S6 Mathematics (Extended Part Module 1) Practice Paper: Binomial Theorem and Sequences, Exponentials and Logarithms, Differentiation, Integration and Applications, Binomial and Poisson Distributions, Normal Distribution and Point Estimation

Level: S6 | Subject: Mathematics (Module 1) | 75 minutes | 100 marks | 24 questions | question paper

Section A: Binomial Theorem and Sequences (18 marks)

Show all working. Binomial coefficients may be written as C(n, r); state the formula before substituting.

#	Question	Marks
1	Expand (1 + 2x)^5, and state the coefficients of x^3 and x^2.	5
2	In the expansion of (2 + x)^6, find the constant term and the coefficient of x^4.	5
3	An arithmetic sequence has first term 5 and common difference 3. Find the 10th term and the sum of the first 10 terms.	4
4	A geometric sequence has first term 3 and common ratio 2. Find the 6th term and the sum of the first 6 terms.	4

Section B: Exponentials and Logarithms (17 marks)

State the log laws used. Give non-integer answers to 3 significant figures.

#	Question	Marks
5	Solve 2^(x + 1) = 32.	4
6	Without a calculator, evaluate (a) log base 3 of 81, (b) log base 2 of 1/8.	4
7	Solve log_2 x + log_2 (x - 2) = 3 and explain why one root is rejected.	5
8	A sum of $5000 is deposited at 5% per annum compounded yearly. After how many complete years will the amount first be at least $8000?	4

Section C: Differentiation (17 marks)

State the rule used (chain, product or implicit). Simplify your answers.

#	Question	Marks
9	Let y = (2x + 3)^5. Find dy/dx and its value when x = 1.	5
10	Let y = x^2 ln x (x > 0). Find dy/dx and its value at x = e (3 significant figures).	4
11	The curve x^2 + y^2 = 25 passes through (3, 4). Find the slope of the tangent there.	4
12	Evaluate lim(x->0) (sin 3x)/x.	4

Section D: Integration and Applications (16 marks)

Include the constant C for indefinite integrals; write the primitive before substituting limits.

#	Question	Marks
13	Evaluate the definite integral of 3x^2 from 0 to 2.	4
14	Find the indefinite integral of (2x + 1)^3 with respect to x.	4
15	Find the area enclosed between y = x and y = x^2 for 0 <= x <= 1.	4
16	Evaluate the integral of 1/x from 1 to e and explain the result.	4

Section E: Binomial and Poisson Distributions (16 marks)

State the distribution and its parameters; give probabilities to 4 decimal places.

#	Question	Marks
17	Let X ~ B(10, 0.3). Find (a) P(X = 3), (b) E(X) and Var(X).	4
18	Let X ~ Po(4). Find P(X = 2) to 4 decimal places.	4
19	A switchboard receives on average 2 calls per minute, modelled by a Poisson distribution. Find the probability of no calls in a given minute.	4
20	A shooter hits the target with probability 0.4 on each independent shot, and fires 8 shots. Find the probability of at least one hit (4 decimal places).	4

Section F: Normal Distribution and Point Estimation (16 marks)

The standard normal table may be used; give table values to 4 decimal places and describe the shaded region.

#	Question	Marks
21	Let Z ~ N(0, 1). Find (a) P(Z < 1.96) and (b) P(-1 < Z < 1).	4
22	Let X ~ N(50, 100). Find P(X > 60).	4
23	For the sample 12, 15, 18, 20, 25, find the sample mean and sample standard deviation (3 significant figures).	4
24	A sample of size 36 has mean 52 and standard deviation 6. Construct a 95% confidence interval for the population mean.	4