

**TVET – Mathematics B**

**T109**

**Wednesday, 22/11/2017**

**08:30 – 11:30 AM**

**WORKFORCE DEVELOPMENT AUTHORITY**



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**ADVANCED LEVEL NATIONAL EXAMINATIONS, 2017,  
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: Thirteen (13) compulsory questions. 55 marks**

**Section II: Attempt any three (3) out of five 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. Thirteen (13) Compulsory questions****55 marks**

- 01.** Find the distance from the point (3, 1, 5) to the plane  $X - 3Y + 2Z - 5 = 0$   
**(2marks)**
- 02.** If matrices  $A = \begin{pmatrix} 4 & 5 \\ 3 & -2 \end{pmatrix}$  and  $B = \begin{pmatrix} 3 & -1 \\ -6 & 7 \end{pmatrix}$  Find  $3A+B$  **(5marks)**
- 03.** Solve in IR;  $2x^2 - 13x - 45 = 0$  **(4marks)**
- 04.** In arithmetical progression, the thirteenth term is 27 and the seventh is three times the second. Find the first term, the common difference and the sum of the first ten terms. **(5marks)**
- 05.** Given that  $\frac{P}{(x-2)} + \frac{K}{(x+3)} = \frac{1}{(x-2)(x+3)}$ , find the value of the constants P and K  
Hence calculate  $\int \frac{1}{(x-2)(x+3)}$  **(5marks)**
- 06.** Find  $\int \sin^2 x dx$  **(5marks)**
- 07.** Solve  $\log_2(x) + \log_2(x - 2) = 3$  **(4marks)**
- 08.** Find  $\frac{dy}{dx}$  if  $y = \sin^3 x$  **(4marks)**
- 09.** Find the equation of the plane through the point (1, -2, 4) and perpendicular to the vector  $\langle 2, 4, -4 \rangle$  **(4marks)**
- 10.** Find  $\lim_{x \rightarrow \infty} \frac{3x}{\sqrt{16x^2 + 1}}$  **(4marks)**
- 11.** Find the vertical and horizontal asymptotes of the curve  $y = \frac{3x+1}{x-3}$   
**(3marks)**
- 12.** Express  $\sin(2t) \sin(4t)$  as sum or difference. **(5marks)**
- 13.** Solve  $\cos(2t) = \cos(t)$  **(5marks)**

14. Given the function study  $f(x) = \frac{2x^2}{2x^2-8}$

- (a) Determine the domain of definition
- (b) Find the intercept point with axe
- (c) Periodicity
- (d) Find the asymptote to the curve
- (e) Compute the first derivative and study its sign
- (f) Compute the second derivative and study its sign
- (g) Sketch the graph of  $f(x)$

15.

**A)** A circle has centre C (-3, 1) and radius  $\sqrt{13}$

**(a)**

**(1)** Express the equation of the circle in the form

$$(x - a)^2 + (y - b)^2 = k$$

**(2)** Hence find the equation of the circle in the form

$$x^2 + y^2 + mx + ny + p = 0 \text{ where } m, n \text{ and } p \text{ are integers}$$

**(b)** The circle cuts the y-axis at the points A and B; find the distance AB.

**(c)**

**(1)** Verify that the points D (-5, -2) lies on the circle.

**(2)** Find the gradient of CD

**(3)** Hence find an equation of tangents to the circle at point D

**B)** If  $\vec{a} = 5\vec{i} + 3\vec{j} - 2\vec{k}$  and  $\vec{e} = 8\vec{i} - 9\vec{j} + 11\vec{k}$ . Find the scalar product  $\vec{a} \cdot \vec{e}$



16.

a) The plane containing the line  $[x, y, z] = [0, 3, -5] + t[6, -2, 1]$  and parallel to the line  $[x, y, z] = [1, 7, -4] + s[1, -3, 3]$

(1) Find the vector equations of each plane

(2) Find parametric equations of the plane

b) Find  $\int x \cos 8x dx$

c) Solve  $16^{2x-5} = 64$

17.

a) Given  $\frac{(x+1)^2}{9} + \frac{(y-2)^2}{25} = 1$  an equation of ellipse

(1) Determine the centre of an ellipse.

(2) Calculate the horizontal distance from the centre to the edge of ellipse.

(3) Calculate the vertical distance from the centre to the edge of ellipse.

b) The polynomial  $P(x)$  is given by  $P(x) = x^3 + cx^2 + dx + 3$  where  $C$  and  $d$  are integers.

(1) given that  $x + 3$  is a factor of  $p(x)$ , show that  $3c - d = 8$

(2) If the remainder of  $P(x)$  when divided by  $x-2$  is 65; find the equation in  $c$  and  $d$

(3) Use the equation obtained from 17b(1) and 17b(2) to find the value  $c$  and value  $d$ .

18.

A. The line  $AB$  has equation  $3x + 2y = 7$ . The point  $C$  has coordinates  $(2, -7)$

(a) (1) Find the gradient of  $AB$ .

(2) The line which passes through  $C$  and which is parallel to  $AB$  crosses the  $y$ -axis at the point  $D$ . Find the  $y$ -coordinate of  $D$ .

(b) The line with equation  $y = 1 - 4x$  intersects the line  $AB$  at the point  $A$ . Find the coordinates of  $A$

(c) The point  $E$  has coordinates  $(5, k)$ . Given that  $CE$  has length 5, find the two possible values of the constant  $k$ .

B. Find  $\frac{dy}{dx}$  if  $y = \tan(4x + 3)$