

Program I

For this program you are to write a simple function to find the roots of quadratic equations. The function proto type should be:

```
int roots(double, double, double, double &, double &, double &, double &);
```

the first three parameters should be the coefficients of the quadratic polynomial. The first, the x^2 coefficient, should be non-zero, in this case roots should return 1, if the x^2 coefficient is zero roots should return 0. If the x^2 coefficient is non-zero the roots should be returned in the last four reference parameters. The forth parameter should contain the real part, and the fifth the imaginary part of one solution. The sixth the real and the seventh the imaginary part of the other root. If the x^2 coefficient is zero the last four parameters should not have their values changed. In addition there should be no output statements in your function **roots**.

Notice that to test your function, you will also need to write a **main()** function to call the **roots** function with the appropriate parameters. If the x^2 coefficient is zero, your program should output that the equation is not quadratic, otherwise your program should output the two roots.

Also you may wish to use the **sqrt()** function, in this case you may need to include the **cmath** header file.

Solving a Quadratic Equation.

If $a \neq 0$ the equation

$$ax^2 + bx + c = 0$$

has 2 solutions given by

$$x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

and

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}.$$

The quantity $b^2 - 4ac$ is called the discriminant. If $b^2 - 4ac = 0$ then the two separate solutions become the same and there is only one solution. If $b^2 - 4ac < 0$ then the two solutions are complex numbers. In this case both solutions have the same real part, that is $\frac{-b}{2a}$ and the imaginary parts are $\frac{\sqrt{4ac-b^2}}{2a}$ and $\frac{-\sqrt{4ac-b^2}}{2a}$.

Notice also that a real number is a complex number with the imaginary part equal to zero.

Test data for you program

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$$2x^2 + 10x + 1 = 0$$

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$$x^2 - 1 = 0$$

•

$$x^2 - 2x + 1 = 0$$

•

$$5x^2 + 1x + 7 = 0$$

•

$$3x + 5 = 0$$