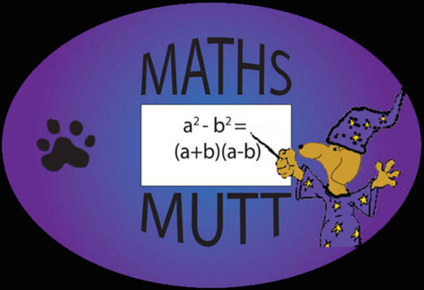
# SQA Revision




# Advanced Higher Maths Checklist

## Apps 1.1 Applying algebraic skills to the binomial theorem and to complex numbers.

- Factorials ☐
- Permutations ☐
- Combinations ☐
- Pascal's Triangle. ☐
- Binomial Co-efficients ☐
- Binomial Co-efficient equations ☐
- Binomial Expansions ☐
- Binomial Theorem ☐
- Probability and the Binomial Theorem ☐
- Binomial Expansions and e ☐
- Complex numbers ☐
- Complex conjugate ☐
- Arithmetic operations ☐
- Argand diagrams ☐
- Loci ☐
- Polar form ☐
- De Moivre's theorem ☐
- Roots of a complex number ☐

$$\begin{aligned}(x+y)^5 &= 1x^5y^0 + 5x^4y^1 + 10x^3y^2 + 10x^2y^3 + 5x^1y^4 + 1x^0y^5 \\ &= {}^5C_0x^5y^0 + {}^5C_1x^4y^1 + {}^5C_2x^3y^2 + {}^5C_3x^2y^3 + {}^5C_4x^1y^4 + {}^5C_5x^0y^5 \\ &= \binom{5}{0}x^5y^0 + \binom{5}{1}x^4y^1 + \binom{5}{2}x^3y^2 + \binom{5}{3}x^2y^3 + \binom{5}{4}x^1y^4 + \binom{5}{5}x^0y^5\end{aligned}$$

## Apps 1.2 Applying algebraic skills to sequences and series.

- Recurrence relations ☐
- Fixed points ☐
- Arithmetic sequences ☐
- Arithmetic series ☐
- nth term of arithmetic sequence ☐
- Sum to n terms of an arithmetic sequence ☐
- Geometric sequences ☐
- Geometric series ☐
- Sum to n terms of a geometric sequence ☐
- Infinite series ☐
- Sum to infinity - geometric series ☐
- Sum first n natural numbers ☐
- Sigma notation - Rules ☐
- Common series - sigma notation ☐
- Power series ☐
- D'alembert's ratio test ☐
- Absolute convergence ☐
- Fibonacci series ☐
- Centre of convergence ☐
- Taylor's series ☐
- Maclaurin's Series ☐
- Maclaurin expansion ☐

$$u_n = a + (n-1)d$$

$$S_n = \frac{1}{2}n(2a + (n-1)d)$$

$$u_n = ar^{(n-1)}$$

$$S_n = \frac{a(1-r^n)}{1-r}, \quad r \neq 1$$

## Apps 1.3 Applying algebraic skills to summation and mathematical proof.

- Standard series ☐
- Examples ☐
- Iteration ☐
- Iteration - graphical method ☐
- First order process ☐
- Second order process ☐
- Rule of false position ☐
- Newton-Raphson iteration ☐
- Proof by induction ☐

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$e^{ax} = \sum_{n=0}^{\infty} \frac{(ax)^n}{n!} = \sum_{n=0}^{\infty} a^n \frac{x^n}{n!} = 1 + \frac{(ax)}{1!} + \frac{(ax)^2}{2!} + \frac{(ax)^3}{3!} + \frac{(ax)^4}{4!} + \ldots\ldots$$

## Apps 1.4 Applying algebraic and calculus skills to properties of functions.

- Modulus function ☐
- Inverse functions ☐
- Polynomials ☐
- Extrema ☐
- Concavity and points of inflexion ☐
- Odd and Even functions ☐
- Asymptotes ☐

