Mathematics B

T109

Wednesday, 09/11/2016

08:30 – 11:30

WORKFORCE DEVELOPMENT AUTHORITY

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ADVANCED LEVEL NATIONAL EXAMINATIONS, 2016, TECHNICAL AND PROFESSIONAL STUDIES

EXAM TITLE: Mathematics B

OPTIONS:

"Electricity (ELC), Computer Electronics (CEL), Electronics and Telecommunication (ETL), Construction (CST), Public Works (PWO), Surveying (SUR), Graphic Arts (ART), Sculpture and Ceramics (SCE), Tailoring (TAL), General Mechanics (GME), Motor Vehicle Mechanics (MVM)"

DURATION: 3 hours

INSTRUCTIONS:

The paper is composed of **two (2) main Sections** as follows:

Section **I**: Fourteen **(14)** questions, all **Compulsory**. **55 marks**

Section **II**: Attempt any **three (3)** out of five (5) given questions. **45 marks**

Note:

Every candidate is required to carefully comply with the above instructions. Penalty measures will be applied on their strict consideration.

Section I. Fourteen (14) Compulsory questions — 55 marks

01. Solve the following inequality: $6(x + 4) - 7 - (3x + 10) \geq 8(x - 1)$ **4 marks**

02. If $p > 0$, and the distance between the points (4, -1) and (-2, p) is 10, find p. **4 marks**

03. Consider the function $f(x) = 3x - x^2 - 1$

(i) Write down $f'(x)$

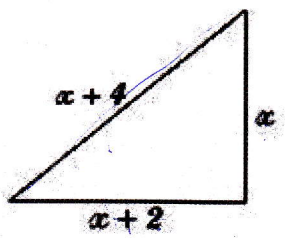
(ii) Find coordinate on the curve $y = f(x)$ for which $f(x) = f'(x)$. **4 marks**

04. The first four terms of an arithmetic sequence are 5,8,11 and 14. Calculate the sum of the first 8 terms. **4 marks**

05. Lauren took four exams. Her scores on the first three are 89, 85, and 90. If her average (arithmetic mean) on all four exams is 90, what did she get on the fourth exam? **4 marks**

06. Find the equation of the tangent line drawn to the graph of $y = x^3 + 3x^2 - 5$ which is perpendicular to the line $2x - 6y + 1 = 0$ **4 marks**

07. A right triangle has sides whose lengths are three consecutive even integers. Find the lengths of the sides and hence find area of the triangle. Consider the figure below **4 marks**



08. Sylvia is paid 90,000rwf a week plus commission of 8% on 600,000 sales. Find the total amount she receives. **2 marks**

09. Find the values a real number x and y in each of the following:

$$\frac{x}{2-i} + \frac{iy}{i+3} = \frac{2}{1+i}$$ **4 marks**

10. Let $G(x) = \frac{2x+1}{x-3}$. Find $G\left(-\frac{1}{2}\right) + G(2)$. **4 marks**

11. The line $y = mx + b$ passes through the points (0, 7) and (-2, 3). Determine the value of m and b. **4 marks**

12. If $y = \sin x$ show that $\frac{d^2y}{dx^2} + y = 0$. **3 marks**

13. Find A and B such that $\frac{4x+2}{(x-1)(x-3)} = \frac{A}{x-1} + \frac{B}{x-3}$ and hence calculate $\int \frac{4x+2}{(x-1)(x-3)} dx$ **5 marks**

14. Z is inversely proportional to t so that $z = \frac{k}{w^2}$. When $w = 4, z = 16$

(a) Find the value of k

(b) Calculate the value of z when $w = 2$

(c) Using the value of k found in question (a) **4 marks**

Section II. Choose and answer any three (3) questions **45 marks**

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15. Let $f(x) = (x-1)(10-x)$ for $1 \leq x \leq 10$. Find:

a. Domain of definition of $f(x)$

b. $f(-6) and\ f(2)$

c. $f(1+2t)$ and give the domain of definition.

d. Graph $f(x)$ **15 marks**

16. Find the equation of tangent and normal at indicated point.

a. $x^2 - 4y^2 = 9\,;(5,2)$

b. $\cos(x+2y) = 0\,;\left(\frac{\pi}{6},\frac{\pi}{6}\right)$ **15 marks**

17. Find the Direction vector and position vector of the line

$D \equiv \begin{cases} 2x - y + 6z = 1 \\ 3x - y + 4z = 5 \end{cases}$ **15 marks**

18. Consider the geometric sequence with the first term 2 and common ratio 1.1.

a. What is the 10^{th} term?

b. Which terms of the sequence are greater than 20? **15 marks**

19. Let $(x) = \frac{5-3x^2}{1-x^2}$. Find:

a. The domain of definition

b. Find equations of all possible asymptotes

c. Find the intervals on which $f(x)$ increases and the intervals on which $f(x)$ decreases

d. Sketch the graph of $f(x)$ **15 marks**