Y12 Pure Chapter 2— Quadratics

What do I need to be able to do?

By the end of this chapter you should be able to:

- Solve quadratic equations using factorisation, the quadratic formula and completing the square
- Read and use f(x) notation when working with functions
- Sketch the graph and find the turning point of a quadratic function
- Find and interpret the discriminant of a quadratic expression
- Use and apply models that involve quadratic functions

Solving quadratic equations

Remember that to solve a quadratic equation you should collect all the terms on one side so that the other side of the equation is 0.
When you solve the equation, it you have found the roots (ie. where the graph of the quadratic function crosses the x-axis).

Factorising
Put the quadratic into brackets. If the product of two expressions is zero one or both of them must be equal to zero.

Eg Solve $x^2 + 6x + 8 = 0$

$(x + 4)(x + 2) = 0$

We need two numbers that add to make the coefficient of x and multiply to give the constant term

$x + 4 = 0$ or $x + 2 = 0$

Therefore: $x = -4$ or $x = -2$

The quadratic formula

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

Eg Solve $3x^2 - 7x - 1 = 0$

$a = 3 \quad b = -7 \quad c = -1$

Substitute into the formula:

$$x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4 \times (3) \times (-1)}}{2 \times (3)}$$

Put each number in a bracket to avoid any sign errors

Therefore: $x = \frac{7+\sqrt{61}}{6}$ or $x = \frac{7-\sqrt{61}}{6}$

Make sure you give your answer in the form asked for. If they want exact leave in surd for like this. If they say 3sf or 1dp then make sure you give the decimal form of the answer

Pure Maths Year 1/AS

Y12 – Chapter 2 Quadratics

Key words:

- Quadratic – Where the highest exponent (index/power) of the variable is a square (2)
- Function – A special relationship where each input has a single output. It is often written as "f(x)" where x is the input value
- Domain – All the values that go into a function
- Range – The set of all output values of a function
- Discriminant – The expression b2 – 4ac used when solving Quadratic Equations. It can "discriminate" between the possible types of answer

The general shape of a quadratic graph:

$y = x^2$ 

$y = -x^2$ 

Completing the square

Completing the square can be used to solve a quadratic equation but it is also very useful in determining the turning point of a quadratic function

The completed square form looks like this:

$$A(x + B)^2 + C = 0$$

Where the turning point is (-B, C)

Remember! If you need to solve the quadratic to find the roots and it is already in the completed square form, you don't need to factorise or use the formula you can just rearrange to find x.

The discriminant

The expression inside the square root sign is called the discriminant and tells you what type of roots to expect.

If $b^2 - 4ac > 0$ there are 2 real roots
(ie. the curve crosses the x-axis in 2 places)

If $b^2 - 4ac = 0$ there is 1 real root
(ie. the curve touches the x-axis in 1 place)

If $b^2 - 4ac < 0$ there are no real roots
(ie. the curve does not cross the x-axis)