

This double-sided A4 sheet contains questions which we expect you to do before coming to your first Further Mathematics lesson.

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 $\sqrt{45}$ in the form $a\sqrt{5}$, where a is an integer. (1)
 2. Express $(2 - \sqrt{3})^2$ in the form $b + c\sqrt{3}$, where b and c are integers to be found. (3)
 3. Express $\frac{2(3 + \sqrt{5})}{(3 - \sqrt{5})}$ in the form $b + c\sqrt{5}$, where b and c are integers. (5)
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Section 2: Indices (fractional, negative and laws of indices)

4. Write down the value of $16^{\frac{1}{4}}$. (1)
5. Evaluate $81^{\frac{3}{2}}$ (2)
6. Simplify $(16x^{12})^{\frac{3}{4}}$ (2)
7. Simplify fully $x^2 \left(4x^{-\frac{1}{2}} \right)^2$ (2)
8. Write $\frac{2\sqrt{x+3}}{x}$ in the form $2x^p + 3x^q$, where p and q are constants.

(2)

Section 3: Completing the square

9. $x^2 + 2x + 3 \equiv (x + a)^2 + b.$

(a) Find the values of the constants a and b . (2)(b) Sketch the graph of $y = x^2 + 2x + 3$, indicating clearly the coordinates of any intersections with the coordinate axes. (3)

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

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 $25x - 9x^3$ (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 , showing clearly 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

$$y = x^3 + x^2 - 5x + k$$

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

14. (a) Factorise completely $x^3 - 6x^2 + 9x$ (3)

(b) Hence sketch the curve with equation

$$y = x^3 - 6x^2 + 9x$$

showing the coordinates of the points at which the curve meets the x -axis. (4)