CHRISTIAN SOCIAL SERVICES COMMISION (CSSC)
NORTHERN ZONE JOINT EXAMINATIONS SYNDICATE (NZ – JES)

FORM SIX PRE – NATIONAL EXAMINATION 2026

142/2 **ADVANCED MATHEMATICS 2**

Time: 3:00 Hours **Friday, 27th February, 2026 p.m**

Instructions

1. This paper consists of sections **A** and **B** with a total of **eight (8)** questions.
2. Answer **all** questions in section A and only **two (2)** questions from section B
3. Section A carries **sixty (60**) marks and section B carries **forty (40)** marks.
4. All work done in answering each question must be shown clearly.
5. NECTA Mathematical tables and non-programmable calculators may be used.
6. All writing must be in blue or black ink except drawing which must be in pencil.
7. Cellular phones and any unauthorized materials are not allowed in the examination room.
8. Write your **examination number** on every page of your answer booklet(s).

SECTION A (60 Marks)

1. (a) (i) How many numbers greater than 40,000 can be formed using the digits 1, 2, 3, 4 and 5 if each digit is used only once in each number?

   (ii) In how many ways can 3 prizes be distributed among 4 boys when a boy can get any number of prizes?

   (b) A bag contains 7 white and 4 blue shirts. Two shirts are picked at random from the bag. Determine the probability that the shirts are of the same colour. (Hint: Use the concept of combination).

   (c) A continuous random variable x is defined by the following probability density function.

$$f(x) = \begin{cases} kx \quad if & 0 \leq x \leq 2 \\ k\,(4-x) & if\ 2 \leq x \leq 4 \\ 0, & elsewhere \end{cases}$$

   (i) Find the value of k

   (ii) Find P $(\frac{1}{2} \leq x \leq \frac{5}{2})$

2. (a) Construct the truth table for ~(p^q) ∨ (p∨ q)

   (b) Simplify $(\sim p \wedge \sim q) \vee (\sim p \wedge q) \vee (p \wedge q)$ using laws of proposition.

   (c) Find the compound statement for the letter S having the following truth table.

P	Q	R	S
T	T	T	T
T	T	F	F
T	F	T	F
.T	F	F	F
F	T	T	T
F	T	F	F
F	F	T	F
F	F	F	T

   (d) Test the validity of the following argument. Either Halima reaches home early or the traffic jam is not there. The traffic jam is not there. Therefore, Halima does not reach home early.

3. (a) Two points A and B have position vectors a = 3i – 2j + 3k and b = 4i + 3j – 4k respectively. Find the position vector of a point that divides AB internally in the ratio 1:4

   (b) If u = $3t^2$- j – 4tk and v = 2ti + $17t^2$j + 151k. Find the value of t given that u .v = 672

   (c) (i) Find the vector projection of a = i – 2j +k onto b = 4i – 4j + 7k

   (ii) Two forces of magnitude 5 and 3 units acting in the direction of the vectors 6i + 2j + 3k and 3i – 2j + 6k respectively, act on a particle which is displaced from the point (2, 1, 3) to the point (4, -3, 1). Find the work done by the forces.

4. (a) Show that $\overline{z_1} + \overline{z_2} = \overline{z_1 + z_2}$

(i) Find the complex number z if arg(z+1) = $\frac{\pi}{6}$ and arg (z – 1) = $\frac{2\pi}{3}$

(ii) Find the roots of the equation $9z^4 - 35z^2 - 4 = \frac{1}{5}$

(iii) Determine the locus defined by arg $\left(\frac{z-1}{z+1}\right) = \frac{\pi}{4}$

(b) Find the roots of the equation $z^3 = 8i$ by expressing your answer in the form a + bi where a and are real numbers

SECTION B (40 Marks)

Answer only **two (2)** questions from this section

5. (a) (i) Prove that $\frac{Sin\ A}{Sec\ A + \tan\ A - 1} + \frac{Cos\ A}{Cosec\ A + \cot\ A - 1} = 1$

(ii) Cos A + Cos B + Cos C – 1=4 Sin$\frac{A}{2}$ Sin $\frac{B}{2}$ Sin $\frac{C}{2}$

(b)(i) Solve the equation $3Sin^2\theta$ – Sin θ Cos θ – $4Cos^2\theta$ = 0 for values of θ from 0 to 360 inclusive.

(ii) Find the maximum and minimum values of the function 12Cos θ + 5Sin θ

(c) In any triangle ABC, prove that:

$$\frac{b-c}{b+c} = \tan \frac{B-C}{2} \text{ Cot } \frac{B+C}{2}$$

6. (a) Find the possible values of x for which

$$\frac{(x+1)(x-3)\ (x+4)}{x-2} = \leq 0$$

(b) Express $\frac{x^3-3x+1}{(x-2)(x+6)}$ into partial fraction

(c) Given that R = $\begin{pmatrix} 1 & 2 & 3 \\ 2 & -3 & 2 \\ 3 & 1 & -1 \end{pmatrix}$

(i) Find the inverse of R
(ii) Use the inverse obtained in c(i) above to solve the following system of equations

x + 2y + 3z = 6
2x + 2z = 14 + 3y
3x + y = z – 2

(d) Expand $\sqrt{1+x}$ in ascending powers of x as far as the term in x^2. Hence estimate $\sqrt{30}$ correct to four significant figures.

7. (a) Solve the differential equations

(i) $\frac{dy}{dx} = yx^2 + 3 + y + 3x^2$

(ii) $xdy = (y + \sqrt{x^2 + y^2})\,dx;\ y(1) = 0$

(b) Solve the differential equation

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0$$

(c) If a radioactive substance had initial mass of 200g, what would be its mass after 30 days if its known that after 8 days, its mass was half of its initial mass?

(d) Find the particular integral of the differential equation $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 5y = 10x^2 + x$

8. (a) If $y = mx + c$ is a tangent to the ellipse $4x^2 + 9y^2 = 36$ then prove that $c = \pm\sqrt{4 + 9m^2}$

(b) Sketch the graph of $r = 5sin3\theta$

(c) (i) Transform the equation $r = \frac{4}{3+5sin\theta}$ into rectangular equation

(ii) Express $(x^2 + y^2)^3 = xy(x^2 - y^2)$ into polar form

(d) Given the hyperbola $9y^2 - 16x^2 + 32x - 36y - 124 = 0$

(i) Express the equation in standard form.

(ii) Find its centre and foci