Specific Elements of the Competency (*in italics*) Standard of Performance: The student must be able to:

1. *To situate the historical context of the development of integral calculus.*

1.1 HISTORICAL DEVELOPMENT
1.1.1 describe some of the factors which led to the development of integral calculus.

2. *To find the indefinite integral of a function using integration techniques.*

2.1 INVERSE TRIGONOMETRIC FUNCTIONS
2.1.1 give the definitions, domains and ranges of the arcsin and arctan functions.
2.1.2 calculate their derivatives (the other four functions are optional).

2.2 ANTIDERIVATIVES
2.2.1 define antiderivative, indefinite integral, constant of integration.
2.2.2 give basic indefinite integrals involving algebraic, trig, log, exponential and inverse trig functions (i.e. those following directly from the derivatives).
2.2.3 find antiderivatives satisfying certain boundary conditions.

2.3 TECHNIQUES OF INTEGRATION
2.3.1 perform algebraic substitutions
2.3.2 integrate functions of sinx, cosx, tanx, their powers and combinations, using trig identities where necessary.
2.3.3 find integrals involving or yielding exponential and log functions.
2.3.4 find integrals using integration by parts, partial fractions, completing the square, trig substitution (easier examples)
2.3.5 find integrals involving or yielding inverse trig functions.

3. To calculate the definite integral of a function on an interval and provide its interpretation.

3.1 THE DEFINITE INTEGRAL
3.1.1 calculate a Riemann sum using summation formulas.
3.1.2 evaluate a definite integral using a Riemann sum.
3.1.3 demonstrate an understanding of the definite integral as an accumulation of infinitesimal quantities.
3.1.4 give the properties of the definite integral.
3.1.5 interpret the definite integral for positive and negative functions.
3.1.6 demonstrate an understanding of both versions of the Fundamental Theorem of Calculus.
3.1.7 calculate a definite integral using the Fundamental Theorem of Calculus, including an integral involving a change of variable (and new limits of integration).
3.1.8 use the techniques of integration listed above to evaluate definite integrals.

3.2 APPLICATIONS OF THE DEFINITE INTEGRAL
3.2.1 find the area of a region in the plane.
3.2.2 find the mean value of a function on an interval.
3.2.3 find volumes of revolution using the method of disks or cylindrical shells and judge which method is most efficient for a particular problem.
3.2.4 apply the definite integral to financial problems such as total cost, revenue, profit.

4. To calculate the limits of a function with indeterminate forms using L'Hôpital's rule.

4.1 FINDING LIMITS OF INDETERMINATE FORMS: L'HOPITAL'S RULE
4.1.1 demonstrate an understanding of L'Hopital's Rule and the conditions under which it applies.
4.1.2 use it to find limits of the form $\frac{0}{0}$ or $\frac{\infty}{\infty}$
4.1.3 recognize the indeterminate forms $0\cdot\infty$, $\infty - \infty$, 1^∞, 0^0 and ∞^0 and evaluate limits of these types by an appropriate method.

5. To calculate the improper integral of a function on an interval and provide its interpretation.

5.1 IMPROPER INTEGRALS
5.1.1 determine the divergence or convergence of an integral where at least one limit is not a real number.
5.1.2 determine the divergence or convergence of an integral which has a discontinuity within the limits of integration.

6. *To analyze a phenomenon using differential equations with separable variables.*

6.1 DIFFERENTIAL EQUATIONS

6.1.1 mathematically formulate a situation involving a differential equation.

6.1.2 solve separable differential equations including exponential growth and decay problems, the spread of disease or rumour, financial mathematics, cost benefit analysis: cost, revenue, profit.

7. *To analyze a phenomenon by checking for convergence of a series.*

7.1. SEQUENCES AND SERIES

7.1.1 recognize arithmetic and geometric sequences and find a formula for the n^{th} term.

7.1.2 find a formula for the n^{th} term of a given sequence.

7.1.3 determine the divergence or convergence of a given sequence.

7.1.4 use Σ notation to write a sum in closed form.

7.1.5 expand a sum written in Σ notation.

7.1.6 state and apply the properties of the Σ notation

7.1.7 state and apply the formulas for Σn, Σn^2, Σn^3.

7.1.8 determine the convergence or divergence of a geometric series and find the sum if convergent.

7.1.9 find Taylor and MacLaurin series for sin x, cos x, e^x, arctan x, *l*n (1 + x) and related functions.

7.1.10 estimate remainder, determine radius of convergence (optional)

7.1.11 perform numerical integration using the Trapezoid Rule, Simpson's Rule or an appropriate Taylor series (optional).

7.1.12 use Newton's Method for solving equations, use Picard's Method (optional).