



ZIMBABWE

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

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL DIPLOMA

IN

CIVIL ENGINEERING/SURVEYING AND GEOMATICS

SUBJECT: Engineering Mathematics II

PAPER NO: 573/15/S12

DURATION: 3 hours

JULY/AUGUST 2021 EXAMINATION

REQUIREMENTS

1. Graph papers
2. Scientific calculator
3. Formulae booklet

INSTRUCTIONS TO CANDIDATE

1. Answer question 1 and any other 4 questions.
2. Show your working.
3. Write legibly.

This paper consists of 5 printed pages.

QUESTION 1

- a) Solve $\cosh x + 2 \sinh x = 4$, correct to 4 decimal places. (4 marks)
- b) Find $\int \cosh 2x \sinh 3x \, dx$ (4 marks)
- c) Resolve $\frac{x^2+x-5}{x^2-2x-3}$ into partial fractions. (3 marks)
- d) Find $\int x^2 e^{2x} dx$ by using integration by parts. (4 marks)
- e) Find the angle between the vectors $\vec{p}$ and $\vec{q}$, given that:
- $$\vec{p} = 2\vec{i} + 2\vec{j} + 3\vec{k}; \quad \vec{q} = \vec{a} \times \vec{b},$$
- $$\vec{a} = -2\vec{i} + 4\vec{j} - 3\vec{k} \text{ and } \vec{b} = 5\vec{j} - 3\vec{k}$$
- (3 marks)
- f) Solve the equation:
- $$x \frac{dy}{dx} = x - y; \text{ given that when } x = 1; y = -\frac{1}{2}$$
- (4 marks)
- g) A bag contains 5 white balls, 2 red balls, 1 green ball and 4 blue balls. If 5 balls are drawn at random, what is the probability of drawing 2 blue, 1 red and 2 white balls? (4 marks)
- h) Evaluate $\int_0^{\frac{2}{5}} \frac{1}{4+25x^2} dx$, correct to 3 significant figures. (4 marks)
- i) Using Maclaurin's method, find the expansion of $\tan x$ in ascending powers of x as far as the term in x^3 . (5 marks)
- j) Find the inverse of the matrix:

$$M = \begin{pmatrix} 1 & 2 & 1 \\ 2 & 4 & 6 \\ 3 & 1 & 2 \end{pmatrix}$$
 (5 marks)

QUESTION 2

- a) Solve for x , y and z using determine $x + y = 4 - z$; $2x + 5z = 12 + 2y$; $3x + y - 3z + 1 = 0$ (6 marks)
- b) Evaluate $\int_0^{\frac{5}{6}} \sqrt{25 - 9x^2} dx$, correct to 3 significant figures. (6 marks)
- c) Evaluate $\int_0^{\frac{\pi}{3}} \frac{\cos x - \sin x}{\cos x + \sin x} dx$, correct to 2 decimal places. (3 marks)