PFC - Workshop 4

1. Fraction Simplifier

In this question you should write 3 functions with prototypes as follows:

> void input(int *num, int *den); // input numerator (num) and denominator of a fraction (den)
> void display(int num, int den); // display the fraction
> void simplify(int *num, int *den); // simplify the fraction

Include negative as well as zero values in your test cases.

The output from your program looks something like

```
1. Input fraction

Enter numerator: 4
Enter denominator: 0
Enter denominator: -8

2. Simplify fraction

4/-8
=
-1/2
Another run (y/n)? y
1. Input fraction

Enter numerator: 15
Enter denominator: 48

2. Simplify fraction

15/48
=
5/16
Another run (y/n)? _
```

2. roots Function

Design and code a C function named roots that calculates the roots of a quadratic equation. Your function receives three doubles that hold the coefficients of the quadratic equation and returns through two other double parameters the real roots of the equation. The function returns the number of real roots as the return value of the function itself. The header for your function looks something like

```
 int roots(double a, double b, double c, double *x1, double *x2)
```

Consider the quadratic equation:

```
f(x)  = a *  x² + b *  x  +  c
```

where a, b and c are constant coefficients. This equation may have up to 2 real roots. The roots are the values of x for which

```
a * x² + b * x + c = 0
```

The roots are given by the equations

```
x₁ = ( - b + sqrt( D ) ) / ( 2 * a )
x₂ = ( - b - sqrt( D ) ) / ( 2 * a )
```

where D is the discriminant

```
D = b² - 4 * a * c
```

If D is positive-valued, there are 2 real roots. If D is zero-valued, there is one real root. If D is negative-valued, there are no real roots.

If there is one real root, set x_1 to its value and leave x_2 unchanged. If there are no real roots, leave x_1 and x_2 unchanged.

The output from your program looks something like

```
1. Input the coefficients of the quadratic equation:
Enter a, b, c: 1 2 1

2. Solve the equation
There is one real root: x0 = -1.000000

Another run (y/n)? y
1. Input the coefficients of the quadratic equation:
Enter a, b, c: 1 2 3

2. Solve the equation
There are no real roots

Another run (y/n)? y
1. Input the coefficients of the quadratic equation:
Enter a, b, c: 1 5 2

2. Solve the equation
There are 2  real roots: x1 = -0.438447, x2 = -4.561553

Another run (y/n)? _
```