THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
DIPLOMA IN SECONDARY EDUCATION EXAMINATION

740 **MATHEMATICS**

Time: 3 Hours **Year: 2020**

Instructions

1. This paper consists of sections A, B and C with a total of **sixteen** (**16**) questions.
2. Answer **all** questions in section A and **two** (**2**) questions from each of sections B and C.
3. Section A carries **forty** (**40**) marks and sections B and C carry **thirty** (**30**) marks each.
4. In both sections, you are required to show clearly all the necessary steps.
5. Non-programmable calculator, mathematical and statistical tables may be used.
6. All communication devices and any unauthorised materials are **not** allowed in the examination room.
7. Write your **Examination Number** on every page of your answer booklet(s).

2 014741 100019

SECTION A (40 Marks)

Answer **all** questions in this section.

1. List four disciplines where mathematics can be applied.

2. Using algebraic laws of propositions, prove that $(P \wedge Q) \Rightarrow (P \vee Q)$ is a tautology.

3. Given that $\underline{a} = 2\underline{i} + 3\underline{j} - \underline{k}$ and $\underline{b} = 4\underline{i} + 6\underline{j} + \lambda\underline{k}$ are perpendicular.

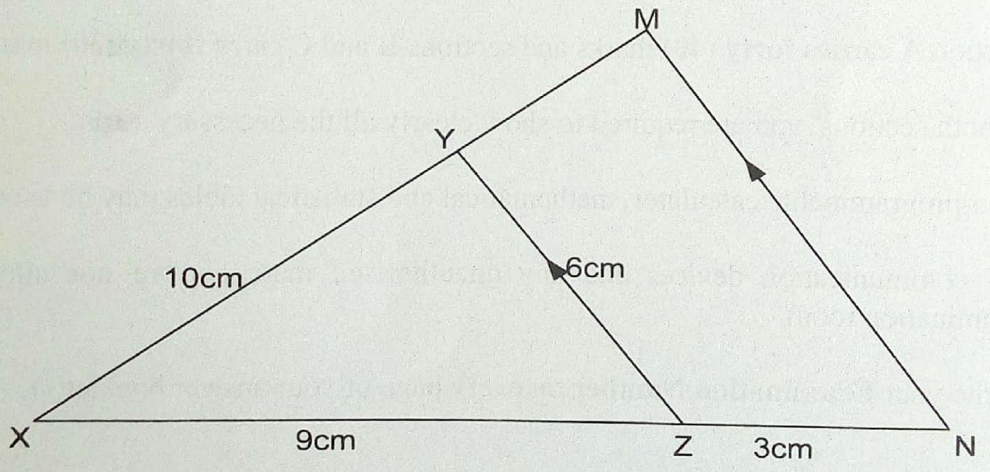
   (a) Find the value of λ.

   (b) Find the projection of vector $\underline{a}$ on vector $\underline{b}$ if $\lambda = 2$.

4. Mention eight important parts of mathematics teachers' subject log book.

5. Find the derivative of $y = \dfrac{e^x \log a^x}{7^x}$.

6. In the following figure, prove that $\triangle XYZ$ is similar to $\triangle XMN$ and hence calculate the lengths $\overline{MN}$ and $\overline{MY}$.



7. (a) In how many ways can three students be selected out of group of ten students?

   (b) How many different colours can be formed from mixing any two out of red, orange, yellow, green and blue if no colour is repeated in any mixture?

8. With the aid of diagram, show how you can guide Form Three students to prove the chord property that, "The perpendicular bisector of a chord passes through the center of a circle".

9. Evaluate the following series;

(a) $\sum_{1}^{4} \frac{1}{n(n+3)}$.

(b) $\sum_{1}^{5} (-1)^n \cdot \bigcap^2$.

10. Define the following terms as applied in Linear Programming:
    (a) Linear Programming problem
    (b) Optimization problem
    (c) Feasible region
    (d) Optimal solution.

SECTION B (30 Marks)

Answer **two (02)** questions from this section.

11. A firm is engaged in breeding goats. The goats are fed on various products grown on the farm. They need certain nutrients, named X, Y and Z. The goats are fed on two products A and B. One unit of product A contains 36 units of X, 3 units of Y and 20 units of Z while one unit of product B contains 6 units of X, 12 units of Y and 10 units of Z. The minimum requirements of X, Y and Z are 108 units, 36 units and 100 units respectively. Product A costs 20Tsh. per unit and product B costs 40Tsh. per unit. How many units of each product must be taken to minimize the cost?

12. (a) Prove the following identities:
    (i) $Sinh3\theta = 3Sinh\theta + 4Sinh^3\theta$.

    (ii) $\frac{1+\tanh x}{1-\tanh x} = e^{2x}$.

    (b) If $\sinh x = \tan y$, show that $e^x = \tan y + \sec y$.

    (c) Prove that $\tanh^{-1} x = \frac{1}{2}\ln\left(\frac{1+x}{1-x}\right)$ and hence approximate the value of $\tanh^{-1} 0.75$.

13. (a) Using standard results of $\sum r^2 = \frac{n}{6}(n+1)(2n+1)$ and $\sum r = \frac{n}{2}(n+1)$; obtain the sum of the first n - terms of the series $2\times3 + 3\times4 + 4\times5 + ...$ in most simplified form.

    (b) If α and β are the roots of quadratic equation $x^2 - 3x - 5 = 0$. Find quadratic equation whose roots are;
    (i) $\alpha - 3$ and $\beta - 3$.

    (ii) $\frac{1}{\alpha+1}$ and $\frac{1}{\beta+1}$.

SECTION C (30 Marks)

Answer **two (02)** questions from this section.

14. Mathematics is perceived by many students as a difficult subject. How can you motivate students to develop interest on the subject? Explain by giving five points.

15. Mathematics classroom should be well organized for effective teaching and learning. Describe five significances of classroom organization.

16. Describe five components of lesson development in the lesson plan.