Odd functions have half-turn symmetry about the origin,
so f(-x) = - f(x)

Even functions are symmetrical about the y – axis
so f(-x) = f(x)

## Apps 1.5 Applying algebraic and calculus skills to problems.

- Rectilinear motion ☐
- Distance, velocity & acceleration ☐
- Applications of differential equations ☐
- Extrema of functions ☐
- Approximating roots ☐
- Uses of parametric equations ☐
- Equations of motion ☐
- ☐

Since

$$a = \frac{dv}{dt} \quad , \quad v = \int a\,dt$$

$$v = \frac{ds}{dt} \quad , \quad s = \int v\,dt$$

## Notes

## GPS 1.1 Applying algebraic skills to matrices and systems of equations.

- Augmented matrix ☐
- Elementary Row Operations ☐
- Gaussian elimination ☐
- Matrix equality ☐
- Matrix addition and subtraction ☐
- Matrix notation ☐
- Matrix elements ☐
- Matrix Scalar multiplication ☐
- Transpose of a matrix ☐
- Matrix multiplication ☐
- Determinant :2 x 2 matrix ☐
- Determinant: 3 x 3 matrix ☐
- Cofactor of a 3 x 3 matrix ☐
- Adjoint of a 3 x 3 matrix ☐
- Inverse of a square matrix ☐
- Product of a square matrix and its inverse ☐
- Using Gaussian elimination to find inverse of matrix ☐
- Diagonal matrix ☐
- Null matrix ☐
- Unit matrix ☐
- Reflections ☐
- Rotations ☐
- Scalings ☐

$$\mathbf{A} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

has determinant

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} + & - & + \\ - & + & - \\ + & - & + \end{vmatrix}$$

$$\det(\mathbf{A}) = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$

$$= a_1 \begin{vmatrix} b_2 & c_2 \\ b_3 & c_3 \end{vmatrix} - \mathrm{b}_1 \begin{vmatrix} a_2 & c_2 \\ a_3 & c_3 \end{vmatrix} + c_1 \begin{vmatrix} a_2 & b_2 \\ a_3 & b_3 \end{vmatrix}$$

### Notes

## GPS 1.2 Applying algebraic and geometric skills to vectors.

- Direction Ratios and Cosines ☐
- Vector product ☐
- Right Hand Screw Rule ☐
- Vector Product properties ☐
- Components ☐
- Scalar triple product ☐
- Intersection of two lines ☐
- Intersection of two planes ☐
- The distance from a point to a plane ☐
- The distance from a point to a line ☐
- Equations of a line ☐
- Planes ☐
- Planes in space ☐
- Vector equations ☐
- The angle between two planes ☐
- The distance between parallel planes ☐
- Coplanar vectors ☐

$|\mathbf{a}\times\mathbf{b}| = |\mathbf{a}||\mathbf{b}|\sin\theta$

describes the area of the parallelogram defined by **a** and **b**

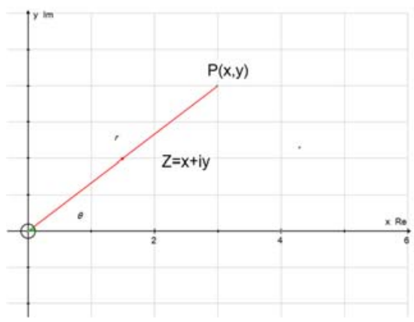
$\mathbf{a}\times\mathbf{b}$ is the determinant of the matrix $\begin{pmatrix} i & j & k \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{pmatrix}$

$$\therefore \mathbf{a}\times\mathbf{b} = \begin{vmatrix} i & j & k \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$$

$$= (a_2b_3 - a_3b_2)\mathbf{i} - (a_1b_3 - a_3b_1)\mathbf{j} + (a_1b_2 - a_2b_1)\mathbf{k}$$

## GPS 1.3 Applying geometric skills to complex numbers.

- Complex numbers ☐
- Complex conjugate ☐
- Arithmetic operations ☐
- Argand diagrams ☐
- Loci ☐
- Polar form ☐
- De moivre's theorem ☐
- Roots of a complex number ☐




