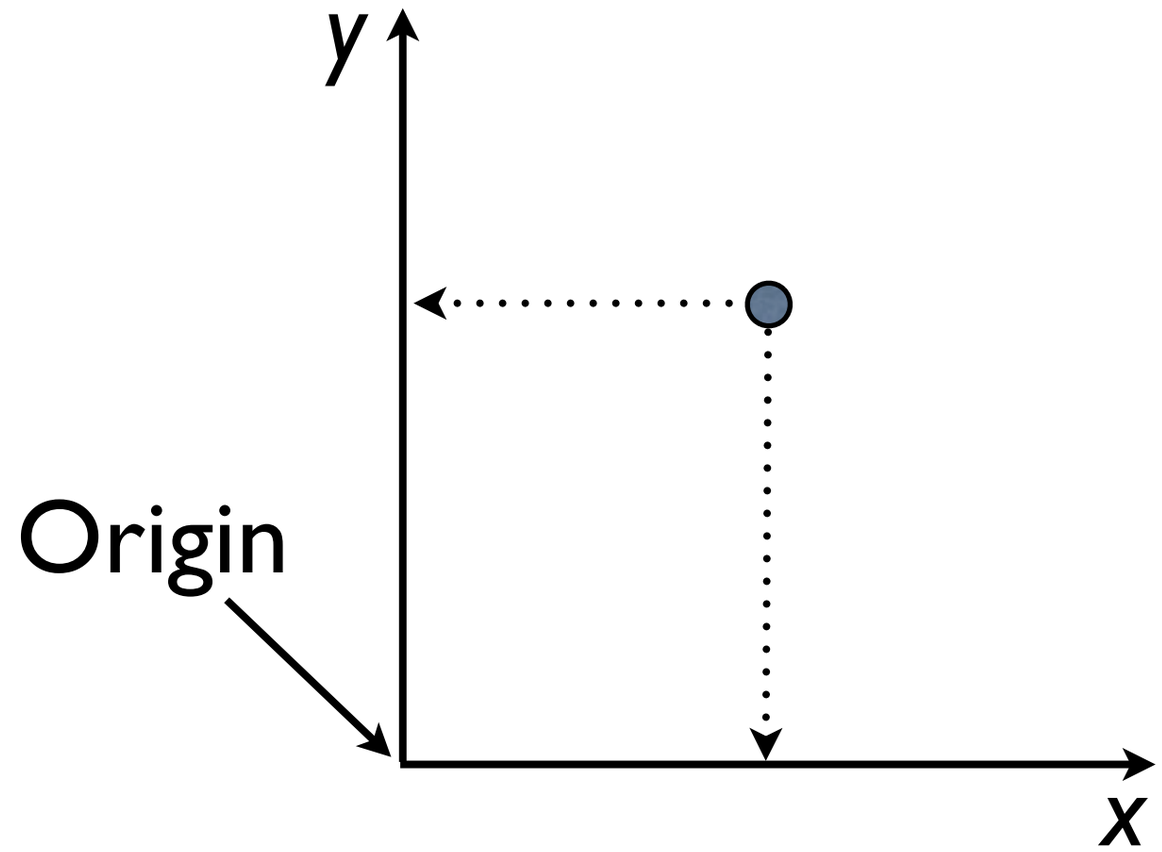
# Coordinates / Drawing

CS 355: Interactive Graphics and Image Processing

# Describing Points

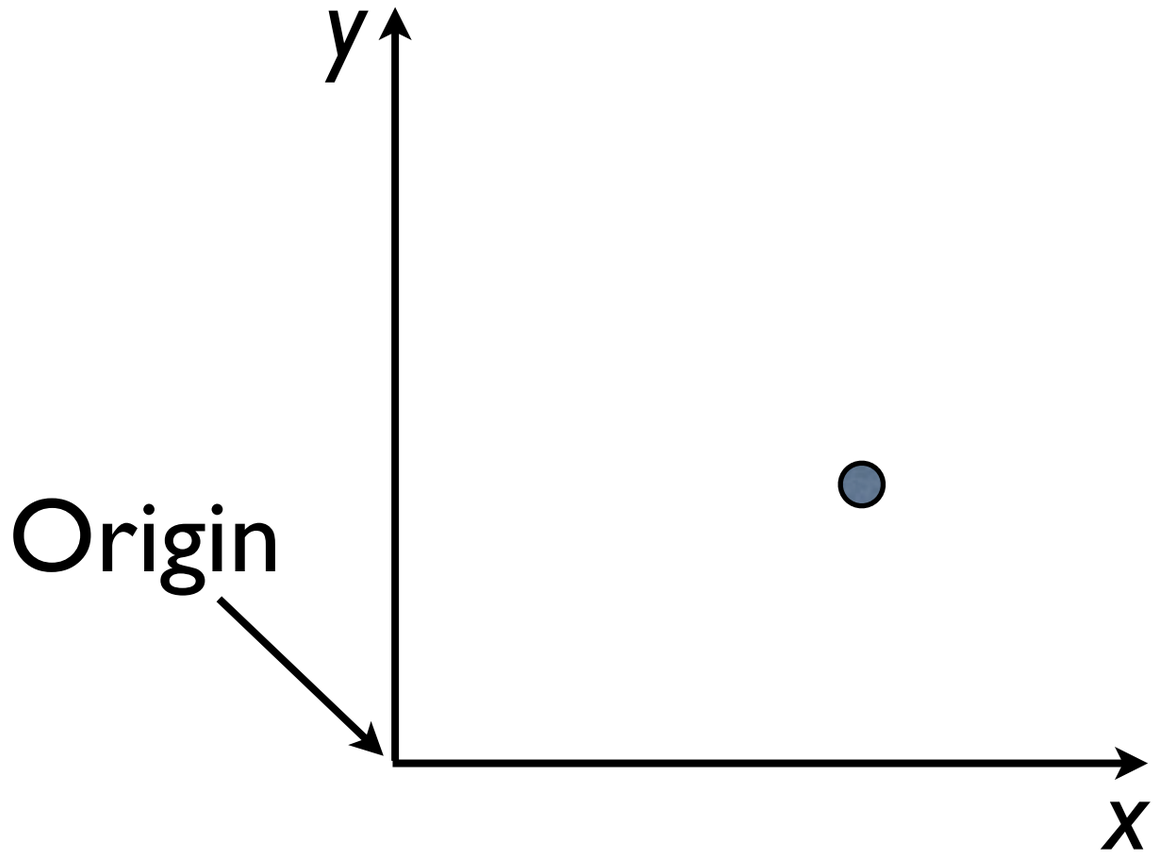
How do you describe this point numerically?

