S5 Maths Extended M1 Practice Paper: binomial theorem and sequences, indices and logarithms, limits and differentiation, applications of differentiation, integration and area, trapezoidal rule, binomial and normal distributions (100 marks)

Level: S5 | Subject: Maths Extended M1 | 75 minutes | 100 marks | 24 questions | question paper

Section A - Binomial Theorem and Sequences (18 marks)

Answer all questions and show your working.

#	Question	Marks
1	Expand (1 + 2x)^5 and find (a) the coefficient of x^3; (b) the sum of all the coefficients; (c) the constant term.	5
2	In the expansion of (2 + x/2)^8, find (a) the coefficient of x^5; (b) the number of terms.	5
3	An arithmetic sequence has first term 7 and common difference 5. Find (a) the value of n for which the nth term is 122; (b) the sum of the first 24 terms.	4
4	A geometric sequence has first term 5 and common ratio 1/3. Find (a) the sum to infinity; (b) the 6th term, correct to 4 decimal places.	4

Section B - Indices, Logarithms and Exponential Growth (16 marks)

Answer all questions and show your working.

#	Question	Marks
5	Solve the equation 3^(2x - 1) = 27^(x + 1).	4
6	Find (a) the value of log2 48 - log2 3; (b) the value of a if log_a 9 = 2.	4
7	Bacteria in a dish double every 4 hours, starting from 500. Find (a) the number after 24 hours; (b) the time for the number to reach 16000 for the first time.	4
8	A radioactive substance has a half-life of 12 years and a sample of mass 80 g. Find (a) the mass after 36 years; (b) the relation between mass m and time t in years.	4

Section C - Limits and Differentiation (18 marks)

Answer all questions and show your working.

#	Question	Marks
9	Let y = 3x^4 - 2x^3 + 5x - 7. Find (a) dy/dx; (b) the slope of the curve at x = 2.	5
10	Let f(x) = (x^2 + 1)(3x - 2). Find (a) f'(x); (b) f'(1).	5
11	Evaluate the limits: (a) as x tends to 3, (x^2 - 9)/(x - 3); (b) as x tends to 0, sin 5x / x.	4
12	Evaluate the limits: (a) as x tends to infinity, (4x^2 + 3x - 1)/(2x^2 - x + 5); (b) as x tends to 2, (x^3 - 8)/(x - 2).	4

Section D - Applications of Differentiation (16 marks)

Answer all questions and show your working.

#	Question	Marks
13	The curve is y = x^3 - 2x. Find (a) the equation of the tangent at x = 1; (b) its y-intercept.	4
14	Let y = x^3 - 3x^2 + 4. Find (a) the x values of all stationary points; (b) the nature of each and the corresponding value of y.	4
15	The radius of a sphere increases at 0.5 cm per second. When the radius is 6 cm, find the rate of increase of the volume (take pi = 3.14, 1 decimal place).	4
16	A rectangular sheet has perimeter 40 cm. Find the largest area it can enclose.	4

Section E - Integration, Area and Trapezoidal Rule (16 marks)

Answer all questions and show your working.

#	Question	Marks
17	Evaluate the integral from 1 to 2 of (6x^2 - 4x + 3) dx.	4
18	Find the area of the region enclosed by the curve y = x^2 and the line y = 4.	4
19	Let f(x) = x^2 with values taken at x = 1, 2, 3 and 4. Find (a) the trapezoidal estimate of the integral from 1 to 4; (b) the absolute error compared with the exact value.	4
20	Evaluate (a) the integral from 0 to 2 of (3x^2 + 2x) dx; (b) the integral from 1 to 4 of the square root of x dx, to 3 significant figures.	4

Section F - Probability and Statistics Applications (16 marks)

Answer all questions and show your working.

#	Question	Marks
21	Let X follow the binomial distribution with n = 10 and p = 0.3. Find (a) the mean and the variance; (b) P(X = 3), to 3 decimal places.	4
22	Exam scores are normally distributed with mean 60 and standard deviation 8. Given P(Z < 1) = 0.8413 and P(Z < 2) = 0.9772, find (a) P(X < 68); (b) k such that P(X < k) = 0.9772.	4
23	Given P(A) = 0.6, P(B | A) = 0.5 and P(B | not A) = 0.25, find (a) P(B); (b) P(A | B).	4
24	A help desk receives 2 calls per hour on average, following a Poisson distribution. Taking e^(-2) = 0.1353, find (a) the probability of no calls in an hour; (b) the probability of at most one call in an hour, to 4 decimal places.	4