# Further Maths KS5

Educate for life

**KEY** — **C** Core  **M** Mechanics  **S** Statistics

## YR12

**Y12 AUTUMN UNIT 1** — **C**
**How do I solve any quadratic equation with real coefficients?**
Can I solve $x^2+1=0$?
Can I rationalise $\frac{1}{(2+3i)}$?
Can I visualise complex numbers on a graph?

**Y12 AUTUMN UNIT 2** — **C**
**What can I glean about the roots of an equation from an equation?**
Do the coefficients always have to be real?

**Y12 AUTUMN UNIT 3** — **C**
**Can I use formulae for the sums of integers, squares and cubes?**
Do I understand sigma notation?
When can I use the method of differences?

**Y12 AUTUMN UNIT 4** — **C**
**Can I construct mathematical proofs by induction?**
What is the process for proving such a statement by induction?

**Y12 AUTUMN UNIT 5** — **C**
**Can I add and multiply matrices?**
When can I add or multiply matrices?
Can I work out what a 2x2 matrix does as a translation?
Can I find an invariant point/line?

**Y12 AUTUMN UNIT 6** — **C**
**Can I sketch a curve including the intersections with axes and any asymptotes?**
For a rational function can I find the range of values for y by considering a quadratic in x?

**Y12 AUTUMN UNIT 7** — **C**
**Do I know the relationship between polar coordinates and Cartesian coordinates?**
What is the graph of $r=k$ and $\theta = \alpha$?

**Y12 AUTUMN UNIT 8** — **C**
**Do I know the relationship between a circle and an ellipse?**
Do I know the general formula for each of the conics – circle, ellipse, hyperbola, rectangular hyperbola and parabola?

**Y12 AUTUMN UNIT 9** — **C**
**Can I use hyperbolic and inverse hyperbolic functions?**
Can I sketch sinh x, cosh x and tanh x and their inverses?
Can I solve a hyperbolic equation using exponentials?

**Y12 SPRING UNIT 1** — **M**
**Can I use the conservation of momentum for linear motion?**
What do I know about a collision between two balls if no outside forces are involved?
What is it about the balls that determines the outcome of a collision in terms of their separation?
Can I find the impulse involved in a collision?

**Y12 SPRING UNIT 2** — **M**
**Can I use the conservation of energy to determine the state of motion at different points of a particle?**
How far up a hill will a car go before coming rest? What are the different types of energy are there?
Can I resolve a force into two perpendicular directions?

**Y12 SPRING UNIT 3** — **M**
**Can I work out the extension of a spring/string and the energy stored when supporting a mass?**
What is the difference in using a spring compared to a string? What is the modulus of elasticity?

**Y12 SPRING UNIT 4** — **M**
**What are the three basic dimensions?**
Can I decide if a formula is consistent by looking at the dimensions?

**Y12 SPRING UNIT 5** — **S**
**For a discrete distribution can I calculate the mean and variance?**
How can I combine two discrete distributions? How will the expected means and variances compare?

**Y12 SPRING UNIT 6** — **S**
**What are the conditions needed for a distribution to be regarded as Poisson?**
What is the connection between the mean and variance for a Poisson Distribution?
For a PDF can I find a probability by using integration?
Can I find the E(X) and Var(X) for a PDF?

**Y12 SPRING UNIT 7** — **C**
**How do I find the mean value of a function for a set interval of values?**
How do I find the volume created by revolving a curve 360° around either axis?

**Y12 SUMMER UNIT 1** — **C**
**Can I work out the vector/cartesian form of a straight line given two points on the line?**
Can I work out if two lines intersect?
Can I work out the angle between two lines?
Can I work out the shortest distance between two lines when they are skew?

**Y12 SUMMER UNIT 2** — **M**
**Can I calculate the speed and acceleration of an object moving in a circular path with constant angular speed?**
Do I know why banking is required on the corner of a horizontal racing-track?

**Y12 SUMMER UNIT 3** — **C**
**Can I find the Maclaurin series of a function including the general term?**
Can I work out the Maclaurin Series for sin x and cos x?
Can I evaluate limits using Maclaurin series or l'Hôpital's rule?

**Y12 SUMMER UNIT 4** — **S**
**Can I, given a sample, generate a confidence interval for a certain percentage accuracy?**
Can I construct confidence intervals for the mean of a normal distribution with known variance?

**Y12 SUMMER UNIT 5** — **S**
**Do I know the difference between type I and type II errors?**
Do I know which error is most serious and in which situations?

## YR13

**Y13 AUTUMN UNIT 1** — **C**
**Can I write 3+4i in exponential form?**
What does De Moivre's Theorem allow me to do?
Can I work out the roots of unity?

