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Processing: Basic Shapes

Elements of Graphics
CS324e

Processing Language

- Java-based syntax for achieving graphics functionality
- Incorporates usual programming language features:
  - Functions
  - Comments
  - Expressions

Primitive Data Types

- boolean
- byte
- char
- int
- float
- color

Example Processing Setup

```
void setup() {
   size(200, 200);
}
```

Draw Loop

- Code inside `setup()` runs once
- Code inside `draw()` runs as a continuous loop

```
void draw() {
  background(102);
}
```

Variable scope

- Variables declared within a block are local to that block
- Global variables are declared outside of all blocks
- What is the relationship between global variables, `setup()` and `draw()`?

Consider…

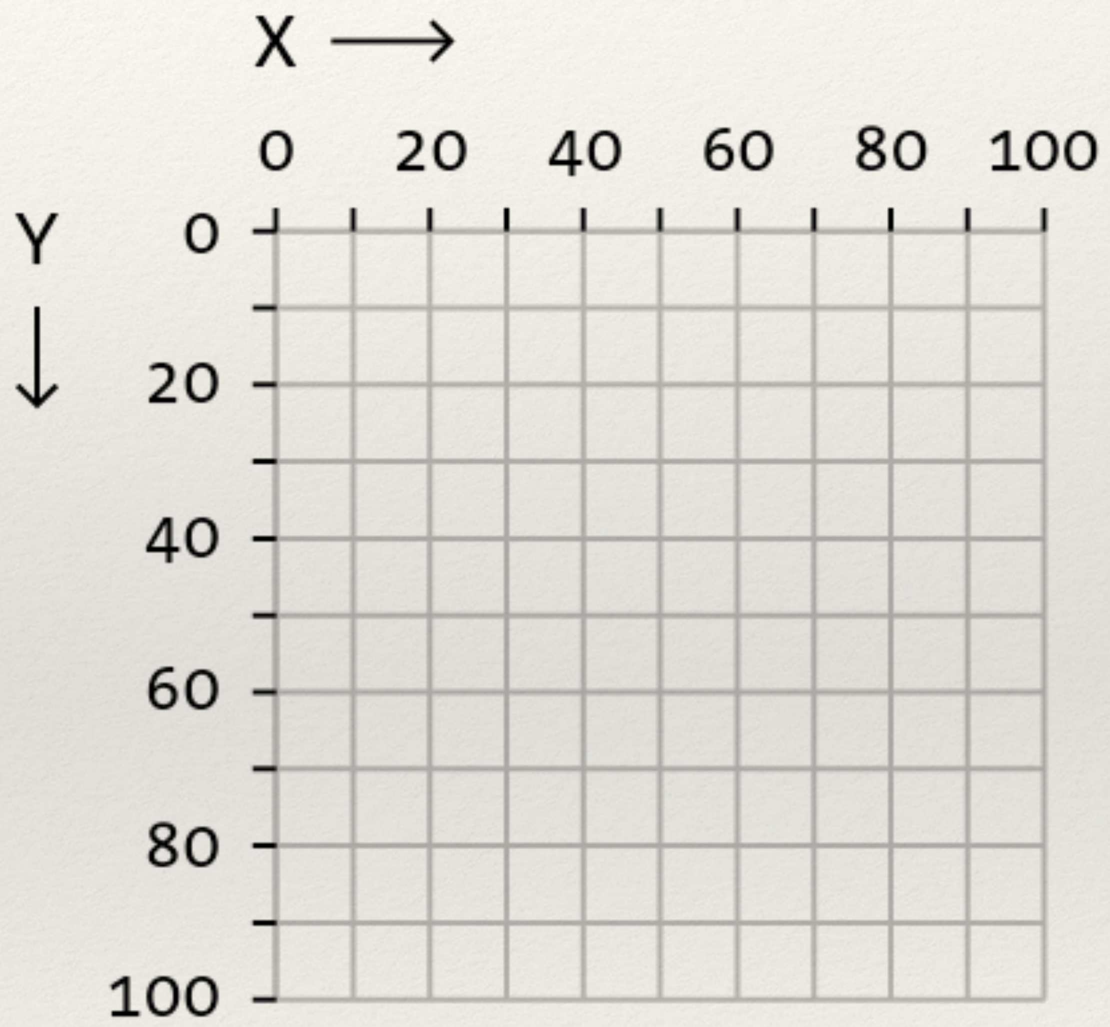
```
int x = 0;
void setup() {
  x += 3;
}

void draw() {
  x++;
}
```

