Further maths and Statistics Revision topic lists

Use Hegarty Maths https://hegartymaths.com/ to support your revision of these topics, simply type the topic into the search bar and it will display a video/quiz for each.
There are also some useful materials on Mr Barton's website: Topic Tests for AQA Level 2 Further Maths on Mr Barton Maths

Here's a topic list of everything covered so far:

Unit 1 – Number (Also GCSE maths content)

- Knowledge and use of numbers and the number system including fractions, decimals, percentages, ratio, proportion and order of operations are expected
- The product rule for counting
    - Work out how many 5-digit odd numbers can be formed using the digits 1 3 4 6 8 with no repetition of any digit
- Manipulation of surds, including rationalising the denominator
    - The use of surds in exact calculations
    - Write $\sqrt{200} - \sqrt{72} + 3\sqrt{162}$ in the form of $a\sqrt{2}$
    - Rationalise and simplify $\frac{3\sqrt{2}+4}{5\sqrt{2}-7}$
    - Write your answer in the form $a + b\sqrt{3}$, where a and b are integers

Unit 2 – Algebra (Also GCSE maths content)

- Definition of a function
    - Notation f (x) will be used, e.g. f (x) = x^2 – 9
- Domain and range of a function
    - Domain may be expressed as, for example, x > 2, or 'for all x, except x = 0' and range may be expressed as f (x) > – 1
- Composite functions
    - The result of two or more functions, say f and g, acting in succession. fg (x) is g followed by f
- Inverse functions
    - The inverse function of f is written f^{-1} Domains will be chosen for f to make f one-one
- Expanding brackets and collecting like terms
    - Expand and simplify $(y^2 - 2y + 3)(2y - 1) - 2(y^3 - 3y^2 + 4y - 2)$
- Expand (a + b) n for positive integer n

- Expand and simplify $(5x+2)^3$
- Use Pascal's triangle to work out the coefficient of x^3 in the expansion of $(3+2x)^5$

- Factorising
  - Factorise fully $(2x+3)^2-(2x-5)^2$
  - Factorise $15x^2-34xy-16y^2$
  - Factorise fully x^4-25x^2
- Manipulation of rational expressions: Use of + – × ÷ for algebraic fractions with denominators being numeric, linear or quadratic
  - Simplify $\frac{5}{x+2}-\frac{3}{2x-1}$
  - Simplify $\frac{x^3+2x^2+x}{x^2+x}$
  - Simplify $\frac{5x^2-14x-3}{4x^2-25} \div \frac{x-3}{4x^2+10x}$
- Use and manipulation of formulae and expressions
  - Rearrange $\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$ to make v the subject
- Completing the square
  - Work out the values of a, b and c such that $2x^2+6x+7 \equiv a(x+b)^2+c$
- Solution of linear and quadratic equations
  - Solutions of quadratics to include solution by factorisation, by graph, by completing the square or by formula Problems will be set in a variety of contexts, which result in the solution of linear or quadratic equations

<u>Unit 3 – Coordinate geometry (Mostly GCSE maths content)</u>

- Know and use the gradient
- Know relationships between gradients of parallel and perpendicular lines
  - Show that A (0, 2), B (4, 6) and C (10, 0) form a right-angled triangle
- Use Pythagoras' Theorem to calculate the distance between two points
- Use ratio to find the coordinates on a straight line
  - Including midpoint
- Equation of a straight line $y = mx + c$ and $y - y_1 = m(x - x_1)$ and other forms
  - Including interpretation of the gradient and y-intercept from the equation
- Draw a straight line from given information

- Equation of circles
- Understand that $x^2 + y^2 = r^2$ is the equation of a circle with centre (0,0) and radius r
    - Including writing down the equation of a circle given centre (0, 0) and radius
    - The application of circle geometry facts where appropriate: the angle in a semi-circle is 90°; the perpendicular from the centre to a chord bisects the chord; the angle between tangent and radius is 90o ; tangents from an external point are equal in length.
- Understand that $(x-a)^2 + (y-b)^2 = r^2$ is the equation of a circle with centre (a,b) and radius r
    - Including writing down the equation of any circle given centre and radius
- Equation of a tangent at a point on a circle

Unit 4 – Calculus

- Know $\frac{dy}{dx}$ gives the gradient of a curve and measures rate of change of y with respect to x
- Know that the gradient of a function is the gradient of the tangent at that point.
- Differentiation of kx^n where n is an integer, including sums of such functions
    - Including expressions which first need to be simplified
    - Given $y = (3x+2)(x-3)$ work out $\frac{dy}{dx}$
    - Given $y = \frac{5}{x^3}$ work out $\frac{dy}{dx}$
- Equations of a tangent and normal at any point on a curve
- Increasing and decreasing functions using the gradient
- Understand and use the notation $\frac{d^2y}{dx^2}$
- Use of differentiation to find maxima and mina points on a curve
- Use differentiation to find maxima and minima in simple problems
    - $V = 49x + \frac{81}{x}$ $x > 0$
    - Use calculus to show that V has a minimum value and work out the minimum value of V
- Sketch and interpret a curve with known maximum and minimum points

Unit 5 – Matrices

Note: All calculations will be restricted to 2x2 or 2 x 1

- Multiplication of matrices
    - Multiplying a 2 x 2 matrix by a 2 x 2 or by a 2 x 1 matrix
    - Multiplication by a scalar
- The identity matrix I
    - 2 x 2 only
- Transformations of the unit square in x-y plane
    - Representation by a 2 x 2 matrix
    - Transformations restricted to 90^{o}, 180^{o} or 270^{o} about the origin, reflections in the line x = 0 y = 0, y = x and y = -x and enlargements centred on the origin
- Combinations of transformations
    - Using matrix multiplications
    - Use of i and j notation is not required