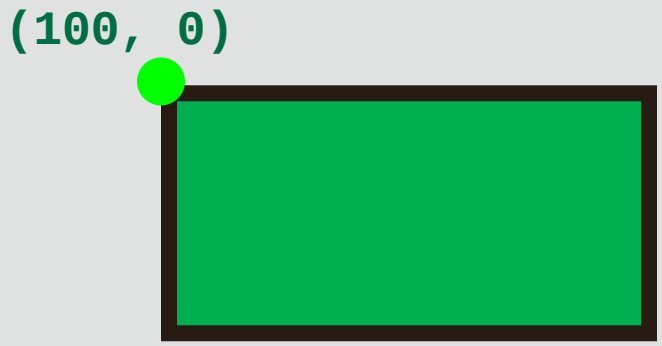
- setX(double d)
- setY(double d)
  - These are preferable in most cases

- setLayoutX(double d)
- setLayoutY(double d)
  - Use these if your Node is locked in a Layout pane, such as a FlowPane
  - Or if setX() is unavailable, which is the case with UI elements, such as Buttons

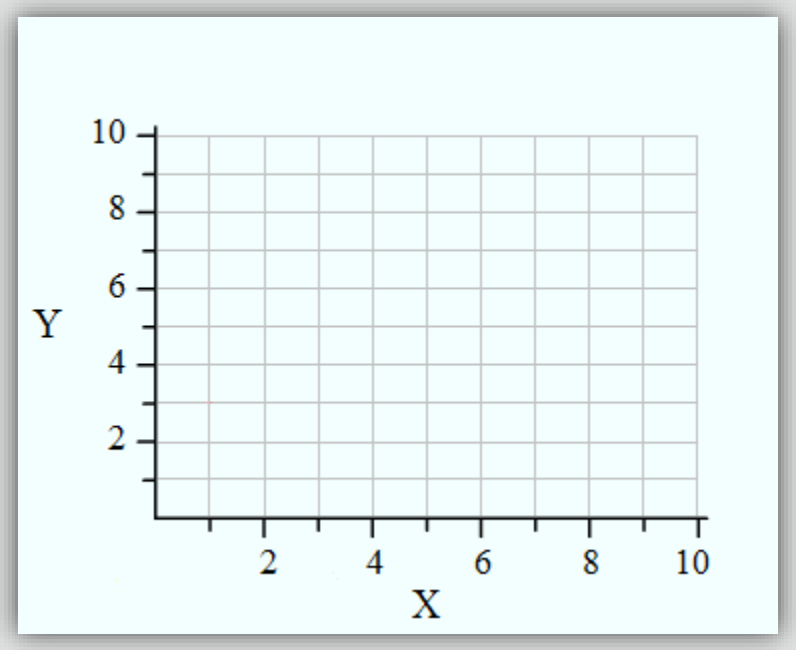
setX() definitely won't work in this case

Positioning a Node

- Most Nodes are positioned with respect to their top-left corner
  - And not with respect to their geographic center
- If you call setX(100) on a Node …
  - The x-position of the Node's top-left corner is set to 100

