

Writing Functions

The following exercises should use input and output arguments to communicate all values. No global variables are needed. No global variables should be used.

1. Write a function that computes the volume of a cylinder given input values of diameter (d) and height (h). Create some test cases (in Arduino code) to show that your function is working correctly.
2. Write a function that computes the surface area of a cylinder given input values of diameter (d) and height (h). Create some test cases (in Arduino code) to show that your function is working correctly.
3. Use algebra to derive the expression for the ratio of volume to surface area of a cylinder. Note that the factor of π and one factor of d cancels in the numerator and denominator of this formula.

Write a function that computes the *ratio* of volume to surface area of a cylinder given input values of diameter (d) and height (h). Use the solution to Exercise 1 and Exercise 2 to create test cases (in Arduino code) to show that your function is working correctly.

Hint: Code for the `setup` function.

```
float d, h, volume, area, ratio, error;

for (d = 0.1; d<2.0; d+=0.5) {

  for ( h=0.1; h<3.0; h+=0.5) {

    volume = cylinderVolume(d,h);
    area = cylinderArea(d,h);
    ratio = cylinderVolAreaRatio(d,h);
    error = ratio - volume/area;

    // print d, h, volume, area, ratio, error

  }
}
```

Debugging Functions

1. The following function should compute the average of three values, but it does not work. Fix the bug(s).

```
function threeAve(float x, float y, float z) {

  average = (x + y + z)/3;
  return(average);
}
```

2. The user who wrote the `threeAve` function from the preceding exercise has fixed the error(s) in that function. Now they are trying to use it in the following Arduino code, but their code has a bug(s). Fix the bugs.

```
void setup() { // incorrect code

  Serial.begin(9600);

  a = float threeAve(1,2,3);

  Serial.print("Average = "); Serial.println(a);
}
```

3. The following Arduino code compiles and downloads to an Arduino UNO, but the code does not produce the results expected by the engineer who wrote the code Fix the bug(s).

```
void setup() {
  Serial.begin(9600);
}

void loop() {

  int potPin, n=15; // wiper pin of a potentiometer
  float v;

  v = averageRead(potPin,n);
}

float averageRead(int nave, int potPin) {

  int i;
  float ave,sum;

  for (i=1; i<=nave; i++) {
    sum = sum + analogRead(A1);
  }
  ave = sum/float(nave);
  return(ave);
}
```