



TANZANIA HEADS OF ISLAMIC SCHOOL COUNCIL
FORM SIX INTER ISLAMIC MOCK EXAMINATION
ADVANCED MATHEMATICS 2

(For Both School and Private Candidates)

142/2

TIME: 3 Hours

Monday, 09th March 2026 a.m.

Instructions

1. This paper consists of section A and B with a total of **eight (8)** questions.
2. Answer **all** questions in section A and **two (2)** questions from section B.
3. All work done and answers of each question must be shown clearly.
4. Mathematical tables and non-programmable calculators may be used.
5. All writing must be in **black** or **blue** ink, **except for drawings** which must be in pencil.
6. Communication devices and any unauthorized materials are **not** allowed in the examination room.
7. Write your **Examination Number** on every page of your answer booklet(s)

SECTION A (60 Marks)

Answer **all** questions in this section

1. (a) Damali has three tickets for a concert. She would like to use one of the tickets herself. She could then offer the other two tickets to any of her four friends. How many ways can 2 people be selected from 4 to go to a concert?

- (b) The random variable X has a probability distribution below. Determine numerical values of X and Y if $E(x) = \frac{14}{3}$

X	2	3	5	7	9
$P(x = x)$	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{4}$	x	y

- (c) A batch of 1500 Lemonate bottles have an average contents of 753 and standard deviation of the contents is 1.8mL. If the volume of the contents is normally distributed, find;
- The number of bottles likely to contain less than 750mL
 - The number of bottles likely to contain between 751 and 754mL.
2. (a) Given the propositions P -today is Friday, q -Asha is clever, r -you will come tomorrow. Use the propositions to write each of the following in words:
- $(p \wedge q) \vee r$
 - $(p \vee q) \wedge r$
 - $(P \vee \sim r) \rightarrow \sim p$
 - $(q \rightarrow p) \vee (p \rightarrow \sim r)$

- (b) Given that p is $2+2 = 4$. Q -Angola is in Africa and r be $0 > 1$. Determine the truth value of the following:

- $(p \wedge q) \vee r$
- $(p \vee q) \wedge r$
- $(q \rightarrow p) \vee (p \rightarrow 2r)$

- (c) Describe the following argument in symbolic form and test its validity by using a truth table. "If he borrows mathematics book, then he will remain at school. Either he is punished or he does not remain at school. He will not be punished. Therefore he did not borrow mathematics book."
3. (a) If A , B and C are angles formed by the vectors $\underline{r} = x\underline{i} + y\underline{j} + z\underline{k}$ with positive axes of a three dimension coordinate system, find the value of $\cos 2A + \cos 2B + \cos 2C$.

- (b) Forces $F_1 = 3\mathbf{i} - 4\mathbf{j} + 5\mathbf{k}$, $F_2 = 2\mathbf{i} + 6\mathbf{j} - 9\mathbf{k}$ and $F_3 = 2\mathbf{i} + 3\mathbf{j} - 6\mathbf{k}$ used to move a particle 7 meters in the direction of $-2\mathbf{i} + 10\mathbf{j} + 11\mathbf{k}$. Find its work done.
- (c) An Engineer found that the velocity $\underline{V}$ of a particle moving in space through a curved path is a function of time t such that $\underline{V} = 6t^2\mathbf{i} + 4e^{-2t}\mathbf{j} + 8\cos 4t\mathbf{k}$. Find its position after time t if the initial position of the particle is $\underline{r}(0) = (1, 1, 1)$.
4. (a) Find the real values of x and y satisfying the equation

$$\frac{x - 2 + (y - 3)i}{1 + i} = 1 - 3i$$

- (b) If $x = 2 - 3i$ is a root of the polynomial $P(x) = x^4 - 4x^3 + 12x^2 + 4x - 13$, find the other roots.
- (c) Describe the locus of the following equation

$$|z + 1| = 2|z - 1 + 3i|.$$

SECTION B (40 Marks)

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

5. (a) Find all θ which satisfy the equation $10\sec^2\theta - 3 = 17\tan\theta$
- (b) Prove the following identities
- (i) $\frac{\tan x - \tan y}{\cot x - \cot y} = \tan x \tan y$
- (ii) $\sqrt{\frac{1 - \sin x}{1 + \sin x}} = \sec x - \tan x$
- (c) A point moves so that its height is given by $h = 4\cos 2x + 3\sin 2x$.
- (i) Find the maximum height the point can reach.
- (ii) If $h = \frac{5\sqrt{2}}{2}$ units, find all values of x for which $0 \leq x \leq 360^\circ$
- (d) (i) Show that

$$\sin^{-1}\left(\frac{2x}{1+x^2}\right) = 2\tan^{-1}x$$

(ii) If $\sin^{-1}x = 2\tan^{-1}y$ prove that $x = \frac{2y}{1+y^2}$

6. (a) Express $\frac{x^3 - 2x^2 - 4x - 4}{x^2 + x - 2}$ into partial fractions
- (b) A phone is secured with a 4-digit passcode. A security analyst discovers some clues from the access logs. The first digit is x , the second digit is y and the last two digits together form a two digit number z . The analyst noted the sum of all three numbers is 37, twice the first digit minus the second digit plus the last two

digits equals to 36 and the first digit plus twice the second digit minus the last two digits equal – 11. Use determinant method to determine the passcode.

- (c) Using Binomial theorem expand $\frac{1}{(4-x)^2}$ in ascending powers of x as far as the term in x^3 and state the limits of values of x for which the expansion is valid.

(d) Show that
$$\sum_{k=1}^n 2k(k-4)(k+6) = \frac{n(n+1)}{6}(3n^2 + 11n - 140)$$

Hence evaluate
$$\sum_{k=20}^{40} 2k(k-4)(k+6)$$

7. (a) Form a differential equation whose solution is a function $((x-a)^2 + y^2 = a^2$
- (b) Solve the differential equation

$$\ln(y+1) + \left(\frac{x}{y+1}\right) \frac{dy}{dx} = \frac{1}{x(x+1)}$$
- (c) Find the general solution of the following differential equation.

$$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = e^{2x}$$
- (d) A tank contains a salt water solution containing initially 20kg of salt dissolved into 10L of water. Fresh water is being poured into the tank at the rate of 3 L/min and the solution (kept uniform by stirring) is flowing out at 2L/min. Find the amount of salt in the tank after 5 minutes.
8. (a) The curve $y^2 = 8x$ has tangent line with gradient 1. Find the equation of the tangent
- (b) A bullet, when shot into the air at a certain angle, follows a path that is a parabolic curve. The bullet reaches a height of 400m and strikes the ground at a distance of 300m from the firing point. What is the equation of the parabola?
- (c) Given an ellipse with the equation

$$x^2 - 8x + 4y^2 + 12 = 0$$

 Determine:
 (i) The coordinates of foci
 (ii) The coordinates of vertices
 (iii) The equations of directrices
- (d) Sketch the graph of $r = 3 - 3 \sin \theta$

Wabillah Tawfiq