## GPS 1.4 Applying algebraic skills to number theory.

- The division algorithm ☐
- The euclidean algorithm ☐
- Diophantine equations ☐
- Pythagorean Triples ☐
- Number bases ☐
- The division algorithm ☐

$$\frac{a}{b} = q + \frac{r}{b}$$

a divided by $b$ gives a quotient and remainder.
The quotient $q$ and remainder $r$ are integers

$0 \le r < |b|$

## GPS 1.5 Applying algebraic and geometric skills to methods of proof.

- Mathematical proof ☐
- Direct proof ☐
- Proof by contradiction ☐
- Proof by contrapositive ☐
- Proof by induction ☐

$b|a$ b divides a

so $a = kb$ , $k \in W$

## MAC 1.1 Applying algebraic skills to partial fractions.

- Rational fractions ☐
- Partial fractions ☐
- Distinct linear factors ☐
- Repeated linear factors ☐
- Irreducible quadratic factor ☐

$$\frac{3x^2-11x+5}{(x-2)(x-1)^2}=\frac{A}{x-2}+\frac{B}{x-1}+\frac{C}{(x-1)^2}$$

$$=\frac{A(x-1)^2+B(x-2)(x-1)+C(x-2)}{(x-2)(x-1)^2}$$

## MAC 1.2 Applying calculus skills through techniques of differentiation.

- Sec, cosec, cot ☐
- Higher Derivatives ☐
- Chain rule. ☐
- Product rule. ☐
- Quotient rule ☐
- Exponentials & Logs ☐
- Differentiating inverse functions ☐
- Differentiating inverse trig functions ☐
- Inverse trig functions:Recap ☐
- Implicit & explicit functions ☐
- Logarithmic functions ☐
- Parametric equations ☐
- Parametric equations:circles ☐
- Parametric constraint equations ☐
- Differentiating parametric ☐
- Second Derivative: parametric equations ☐
- Uses of parametric equations ☐

$$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

$$\frac{dy}{dx}=\frac{dy}{du}\times\frac{du}{dt}\times\frac{dt}{dx}$$

If $f(x)=g(x)\bullet h(x)$

then $f'(x)=g'(x)\bullet h(x)+g(x)\bullet h'(x)$

*If* $f(x)=\frac{g(x)}{h(x)}$

then , $f'(x)=\left(\frac{g(x)}{h(x)}\right)'=\frac{g'(x)h(x)-g(x)h'(x)}{(h(x))^2}$

$$f'x=\frac{y'(t)}{x'(t)}$$

$$f''x=\frac{x'(t)y''(t)-x''(t)y'(t)}{(x'(t))^3}$$

### Notes

## MAC 1.3 Applying calculus skills through techniques of integration.

- Standard integrals ☐
- $e^x$ and 1/x ☐
- Infinite integrals (discontinuities) ☐
- $\sec^2 x$ ☐
- Integrating Inverse trig functions ☐
- Integration of rational functions ☐
- Volumes of revolution ☐
- Integration by substitution. ☐
- Integration by parts ☐

$$\lim_{\delta x \to 0} \sum_{x=a}^{b} \pi y^2 dx = \int_a^b \pi y^2 dx$$

$$\int \frac{f'(x)}{f(x)} dx = \ln|f(x)| + C$$

$$\int f'(x) f(x) dx = \frac{1}{2}(f(x))^2 + C$$

## MAC 1.4 Applying calculus skills to solving differential equations.

- Differential equations ☐
- First-order differential equations ☐
- Second-order homogenous differential equations ☐
- Second order non – homogeneous Differential Equations ☐

$$\frac{dy}{dx} = f(x)g(y)$$

$$\Rightarrow \frac{dy}{g(y)} = f(x)dx$$

$$\Rightarrow \int \frac{dy}{g(y)} = \int f(x)dx$$

### Notes