

SECTION A (40 marks)

Answer **all** questions in this section.

1. (a) If $2^x = 0.5$, find the value of x without using tables or calculators. (02 marks)

(b) Solve the equation $\left[y^{2/3}\right]^3 - 4 = 0$. (03 marks)

2. A fair coin is tossed three times.
- (a) Obtain the probability distribution table for the possible number of heads that show up. (04 marks)
- (b) Use your table to find the expected number of heads that show up. (01 marks)

3. The roots of the quadratic equation $y^2 - py + q = 0$ are α and β . Determine the equation whose roots are $\alpha^2 + 1/\beta^2$ and $\beta^2 + 1/\alpha^2$. (05 marks)

4. Three bags A, B and C each contain fruits; mangoes, Oranges and Apples as follows.

	Bag A	Bag B	Bag C
Mangoes	3	2	5
Oranges	1	3	6
Apples	3	3	4

A bag is chosen at random and then a fruit is picked from the selected bag at random. Determine the probability that the fruit is;

- (i) an orange. (03 marks)
- (ii) not an orange. (02 marks)

5. Given the curve $y = x^2 + 6x - 4$ at (1,3). Determine the equation of the;

- (i) tangent. (03 marks)
- (ii) normal. (02 marks)

6. The table below shows the diameter of samples of oranges measured by a given farmer on his farm.

Diameter (cm)	8	9	10	11	12	13	14
No. of oranges	9	15	21	32	19	13	11

Determine the mean number of oranges. (05 marks)

7. Evaluate $\int_{-1}^2 \left(\frac{4x - x^2 + 3x^3}{x} \right) dx$ (05 marks)

8. A group of 20 students is to be selected from a group of 30 students. Two of the 20 students are to be selected as a class captain and assistant class captain respectively. In how many ways can this be carried out?

(05 marks)

SECTION B (60 marks)

Answer only **four** questions from this section with at least one question from each part. All questions carry equal marks.

PART I (PURE MATHEMATICS)

9. (a) Given that $P = \begin{pmatrix} 4 & 3 \\ -1 & 0 \end{pmatrix}$, $Q = \begin{pmatrix} 5 & 1 \\ 2 & -1 \end{pmatrix}$
Find Matrix R such that $P^2 + 2Q = R$ (03 marks)
- (b) Use the matrix method to solve the simultaneous equation.
 $3x + 4y = 27$
 $y + 5x - 11 = 0$ (06 marks)
- (c) Given that one root of the equation $3x^2 + 4x + m = 0$ is three times the other, find the value of m. (06 marks)

10. According to World Food Program, a depot for Vulnerable poor relief should have at most 20 bags of beans and 35 bags of flour. The mass, volume and the number of meals ratio per bag are as shown in the table below.

Bag of ;	Mass	Volume	Number of meals
Beans	25	0.05	800
Flour	10	0.05	160

A delivery van is to carry a largest possible number of bags. It can carry a mass of up to 600 kg occupying 2 m^3 .

- (a) If a load is made up of x bags of beans and y bags of flour.
Write down six inequalities for the given information. (05 marks)
- (b) Represent the inequalities on a graph paper by shading the unwanted regions. (Use a scale of 2 cm to represent 5 units on both axes) (06 marks)
- (c) Determine the number of bags of beans and flour that should be delivered to make the total number of meals ratios the largest. (04 marks)
11. (a) Given that $P = \frac{1 - \sin \theta}{1 + \sin \theta}$, Show that $P = (\sec \theta - \tan \theta)^2$. Hence deduce that if $\theta = 60^\circ$ then $P = 7 - 4\sqrt{3}$. (08 marks)
- (b) Solve the equation; $3\cos^2 x - 2\sin^2 x - \sin x + 1 = 0$, for $0^\circ \leq x \leq 360^\circ$. (07 marks)
12. (a) A pilot is flying an aeroplane at 680 kmhr^{-1} due East and finds a steady wind blowing at 70 kmhr^{-1} due North. Find the true velocity of the wind. (05 marks)
- (b) Three points A, B and C have position vectors **a**, **b** and **c** respectively where $\mathbf{a} = 3\mathbf{i} + \mathbf{j}$, $\mathbf{b} = 2\mathbf{i} + 3\mathbf{j}$ and $\mathbf{c} = 5\mathbf{i} - 4\mathbf{j}$.
- (i) Determine \overline{AB} and \overline{CB} (04 marks)
- (ii) Find the angle ABC (03 marks)
- (iii) Find the midpoint of \overline{AC} (03 marks)

Turn Over

PART I (Statistics and Probability)

13. The table below shows the prices of some items in 2005 and 2008 with 2005 as the base year.

Item	2005(shs)	2008(shs)
Bread	525	1500
Rice	2000	2500
Beans	1500	1800
Sorghum	1200	1500
Water	300	450

- (i) Calculate the price relatives of the items in 2008 to those of 2005.
Hence find simple aggregate price index. (10 marks)
- (ii) If the weights of the items were 3, 5, 1, 2 and 4 respectively, calculate the weighted aggregate price index for 2008.
Hence comment on the general price level in 2008. (05 marks)
14. The table below shows the marks received by 10 students in mathematics and chemistry.
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|-------------|----|----|----|----|----|----|----|----|----|----|
| Mathematics | 50 | 35 | 55 | 60 | 85 | 25 | 65 | 90 | 45 | 40 |
| Chemistry | 46 | 26 | 48 | 44 | 62 | 28 | 30 | 60 | 34 | 42 |
- (a) Calculate a rank correction co-efficient for the data. (06 marks)
- (b) (i) Draw a scatter diagram for the data above.
(ii) Draw a line of best fit on the scatter diagram.
(iii) Use the line of best fit to estimate the score in mathematics for score of 52 in chemistry. (09 marks)
15. A continuous random variable y has a pdf given by
- $$f(y) = \begin{cases} \frac{1}{4}y & ; 0 \leq y \leq 2 \\ \frac{1}{4}(4 - y); & 2 < y < 4 \\ 0; & \text{else where} \end{cases}$$
- (a) Show that the distribution is a pdf. (04 marks)
- (b) Find the; (i) Mean (04 marks)
(ii) Variance (04 marks)
(iii) $P(y < 1)$ (03 marks)
16. The life of an electric bulb produced by Phillips Company is approximately normally distributed with a mean time of 150 hours and a variance of 900 hours.
- (a) Calculate the;
- (i) Probability that a bulb selected at random will light for less than 145 hours. (04 marks)
- (ii) Probability that a bulb selected at random will light for more than 170 hours. (04 marks)
- (iii) Probability that a bulb selected at random will light between 125 to 185 hours. (07 marks)

END