# S5 Mathematics Extended Part Module 1 Practice Paper: Binomial Theorem, Exponentials and Logarithms, Limits and Derivatives, Applications of Differentiation, Integration, Probability Distributions

S5 | Mathematics Extended Part Module 1 | Time: 75 minutes | Total: 100 marks | 24 questions

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## Part A Binomial Theorem (16 marks)

**Answer all questions and show your working.**

**1. Find the coefficient of x^3 in the expansion of (1 + 2x)^7 and write down that term.** [4]

**2. Find the constant term in the expansion of (x + 2/x^2)^6.** [4]

**3. Find the sum of all coefficients in the expansion of (3 - x)^8 and state which value of x is substituted.** [4]

**4. How many terms are there in the expansion of (2 + x)^12? Find the coefficient of the middle term.** [4]

## Part B Exponentials and Logarithms (16 marks)

**Show your working; give numerical answers to the stated accuracy.**

**5. Find the value of log base 9 of 27, giving your answer as a fraction.** [4]

**6. Solve 2^x = 5, giving your answer correct to 4 decimal places.** [4]

**7. A radioactive substance has a half-life of 8 years and an initial mass of 640 g. (a) Find the mass after 24 years. (b) Find the time for the mass to fall to 40 g.** [4]

**8. A solution has hydrogen ion concentration 2.5 x 10^-5 mol/L. Find its pH correct to 1 decimal place.** [4]

## Part C Limits and Derivatives (16 marks)

**State the rules used; answers may be exact or to the stated accuracy.**

**9. Evaluate lim (x -> 3) of (x^2 - 9) / (x - 3).** [4]

**10. Let y = x^2 e^(3x). Find dy/dx at x = 1, exact and to 3 decimal places.** [4]

**11. Let y = ln(3x^2 + 1). Find dy/dx at x = 2 as a fraction.** [4]

**12. Let y = sqrt(2x + 5). Use the chain rule to find dy/dx at x = 2.** [4]

## Part D Applications of Differentiation (16 marks)

**State the conditions used and justify the nature of each stationary point.**

**13. The curve is y = x^3 - 2x. Find the equation of the tangent at x = 1.** [4]

**14. The curve is y = x^3 - 3x^2 + 4. Find all stationary points and determine whether each is a maximum or a minimum.** [4]

**15. A rectangle has a fixed perimeter of 40 cm. Find its maximum area and the corresponding side lengths.** [4]

**16. The radius of a sphere increases at 0.5 cm/s. Find the rate of increase of volume when the radius is 3 cm, exact and to 3 decimal places.** [4]

## Part E Integration and Area (16 marks)

**Show the primitive or formula used; exact answers are acceptable.**

**17. Evaluate the integral from 0 to 2 of (3x^2 + 2x) dx.** [4]

**18. Find the area enclosed by y = x and y = x^2 for 0 <= x <= 1.** [4]

**19. Evaluate the integral from 1 to e of (1/x) dx.** [4]

**20. The curve y = x^2 from x = 0 to x = 1 is rotated about the x-axis. Find the volume, in terms of pi and to 3 decimal places.** [4]

## Part F Probability and Distributions (20 marks)

**State the distribution and formula used and show the substitution.**

**21. X ~ B(10, 0.3). Find P(X = 3) correct to 4 decimal places.** [5]

**22. X ~ B(20, 0.3). Find the mean, variance and standard deviation (3 decimal places).** [5]

**23. X ~ N(50, 8^2). Find P(X > 62) correct to 4 decimal places.** [5]

**24. X ~ N(50, 8^2). Find P(42 < X < 58) to 4 decimal places and relate it to the 68% rule.** [5]

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