### Purpose:

Develop a better understanding of:

1. Functions
2. Pass by value
3. Pass by reference

### Problems

For the questions that follow, use `main()` as given below:

```cpp
#include <iostream>
using namespace std;

int main()
{
  double fahren = -40, celsius = 0;

  cout << "F: " << fahren << " C: " << celsius << endl;
  fahr2cels(fahren, celsius);
  cout << "F: " << fahren << " C: " << celsius << endl;
  return 0;
}
```

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| 1. Assuming the function `fahr2cels()`, at right, is used, what is the output from `main()`? | void fahr2cels(double f, double & c)  
{  
c = (5.0/9) * (f - 32.0);  
f = 0;  
} |
| 2. Assuming the function `fahr2cels()`, at right, is used, what is the output from `main()`? | void fahr2cels(double f, double c)  
{  
c = (5.0/9) * (f - 32.0);  
f = 0;  
} |
3. Assuming the function `fahr2cels()`, at right, is used, what is the output from `main()`?

```cpp
void fahr2cels(double & f, double & c) {
    c = (5.0/9) * (f - 32.0);
    f = 0;
}
```

4. Assuming line 8 in `main()` was changed to the following:

```cpp
celsius = fahr2cels(fahrenheit);
```
When used together with `fahr2cels()`, at right, what is the output from `main()`?

```cpp
double fahr2cels(double f) {
    f = 32;
    return ((5.0/9) * (f - 32.0));
}
```

---

For the questions that follow, use `main()` as given below:

```cpp
#include <iostream>
using namespace std;

const double PI = 3.14159;

int main() {
    double radius = 1, length = 2;
    double volume = -999, surfaceArea = -999;

    cout << "Radius: " << radius << " Length: " << length << endl;
    cout << "Volume: " << volume << " Surface Area: " << surfaceArea << endl;
    cylinderInfo(radius, length, volume, surfaceArea);

    cout << "Radius: " << radius << " Length: " << length << endl;
    cout << "Volume: " << volume << " Surface Area: " << surfaceArea << endl;
    return 0;
}
```
5. Assuming the function `cylinderInfo()`, at right, is used, what is the output from `main()`?

```c
void cylinderInfo(double r, double l,
                  double & vol, double & sa)
{
    // cylinder volume
    vol = 2 * PI * r * l;

    // cylinder surface area
    sa = PI * pow(r, 2.0) * l;
    r = -1;
    l = -1;
}
```

6. Assuming the function `cylinderInfo()`, at right, is used, what is the output from `main()`?

```c
void cylinderInfo(double r, double l,
                  double & vol, double & sa)
{
    vol = 2 * PI * r * l;
    sa = PI * pow(r, 2.0) * l;
    r = -1;
    l = -1;
}
```

7. Assuming the function `cylinderInfo()`, at right, is used, what is the output from `main()`?

```c
void cylinderInfo(double & r, double & l,
                  double & vol, double & sa)
{
    vol = 2 * PI * r * l;
    sa = PI * pow(r, 2.0) * l;
    r = -1;
    l = -2;
}
```

8. Assume the following replaced line 14 in `main()`:

```c
double saRet = cylinderInfo(
    radius, length
    surfaceArea, volume);
cout << "Returned SA: "
    << saRet << endl;
```

When used together with the function `cylinderInfo()` at right, what is the output from `main()`?

```c
double cylinderInfo(double r, double l,
                   double & vol, double & sa)
{
    vol = 2 * PI * r * l;
    sa = PI * pow(r, 2.0) * l;
    r = -1;
    l = -2;

    return(sa);
}
```
Answers

1. F: −40  C: 0
   F: −40  C: −40

2. F: −40  C: 0
   F: −40  C: 0

3. F: −40  C: 0
   F: 0  C: −40

4. F: −40  C: 0
   F: −40  C: 0

5. Radius: 1  Length: 2
   Volume: −999  Surface Area: −999

5. Radius: 1  Length: 2
   Volume: 12.56  Surface Area: 6.28

6. Radius: 1  Length: 2
   Volume: −999  Surface Area: −999

6. Radius: 1  Length: 2
   Volume: −999  Surface Area: −999

7. Radius: 1  Length: 2
   Volume: −999  Surface Area: −999

7. Radius: −1  Length: −2
   Volume: 12.56  Surface Area: 6.28

8. Radius: 1  Length: 2
   Volume: −999  Surface Area: −999

8. Radius: 1  Length: 2
   Volume: 12.56  Surface Area: 6.28

Returned SA: 6.28
Radius: 1  Length: 2
Volume: 12.56  Surface Area: 6.28