STEM PREP
STEERING YOU TO SUCCESS!

A level Edexcel – Pure Maths Checklist

1. Proof

- ☐ 1 Proof by deduction
- ☐ 2 Proof by exhaustion
- ☐ 3 Disproof by counter example
- ☐ 4 Proof by contradiction

2. Algebra and functions

- ☐ 1 Laws of indices – rational exponents
- ☐ 2 Surds including rationalising the denominator
- ☐ 3 Quadratic functions and their graphs
- ☐ 4 Discriminant of a quadratic function, conditions for real and repeated roots
- ☐ 5 Completing the square
- ☐ 6 Solution of quadratic equations by factorisation, use of the formula, use of a calculator or completing the square
- ☐ 7 Simultaneous equations in two variables including one linear and one quadratic equation
- ☐ 8 Linear and quadratic inequalities in a single variable
- ☐ 9 Interpret inequalities graphically
- ☐ 10 Express solutions through correct use of 'and' and 'or', or through set notation
- ☐ 11 Represent linear and quadratic inequalities graphically
- ☐ 12 Manipulate polynominals algebraically - expanding brackets, collecting like terms, factorisation and algebraic division
- ☐ 13 The factor theorem
- ☐ 14 Simplify rational expressions – factorising and cancelling, algebraic division
- ☐ 15 Sketch curves of simple cubic and quartic functions
- ☐ 16 Modulus of a linear function
- ☐ 17 Sketch curves $y = \frac{a}{x}$ and $y = \frac{a}{x^2}$ (including vertical and horizontal asymptotes)
- ☐ 18 Interpret algebraic solution of equations
- ☐ 19 Proportional relationships and their graphs
- ☐ 20 Understand and use composite functions
- ☐ 21 Inverse functions and their graphs
- ☐ 22 Simple transformations including sketching $y = af(x)$, $y = f(x) + a$, $y = f(x + a)$, $y = f(ax)$
- ☐ 23 Combinations of these transformations
- ☐ 24 Decompose rational functions into partial fractions
- ☐ 25 Application of partial fractions to integration, differentiation and series expansions - trigonometric, exponential and reciprocal functions
- ☐ 26 Use of functions in modelling

3. Coordinate geometry in the (x,y) plane

- ☐ 1 The equation of a straight line : $y = mx + c$, $y - y_1 = m(x - x_1)$ and $ax + by + c = 0$
- ☐ 2 Equation of a line through two given points, and the equation of a line parallel (or perpendicular) to a given line through a given point using gradient conditions
- ☐ 3 Use of straight line models in a variety of contexts
- ☐ 4 The equation of a circle in the form $(x - a)^2 + (y - b)^2 = r^2$ and $x^2 + y^2 + 2fx + 2gy + c = 0$
- ☐ 5 Completing the square to find the centre and radius of a circle
- ☐ 6 The 3 properties : angle in a semicircle is a right angle, the perpendicular from the centre to a chord bisects the chord and the radius of a circle at given point is perpendicular to the tangent to the circle at that point
- ☐ 7 The equation of a circumcircle of a triangle with given vertices
- ☐ 8 The equation of a tangent and normal at a specified point
- ☐ 9 The parametric equations of curves and conversion between Cartesian and parametric forms
- ☐ 10 Parametric equations in modelling

4. Sequences and series

- ☐ 1 Pascal's triangle
- ☐ 2 The binomial expansion of $(a + bx)^n$ for positive integer n
- ☐ 3 Binomial expansion of $(a + bx)^n$ any rational n
- ☐ 4 Use of binomial expansion for approximation
- ☐ 5 Sequences given by a formula for the nth term
- ☐ 6 Increasing sequences, decreasing sequences and periodic sequences
- ☐ 7 Sigma notation for sums of series
- ☐ 8 Proof of the sum formula for an arithmetic sequence
- ☐ 9 Arithmetic sequences including the formulae for n^{th} term and the sum to terms
- ☐ 10 The proof of the sum formula for a geometric sequence
- ☐ 11 Geometric sequences including the formulae for the n^{th} term and the sum of a finite geometric series
- ☐ 12 The sum to infinity of a convergent geometric series
- ☐ 13 Use sequences and series in modelling

5. Trigonometry

- ☐ 1 Use of x and y coordinates of points on the unit circle to give cosine and sine respectively
- ☐ 2 The sine and cosine rules including the ambiguous case of the sine rule the area of a triangle using $\frac{1}{2}ab\sin C$

- ☐ 3 Radian measure
- ☐ 4 Arc length $s = r\theta$ and area of sector $A = \frac{1}{2}r^2\theta$
- ☐ 5 Standard small angle approximations of sine, cosine and tangent
- ☐ 6 **Sine, cosine and tangent functions; their graphs, symmetries periodicity and transformations**
- ☐ 7 Exact values of sin and cos for $0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \pi$ and multiples thereof, and exact values of tan for and multiples $0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \pi$ thereof
- ☐ 8 Secant, cosecant, cotangent, arcsin, arccos and arctan
- ☐ 9 Trigonometric function graphs; their ranges and domains
- ☐ 10 **Identities** $\tan\theta = \frac{\sin\theta}{\cos\theta}$, $\sin^2\theta + \cos^2\theta = 1$
  $\sec^2\theta = 1 + \tan^2\theta$, $\operatorname{cosec}^2\theta = 1 + \cot^2\theta$
- ☐ 11 Double angle formulae and application to half angles
- ☐ 12 Sin (A ± B), cos (A ± B), and tan (A ± B)
- ☐ 13 Geometrical proofs of these formulae
- ☐ 14 Expressions for acos θ + bsin θ in the equivalent forms of rcos (θ ± α) or rsin (θ ± α)
- ☐ 15 **Solve trigonometric equations in a given interval**
- ☐ 16 Solve trigonometric equations acos θ + bsin θ = c in the given interval
- ☐ 17 Proofs involving trigonometric functions and identities
- ☐ 18 Trigonometric functions to solve problems in context, including problems involving vectors, kinematics and forces

