THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

740 **MATHEMATICS**

Time: 3 Hours. **ANSWER** **Year: 2009**

Instructions

1. This paper consists of sections A, B and C.
2. Answer **all** questions from Section A and **two (2)** questions from each of section B and C.
3. Section A and B carry **30** marks, Section C carry 40 marks.
4. Mathematical tables and non-programmable calculators may be used
4. Cellular phones are **not** allowed inside the examination room.
5. Write your **Examination Number** on every page of your answer booklet

SECTION A (40 Marks)

Answer all questions in this section.

1. A survey of 240 houses showed that all of them kept a cat or a dog or both. If 180 houses kept dogs and 79 houses kept cats, how many houses kept both?

Let D represent houses that kept dogs and C represent houses that kept cats.
Total houses = 240

$n(D \cup C) = n(D) + n(C) - n(D \cap C)$

$240 = 180 + 79 - n(D \cap C)$

$240 = 259 - n(D \cap C)$

$n(D \cap C) = 259 - 240$

$n(D \cap C) = 19$

Therefore, 19 houses kept both a cat and a dog.

2. A die and a coin are tossed. Find the probability that a number greater than 4 appears on the die and a tail appears on the coin.

Numbers greater than 4 on a die are 5 and 6.
Probability of number greater than 4 on die = 2/6 = 1/3

Probability of tail on a coin = 1/2

Probability of both events occurring

$= 1/3 \times 1/2$

$= 1/6$

3. Prove that if A is a subset of B and B is a subset of C, then A is a subset of C.

Let x be any element of A.

Since A is a subset of B, x is an element of B.

Since B is a subset of C, x is also an element of C.

Therefore every element of A is an element of C.

Hence A is a subset of C.

4. Find the derivative of $f(x) = \sqrt{(2x + 1)}$ from the first principle.

$f(x) = \sqrt{(2x + 1)}$

$f(x + h) = \sqrt{(2(x + h) + 1)}$

$f(x + h) = \sqrt{(2x + 2h + 1)}$

$f'(x)$ = limit as h approaches 0 of

$[\sqrt{(2x + 2h + 1)} - \sqrt{(2x + 1)}] / h$

Multiply numerator and denominator by the conjugate

$f'(x)$ = limit as h approaches 0 of

$[(2x + 2h + 1) - (2x + 1)] / [h(\sqrt{(2x + 2h + 1)} + \sqrt{(2x + 1)})]$

Simplify numerator

= limit as h approaches 0 of

$2h / [h(\sqrt{(2x + 2h + 1)} + \sqrt{(2x + 1)})]$

Cancel h

f′(x) = limit as h approaches 0 of
2 / [√(2x + 2h + 1) + √(2x + 1)]

Substitute h = 0

f′(x) = 2 / [2√(2x + 1)]

f′(x) = 1 / √(2x + 1)

5.(a) Construct a truth table for p → q.

P	**q**	**p → q**
T	T	T
T	F	F
F	T	T
F	F	T

(b) Construct a truth table for (¬p ∨ q) ↔ (p → q).

P	q	¬p	¬p ∨ q	p → q ↔	
T	T	F	T	T	T
T	F	F	F	F	T
F	T	T	T	T	T
F	F	T	T	T	T

6.(a) In triangles ABC and DEF, angles A and B are respectively congruent to angles D and E. If side AB is represented by $3a - 6$ and side DE by $a + 8$, for what values of a are the two triangles congruent?

For triangles to be congruent, corresponding sides must be equal.

$3a - 6 = a + 8$

$3a - a = 8 + 6$

$2a = 14$

$a = 7$

7.(a) Critically observe Figure 1. If the shaded part is a lake, find the length of the lake.

From the figure, the top horizontal distance is 36 m.
The two slanted sides from the top meet at a point and continue downward symmetrically.
Each slanted side has length 75 m from the meeting point to the lake edge.
The two upper slanted sides are equal, forming two similar triangles.

The ratio of corresponding sides remains constant.
The lower base of the similar triangle represents the lake length.

Since the figure is symmetric, the lower base is equal to the upper base.

Therefore, length of the lake = 36 m.

8.(a) Show that $\cosh^2 x - \sinh^2 x = 1$.

$\cosh x = (e^x + e^{-x})/2$

$\sinh x = (e^x - e^{-x})/2$

$\cosh^2 x = (e^{2x} + 2 + e^{-2x})/4$

$\sinh^2 x = (e^{2x} - 2 + e^{-2x})/4$

$\cosh^2 x - \sinh^2 x$

$= [\ (e^{2x} + 2 + e^{-2x}) - (e^{2x} - 2 + e^{-2x})\ ] / 4$

$= 4/4$

$= 1$

9.(a) In a Mathematics laboratory, one bag contains 10 marbles where 7 are red and 3 are black. During the Mathematics club session, a student drew one marble at random and then replaced it. If another student drew another marble at random, what is the probability that both marbles drawn are red?

Probability of drawing a red marble

$= 7/10$

Since the marble is replaced, probability remains the same for the second draw.

Probability both marbles are red

$= 7/10 \times 7/10$

$= 49/100$

10.(a) A box is represented by Figure 2. Using the scale of 1 cm : 20 cm draw the plan, front and side elevations of the box.

Actual length = 60 cm

Scaled length = 60 ÷ 20 = 3 cm

Actual height = 40 cm

Scaled height = 40 ÷ 20 = 2 cm

Actual depth = 30 cm

Scaled depth = 30 ÷ 20 = 1.5 cm

The plan is a rectangle of length 3 cm and depth 1.5 cm.

