

Secondary Form Mathematics Extended Part
Module 1 (Calculus and Statistics)

	Learning Unit	Learning Objective
1	Binomial expansion	1.1 recognize the expansion of $(a + b)^n$, where n is a positive integer
2	Exponential and logarithmic functions	2.1 recognize the definition of the number e and the exponential series $e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$ 2.2 recognize exponential functions and logarithmic functions 2.3 use exponential functions and logarithmic functions to solve problems 2.4 transform $y = kx^n$ and $y = ka^x$ to linear relations, where a, n and k are real numbers, $a > 0$ and $a \neq 1$
3	Derivative of a function	3.1 recognize the intuitive concept of the limit of a function 3.2 find the limits of algebraic functions, exponential functions and logarithmic functions 3.3 recognize the concept of the derivative of a function from first principles 3.4 recognize the slope of the tangent of the curve $y=f(x)$ at a point $x = x_0$
4	Differentiation of a function	4.1 understand the addition rule, product rule, quotient rule and chain rule of differentiation 4.2 find the derivatives of algebraic functions, exponential functions and logarithmic functions
5	Second derivative	5.1 recognize the concept of the second derivative of a function 5.2 find the second derivative of an explicit function
6	Applications of differentiation	6.1 use differentiation to solve problems involving tangents, rates of change, maxima and minima
7	Indefinite integrals and their applications	7.1 recognize the concept of indefinite integration 7.2 understand the basic properties of indefinite integrals and basic integration formulae 7.3 use basic integration formulae to find the indefinite integrals of algebraic functions and exponential functions 7.4 use integration by substitution to find indefinite integrals 7.5 use indefinite integration to solve problems

8	Definite integrals and their applications	8.1 recognize the concept of definite integration 8.2 recognize the Fundamental Theorem of Calculus and understand the properties of definite integrals 8.3 find the definite integrals of algebraic functions and exponential functions 8.4 use integration by substitution to find definite integrals 8.5 use definite integration to find the areas of plane figures 8.6 use definite integration to solve problems
9	Approximation of definite integrals using the trapezoidal rule	9.1 understand the trapezoidal rule and use it to estimate the values of definite integrals
10	Conditional probability and independence	10.1 understand the concepts of conditional probability and independent events 10.2 use the laws $P(A \cap B) = P(A) P(B A)$ and $P(D C) = P(D)$ for independent events C and D to solve problems
11	Bayes' theorem	11.1 use Bayes' theorem to solve simple problems
12	Discrete random variables	12.1 recognize the concept of a discrete random variable
13	Probability distribution, expectation and variance	13.1 recognize the concept of discrete probability distribution and its representation in the form of tables, graphs and mathematical formulae 13.2 recognize the concepts of expectation $E(X)$ and variance $VarX$ and use them to solve simple problems 13.3 use the formulae $E(aX+b)=aE(X)+b$ and $Var(aX + b) = a^2Var(X)$ to solve simple problems
14	Binomial distribution	14.1 recognize the concept and properties of the binomial distribution 14.2 calculate probabilities involving the binomial distribution
15	Geometric distribution	15.1 recognize the concept and properties of the geometric distribution 15.2 calculate probabilities involving the geometric distribution
16	Poisson distribution	16.1 recognize the concept and properties of the Poisson distribution 16.2 calculate probabilities involving the Poisson distribution

17	Applications of binomial, geometric and Poisson distributions	17.1 use binomial, geometric and Poisson distributions to solve problems
18	Basic definition and properties	18.1 recognize the concepts of continuous random variables and continuous probability distributions, with reference to the normal distribution 18.2 recognize the concept and properties of the normal distribution
19	Standardization of a normal variable and use of the standard normal table	19.1 standardize a normal variable and use the standard normal table to find probabilities involving the normal distribution
20	Applications of the normal distribution	20.1 find the values of $P(X > x_1)$, $P(X < x_2)$, $P(x_1 < X < x_2)$ and related probabilities, given the values of x_1 and x_2 , μ and σ , where $X \sim N(\mu, \sigma^2)$ 20.2 find the values of x , given the values of $P(X > x)$, $P(X < x)$, $P(a < X < x)$, $P(x < X < b)$ or a related probability, where $X \sim N(\mu, \sigma^2)$ 20.3 use the normal distribution to solve problems
21	Sampling distribution and point estimates	21.1 recognize the concepts of sample statistics and population parameters 21.2 recognize the sampling distribution of the sample mean from a random sample of size n 21.3 recognize the concept of point estimates including the sample mean, sample variance and sample proportion 21.4 recognize Central Limit Theorem
22	Confidence interval for a population mean	22.1 recognize the concept of confidence interval 22.2 find the confidence interval for a population mean
23	Confidence interval for a population proportion	23.1 find an approximate confidence interval for a population proportion
24	Inquiry and investigation	Through various learning activities, discover and construct knowledge, further improve the ability to inquire, communicate, reason and conceptualize mathematical concepts