**Y13 AUTUMN UNIT 2** — **C**
**Can I find the inverse of a 3x3 matrix?**
Can I use row/column operations to factorise the determinant of a 3x3 matrix?
Can I find the Eigen values/vectors of a 3x3 matrix?
Can I diagonalise a 3x3 matrix?

**Y13 AUTUMN UNIT 5** — **C**
**Can I find the vector product?**
Can I find the vector product of 2 vectors?
What does the Cartesian equation of a plane tell me?
Can I find the acute angle between 2 planes?
Can I find the distance of a point to a plane?

**Y13 AUTUMN UNIT 4** — **C**
**Can I derive the logarithmic forms of the inverse hyperbolic functions?**
Can I use $\cosh^2\theta - \sinh^2\theta = 1$?

**Y13 AUTUMN UNIT 3** — **C**
**Given a curve $y=f(x)$ can I sketch $y=\frac{1}{f(x)}$ and $y=|f(x)|y$**
Can I transform a graph by rotating, reflecting and translating?
Can I establish the inverse hyperbolic functions?
What does Osborn's Rule mean?
Do I know when a rational function gives oblique asymptotes?

**Y13 AUTUMN UNIT 6** — **C**
**Can I apply F=ma banking to corner problems? What difference does it make that the corner is banked?**
Can I apply circular motion ideas to conical pendulum problems?
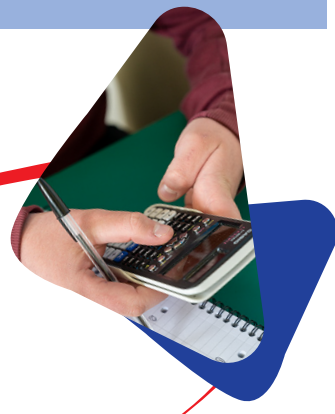Can I use energy considerations to develop expressions for v in vertical circular motion?
Can I determine when a ball loses contact with a spherical surface?

**Y13 SPRING UNIT 1** — **M**
**Can I find the centre of mass of a composite lamina? And a composite solid?**
Can I use integration to find the centre of mass of a solid of revolution?
Can I determine whether an object on a slope will slide or topple first?

**Y13 SPRING UNIT 3** — **C**
**How do I find the area under a polar curve?**
Can I find the length of a curve?
Can I find the surface area of revolution when a curve is rotated?

**Y13 SPRING UNIT 2** — **C**
**Do I know when an integral is improper and what does it mean?**
Can I recognise how to integrate with the full range of methods available?
Can I recognise what substitutions to make for $\frac{1}{(x^2+a^2)}$, $\frac{1}{(\sqrt{a^2-x^2})}$ and $\frac{1}{\sqrt{(\{..\}\ x^2+a^2\ )}}$?
Can I use partial fractions to complete an integration?
When will the reduction formula enable an integration to be resolved?

**Y13 SPRING UNIT 4** — **C**
**Do I know what a Differential Equation is?**
**Can I solve a $1^{st}$ Order Differential Equation with an integrating factor?**
**A $2^{nd}$ Order Differential Equation?**
Can I use a given substitution to solve a $1^{st}$ Order Differential Equation?
Do I know the 3 different general solutions (for the complementary function) to a homogeneous $2^{nd}$ Order Differential Equations?
The general solution to a $2^{nd}$ ODE is the CF + PI. How do I determine the PI (particular integral)?

**Y13 SUMMER UNIT 1** — **S**
**If f(x) is a PDF, do I know what is F(x)?**
Can I find the mean and variance of a rectangular probability distribution for the interval (a,b)?
If a random variable is given by $f(x)=\lambda e^{-\lambda x}$, can I evaluate the mean and variance?

**Y13 SUMMER UNIT 2** — **C**
**When might I use a numerical method?**
**Do I know the mid- ordinate rule of integration?**
Can I find an area by Simpson's Rule?
Can I find further values of a function using Euler's step-by-step Method and his improved method?

**Y13 SUMMER UNIT 3** — **S**
**Can I find the probability of a type I and type II error?**
What is the power of a hypothesis test?
When is a t-test unsuitable?
Can I calculate the t-test statistic from a sample?

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**Exam preparation**
How can I make sure I am revising effectively for this subject?
How do I memorise and recall knowledge I need for the exam?
How do I maximise marks in this subject's exam?
What are the gaps in my knowledge and how can I address them?
How do I approach exam questions in this subject to ensure I reach the highest grade?
What do I need to do to prepare myself for university courses?
What do I need to do to prepare myself for employment?