

2901/102  
APPLIED MATHEMATICS  
AND ECONOMICS  
June/July 2022  
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN PETROLEUM GEOSCIENCE  
MODULE I

APPLIED MATHEMATICS AND ECONOMICS

3 hours

INSTRUCTIONS TO CANDIDATES

*You should have the following for this examination:*

*non programmable scientific calculator;*

*answer booklet.*

*This paper consists of EIGHT questions in TWO sections: A and B.*

*Answer FIVE questions, taking at least TWO questions from each section.*

*Maximum marks for each part of a question are indicated.*

*Candidates should answer the questions in English.*

*An abridged standard normal distribution table is attached.*

**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.**

## SECTION A: APPLIED MATHEMATICS

*Answer at least TWO questions from this section.*

1. (a) Three students A, B and C sit for an aptitude test. Their probabilities of passing the test are  $\frac{1}{2}$ ,  $\frac{1}{3}$  and  $\frac{1}{4}$  respectively.

Determine the probability that:

- (i) all pass;
- (ii) all fail;
- (iii) one passes;
- (iv) at most two pass the test.

(8 marks)

- (b) The data in table I shows the heights of students in a class.

**Table I**

Height (cm)	130 - 135	135 - 140	140 - 145	145 - 150	150 - 155	155 - 160
Number of students	3	5	4	7	10	4

Determine the:

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

(12 marks)

2. (a) Evaluate the integral  $\int_0^{\pi} \sin 8x \cos 4x dx$ . (3 marks)

- (b) Given that  $y = \ln \left[ \frac{\sin x + \cos x}{\sin x - \cos x} \right]$ , show that  $\frac{dy}{dx} = 2 \sec 2x$ . (9 marks)

- (c) The modulus of rigidity  $G$  of a metal is given by  $G = \frac{R^4 \theta}{L}$ , where  $R$  is the radius,  $\theta$  is the angle of twist and  $L$  is the length. Determine using partial differentiation the percentage change in  $G$  when  $R$  increases by 4%,  $L$  increases by 6% and  $\theta$  reduces by 8%. (8 marks)

3. (a) Solve the equation  $9^x + 3^{2x} - 1 = 53$ . (6 marks)

- (b) (i) Use binomial theorem to expand  $\sqrt{\frac{1 - \frac{1}{2}x}{1 + \frac{1}{2}x}}$  up to the term in  $x^3$ . (10 marks)

- (ii) By letting  $x = \frac{1}{2}$  in (i), determine  $\sqrt{0.6}$  correct to 4 decimal places. (4 marks)

- (c) Use factorization to solve the equation  $x^2 + 10x + 21 = 0$ . (4 marks)
4. (a) Prove that  $\sin^{-1} \frac{4}{5} + \sin^{-1} \frac{3}{5} = \frac{\pi}{2}$ . (6 marks)
- (b) Express  $\sinh 3A$  in terms of powers of  $\sinh A$ . (4 marks)
- (c) (i) Express  $8\sin x + 6\cos x$  in the form  $R\sin(x + 2)$  where  $x$  is an acute angle. (4 marks)
- (ii) Hence solve the equation  $8\sin x + 6\cos x = 7$  for  $0^\circ \leq x < 360^\circ$ . (8 marks)

### SECTION B: ECONOMICS

*Answer at least TWO questions from this section.*

5. (a) Explain **four** features of economic resources. (8 marks)
- (b) Explain **four** roles played by commercial banks in an economy. (8 marks)
- (c) Highlight **four** factors that may account for low economic growth in developing countries. (4 marks)
6. (a) Explain **four** disadvantages of a free market system. (8 marks)
- (b) Explain **two** exceptions to the law of demand. (4 marks)
- (c) Explain **four** roles played by the International Monetary Fund (IMF) in developing countries. (8 marks)
7. (a) Explain **three** challenges that may be associated with unemployment in developing countries. (6 marks)
- (b) Outline **four** characteristics of land as a factor of production. (4 marks)
- (c) Explain **five** factors that may influence the supply of a commodity. (10 marks)
8. (a) Certain factors determine the choice of goods to be produced in a firm. Explain **four** such factors. (8 marks)
- (b) Explain **three** advantages of indirect taxes. (6 marks)
- (c) Explain **three** circumstances under which demand-pull inflation may occur in a country. (6 marks)