Coordinate Systems

- Coordinate systems define the "space" of the scene within the computer
- Common coordinate systems:
    - World coordinate system
    - Object coordinate system
    - Camera coordinate system
    - Screen coordinate system
- Multiple coordinate systems allow for multiple levels of interaction
    - Multiple coordinate systems also require conversion between systems

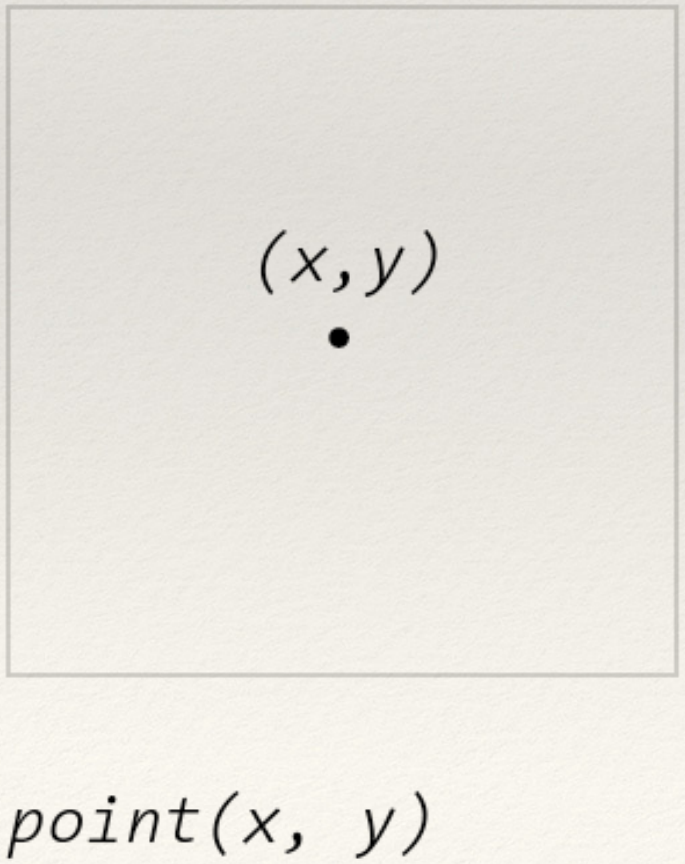
Screen Coordinate System

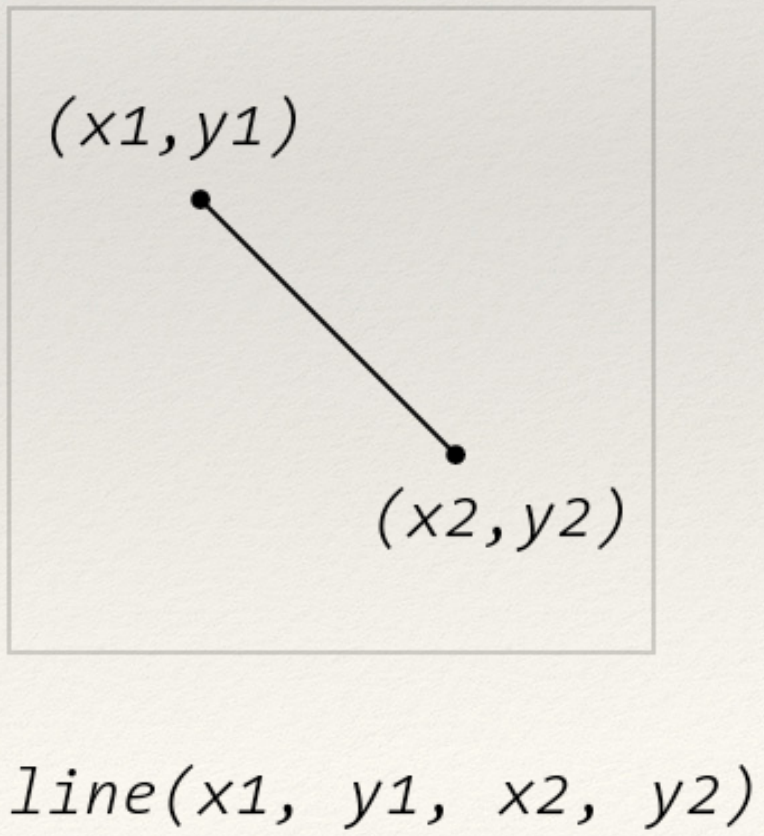
- 2-D, pixel-based coordinate system
- Based on the size (resolution) of the screen / window
- Pixel position defined using (x, y) coordinate notion



