# S5 Mathematics Extended Part Module 1 Practice Paper: Binomial Theorem, Exponential and Logarithmic Functions, Differentiation and Extrema, Integration and Area, Binomial Distribution, Growth and Optimisation

S5 Mathematics Extended Part Module 1 | Time: 75 minutes |

---

## Section A: Binomial Theorem (16 marks)

**Show all necessary working and simplify your answers.**

**1. Find the coefficient of x^3 in the expansion of (1 + 2x)^10.**

**2. Find the constant term in the expansion of (x – 3/x)^6.**

**3. Find the sum of all coefficients in the expansion of (2 + x)^7.**

**4. Find the coefficient of x^5 in the expansion of (1 – x)^8.**

## Section B: Exponential and Logarithmic Functions (16 marks)

**Unless otherwise stated, give answers correct to 3 significant figures.**

**5. Solve 4^(x+1) = 8^(2x–1).**

**6. Solve $\log_2 x + \log_2 (x - 3) = 2$.**

**7. A bacteria culture grows as N = 500 e^(kt). After 3 hours N = 4000. (a) Find k. (b) How long does it take to reach 20000?**

**8. A radioactive substance has a half-life of 12 years. (a) Find the decay constant k. (b) What percentage remains after 30 years?**

## Section C: Differentiation and Applications (20 marks)

**Use standard differentiation rules and state the rule used.**

**9. Let $y = (3x^2 + 1)(x - 2)$. (a) Find dy/dx. (b) Find dy/dx when x = 2.**

**10. Let y = (2x + 5)/(x – 1). Use the quotient rule to find dy/dx in simplest form.**

**11. Let $y = (3x^2 + 4)^5$. Use the chain rule to find dy/dx.**

**12. Let $f(x) = x^3 - 6x^2 + 9x + 2$. Find the stationary points, determine whether each is a maximum or a minimum, and give the corresponding values of f(x).**

## Section D: Integration and Area (20 marks)

**Include the constant of integration; list the ordinates used in any approximation.**

**13. Find $\int (6x^2 - 4x + 3)\,dx$.**

**14. Evaluate $\int_0^2 (3x^2 + 2x)\,dx$.**

**15. Find the area enclosed by the curve $y = 4 - x^2$ and the x-axis, correct to 3 significant figures.**

**16. Use the trapezoidal rule with 4 equal subintervals to approximate $\int_0^2 x^3\,dx$, then compare with the exact value and state the absolute error.**

## Section E: Binomial Distribution and Expectation (16 marks)

**Give probabilities correct to 4 decimal places.**

**17. Let $X \sim B(10, 0.3)$. Find $P(X = 3)$.**

**18. For the same distribution, find the mean and the variance of X.**

**19. For the same distribution, find $P(X \geq 1)$.**

**20. A player scores with probability 0.8 on each free throw and takes 5 throws, so $Y \sim B(5, 0.8)$. (a) Find the probability of scoring all 5. (b) Find $P(Y \geq 4)$.**

## Section F: Applications and Optimisation (12 marks)

**State the formula or test you use.**

**21. An investment grows continuously as A = 10000 e^(0.05t), where t is in years. Find the amount when t = 10, correct to the nearest dollar.**

**22. The production cost in hundreds of dollars is $C(x) = 0.5x^2 - 20x + 500$ for output x. Find the output that minimises cost and the minimum cost.**

**23. Find the average value of $f(x) = x^2$ on the interval [0, 3].**

**24. A sphere has volume $V = (4/3)\pi r^3$. (a) Find $dV/dr$ when $r = 5$. (b) If the radius increases at 0.02 cm/s, find the rate of change of volume then, correct to 3 significant figures.**

---

TutorZoneOriginal material written for TutorZone, not from any school or publisher.