# Coordinate Systems



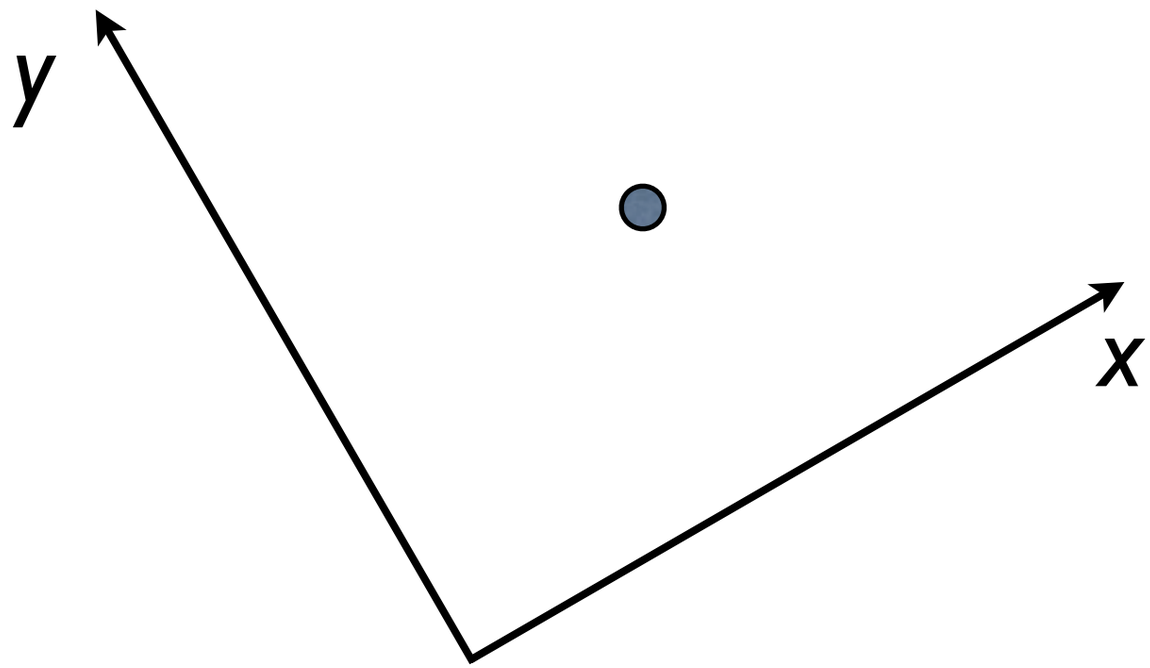

How do you describe this point numerically?

