# 3 Checkpoint 3

## Aim of Checkpoint

This checkpoint consists of a more complex program to calculate the roots of a quadratic equation. This program demonstrates the use of conditional statements, mainly the `if(){}else{}` construct to deal with the various input conditions. This checkpoint is worth **20%** of the course mark.

A quadratic equation of the form

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

has roots given by the well known formula of

$$x_0 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

when $a \neq 0$! There are three possible conditions depending on the value of the formula under the $\sqrt{}$. In particular, if $b^2 - 4ac$

- $> 0$ Two real roots.
- $= 0$ A single root.
- $< 0$ Two complex roots.

Obviously when $a = 0$ we have a linear equation with a single root.

## Submission Dates

It is expected that this checkpoint is completed during the **third** or start of the **fourth** laboratory session.

Final submission date for this checkpoint is: **5.00 pm, Thursday 20th October**.

## Computing Task

Write a JAVA program to using the *Display* class to:

1. Read the *values* for the three coefficients $a$, $b$ and $c$ as `doubles`.
2. Calculate and print the roots of the quadratic to the *Display* output panel in a nice format.
3. Test your program with the following values of $a$, $b$ and $c$.

| $a$ | $b$ | $c$ |
|---|---|---|
| 1 | -6 | 5 |
| 2 | 8 | 8 |
| 1 | 2 | 5 |
| 0 | 4 | 8 |
| 0 | 0 | 6 |

   and make sure you get what you expect, *including dealing correctly with complex roots.*

*Hint: The logic of this program is more difficult than you first think. Write out all the possible conditions that can occur on paper before you try and write your program.*

## End of Checkpoint

When you have completed **and** tested your program, call a demonstrator and show them the code and and your program working with at least the first *three* of the set of test data. (The final two are a bit trickier). This is the end of **checkpoint 3**. Ensure that the demonstrator checks off your name.

Keep this program in a working state, you will use it again in the next section.

## Material Needed

*In addition to the material for Checkpoint 2 you will need material from the following documents:*

1. *Mathematical Functions*
2. *Conditional Statements.*

## What Next?

Read through the next two sections of "LOOPS" and "GRAPHS" before attempting the next checkpoint.