Review

- Loops
  - Condition
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- Functions
  - Definition
  - Call
  - Parameters
  - Return value

Execution

- Statements are executed one at a time in the order written
- Execution order
  - Globals and initializations
  - setup() called once
  - draw() called repeatedly
  - If any mouse or keyboard events occur, the corresponding functions are called between calls to draw() – exact timing can not be guaranteed.

Variable Scope

- The region of code in which a particular variable is accessible.
- To a first approximation, the scope of a section of your code is demarcated by { and }.
  - Functions
  - Loops
  - Conditionals
- A variable is only accessible/available within the scope in which it is declared.

Variable Lifetime

- Variables cannot be referenced before they are declared.
- A variable is created and initialized when a program enters the block in which it is declared.
  - Functions
  - Loops
  - Conditionals
  - Function parameters
- A variable is destroyed when a program exists the block in which it was declared.

Global variables

- Variables that are declared outside of any scope are considered globals (versus locals).
- Global variables should be declared at the top of your program.
- Do not sprinkle them between functions!

Shadowing

- When there is a name conflict between variables of different scopes

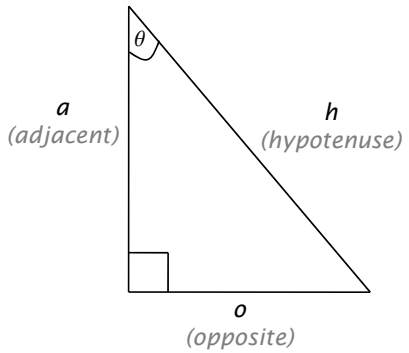
```
int x = 10;
void setup() {
  int x = 5;
  int y = x;
}
```

- The conflicting variables can not have different types (or it's considered a re-declaration and is not allowed)
- When shadowed, smaller (inner) scopes have precedence over larger (outer) scopes

```
int a = 20;

void setup() {
  size(200, 200);
  background(51);
  stroke(255);
  noLoop();
}

void draw(){
  line(a, 0, a, height);
  for(int a=50; a<80; a += 2) {
    line(a, 0, a, height);
  }
  int a = 100;
  line(a, 0, a, height);
  drawAnotherLine()
  drawAnotherLine();
  drawYetAnotherLine()
  drawYetAnotherLine();
}

void drawAnotherLine() {
  int a = 185;
  line(a, 0, a, height);
}

void drawYetAnotherLine() {
  line(a+2, 0, a+2, height);
}
```

- What is drawn?

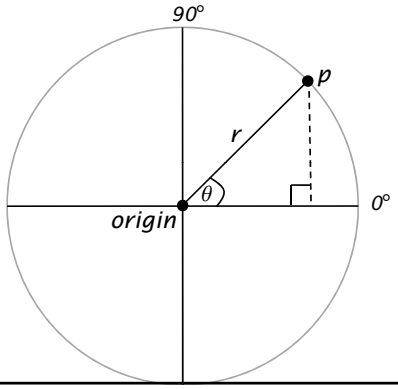
Basics of Trigonometry



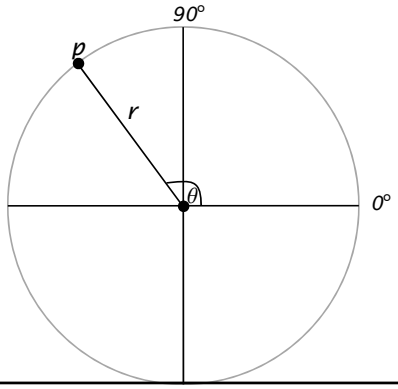
Definition

- $sin(\theta) = o/h$
- $o = h*sin(\theta)$
- $cos(\theta) = a/h$
- $a = h*cos(\theta)$
- $tangent(\theta) = o/a = sin(\theta)/cos(\theta)$

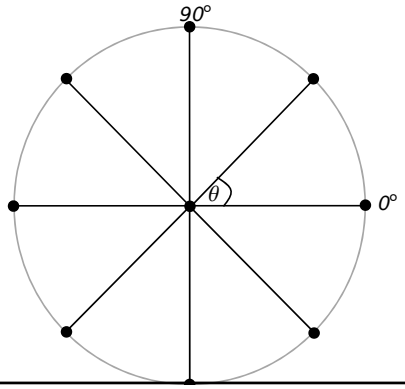
Trigonometry on a unit circle



Trigonometry on a unit circle



Trigonometry on a unit circle



Drawing points along a circle

```
int steps = 8;
int radius = 20;
float angle = 2*PI/steps;

for (int i=0; i<steps; i++) {
  float x = cos(angle*i)*radius;
  float y = sin(angle*i)*radius;

  // draw a point every 1/8th of a circle
  ellipse(x, y, 10, 10);
}
```