# Coordinate Systems



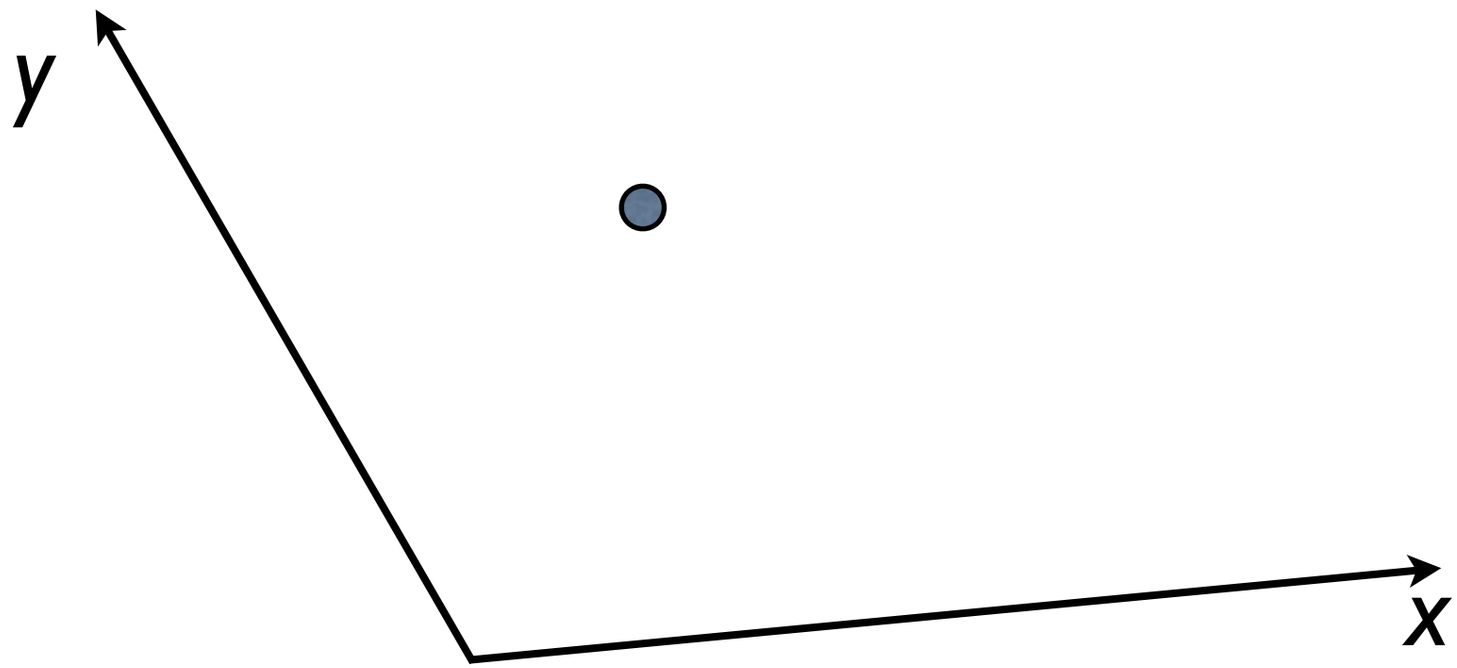

How about this coordinate system?

# Coordinate Systems



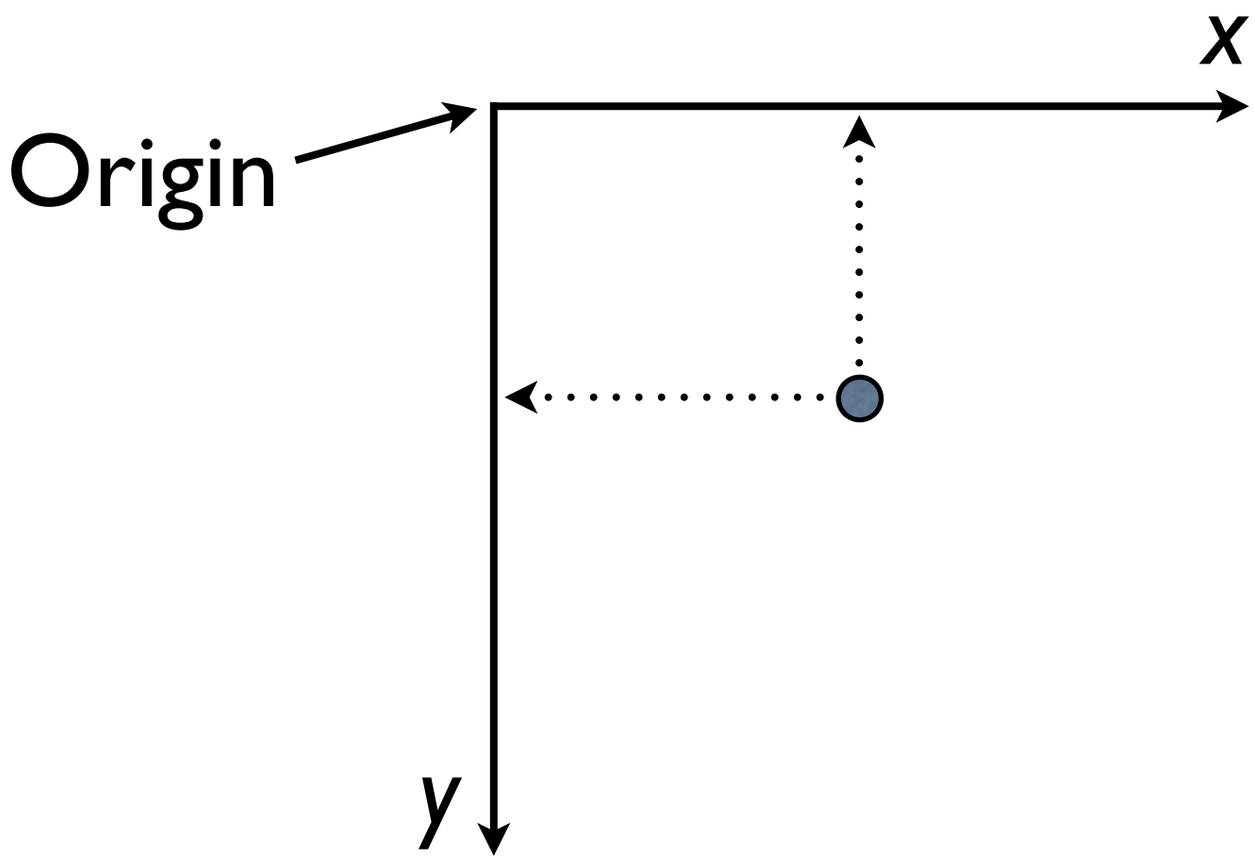

Or this one?