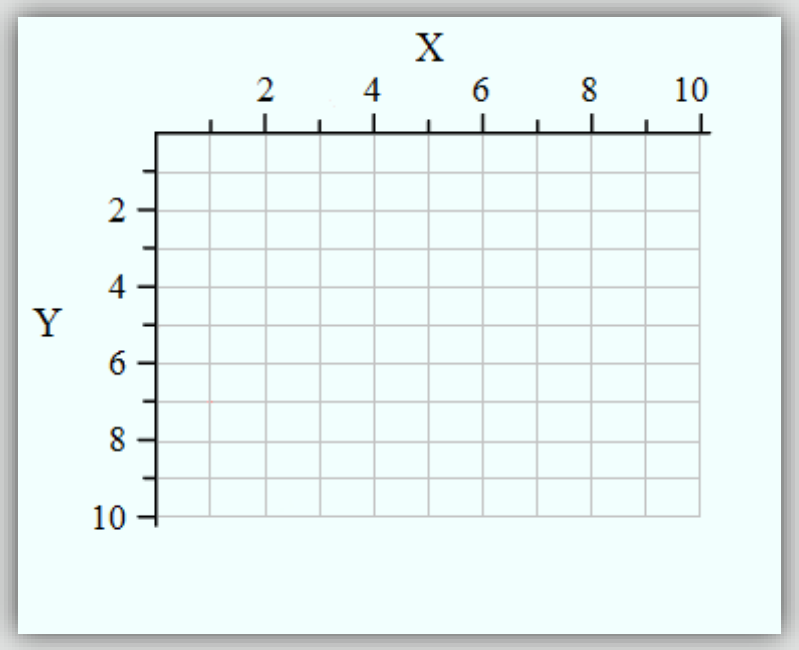


Coordinate Systems



Mathematical Coordinate System

- The origin is located at the bottom-left corner

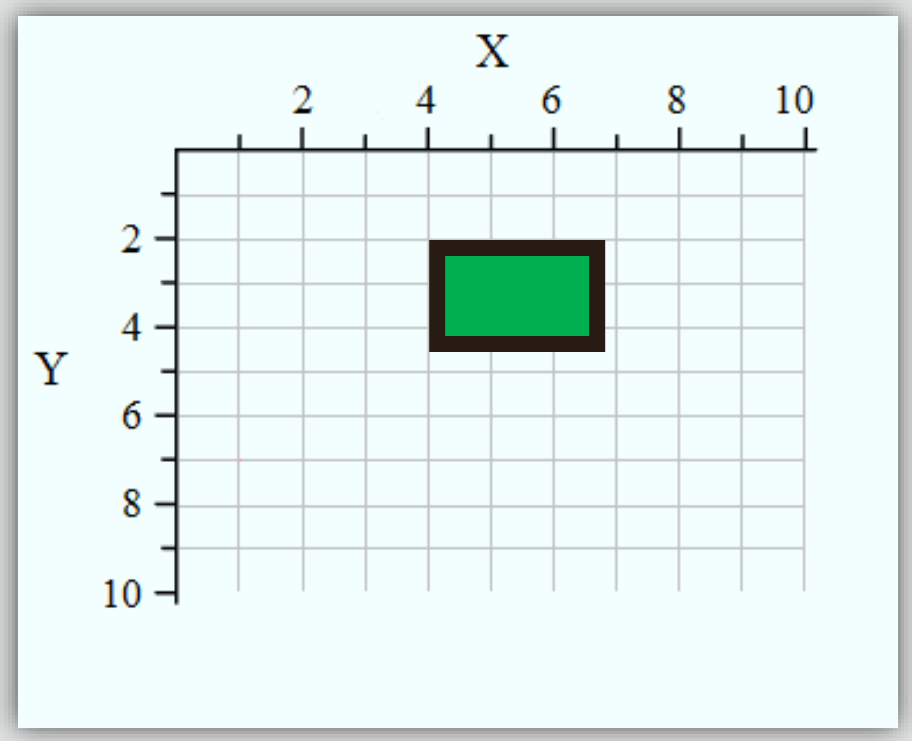


JavaFX Coordinate System

