# Quadratics - Revision Notes

Quadratics

There are 3 methods one can use to find the roots of a quadratic, i.e. the solutions of $ax^2 + bx + c = 0$.

1. **Factorising** - Factorise the quadratic so that we can see its factors. We want to see the factors because 2 numbers multiplied together to make 0 means that one or the other must be 0.

2. **Completing the Square** - write the equation in the form $\alpha \left(x + \beta \right)^2 + \gamma = 0$ and solve by making x the subject.

3. **Quadratic Formula** - substitute the values of a, b and c into the formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ to obtain the roots.

Note that the quadratic formula will work in all situations IF the quadratic has roots, as does completing the square. Factorising is generally quicker when the roots are integers.

Sketching $y = ax^2 + bx + c$:
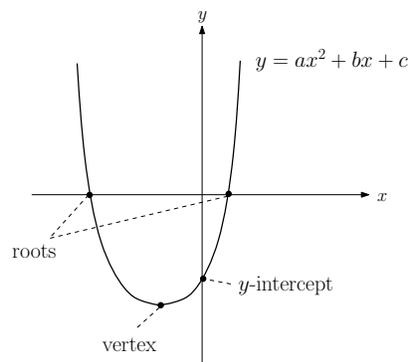
1. Find the roots using one of the above methods, roots occur when $y = 0$.

2. Find the y-intercept, this occurs when $x = 0$.

3. Find the coordinates of the vertex by completing the square and applying transformations to $y = x^2$.

Quadratic Inequalities

1. Quadratic inequalities can be treated in a similar way to quadratic equations. Your solution should be a range of values of x. Sketch the quadratic to find this range.

2. When multiplying both sides of an inequality by a negative number, remember to reverse the sign of the inequality. (The same applies when taking the reciprocal of both sides.)

Discriminants

The discriminant of the quadratic $ax^2 + bx + c$ is given by $b^2 - 4ac$.

1. If $b^2 - 4ac > 0$, the quadratic has 2 real distinct roots.

2. If $b^2 - 4ac = 0$, the quadratic has one repeated root.

3. If $b^2 - 4ac < 0$, the quadratic has no roots.

This is because of the term $b^2 - 4ac$ in the quadratic formula is being square-rooted.

If the question mentions the number of roots, then you know that you should be working with the discriminant.

Simultaneous Equations

Solving simultaneous equations that involve quadratics will require a substitution. Make one of the unknowns the subject. Substitute this expression into the other equation and solve for the remaining unknown by choosing one of the methods above. Find the first unknown and check.