The front elevation is a rectangle of length 3 cm and height 2 cm.

The side elevation is a rectangle of depth 1.5 cm and height 2 cm.

SECTION B (40 Marks)

Answer two questions from this section.

11.(a) Mathematics subject is perceived by many as a very difficult subject but also very important in facilitating day to day living of an individual. As a new Mathematics teacher in a secondary school, what will you do to help your learners develop interest in learning Mathematics?

I will relate Mathematics concepts to real life situations such as shopping, transport fares, farming activities, and budgeting so that learners clearly see the usefulness of Mathematics in their daily lives. When learners understand how Mathematics helps them solve real problems, their interest naturally increases.

I will use learner centered teaching methods such as group discussions, problem solving activities, and projects instead of relying only on lectures. This approach actively involves learners in the learning process and reduces fear associated with Mathematics.

I will create a supportive classroom environment where learners are encouraged to ask questions and make mistakes without fear. Positive reinforcement and encouragement help learners build confidence and develop a positive attitude toward Mathematics.

I will use teaching aids, diagrams, and technology where possible to make abstract concepts more concrete and interesting. Visual and interactive materials help learners understand difficult ideas more easily.

12.(a) Secondary school Mathematics syllabus has changed from content based to competence based. Discuss the main reason for this change.

The main reason for the change is to focus on what learners can do with the knowledge they acquire rather than how much content they memorize. Competence based education emphasizes skills, application, and problem solving, which are essential for real life situations.

Another reason is to prepare learners to be independent thinkers who can apply Mathematics in everyday life, work environments, and further studies. This approach helps learners develop critical thinking, creativity, and decision making skills.

The change also aims to address the needs of a changing society and labor market, where practical skills and competencies are more valued than rote learning of facts and formulas.

(b) What is your role in implementing Mathematics competence based teaching and learning?

My role is to design learning activities that allow learners to practice and apply Mathematical skills in meaningful contexts. This includes using tasks that promote reasoning, investigation, and problem solving.

I will continuously assess learners using formative assessment methods to monitor their progress and provide timely feedback that supports competence development.

I will guide learners to reflect on their learning and help them connect Mathematical concepts to real life situations, ensuring that competencies are developed effectively.

13.(a) Describe situations in which Mathematics subject is important to our daily life.

Mathematics is important in financial management where individuals use it to budget income, calculate expenses, savings, profit, and loss. These skills are essential for personal and family economic stability.

It is also important in measurements such as measuring land, constructing houses, cooking, and tailoring, where accuracy is required to achieve correct results.

Mathematics is used in time management, for example in planning daily schedules, calculating travel time, and organizing activities efficiently.

In business and trade, Mathematics is used to calculate prices, discounts, interest, and taxes, which are essential for successful transactions.

14.(a) What does the concept shift of paradigm mean to Mathematics teaching and learning?

Shift of paradigm refers to a change from teacher centered teaching to learner centered teaching in Mathematics. It emphasizes active participation of learners rather than passive reception of information.

It also means moving from memorization of procedures to understanding, application, and development of problem solving skills. Learners are encouraged to think, reason, and explore Mathematical ideas.

(b) With examples, indicate how this shift is demonstrated in the following.

(i) Secondary school Mathematics syllabus.

The syllabus emphasizes competencies such as problem solving, communication, and application of Mathematics in real life rather than listing content topics only. For example, learners are expected to apply algebraic concepts to solve real life problems.

The syllabus includes learner centered activities and assessment methods that focus on skills development rather than memorization.

(ii) Secondary school Mathematics teachers' guide.

The teachers' guide provides guidance on interactive teaching methods such as group work, investigations, and use of teaching aids. This supports learner centered teaching.

It also suggests formative assessment techniques and continuous feedback, which help learners develop competencies through active learning and reflection.

SECTION C (20 Marks)

Answer two questions from this section.

15. Discuss two important aspects of assessing Mathematics work.

One important aspect is formative assessment, which helps the teacher monitor learners' understanding during the learning process. It provides immediate feedback that guides both teaching and learning and helps learners improve continuously.

Another important aspect is summative assessment, which evaluates learners' achievement at the end of a topic or course. It helps determine whether learning objectives have been achieved and provides information for grading and certification.

16. Discuss the relationship between the competence and the specific objectives of the lesson plan.

Specific objectives describe the particular skills, knowledge, or attitudes learners should achieve at the end of a lesson. These objectives guide the teaching and learning activities.

Competence represents the broader ability that learners develop by achieving the specific objectives. When specific objectives are well achieved, they collectively lead to the development of the intended competence.

17. Write short notes on the following concepts as used in planning Mathematics lesson.

Teaching activities refer to actions planned by the teacher to facilitate learning, such as explaining concepts, asking questions, demonstrating procedures, and guiding discussions.

Learning activities are tasks designed for learners to engage actively with the content, such as solving problems, group work, experiments, and discussions that promote understanding.

Assessment activities are methods used to evaluate learners' understanding and progress, including quizzes, oral questions, assignments, and observations during the lesson.

Student's lesson evaluation involves reflecting on the lesson to determine what learners have understood, challenges faced, and areas that need improvement for future teaching.

18. Elaborate the steps which you should follow when constructing a Mathematics test.

The first step is to identify the learning objectives and competencies to be assessed so that the test aligns with what was taught.

The second step is to prepare a table of specification to ensure balanced coverage of content areas and cognitive levels.

Another step is to construct test items that are clear, valid, and appropriate to learners' level, ensuring instructions are well stated.

The final step is to review and moderate the test to eliminate errors, ensure fairness, and confirm that the test measures the intended objectives accurately.