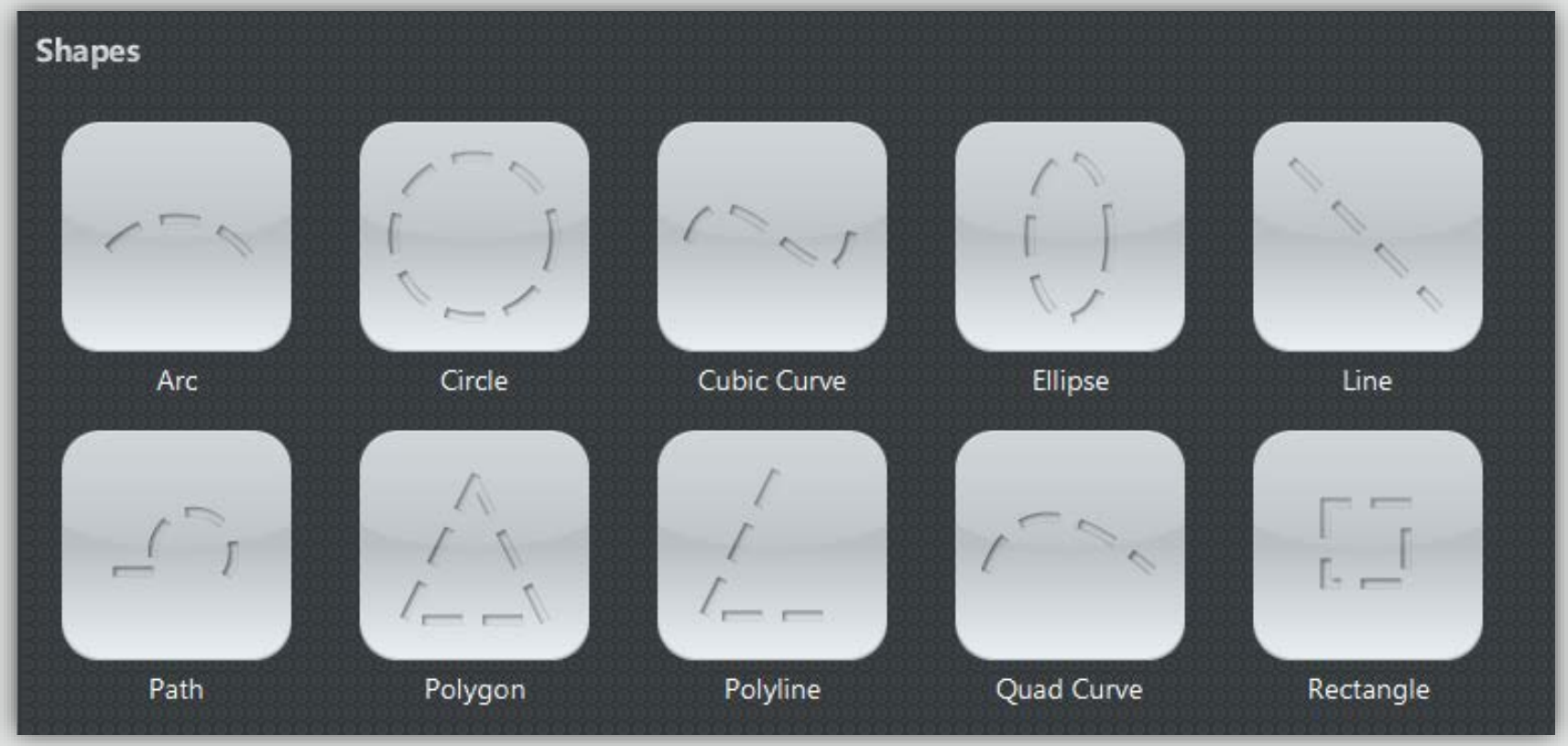
- The origin is located at the top-left corner
- The y-axis is backward

Positioning Example

- This Rectangle is positioned at (4,2) by calling:
  - `setX(4);`
  - `setY(2);`



