



ZIMBABWE

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

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL DIPLOMA

IN

**APPLIED BIOTECHNOLOGY/APPLIED CHEMICAL TECHNOLOGY/FOOD
SCIENCE**

SUBJECT: Mathematics and Statistics PAPER NO: 501/15/S08

DURATION: 3 hours

JUNE 2026 EXAMINATION

REQUIREMENTS

1. Statistics tables and mathematical tables
2. Scientific calculator

INSTRUCTIONS TO CANDIDATE

1. Section A - Answer all questions (40 marks)
2. Section B - Answer any three questions. Each question carries 20 marks.

This paper consists of 4 printed pages.

SECTION A

QUESTION 1

Solve the following system of equations:

$$x + y = 5$$

$$x - w = 10$$

$$x + y + 2w = 2 \quad (10 \text{ marks})$$

QUESTION 2

Solve the following differential equation:

$$y'' + 2y' - 8y = \cos x \quad (10 \text{ marks})$$

QUESTION 3

Given that:

$$X \sim \text{Bin} \left(20, \frac{2}{5} \right)$$

Calculate

$$\text{a) } P(X = 10) \quad (3 \text{ marks})$$

$$\text{b) } P(X \geq 2) \quad (3 \text{ marks})$$

QUESTION 4

Solve the following, integral using substitution, $x = \sin \theta$

$$\int_0^{\frac{1}{2}} \sqrt{1 - x^2} dx \quad (14 \text{ marks})$$

SECTION B

QUESTION 5

- a) Evaluate $\int_1^3 x \ln x \, dx$ using trapezium rule with 6 intervals. (10 marks)
- b) Using normal integration calculate the relative error in your answer in 5(a). (10 marks)

QUESTION 6

Body mass (g) and heart mass (mg) of mice were recorded in a Biological laboratory as shown below.

Heart mass	118	136	156	150	140	155	157	114	144	159
Body mass	27	30	37	38	32	36	32	32	38	42

- a) Calculate the correlation coefficient and comment. (10 marks)
- b) Calculate the regression line equation using the above data. (10 marks)

QUESTION 7

- a) Show that

$$\frac{d^2y}{dx^2} = \frac{-25}{(7-5x)^2}$$

Given that $y = \ln(7 - 5x)$.

(6 marks)

- b) Find the x co-ordinates of the turning points of the following equation clearly indicating their nature.

$$-x^3 + x^2 + 5x - 8 = y$$

(8 marks)

- c) Solve the differential equation

$$\frac{dy}{dx} = \frac{4}{2x-4}$$

(6 marks)

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QUESTION 8

A bag contains 5 red balls and 4 blue balls. 3 balls were picked at random one after another with replacement. Calculate variance of getting:

- a) Red balls, Var (Red)
- b) Blue balls, Var (Blue) (20 marks)

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