Defining Geometry in Processing

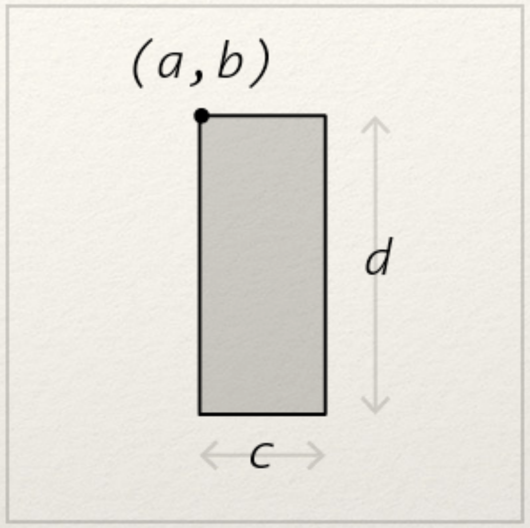
- Function `point(x,y)` defines a pixel within the window
- Function `line(x1,y1,x2,y2)` defines a line of pixels between (x1, y1) and (x2, y2)



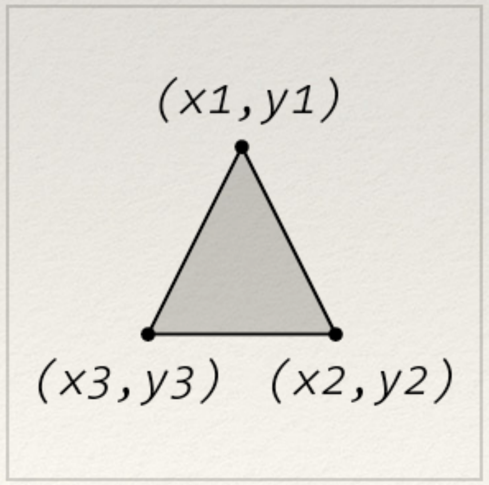


Shape Primitives

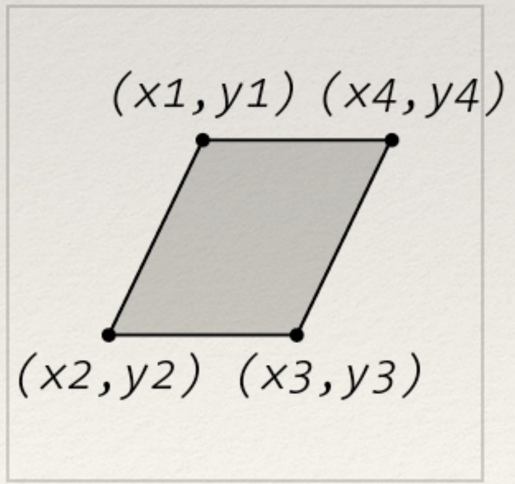
- Other shape primitives in Processing:
  - `rect(a,b,c,d)`
  - `ellipse(a,b,c,d)`
  - `triangle(x1,y1,x2,y2,x3,y3)`
  - `quad(x1,y1,x2,y2,x3,y3,x4,y4)`