Many Shapes Are Available in JavaFX

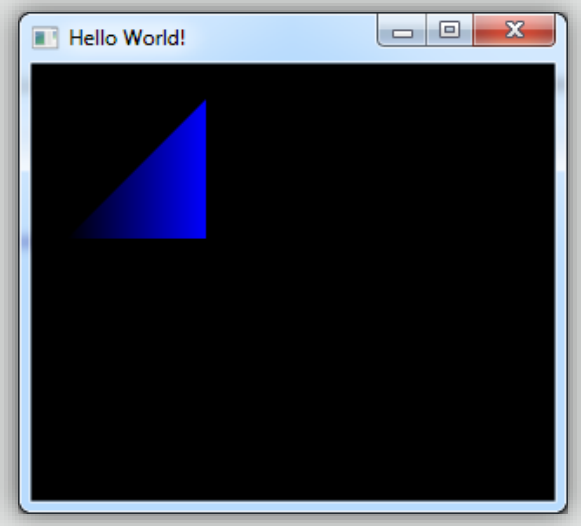


The JavaFX API Documentation

- This contains class information and code examples of JavaFX features
- Go to https://openjfx.io/javadoc/17/index.html
- The Graphics module is a helpful starting point
- There is a search feature to allow you to locate specific classes, or you can browse the packages for ideas

Exercise 3

- Explore the JavaFX API Documentation
- Can you figure out how to create a right triangle with a gradient coloring using the JavaFX project that you created in the previous exercise?
- Hint: use the search box to first search for gradient, then search for Polygon



Exploring the API Documentation: Linear Gradient Example

- The Linear Gradient example shows us …
  - How to create a gradient:

```
//create simple linear gradient
LinearGradient gradient1 = new LinearGradient(0, 0, 1, 0, true,
CycleMethod.NO_CYCLE, new Stop[] {
        new Stop(0, Color.DODGERBLUE),
        new Stop(1, Color.BLACK)
});
```

  - How to color a shape with a gradient:

```
//First rectangle
Rectangle rect1 = new Rectangle(0,0,80,80);

//set rectangle fill
rect1.setFill(gradient1);
```

  - Remember to make the proper imports

Exploring the API Documentation: Polygon Example

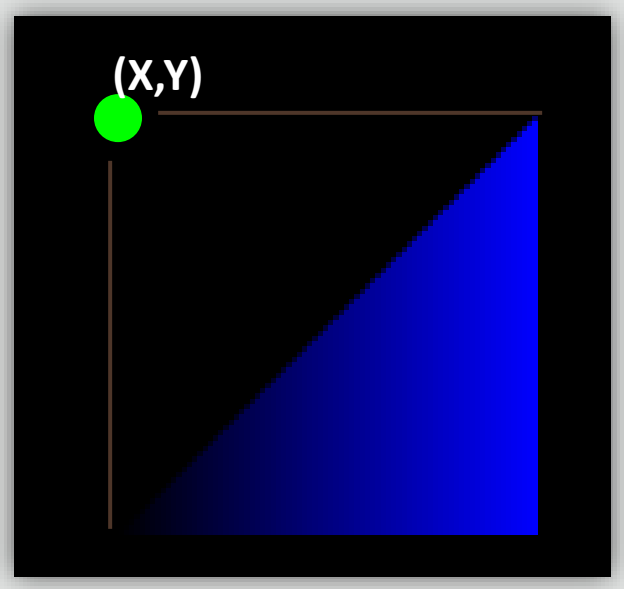
- Type polygon in the API search box - the Polygon example shows us …
  - How to create a polygon from an array of points:

```
//Simple triangle
Polygon polygon1 = new Polygon(new double[]{
        80.0, 10.0,
        80.0, 80.0,
        10.0, 80.0
});
```

- Combine this with the gradient example, and you'll have your solution
  - But even better, you'll understand how the API Documentation is a valuable resource
  - This could prove very useful when you do the problem set

The Polygon

- The Polygon has similar methods as a Rectangle
  - Nodes share the same methods
- If you experiment with setLayoutX()…
  - You'll notice that the Polygon is positioned with respect to where its top-left corner would be



Secrets about Java Puzzle Ball

- We drew lines and polygons for collision detection
  - But these lines are hidden in the latest version

- We also drew two octagons around each bumper
  - An inner octagon handles collision detection
  - An outer octagon detects if the ball is far enough away for the bumper to rotate
- We had to do extra work to position and rotate Nodes the way we wanted

Summary

- In this lesson, you should have learned how to:
  - Create and use custom colors
  - Create shapes and explain their properties and behaviors
  - Reference the JavaFX API Documentation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