

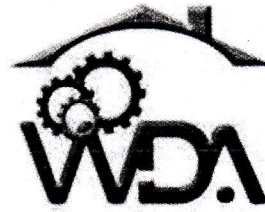
Mathematics B

T082

Wednesday, 11/11/2015

08:30 – 11:30

WORKFORCE DEVELOPMENT AUTHORITY



P.O. BOX 2707 Kigali, Rwanda Tel: (+250) 255113365

**ADVANCED LEVEL NATIONAL EXAMINATIONS, 2015,
TECHNICAL AND PROFESSIONAL TRADES**

EXAM TITLE: Mathematics B

OPTIONS:

- Electricity (ELC)
- Construction (CST)
- Public Works (PWO)
- Motor Vehicle Mechanics (MVM)
- Electronics and Telecommunication (ETL)
- Computer Electronics (CEL)
- Tailoring (TAL)
- General Mechanics (GME)

DURATION: 3hours

INSTRUCTIONS:

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

Section I: Thirteen (13) questions, all **Compulsory.**

55marks

Section II: Five (5) questions, **Choose Three (3) only.**

45marks

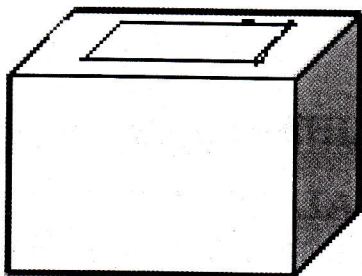
Every candidate is required to strictly obey the above instructions. Punishment measures will be applied to anyone who ignores these instructions.

Section I. Thirteen (13) Compulsory questions 55marks

01. Factorize $4x^2 - 64$ **2marks**

02. Calculate the derivative of $y = \frac{x^2+1}{x^2-1}$; $x^2 \neq 1$ **2marks**

03. The figure below represents an open rectangular box made of wood 1cm thick.



If the external dimensions of the box are 42cm long, 32cm wide and 15cm deep; and the internal measurement of the box are 40cm long, 30 cm wide and 14cm deep. Calculate the volume of wood in the box. **4marks**

04. Calculate $\lim_{x \rightarrow \infty} \frac{e^x - 1}{x}$ **3marks**

05. Calculate the size of each angle of a regular pentagon. **4marks**

06. Solve in IR, $\log_6(x+4) + \log_6(x-2) = \log_6(4x)$ **5marks**

07. Given that $\vec{a} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$; $\vec{b} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$

Calculate:

i. $2\vec{a} + \vec{b}$ **3marks**

ii. $|2\vec{a} + \vec{b}|$ **2marks**

08. Solve the following equation for $0 \leq x \leq 2\pi$

$$\cos 2x = 3 \sin x + 2\pi$$
5marks

09. A cuboid has 12cm of length, 8cm of width and 7cm of height.

i. Calculate its area.

ii. Find its volume. **5marks**

10. Solve the following equation in \mathbb{R}^2 **5marks**

$$\begin{cases} y = 3x + 2 \\ y - x = 2 \end{cases}$$

11. Evaluate $\int \frac{3x+1}{\sqrt{4x^2+9}} dx$ **5marks**

12. i. Construct the triangle PQR in which PQ = 10cm, angle PQR = 40° and angle PRQ = 75° 2marks
- ii. Calculate the third angle of the triangle. 2marks
- iii. Calculate the area of the triangle if its height is 6cm. 1mark
13. Given points P, Q, R in space, find the equation of the plane through the points. P = (1, 1, 1), Q = (1, 2, 0), R = (-1, 2, 1). 5marks

Section II. Answer any three (3) questions of your choice

(Do not choose more than three questions). 45marks

14. a. The third term of an Arithmetic Progression is 73 and the eight terms is 13.
- i. Find the common difference 6marks
- ii. Find the first 4marks
- iii. Find the 12th 2marks
- b. If $\vec{a} = 7\vec{i} + 8\vec{j}$ and $\vec{b} = 5\vec{i} - 2\vec{j}$; Find the scalar product $\vec{a} \cdot \vec{b}$ 3marks
15. Solve the following system of linear equations using Cramer's methods:
- $$\begin{cases} 3x + 4y + z = 10 \\ 2x - 3y + 5z = -9 \\ x + 2y - z = 6 \end{cases} \quad \text{15marks}$$
16. A line passes through points A (2,-1, 5) and B(3,6,-4)
- a) Write a vector equation of the line; 5marks
- b) Write parametric equations for the line; 6marks
- c) Determine if the point C (0,-15, 9) lies on the line. 4marks
17. a) Verify that $\arctan \frac{1}{2} + \arctan \frac{1}{3} = \frac{\pi}{4}$ 12marks
- b) Solve in IR: $9^x - 2 \cdot 3^{x+1} = 27$ 3marks
18. Let $f(x) = \frac{x+2}{x+1}$
- a) Find domain of definition of f(x); 2marks
- b) Verify the parity; 2marks
- c) Calculate the boundary limits and relative asymptotes to f(x); 3marks
- d) Find $f'(x)$ and its table of signs; 3marks
- e) Find $f''(x)$ and its table of signs; 2marks
- f) Sketch the graph of f(x). 3marks