This double-sided A4 sheet contains questions which we expect you to do before coming to your first Further Mathematics lesson. They are all GCSE-level problems, so if you have need to remind yourself how to do them, you could use your GCSE Mathematics notes, a GCSE Mathematics textbook, or the website [www.mymaths.co.uk](http://www.mymaths.co.uk) (the logon is wqeic and the password is surds).

You **MUST** show all your working, and you are **not allowed to use a calculator**!

You will be awarded marks for **presentation**, so make sure you write out your solutions on **A4 lined** or **squared paper**, **underline** your answers, and write your **name** and **student** number on your work. This work will be collected in at the beginning of your first Further Mathematics lesson.

**Section 1: Surds (simplifying and rationalising)**

**Show all your working**

1. Write 45 in the form *a*5, where *a* is an integer. **(1)**

**2.** Express (2 – 3)2 in the form *b* + *c*3, where *b* and *c* are integers to be found.  **(3)**

**3.** Express  in the form *b* + *c*5, where *b* and *c* are integers. **(5)**

**Section 2: Indices (fractional, negative and laws of indices)**

**4.** Write down the value of . **(1)**

**5.** Evaluate  **(2)**

**6.** Simplify .  **(2)**

**7.** Simplify fully 

**(2)**

**8.** Write  in the form *2x* *p* + 3*x* *q*, where *p* and *q* are constants. **(2)**

**Section 3: Completing the square**

**9.** *x*2 + 2*x* + 3  (*x* + *a*)2 + *b*.

1. Find the values of the constants *a* and *b*. **(2)**

(*b*) Sketch the graph of *y* = *x*2 + 2*x* + 3, indicating clearly the coordinates of any intersections with the coordinate axes. **(3)**

**10.** Given that f(*x*) = 2*x*2 + 8*x* + 3,

Express f(*x*) in the form *p*(*x* + *q*)2 + *r* where *p*, *q* and *r* are integers to be found. **(3)**

**Section 4: Factorising & Graph sketching**

**11.** Factorise fully 25*x* – 9*x*3. **(3)**

**12.** Sketch the graph of *y* = *x*(6 – *x*), showing clearly the coordinates of the points where the curve meets the coordinate axes. **(3)**

**13.** The curve *C* has equation

*y* = (*x* + 3)(*x* – 1)2.

(*a*) Sketch *C*, clearly showing the coordinates of the points where the curve meets the coordinate axes. **(4)**

(*b*) Show that the equation of *C* can be written in the form

*y* = *x*3 + *x*2 – 5*x* + *k*,

where *k* is a positive integer, and state the value of *k*. **(2)**

**14.** (*a*) Factorise completely *x*3 – 6*x*2 + 9*x* **(3)**

(*b*) Sketch the curve with equation

*y* = *x*3 – 6*x*2 + 9*x*

showing the coordinates of the points where the curve meets the *x*-axis.

**(4)**