2901/102
APPLIED MATHEMATICS
AND ECONOMICS
June/July 2020
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN PETROLEUM GOESCIENCE

MODULE I

APPLIED MATHEMATICS AND ECONOMICS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
A non programmable scientific calculator;
An answer booklet.
*This paper consists of **TWO** sections; A (**Applied Mathematics**) and B (**Economics**).*
*Section A and B have **4** questions each.*
*Answer a total of **FIVE** questions choosing at least **TWO** questions from each section.*
Maximum marks for each part of a question are indicated.
Candidates should answer the questions in English.

This paper consists of 4 printed pages.

Candidates should check the question paper to ascertain that all
the pages are printed as indicated and that no questions are missing.

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SECTION A: APPLIED MATHEMATICS
*Answer at least **TWO** questions from this section.*

1. (a) (i) Express $\sinh^{-1}x$ in logarithmic form.
   (ii) Hence determine the value of $\sinh^{-1}x(1.7)$ correct to **four** decimal places.

   (7 marks)

   (b) Determine the polar form of the curve $y^2 + 4x = 4$.

   (7 marks)

   (c) Prove the identities:

   (i) $\dfrac{\cos 3\theta + \cos 5\theta}{\sin 5\theta - \sin 3\theta} = \cot \theta$;

   (ii) $\tan h\, 2x = \dfrac{2\tan h\, x}{1 + \tan h^2\, x}$.

   (6 marks)

2. (a) A metal sphere expands when heated such that the radius increases at the rate of 0.005 cm/s. Use differentiation to determine the rate of increase of the volume at the instant when the radius is 1.5 cm.

   (6 marks)

   (b) Determine the volume of the solid formed when the curve $y = 2\sqrt{x} + 1$ is rotated through 360° about the x axis between the ordinates $x = 1$ and $x = 4$.

   (7 marks)

   (c) Evaluate the integral $\displaystyle\int_0^{\pi} \sin 3x \cos 2x \, dx$.

   (7 marks)

3. (a) 15% of the number of workers in a petrol station suffer from hypertension. Determine in a group of 12 workers selected at random, the probability that:

   (i) **none** suffer from the disease;
   (ii) **one** suffer from the disease;
   (iii) **two** suffer from the disease; and
   (iv) almost **three** suffer from the disease.

   (6 marks)

(b) Table I shows the frequency distribution of the floor area of 70 petrol stations in square metres. Study and use it to answer the questions that follow.

Table I

Floor area (m^2)	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20
Frequency	2	3	7	13	16	12	8	6	3

Determine the:

(i) mean;
(ii) standard deviation;
(iii) median.

(14 marks)

4. (a) Use elimination method to solve the simultaneous equations:

$$x + y - z = 0$$
$$-x + 2y + z = 9$$
$$2x + y + z = 12$$

(8 marks)

(b) Use the method of completing the square to solve $4x^2 + 7x - 3 = 0$. (6 marks)

(c) Solve the equation $5^{2x} = 7(5^x) - 12$ correct to four decimal places. (6 marks)

SECTION B: ECONOMICS

Answer at least TWO questions from this section.

5. (a) Outline **four** features of a traditional economic system. (4 marks)

(b) (i) Distinguish between Gross National Product (GNP) and Gross Domestic Product (GDP).

(ii) Explain **three** reasons that make it necessary for a country to maintain national income statistics. (10 marks)

(c) Explain **three** agency functions that commercial banks perform on behalf of their customers. (6 marks)

6. (a) With the aid of illustrative diagrams, distinguish between movement along the demand curve and shift of the demand curve. (6 marks)

(b) Explain **four** strategies that the Kenyan government may adopt to reduce unemployment rates in the country. (8 marks)

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(c)   (i)   Describe demand-pull inflation.

       (ii)   Explain **two** causes of demand-pull inflation.

                                               (6 marks)

7.   (a)   Explain **four** indicators of a perfectly competitive market   (8 marks)

     (b)   (i)   Explain the term fiscal policy.

            (ii)   State **four** objectives of fiscal policy in a developing country

                                             (6 marks)

     (c)   Explain **three** factors that may influence the price of a product.   (6 marks)

8.   (a)   State **six** barriers to geographical mobility of labour as a factor of production.

                                             (6 marks)

     (b)   (i)   Distinguish between *tariff* and *quota* as used in international trade.

            (ii)   Outline **four** ways in which a country may encourage international trade.

                                             (8 marks)

     (c)   Explain **three** factors that may cause a fall in the supply of a product in the market.

                                             (6 marks)

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