4tφ Scholarship Calculus: compressed course fundamentals

The following is my opinion of which areas of the Y12/13 programmes are most important for a student to cover if the full 2 years is not available. This work should take approximately an hour a week of class time for 3 terms (or an equivalent number of hours if the student is working independently), plus time for students to answer questions; it is estimated at 60 hours of work, but this is variable depending on the student.

Note: functions and limits should be covered in sufficient depth in the normal programme of study, so have been excluded here; however, more practice can be obtained in this area from TN pp 56-70. Likewise, implicit and parametric differentiation should be comfortable skills after L3, so need not be covered in great depth here; however, TN pp 157-170 offer more practice.

The warm-up problems (TN pp 321-325, with solutions on pp 326-332) could be used for warm-ups or additional problem-solving practice, particularly as they cover a wide range of areas outside of those included elsewhere in the course.

Y12 content:

- Division section (TN pp 1-8)
- Remainders and factorisation section (TN pp 9-11) (note this is in the L3 curriculum)
- Partial fractions section (TN pp 12-18)
- Sigma notation and manipulating sigma notation (TN pp 33-36) (note sigma notation may be introduced at L2 and plays a larger role in Statistics and Modelling)
- Inequalities section (TN pp 49-55)
- Conic sections – standard equations and properties section (TN pp 73-82) (note this is in the L3 curriculum, so should be largely revision)
- Foci, directrices and eccentricity and loci of conic sections (TN pp 83-94)
- Conic sections – tangents and intersections section (TN pp 107-113)
- Forming a straight line equation and normals to conics (TN pp 114-117)
- Parametric equations of conics (TN pp 124-126) (note this is in the L3 curriculum, so should be revision)

Y13 content:

- Differentiation – basics section (TN pp 149-156)
- Implicit differentiation and conic sections (TN pp 159-160)
- Tangents to parametric conics and normals to parametric conics (TN pp 167-170)
- Differentiation – interpretations and graphs section (TN pp 171-178) (note this is knowledge expected from L3 work, so should be largely revision)
- Differentiation – applications section except extended related rates and substitution (TN pp 179-185, 188-191)
- Identities and triangle identities (TN pp 199-203)
- Special triangle angles and solving trig equations (TN pp 204-210)
- Rolling loci and trigonometry (TN pp 216-218) (applets can be found on the internet which trace out these loci. Note that the emphasis here should be on understanding how to break

a locus problem into components and find each component using trigonometry and geometry)

- Integration from first principles (Riemann sums) (TN pp 219-222) (note the emphasis here should be on understanding what integration IS, not necessarily on the algebraic details of the method)
- The reverse chain rule (TN pp 223-225)
- Integration by partial fractions (TN pp 236-239)
- Volumes of revolution – shells method (TN pp 243-246)
- Differential equations section except the integrating factor method (TN pp 253-256, 260-270)
- Regular polygons and symmetry in the complex plane (TN pp 276-280)
- Complex loci section (TN pp 281-291) (note the standard locus definitions should be treated as revision from the conic sections loci work and coordinate geometry from L2)
- Reading and Writing Mathematics section (TN pp 292-297)
- Scholarship-style homework assignments (TN pp 299-325) (as many of these should be done as possible, when students have mastered the required skills. The emphasis should be on interpreting the question, problem-solving, using calculus skills, and mathematical communication)

If there are any questions, please contact me at simon@scholcalc.co.nz.