## Assignment 1

1. **Program:**

```c
#include <stdio.h>
#include <math.h>

double calculateSpeed(double); // This is the declaration of the function calculateSpeed

int main()
{
    double v; // v represents speed
    double t; // t represents time
    printf("Please enter a time in seconds, after the plane has accelerated: "); // Asks the user for and obtains the time after the plane has accelerated
    scanf("%lf", &t);
    v = calculateSpeed(t); // This calls the function calculateSpeed
    printf("At time %lf, the speed of the plane is %lf m/s\n\n", t, v); // This tells the user what the speed of the plane is, in meters/second at the time which they previously provided

}

double calculateSpeed(double t) // This function calculates the speed of the plane at the provided time
{
    double v = 0.00001*(pow(t, 3)) - 0.00488*(pow(t, 2)) + 0.75795*t + 181.3566;
    return v;
}
```

**Output of test cases:**

t = 0.00s

```
Please enter a time in seconds, after the plane has
accelerated: 0.00
At time 0.000000, the speed of the plane is 181.356600 m/s

Program ended with exit code: 0
```

t = 2.00s

```
Please enter a time in seconds, after the plane has
accelerated: 2.00
At time 2.000000, the speed of the plane is 182.853060 m/s

Program ended with exit code: 0
```

t = 10.00s

```
Please enter a time in seconds, after the plane has
accelerated: 10.00
At time 10.000000, the speed of the plane is 188.458100 m/s

Program ended with exit code: 0
```

t = 50.00s

```
Please enter a time in seconds, after the plane has
accelerated: 50.00
At time 50.000000, the speed of the plane is 208.304100 m/s

Program ended with exit code: 0
```

t = 100.00s

```
Please enter a time in seconds, after the plane has
accelerated: 100.00
At time 100.000000, the speed of the plane is 218.351600 m/s

Program ended with exit code: 0
```

t = 120.00s

```
Please enter a time in seconds, after the plane has
accelerated: 120.00
At time 120.000000, the speed of the plane is 219.318600 m/s

Program ended with exit code: 0
```

2. **Program:**

```c
#include <stdio.h>
#include <math.h>
double calculateRref(double Rl, double L); // Declares the function calculateRref
double calculateMaterialR(double, double, double); // Declares the function calculateMaterialR

int main()
{
    double Rl, T, Rref, L, a, R; // Rl represents the resistance per unit length, L represents the length of the conductor, Rref represents the reference resistance, a represents the resistance temperature coefficient of the material, R represents the material's resistance

    // The following obtains the resistance value per unit length and the length of the conductor from the user in order to calculate its Reference resistance value
    printf("Please provide a value for the resistance per unit length, in ohms/meter, and a value for the length of the conductor, in meters, respectively: ");
    scanf("%lf%lf", &Rl, &L);

    Rref = calculateRref( Rl, L);// This calls the function calculateRref

    // The following tells the user the calculated value of the reference resistance
    printf("\nAt temperature 20ºC and the provided length of the conductor and the provided resistance per unit length of the material, the reference resistance is %E ohms\n\n", Rref);

    printf("Please provide the material's temperature in ºC as well as its resistance temperature coefficient, respectively: "); // This obtains the T value and a value from the user
    scanf("%lf%lf", &T, &a);

    R = calculateMaterialR(Rref, T, a); // This calls the function calculateMaterialR

    printf("\nAt the provided temperature and resistance temperature coefficient, the material resistance is %E ohms\n\n", R); // This tells the user material's resistance value in ohms
}


double calculateRref(double Rl, double L) // This function calculates the reference resistance value using the resistance per unit length and length value provided by the user
{
    double Rref = Rl*L;
    return Rref;
}

double calculateMaterialR(double Rref, double T, double a) // This function calculates the material's resistance value using the previously calculate Rref value and the previously provided T and a values
{
    double R = Rref*(1+a*(T-20));
    return R;
}
```

**Test Case Values:**

| Test case | Rl value | L value | Calculated Rref value | T value | a value | Calculated R value |
|---|---|---|---|---|---|---|
| 1 | 0.00327 | 0.1 | 0.000327 | 60 | 0.004308 | 3.833486E-4 |
| 2 | 2.4 | 37 | 8.880000E1 | 49 | 0.004308 | 9.989396E1 |
| 3 | 3.46 | 83 | 2.871800E2 | 34 | 0.004308 | 3.045004E2 |
| 4 | 1.55786 | 63.56 | 9.901758E1 | 23 | 0.004041 | 1.002180E2 |
| 5 | 2.76683 | 99.6739 | 2.757807E2 | 85 | 0.004041 | 3.482187E2 |

**Output captures of test cases:**

1.

```
Please provide an value for the resistance per unit length, in
ohms/meter, and a value for the length of the conductor, in
meters, respectively: 0.00327
0.1

At temperature 20ºC and the provided length of the conductor and
the provided resistance per unit length of the material, the
reference resistance is 3.270000E-04 ohms

Please provide the material's temperature in ºC as well as its
resistance temperature coefficient, respectively: 60
0.004308

At the provided temperature and resistance temperature
coefficient, the material resistance is 3.833486E-04 ohms

Program ended with exit code: 0
```

2.

```
Please provide a value for the resistance per unit length, in
ohms/meter, and a value for the length of the conductor, in
meters, respectively: 2.4
37

At temperature 20ºC and the provided length of the conductor and
the provided resistance per unit length of the material, the
reference resistance is 8.880000E+01 ohms

Please provide the material's temperature in ºC as well as its
resistance temperature coefficient, respectively: 60
0.004308

At the provided temperature and resistance temperature
coefficient, the material resistance is 1.041020E+02 ohms

Program ended with exit code: 0
```

3.

```
Please provide a value for the resistance per unit length, in
ohms/meter, and a value for the length of the conductor, in
meters, respectively: 3.46
83

At temperature 20ºC and the provided length of the conductor and
the provided resistance per unit length of the material, the
reference resistance is 2.871800E+02 ohms

Please provide the material's temperature in ºC as well as its
resistance temperature coefficient, respectively: 34
0.004308

At the provided temperature and resistance temperature
coefficient, the material resistance is 3.045004E+02 ohms

Program ended with exit code: 0
```

4.

```
Please provide a value for the resistance per unit length, in
ohms/meter, and a value for the length of the conductor, in
meters, respectively: 1.55786
63.56

At temperature 20ºC and the provided length of the conductor and
the provided resistance per unit length of the material, the
reference resistance is 9.901758E+01 ohms

Please provide the material's temperature in ºC as well as its
resistance temperature coefficient, respectively: 23
0.004041

At the provided temperature and resistance temperature
coefficient, the material resistance is 1.002180E+02 ohms

Program ended with exit code: 0
```

5.

```
Please provide a value for the resistance per unit length, in
ohms/meter, and a value for the length of the conductor, in
meters, respectively: 2.76683
99.6739

At temperature 20°C and the provided length of the conductor and
the provided resistance per unit length of the material, the
reference resistance is 2.757807E+02 ohms

Please provide the material's temperature in °C as well as its
resistance temperature coefficient, respectively: 85
0.004041

At the provided temperature and resistance temperature
coefficient, the material resistance is 3.482187E+02 ohms

Program ended with exit code: 0
```