S6 M2 Practice Paper 1 | Induction, binomial, trigonometry, calculus and vectors

Senior Secondary Mathematics (Extended Part Module 2)

S6 M2 practice paper with worked answers: induction and series sums, binomial theorem, trig identities, limits, differentiation, definite integrals and vectors.

1. Mathematical induction and sequences (16 marks)

Show working; give answers as exact integers.

#	Question
1	(a) Find the sum 1 + 3 + 5 + … + 39 and state the number of terms.
2	(b) A geometric sequence has first term 3 and common ratio 2. Find T8 and S8.
3	(c) An arithmetic sequence has first term 7 and common difference 5. Find T20 and S20.
4	(d) Prove by induction that 1^3 + 2^3 + … + n^3 = [n(n+1)/2]^2, then check with n = 10.

2. Binomial theorem (18 marks)

Write the general term; coefficients are integers.

#	Question
5	(a) Find the coefficient of x^3 in the expansion of (1 + 2x)^8.
6	(b) Find the constant term in the expansion of (x - 3/x)^6.
7	(c) Find the coefficient of x^7 in the expansion of (2 + x)^10.
8	(d) Find the sum of all coefficients in (2 + x)^10 and state the method used.

3. Trigonometric identities and equations (16 marks)

θ is acute; give angles in degrees.

#	Question
9	(a) Given sin θ = 3/5 and θ acute, find cos θ and tan θ.
10	(b) Using (a), find the values of sin 2θ and cos 2θ.
11	(c) Solve 2 sin^2 x - sin x - 1 = 0 for 0° ≤ x ≤ 360°.
12	(d) Given tan A = 1/2 and tan B = 1/3, find tan(A + B) and the corresponding acute angle.

4. Limits and differentiation (18 marks)

Show working; give values to 3 decimal places.

#	Question
13	(a) Evaluate lim (x→3) (x^2 - 9)/(x - 3).
14	(b) Let y = x^3 e^(2x). Find dy/dx and the slope at x = 1.
15	(c) Let y = ln(x^2 + 1). Find dy/dx and the slope at x = 2.
16	(d) For the curve y = x^3 - 3x^2 + 2, find all stationary points and classify them.

5. Definite integrals and areas (16 marks)

Give the antiderivative; areas to 3 decimal places.

#	Question
17	(a) Evaluate the integral of (3x^2 + 2x) from 0 to 2.
18	(b) Evaluate the integral of 1/x from 1 to e.
19	(c) Evaluate the integral of x e^x from 0 to 1.
20	(d) Find the area enclosed by y = 2x and y = x^2.

6. Matrices, determinants and vectors (16 marks)

Give vectors in components; angles to 1 decimal place.

#	Question
21	(a) Let A = [[2, 1], [3, 4]]. Find det A and the inverse of A.
22	(b) Let B = [[1, 2], [2, 1]]. Find det B and state whether B is invertible.
23	(c) Let a = (2, -1, 3) and b = (1, 4, -2). Find a.b and the angle between them.
24	(d) Using a and b in (c), find a x b.