S4 Mathematics Module 2 Practice Paper 1 | Trigonometry, logarithms, calculus, matrices, vectors

Senior Secondary Mathematics (Module 2)

S4 Mathematics Module 2 practice paper with worked answers: compound angles, logarithms, limits and derivatives, definite integrals, matrices and vectors.

1. Trigonometric identities and compound angles (16 marks)

The cosine is negative in the second quadrant; give the exact value in surd form.

#	Question
1	(a) Given sin θ = 3/5 and θ in the second quadrant, find cos θ.
2	(b) Use a compound angle formula to find the exact value of sin 75 degrees.
3	(c) Simplify sin 2x cos x + cos 2x sin x.
4	(d) Solve 2 sin squared x - sin x - 1 = 0 for 0 to 360 degrees.

2. Logarithmic and exponential equations (16 marks)

Check the domain after solving; give answers in (b) to 3 decimal places.

#	Question
5	(a) Simplify log base 2 of 48 minus log base 2 of 3.
6	(b) Solve e to the power 2x minus 5 e to the power x plus 6 equals 0, answers to 3 decimal places.
7	(c) Solve 3 to the power (2x - 1) equals 27.
8	(d) Solve ln x + ln(x - 3) = ln 10.

3. Limits and differentiation (18 marks)

Factorise before cancelling the denominator; use the product rule in (b).

#	Question
9	(a) Find the limit as x tends to 3 of (x squared - 9)/(x - 3).
10	(b) Differentiate 3 x squared ln x with respect to x.
11	(c) Find the gradient of the tangent to y = x cubed - 3x at x = 1.
12	(d) Given y = (2x + 1) to the power 5, find dy/dx at x = 0.

4. Integration and area (16 marks)

Write the antiderivative first for definite integrals; use the substitution u = x squared in (c).

#	Question
13	(a) Find the integral of 6x with respect to x.
14	(b) Evaluate the integral from 1 to 2 of (2x + 1) dx.
15	(c) Evaluate the integral from 0 to 1 of x times e to the x squared dx, to 3 decimal places.
16	(d) Find the area bounded by y = x squared, the x-axis and the lines x = 0 and x = 3.

5. Matrices and determinants (18 marks)

The inverse is 1 over det A times the adjugate; check (c) by substitution.

#	Question
17	(a) Let A be the matrix with rows (3, 4) and (1, 2). Find det A.
18	(b) From (a), find the inverse of A.
19	(c) Use the inverse matrix to solve 3x + 4y = 10 and x + 2y = 4.
20	(d) Let B be the matrix with rows (1, 2) and (3, 4). Find B squared.

6. Vectors and applications (16 marks)

Use cos theta = (a dot b) over the product of the lengths; find the unit vector first in (d).

#	Question
21	(a) Let a be the vector (3, 4). Find its length.
22	(b) Let b be the vector (1, -2). Find the dot product of a and b.
23	(c) From (a) and (b), find the angle between a and b, to 1 decimal place.
24	(d) Point A is (1, 2). Moving 10 units from A in the direction of the vector (4, 3) reaches point P. Find the coordinates of P.