6. Exponentials and logarithms

- ☐ 1 **The function a^x and its graph, where a is positive**
- ☐ 2 **The function e^x and its graph**
- ☐ 3 **The gradient of e^{kx} and the applications of exponential model e^{kx}**
- ☐ 4 **$\log_a x$ as the inverse of a^x, where a is positive and $x \geq 0$**
- ☐ 5 **The function ln x and its graph**
- ☐ 6 **Ln x as the inverse function of e^x**
- ☐ 7 **Solution of equations of the form $e^{ax+b} = p$ and ln (ax + b) = q**
- ☐ 8 **The laws of logarithms**
- ☐ 9 **Solve equations of the form $a^x = b$, including the change of base formula**
- ☐ 10 **Use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$ and $y = kb^x$, given data for x and y**
- ☐ 11 **Plot log y against log x**
- ☐ 12 **Plot log y against x**
- ☐ 13 **Exponential growth and decay; use in modelling**

7. Differentiation

- ☐ 1 **Derivative of f (x) as the gradient of the tangent to the graph of y = f (x) at a general point (x, y)**
- ☐ 2 **The gradient of the tangent as a limit**
- ☐ 3 **Interpretation of $\frac{dy}{dx}$ as a rate of change of y with respect to x**
- ☐ 4 **Sketching the gradient function for a given curve**
- ☐ 5 **Second derivatives**
- ☐ 6 **Differentiation from first principles for small positive integer powers of x** and for sin x and cos x
- ☐ 7 **The second derivative as the rate of change of gradient**
- ☐ 8 **Use the condition f ''(x) > 0 implies a minimum and f ''(x) < 0 implies a maximum for points where f '(x) = 0**
- ☐ 9 Connection to convex and concave sections of curves and points of inflection
- ☐ 10 **Differentiate x^n and related constant multiples additions and differences**
- ☐ 11 Differentiate e^{kx} and a^{kx} $\left(\frac{d}{dx}(a^{kx}) = ka^{kx}\ln a\right)$
- ☐ 12 Differentiate sin kx, cos kx, tan kx
- ☐ 13 Use the derivative of ln x
- ☐ 14 **Differentiation to find gradients, tangents and normals at specific points on a curve**
- ☐ 15 **Maxima, minima and stationary points**
- ☐ 16 **Applications to curve sketching**
- ☐ 17 Points of inflection
- ☐ 18 **Increasing or decreasing functions**
- ☐ 19 The product rule of differentiation
- ☐ 20 The quotient rule of differentiation
- ☐ 21 The chain rule of differentiation
- ☐ 22 Connected rates of change
- ☐ 23 Inverse functions
- ☐ 24 Differentiate functions defined implicitly
- ☐ 25 Differentiate parametrically
- ☐ 26 Equations of tangents and normals to curves given parametrically or implicitly
- ☐ 27 Simple differential equations in pure mathematics and in context

8. Integration

- ☐ 1 **Fundamental Theorem of Calculus**
- ☐ 2 **Integrate x^n**
- ☐ 3 **Given f '(x) and a point on the curve, find an equation of the curve**
- ☐ 4 Integrate e^{kx}, $\frac{1}{x}$, sin kx, cos kx
- ☐ 5 Use trigonometric identities to integrate
- ☐ 6 **Evaluate definite integrals**
- ☐ 7 **Use a definite integral to find the area under a curve**

Source: Pearson Edexcel A-level maths specifications

- ☐ **8 Evaluate the area of a region bounded by a curve and given straight lines**
- ☐ 9 Evaluate the area of a region between two curves. (Including curves defined parametrically)
- ☐ 10 Integration as the limit of a sum
- ☐ 11 Integration by substitution
- ☐ 12 Integration by parts, $\int \ln x \, dx$
- ☐ 13 Integrate using partial fractions
- ☐ 14 The analytical solution of simple first order differential equations with separable variables
- ☐ 15 Sketch members of the family of solution curves
- ☐ 16 Interpret the solution of a differential equation in the context of solving a problem

9. Numerical methods

- ☐ 1 Locate roots of f(x) = 0 by considering changes of sign of f(x) in an interval
- ☐ 2 How change of sign methods can fail
- ☐ 3 Solve equations approximately using simple iterative methods
- ☐ 4 Draw associated cobweb and staircase diagrams
- ☐ 5 Use an iteration of the form $x_{n+1} = f(x_n)$ to find a root of the equation $x = f(x)$
- ☐ 6 The convergence in geometrical terms by drawing cobweb and staircase diagrams
- ☐ 7 Solve equations using the Newton-Raphson method
- ☐ 8 Understand its failure near to points where the gradient is small
- ☐ 9 The use of the trapezium rule
- ☐ 10 Numerical methods to solve problems in context

10. Vectors

- ☐ **1 Use vectors in two dimensions**
- ☐ 2 Use vectors in three dimensions
- ☐ **3 The magnitude and direction of a vector**
- ☐ **4 Convert between component form and magnitude/direction form**
- ☐ **5 Add vectors diagrammatically**
- ☐ **6 The triangle and parallelogram laws of addition**
- ☐ **7 Algebraic operations of vector addition and multiplication by scalars**
- ☐ **8 Parallel vectors**
- ☐ **9 Position vectors**
- ☐ **10 Calculate the distance between two points represented by position vectors**
- ☐ **11 Vectors to solve problems in pure mathematics and in context**

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