# Coordinate Systems



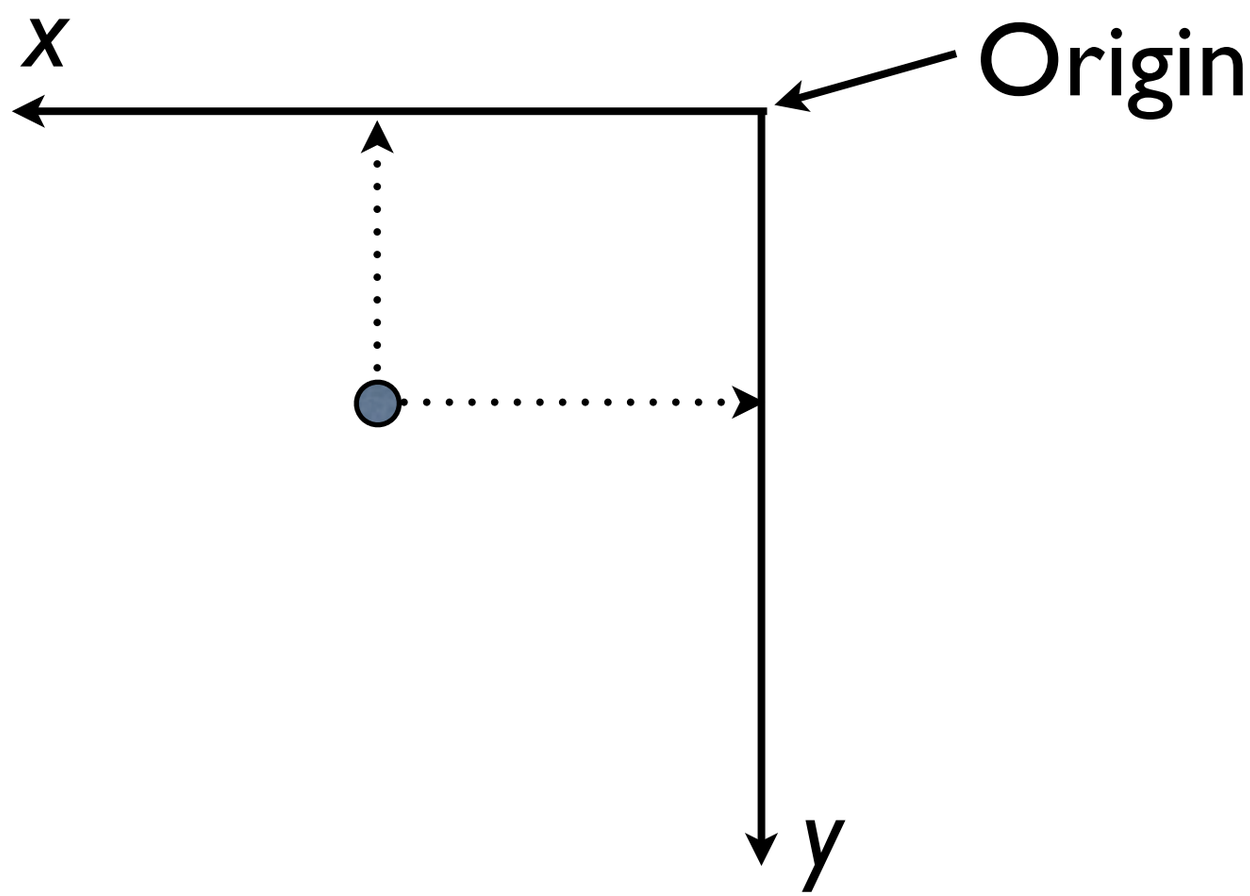

What about this one?

