Name: _____ Index No: _____/_____

9516/1
MATHEMATICS
Paper 1
D.T.E.
March / April 2018
Time: 3 hours

Candidate's Signature: _____

Date: _____

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN TEACHER EDUCATION

MATHEMATICS

Paper 1

3 hours

INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.
Sign and write the date of examination in the spaces provided above.
*This paper consists of **FOUR** sections; **A**, **B**, **C**, and **D**.*
*Answer **SIX** questions as follows:*
*Question **ONE** in section **A** is **compulsory**;*
*Answer any **THREE** questions from section **B**;*
*Answer any **ONE** question from section **C**;*
*Answer any **ONE** question from section **D**.*
*Answers to the questions **MUST** be written in the spaces provided.*
Mathematical tables and/or scientific calculators may be used.
*Do **NOT** remove any pages from this booklet.*
Candidates should answer the questions in English.

For Examiner's Use Only

Section	Question	Maximum Score	Candidate's Score
A	1	25	
B	2	15	
	3	15	
	4	15	
	5	15	
	6	15	
C	7	15	
	8	15	
D	9	15	
	10	15	
		Total Score	

This paper consists of 18 printed pages.

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

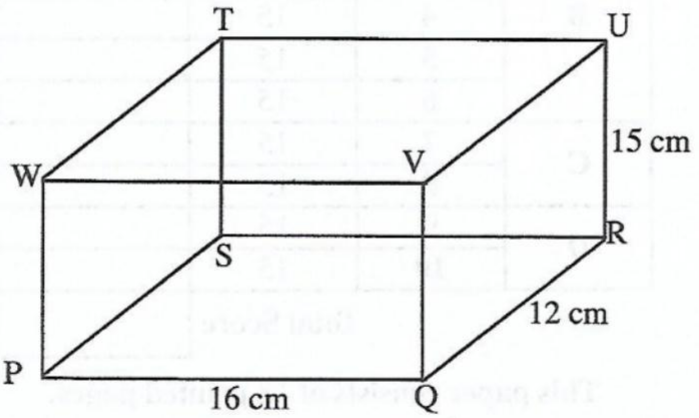
SECTION A (25 marks)

*Answer **ALL** the questions in this section in the spaces provided.*

1. (a) Find the image of the point Q(6,3) under a rotation of 60° anticlockwise about the origin. (4 marks)

(b) A circle passes through the points (1,7), (-2,-2) and (-8,10). Determine it's equation. (4 marks)

(c) The figure below shows a cuboid PQRSTUVW with dimensions as shown.



Calculate the angle between the plane PQRS and the line WR. (4 marks)

(d) The equation of an ellipse is $x^2 + 9y^2 - 4x - 18y + 4 = 0$. Determine the foci and the vertices of the ellipse. (5 marks)

(e) In a game one participant tosses a coin and another throws a die. Determine the probability that the outcome will be:

(i) a tail and a three; (2 marks)

(ii) a head and an odd number. (2 marks)

(f) If vectors **a** and **b** are neither parallel nor zero, determine the values of the scalars h and k such that $h(3\mathbf{a} - \mathbf{b}) = (2 - 3k)\mathbf{b} + k\mathbf{a}$. (4 marks)

SECTION B: ANALYSIS AND CALCULUS (45 marks)

*Answer any **THREE** questions from this section in the spaces provided after question 6.*

2. (a) Given the function $f(x) = x^2 + 2x + 1$, evaluate $f^{-1}(3)$. (3 marks)

(b) Using the first principles, find the derivative of

$$f(x) = \frac{1}{x^2+1}.$$

(5 marks)

(c) Evaluate the integral

$$\int \frac{2x-1}{(x+1)^2} dx.$$

(4 marks)

(d) Evaluate $\int_0^2 f(x)\,dx$, where

$$f(x) = \begin{cases} 5x^4 + 1, & \text{if } 0 \le x < 1 \\ x^5 - 3 & \text{if } 1 < x \le 2 \end{cases}$$

(3 marks)

3. (a) Find the domain and the range of the function $f(x) = \sqrt{9 - x^2}$. Hence sketch the curve. **(4 marks)**

(b) Evaluate $\int \cos^2\theta \cos 5\theta d\theta$ **(4 marks)**

(c) Given the function $f(x) = 4x^3 - 12x + 8$, determine the x and y intercepts of the curve and the nature of the turning points of the curve.

(7 marks)

4. (a) Evaluate

$$\lim_{x \to \infty} \sqrt{x^2 + x + 1} - x.$$

(4 marks)

(b) Determine the length of the arc of the curve $y^2 = (x - 1)^3$ from A(1,0) to B(2,1).

(5 marks)

(c) Solve the differential equation

$$\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 6e^{3x} + e^{-2x}.$$

(6 marks)

5. (a) Evaluate

$$\lim_{x \to -2} \frac{x^2 - 4}{x^2 + x - 2}.$$

(3 marks)

(b) Differentiate the function $y = \log_2(5x^3)$.

(3 marks)

(c) Evaluate $\int (x+3)\sqrt{2x-1}\,dx$.

(3 marks)

(d) Solve the initial value problem

$$x^2 \frac{dy}{dx} + y - 2xy = x^2,\ y(1) = 2.$$

(6 marks)

6. (a) Evaluate $\lim_{x \to 0} \frac{\cos x - x}{x^2}$.

(3 marks)

(b) Given $y = 3^{x^2}$, find $\frac{dy}{dx}$.

(3 marks)

(c) Evaluate $\int x^3 \ln x\,dx$. (3 marks)

(d) The rate at which the ice melts is proportional to the amount of ice at that instant. Find the amount of ice left after 2 hours if half the quantity melts in 30 minutes.

(6 marks)