Mathematics B
T065

Wednesday, 30/10/2013
8: 30 – 11: 30 AM

WORKFORCE DEVELOPMENT AUTHORITY

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

ADVANCED LEVEL NATIONAL EXAMINATION, 2013, TECHNICAL AND PROFESSIONAL TRADES

EXAM TITLE: Mathematics B

OPTIONS:

01. Electricity	(ELC)	07. Computer Electronics	(CEL)
02. Graphic Arts	(ART)	08. Electronics and Telecommunication	(ETL)
03. Sculpture Ceramics	(SCE)	09. General Mechanics	(GME)
04. Carpentry	(CAP)	10. Motor Vehicle Mechanics	(MVM)
05. Tailoring	(TAL)	11. Public Works	(PWO)
06. Construction	(CST)		

DURATION: 3hours

INSTRUCTIONS:

The paper contains **two (2)** Sections:

Section I: Fifteen **(15)** Compulsory Questions **55marks**

Section II: Five **(5)** questions, choose three **(3)** **45marks**

Section I: Attempt all 15 questions. 55marks

01. Find the values of x which satisfy the equation $2x^2 - 3x = 0$. **2marks**

02. Solve in IR the equation $\sqrt{x+6} + x = 14$. **3marks**

03. Given that $f(x) = 3 - 7x + 5x^2 - x^3$, show that $3 - x$ is a factor of $f(x)$. Factorize $f(x)$ completely and hence state the set of values for which $f(x) \leq 0$. **4marks**

04. Solve, using substitution, the following simultaneous equations. **3marks**

$$\begin{cases} y + 7 = 12x - 3x^2 \\ 13 = 9x - y \end{cases}$$

05. For what value of d does $p(x) = x^2 + dx + 4$ yield the same remainder when divided by either $x - 1$ or $x - 3$? **3marks**

06. Find centre and radius of the circle represented by the following equation : $x^2 + y^2 - 4x + 2y - 11 = 0$. **3marks**

07. Find the coordinates of the points where the curve $y = x^3 + 6x^2 + 11x + 6$ cuts :

(a) The $y - axis$. **4marks**

(b) The $x - axis$.

08. Evaluate: $\lim_{x \to 1} \frac{\sqrt{5x-4} - \sqrt{x}}{x - 1}$. **3marks**

09. Find all the angles between 0 and 2π which satisfy the equation

$$(1 + 2sinx)cos2x = 0.$$ **4marks**

10. Find the point where the line joining (3,2,1) and (5,4,2) cuts the plan $x + y + 2z = 19$. **4marks**

11. The sum of the first and fourth terms of an arithmetic sequence is 2, and the sum of their squares is 20.

i. Find the common difference **2.5marks**

ii. Find the sum of the first eight terms of the sequence. **2.5marks**

12. If $V = 30t - 6t^2$, find $\frac{dV}{dt}$ and hence find the maximum value of V and the value of t for which it occurs. **3marks**

13. Find the equations of asymptotes of the following function:

$$y = \frac{x^2+5x+4}{x}$$ **4marks**

14. Given that $z_1 = 3 + 2i$ and $z_2 = 4 - 3i$,

i. Find $z_1 z_2$ and $\frac{z_1}{z_2}$, each in the form $a + bi$.

ii. Verify that $|z_1 z_2| = |z_1||z_2|$. **5marks**

15. Evaluate $\int_3^4 \frac{3}{x^2-4} dx$, correct to 3 significant figures. **5marks**

Section II: Attempt any three (3) questions 45marks

16. Given the function $f(x) = \frac{1}{x-3} + 2$.

a) Find the domain of definition. **1mark**

b) Find asymptotes to the curve. **3marks**

c) Compute the first derivative and study its sign. **3marks**

d) Compute the second derivative and study its sign. **2marks**

e) Find the variation table. **2marks**

f) Find intercept point with axes. **2marks**

g) Sketch the graph of function $f(x)$. **2marks**

17. The table below shows marks scored by 10 students in physics and mathematics tests.

Physics (x_i)	8	7	6	9	8	9	7	8	5	6
Math (y_i)	7	8	7	9	8	8	7	9	7	5

(a) Represent the data above on a scatter diagram. **2marks**

(b) Find means, variances, covariance and standard deviations. **6marks**

(c) Find an equation of line of best fit (regression line) in the form:

$y = a + bx$. **3marks**

(d) If a student scored 7.5 in physics, predict his score in mathematics. **2marks**

(e) Find coefficient of correlation. **2marks**

18. a) Given a complex number $z = \left(\frac{-1}{2} + i\frac{\sqrt{3}}{2}\right)$

i. Put z in polar form (trigonometric form) **3marks**

ii. Calculate z^{2014} ; leave your answer in algebraic form $(a + bi)$. **3marks**

iii. Find the fourth roots of z . Leave your answer in algebraic form $(a + bi)$. **5marks**

b) In argand diagram, the point P represents the complex number.

Given that $|z - 1 - i| = \sqrt{2}$, Sketch the locus of P. **4marks**

19. a) The curves $y = 2x^2 - 3x$ and $y = x^2$ intersect at two points.

i. Find these points of intersection. **3marks**

ii. Find the equation of the straight line joining these points. **3marks**

b) Given a triangle with vertices $A(1,-2,3)$; $B(2,4,-1)$ and $C(1,3,2)$.

i. Find equations of sides. **3marks**

ii. Find equation of the plane ABC. **3marks**

iii. Find area of the triangle ABC. **3marks**

20. a) Solve the following equations :

i. $6^{3x+1} = 7^{2-x}$. **3marks**

ii. $\begin{cases} 5x + 4y = 12 \\ ln(x-1) + lny = ln3 - ln5 \end{cases}$ **3marks**

iii. $e^{2x} + 3e^{x} - 4 = 0$ **3marks**

b) Evaluate the following integrals

i. $\int_0^{\pi/2}(5sin3x + 2cosx)dx$ **3marks**

ii. $\int_0^1 \left(\frac{x}{x+1}\right)dx$ **3marks**