# Coordinate Systems



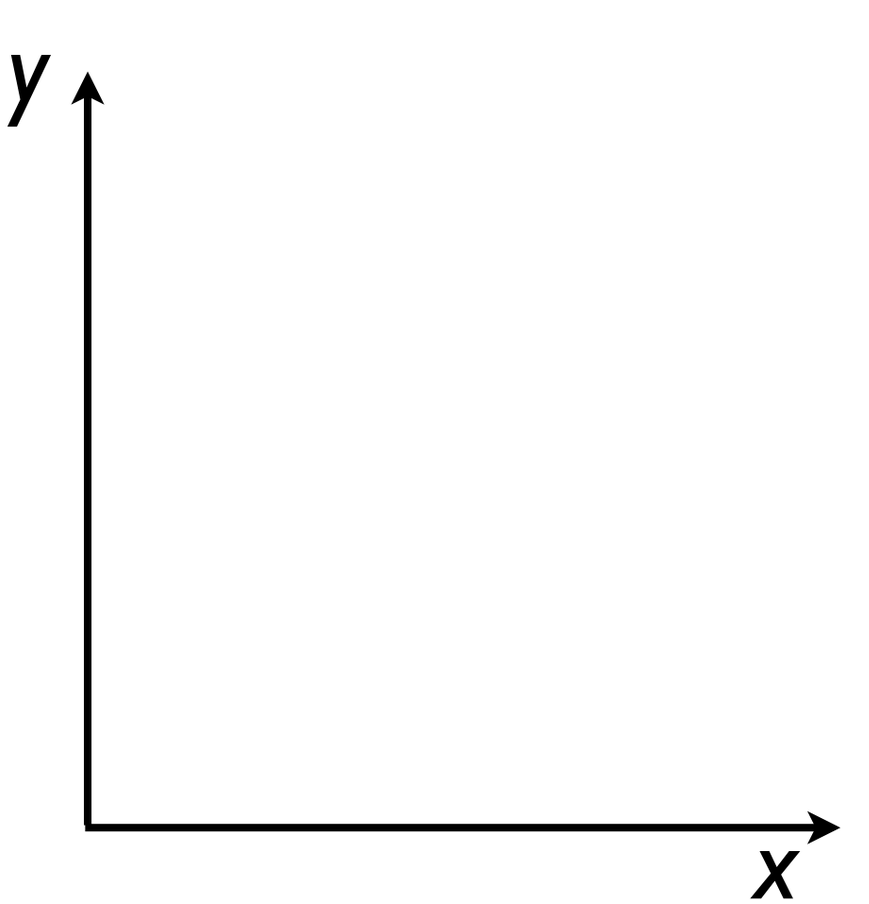

Why not this?

# Coordinate Systems

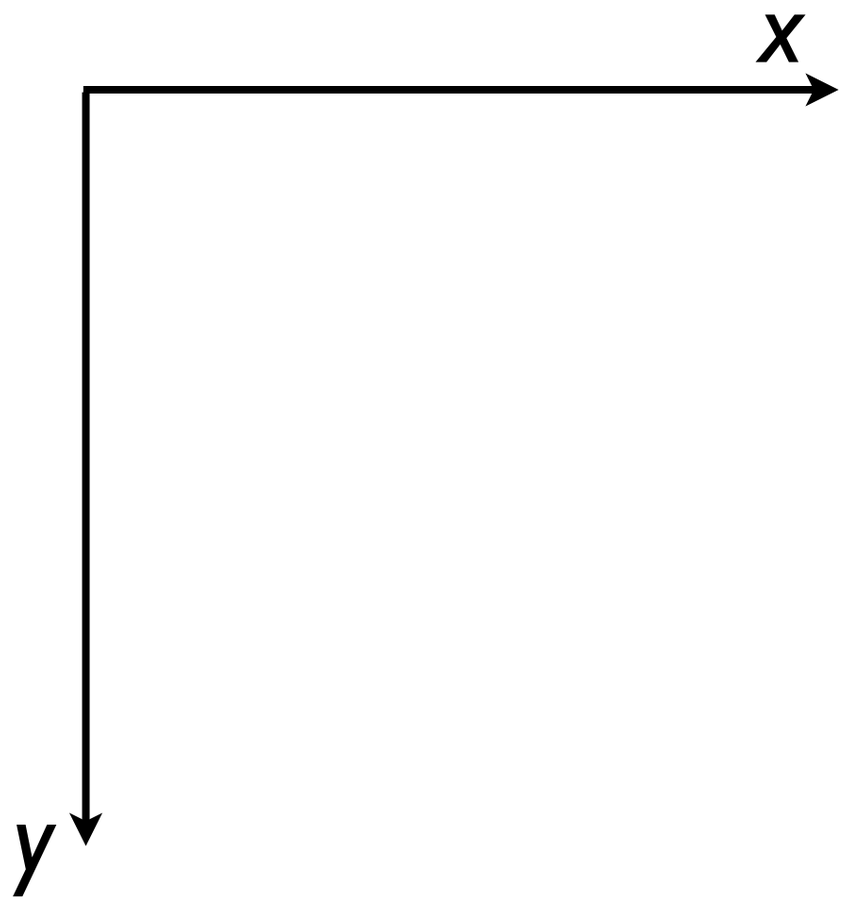



Or this?

