Information about the final exam

- The final exam will be on **FRIDAY 26th APRIL** at **13:00**.
- It is worth 60% of your final mark, and must be attempted (unless you have a confirmed valid extenuating circumstance).
- It will comprise 6–8 questions, last 120 minutes, and be marked out of 100.
- You should have a calculator, though **graphing calculators are not permitted**.
- You will not be provided with a formula sheet.
- The following material is examinable in the final:

Examinable material for final

Stewart sections which will help

- Chapters 3–5,
- 6.1, 6.4, NOT 6.2–6.3, 6.5
- 7.1–7.5, 7.8, 8.1, 8.3–8.5, NOT 7.6–7.7, 8.2,
- 9.1, NOT 9.2–9.6
- 10.1–10.4, NOT 10.5–10.6
- Chapter 11 (all)
- 12.1–12.5, NOT 12.6

Differentiation, trigonometry & curve sketching

Everything from first half of course.

Integration & applications of integration

Everything from first half of course, except:

NOT EXAMINABLE IN FINAL:

- Finding areas between curves.
- Using approximations like *Riemann sums*, *Trapezium Rule*, *Midpoint Rule*, *Simpson's Rule*.
- *Trapezium / Midpoint Rule Error Bound*.
- Speed, velocity, acceleration.
- Total distance travelled by an object.

- Parametric equations.
- Arc length of parametric curves.

All other applications including volumes of revolution, centre of mass, work, and polar co-ordinates are still examinable.

Differential equations

- Find the order of a differential equation.
- Understand general solutions, and solutions to initial value problems.
- Use forward, backward, or central difference to estimate the rate of change of a population, based on data in a table.
- NOT EXPECTED: Identify a separable differential equation, and be able to solve it.
- NOT EXPECTED: Identify exponential growth, the logistic equation, and the mixing problem, and be able to solve it (you do not need to memorise the standard solutions, but you will be expected to show the process of finding a solution).

Sequences & series

- Determine whether a sequence is increasing or decreasing (monotonic).
- Write down formulas for the nth term of a sequence.
- Theorem 5.1.7; Know the arithmetic of convergent sequences.
- Theorem 5.1.8; Use the Power Law for sequences.
- Theorem 1.3.4; Use the Squeeze Theorem (Pinching Theorem / Sandwich Theorem) to decide if a sequence is convergent by comparing it to another sequence.
- Theorem 5.1.10; Know that if $|a_n|$ converges to 0, then (a_n) converges to 0.
- Understand series notation, and what it means for a series to converge to a sum or diverge.
- Be able to write series in Σ notation.
- Find the partial sums of a series.
- Identify an arithmetic or a geometric series.
- Know that a geometric series Σar^n converges if and only if $|r| < 1$, and converges to $a/(1-r)$.
- Identify a p-series $\Sigma 1/(n^p)$, and know that it converges if and only if $p > 1$.
- Use the *Term Test for Divergence* to decide whether a series diverges.
- Be able to find the sum of an infinite geometric series, and know under which conditions it converges
- Use arithmetic of convergent series (that is, if two series converge, you can add them up term-by-term and get a new convergent series, but if one of them doesn't converge and the other does, then their sum does not converge).

- Understand when p-series converge.
- Know the difference between non-negative, non-positive, and alternating series.
- Know what it means for a series to converge conditionally or absolutely.
- Know the *handy limits* (5.5.5) like
$$\lim_{n\to\infty} \sqrt[n]{n} = 1.$$
- NOT EXPECTED: Telescoping series.

Series convergence tests

- Integral Test (and know when to use)
- Direct comparison
- Limit comparison
- Ratio Test
- Root Test
- Alternating Series Test
- Absolute Convergence Test

Power series

- Use the *Ratio Test* to find the radius of convergence of a power series
- Plug in the endpoints of the interval of convergence to decide whether they are included or excluded from the interval (that is, does the interval look like $[a, b]$, $(a, b]$, $[a, b)$ or (a, b)?)
- Find the Maclaurin series of a function.
- Find the Taylor series of a function.
- Write the kth Maclaurin and Taylor polynomials.
- Find the absolute error between an approximation and the actual value.
- Use the *Lagrange Error Bound* to work out the maximum error in approximating a function by a polynomial.

Vectors, lines & planes

- Find the direction and magnitude of a vector.
- Find a unit vector with the same direction as a given vector.
- Add and subtract vectors, and find the vector between two given points.
- Decide if two vectors are parallel.
- Find the equation (vector, parametric, or symmetric) of a line which is parallel to a given vector, and which passes through a given point.

- Find the equation of a plane which is perpendicular to a given vector, and which passes through a given point.
- Find the intersection points between lines and planes, by putting the equations equal to each other.
- Use the dot product to find the angle between two vectors.
- Understand that if the dot product is zero, then the vectors are perpendicular.
- Find the projection and component of a vector along another, $\mathbf{w}$. Hence write a vector as the sum of two orthogonal vectors, one parallel and one perpendicular to some given vector $\mathbf{w}$.
- Use the cross product to find a third vector perpendicular to two given vectors.
- Use the cross product to find a vector perpendicular to a plane.
- NOT EXPECTED: Find the angle between two planes, by using the dot product of their normal vectors (*Stewart* §12.5 Example 7).
- Find the distance from a point M to a plane by using

$$d = |\text{comp}_{\mathbf{n}}\vec{PM}| = \frac{|\mathbf{n} \cdot \vec{PM}|}{|\mathbf{n}|},$$

  where P is some point on the plane (*Stewart* §12.5 Distances).
- NOT EXPECTED: product rule for dot and cross product.
- NOT EXPECTED: triple product.
- NOT EXPECTED: cylindrical surfaces.