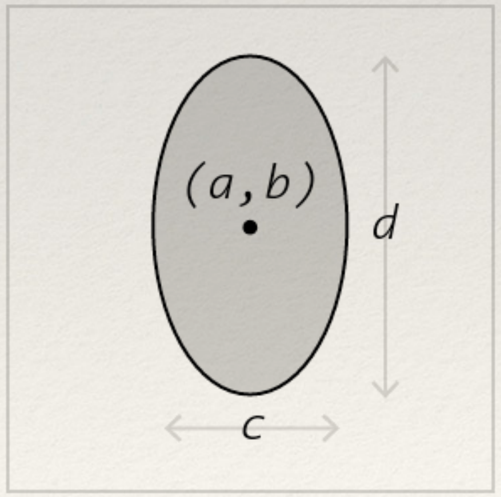
`rect(a, b, c, d)`



`triangle(x1, y1, x2, y2, x3, y3)`



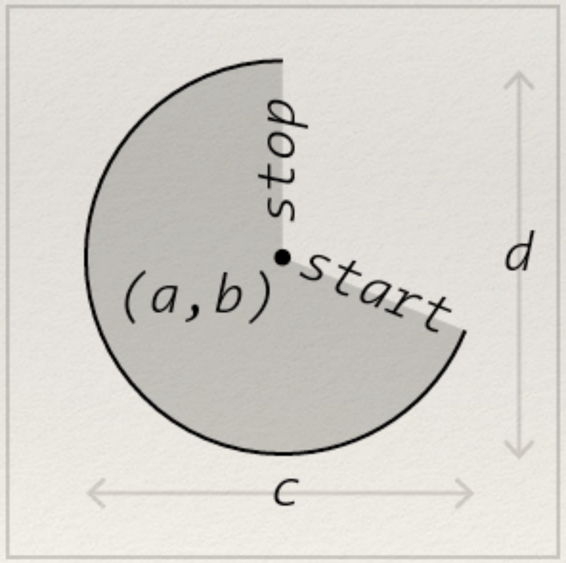
`quad(x1, y1, x2, y2, x3, y3, x4, y4)`



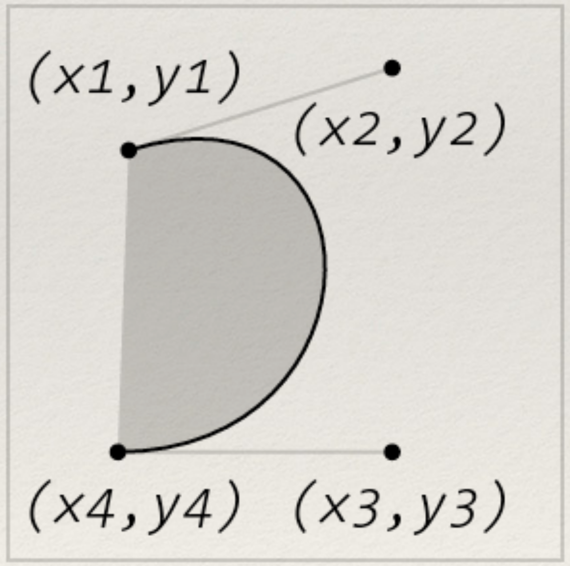
`ellipse(a, b, c, d)`

Curves

- `arc(a,b,c,d,start,stop)`
- `bezier(x1,y1,x2,y2,x3,y3,x4,y4)`



arc(a, b, c, d, start, stop)



bezier(x1, y1, x2, y2, x3, y3, x4, y4)

- `arc` models elliptical arcs
- `arc` expects radians (0 to 2π) rather than degrees (0 to 360) by default
- `bezier` models cubic Bezier curves
- Bezier curves are
    - Smooth
    - Scalable
    - Parametric
- bezierVertex can model higher order Bezier curves
    - We will come back to this concept later in the semester

Hands-on: Creating Geometry

- Today's activities:
  1. Create a Processing sketch
  2. Use the `point`, `line`, `rect`, `ellipse`, `triangle`, and `quad` methods at least two times each
  3. Create at least one shape with the `arc` method
  4. Create at least one shape with the `bezier` method
     - Consider: What makes `bezier` challenging to work directly with in code?