# Coordinate Systems

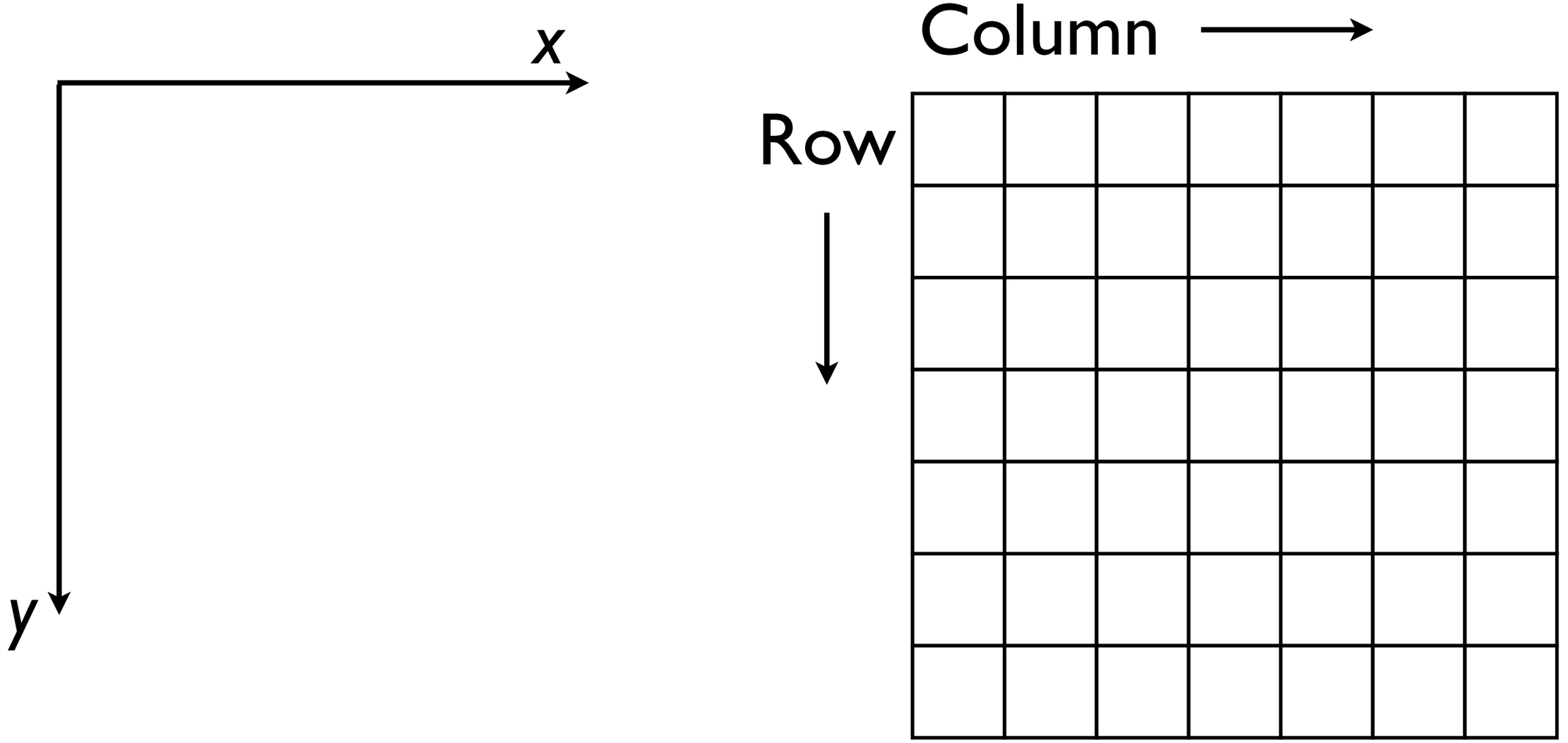



Math teachers




Computer screens

# Math vs. Code




How we draw
(x,y)

How we store
(row,col)

