



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

**MOTOR MECHANICS; PRECISION MACHINING; MVBR; AUTOMOBILE
ELECTRICS AND ELECTRONICS, DPF**

SUBJECT: Engineering Mathematics

**PAPER NO: 346/13/S08
346/18/S08**

DURATION: 3 Hours

MARCH/APRIL 2023 EXAMINATION

REQUIREMENTS

Scientific Calculator and graph paper.

INSTRUCTIONS TO CANDIDATE

- | | | |
|-------------------|---|------------------|
| Section A: | Answer ALL questions. | 40 marks. |
| Section B: | Answer ANY FIVE (5) questions. Each question carries 12 marks. | 60 marks. |

This paper consists of 4 printed pages.

SECTION A

Answer ALL questions.

40 marks.

QUESTION 1

- (a) Express 0.0453 in
- (i) Standard form (1 mark)
- (ii) Preferred Standard form (1 mark)
- (b) Evaluate: $\log_{16} 8$ (2 marks)
- (c) Transpose: $\frac{1}{R_T} = \frac{1}{R_A} + \frac{1}{R_B}$ to make R_A the subject. (3 marks)
- (d) Solve for x : $9^x = 729$ (2 marks)
- (e) Factorise $16x^2\pi + 40xy\pi + 25y^2\pi$ (4 marks)
- (f) Find the gradient of a straight line $7x + 4y + 2 = 0$ and its intercepts on the axes. (3 marks)
- (g) Determine the surface area of a solid cone of perpendicular height 4cm and radius of 3cm. (4 marks)
- (h) Differentiate with respect to x ; $y = 3x^3 + 2x^2 - 5\pi + 5$. (2 marks)
- (i) Find the gradient of the curve $2x^2 - 5 = y$ at a point(2; -2). (2 marks)
- (j) Solve simultaneously:-
- $$\frac{3}{x} + \frac{6}{y} = 4 \quad ; \quad \frac{9}{x} + \frac{12}{y} = -3$$
- (4 marks)
- (k) Evaluate: $\int_1^3 \left(2x - \frac{1}{x^2} \right) dx$ (4 marks)
- (l) Simplify without using a calculator
- $$\frac{2^5 \times 16 \times 9^{-1}}{4^2 \times 8^2 \times 3}$$
- (3 marks)
- (m) If $A = \begin{bmatrix} 3 & -1 & 2 \\ -4 & 5 & 0 \\ -2 & 1 & 0 \end{bmatrix}$
- Find: (i) $\det A$ (3 marks)
- (ii) Minor of 3 (2 marks)

SECTION B

Answer ANY FIVE questions.

QUESTION 2

Factorise the following:

(a) $f(x) = x^3 - 6x^2 + 11x - 6$ (6 marks)

(b) $16x^2 + 40xy + 25y^2$ (4 marks)

(c) $49x^2 - 81y^2$ (4 marks)

QUESTION 3

A solid metal cylinder of radius 6cm and height 15cm is melted down and recast into a shape comprising a hemisphere surmounted by a cone. Assuming that 8% of the metal is wasted in the process, determine the height of the conical portion if its diameter is to be 12cm. (12 marks)

QUESTION 4

The angle of elevation of the top of a pylon is found to be 19° , measured from a certain point on the ground. Moving 120m nearer the pylon gives the angle of elevation as 47° . Determine the height of the pylon.

Include a diagram

Assume the ground is level for all measurements.

QUESTION 5

Find the equation of the tangent to the curve $y = x^2 - 6x + 5$ at each of the points where the curve crosses the x -axis. Find also the co-ordinates of the point where these tangents meet. (12 marks)

QUESTION 6

(a) Find the integral of $y = 1 + x^7 + \frac{1}{x^2} - \sqrt{x}$ with respect to x . (5 marks)

(b) Evaluate $\int_1^4 \left(\frac{1}{x^2}\right) dx$ (3 marks)

(c) Find the second derivative of $y = 3x^3 + 6x^2 + 3x - 1$. (4 marks)

QUESTION 7

Solve the set of simultaneous equations using determinants methods.

$$4x + 9y + 2Z = 21$$

$$-8x + 6y - 3Z = 41$$

$$3x + y - 5Z = -73$$

(12 marks)

QUESTION 8

Differentiate from first principles:

$$y = x^3 + 5$$

(12 marks)

QUESTION 9

(a) Solve for x in the given indicial equation

$$5(2^{2x+1}) - 13(2^x) - 4 = 0$$

(7 marks)

(b) Simplify the following expression

$$\frac{\log 125 + \log 25 - \log 5}{\log 5^6}$$

(5 marks)

...../cn