# What About 3D?

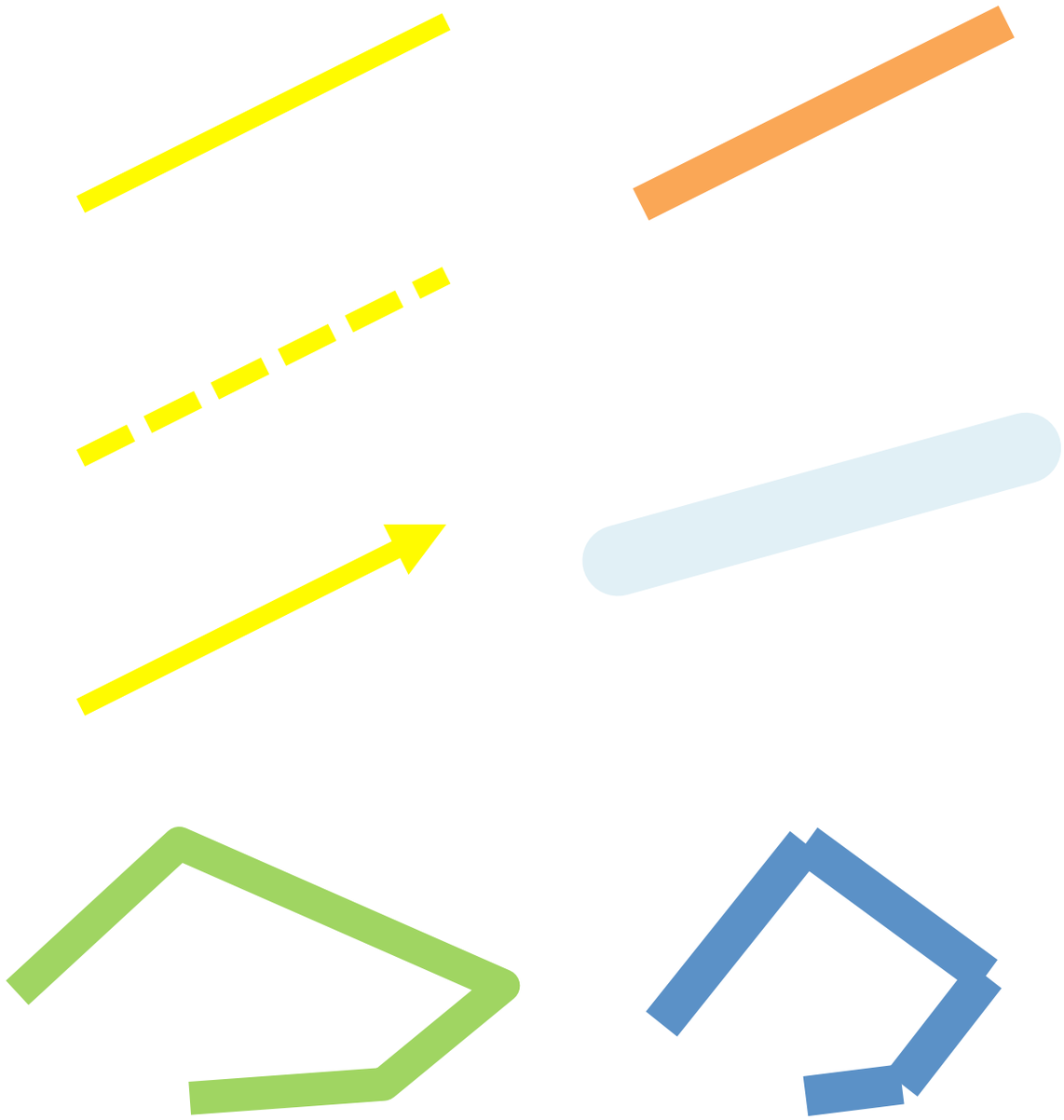
- Same ideas apply in 3D
- New issue: right-handed vs. left-handed

# Drawing Shapes

- Have to rasterize (scan convert) shape to dots
- May want to anti-alias
- Lots of algorithms for lots of shapes
  - Try to be efficient and determine in a single pass, visiting the pixels in (some) order

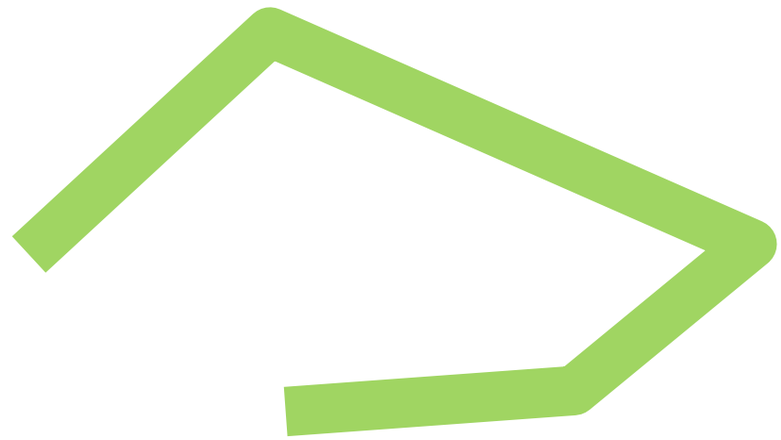
# Drawing Lines

- How thick?
- Pattern?
- Ends?
- Joining with other lines?



# Polylines

- A *polyline* is a connected group of lines in order



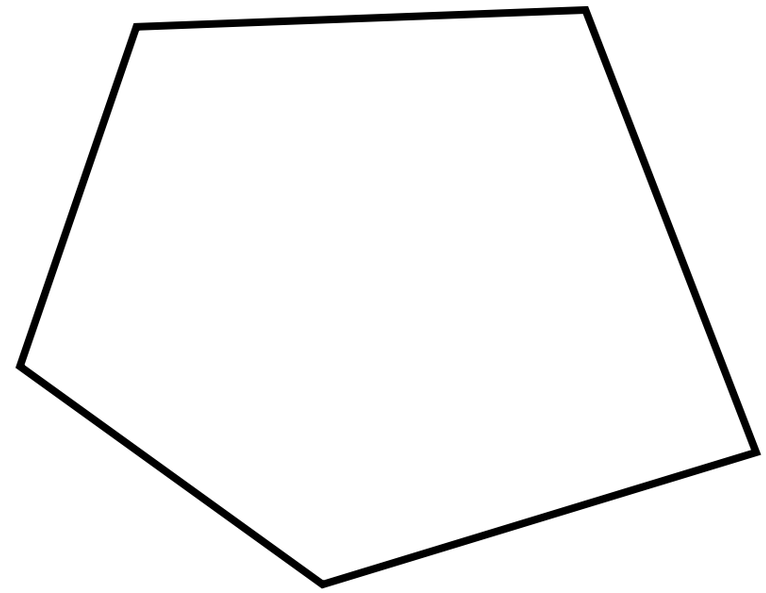
# Polygons

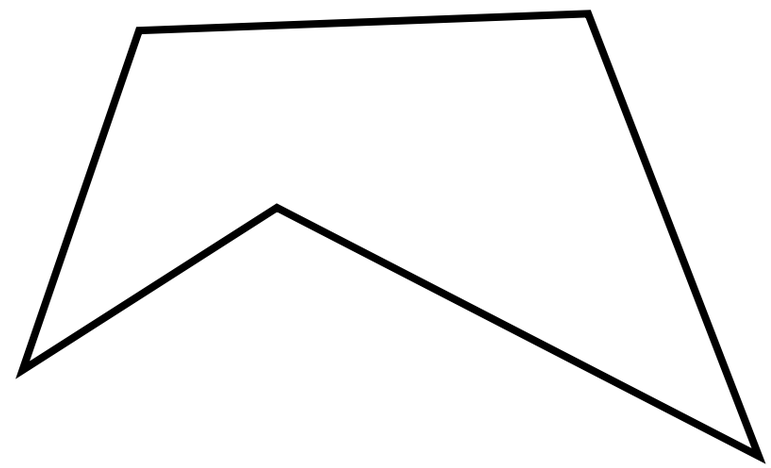
- A *polygon* is a closed *polyline*

- Can be filled
  (have to scan convert)

- Can be *convex*:
  No line from one point to another
  on the polygon crosses the polygon

- Or *concave*:
  Not convex

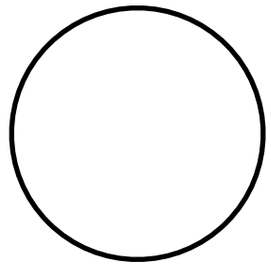




# Circles and Ovals

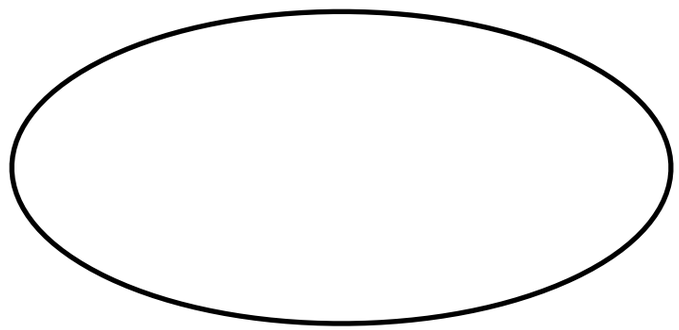
- Circles:

$$x^2 + y^2 = r^2$$



- Ellipses (ovals):

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 = r^2$$



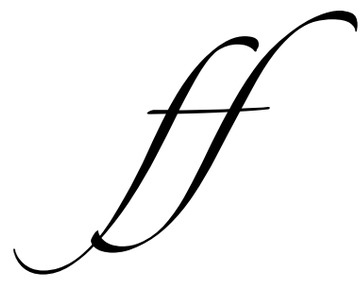
# Curves

- Arbitrary continuous curves require some form of interpolation between discrete points
- More complicated, we'll come back to this

# Text

- Lots of properties to text:
  - Font
  - Size
  - Ligatures
  - Spacing
  - Kerning

Text



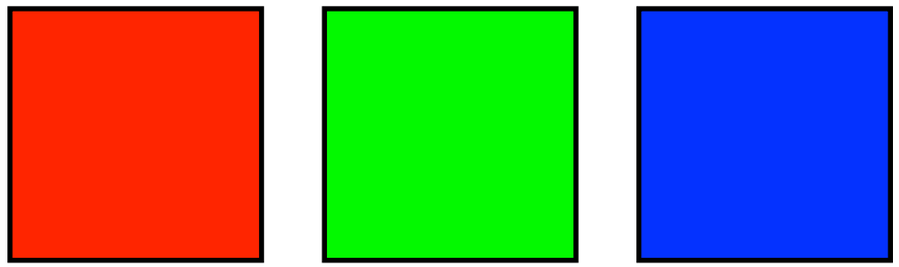
Text

Text

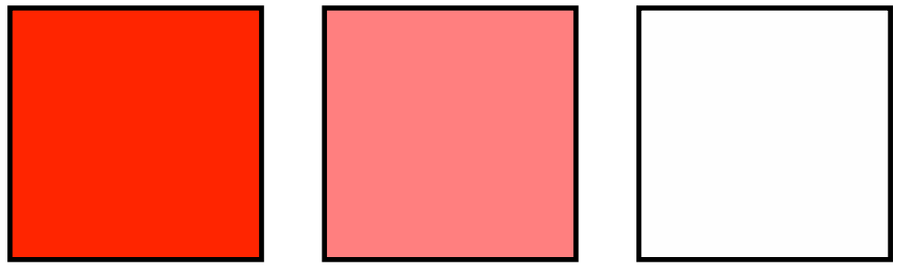
VA VA

# Color

- Red, Green, Blue
  isn't all that intuitive
- Hue, Saturation, Brightness
  is much more intuitive
  (lots of variations)
  - Hue - the "color"
    red vs. blue
  - Saturation - how pure
    red vs. pink
  - Intensity - how bright
    dark red vs. bright red



Different hues



Different saturations

Different brightnesses

# Next time...

- Points, vectors, and lines
- Oh my!