

P425/2
APPLIED MATHEMATICS
Paper 2
June/July 2022
3 Hours

MWALIMU EXAMINATIONS BUREAU

UACE RESOURCE MOCK EXAMINATIONS 2022

APPLIED MATHEMATICS

PAPER 2

3 HOURS

INSTRUCTIONS TO CANDIDATES

Answer **all** the **eight** questions in Section **A** and any **Five** from Section **B**.

All necessary working **must** be shown clearly.

Graph paper is provided.

Begin each answer on a fresh page.

In numerical work, take **g** to be 9.8ms^{-2}

Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

SECTION A (40 MARKS)
(Answer all questions in this section)

1. The increase in water levels in a certain lake follow a uniform distribution between 4m and 6m, if the mean increase in water level is 4.5m, find the;
 - (i) Value of b.
 - (ii) Standard deviation. **(5 marks)**
2. A particle of weight 4N is attached at the end of a light inextensible string of length 2m and the end is attached to a fixed point on a horizontal force, determine the;
 - (i) Horizontal force.
 - (ii) Tension in the string. **(5 marks)**
3. Given that $x = 3.42$, $y = 4.21$ and $z = 1.2$, find the maximum value and minimum value in the expression $\frac{xy}{z}$, hence the absolute error. **(5 marks)**
4. The table below shows the expenditure of a certain student in 2019 and 2020.

Item	Expenditure		Weight
	2019	2020	
Clothings	46,500	49,350	5
Pocket money	55,200	57,500	3
Books	80,000	97,500	8

Using the expenditure of 2019 as the base calculate the;

- (i) Average weighed expenditure index.
 - (ii) Hence estimate the cost in 2020, if it costed 65,000 in 2019. **(5 marks)**
5. A particle is moving at a speed of 7ms^{-1} , when it begins to ascend a rough slope of 5 in 13, if the co-efficient of friction is $\frac{5}{8}$, find the;
 - (i) Deceleration.
 - (ii) Distance moved up the plane before it comes to rest. **(5 marks)**
6. Find the approximate value of $\int_0^2 \log_e(x^2 + 3)dx$, using the trapezium rule with 6 ordinate. Correct to 3 decimal places. **(5 marks)**
7. The probability that two independent events A and B occur together is $\frac{1}{8}$, the probability that either or both events occur is $\frac{5}{8}$, find;
 - (i) $P(A)$.
 - (ii) $P(B)$. **(5 marks)**
8. Two particles of masses 6kg and 10kg are connected by a light inextensible string as indicated in Figure 1.

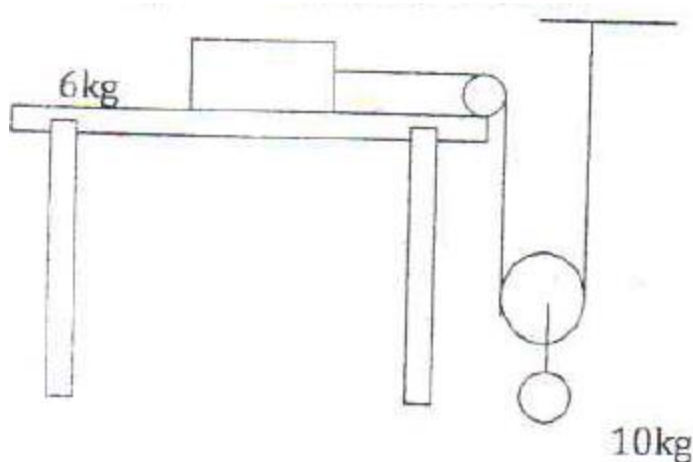


Figure 1.
Determine the accelerations of 6kg and 10kg masses,

SECTION B
(Answer any five questions from this section)
(All questions carry equal marks)

9. The table below show marks obtained by students of a certain school in a certain class.

Marks	40-45	45-50	50-55	55-60	60-70	70-80
Number of students	4	13	17	44	59	7

- (i) Construct a histogram and use it to estimate the mode.
(ii) Calculate the; (i) mean
(ii) standard deviation

(12 marks)

10. At 12:00 noon the position vector (r) and velocity vector (v) for two trains A and B are as follows;

Trains	Position vector (r)	Velocity vector (v)
A	$P_A = (5i - 3j + 4k) \text{ km}$	$V_A = (2i + 5j + 3k) \text{ kmhr}^{-1}$
B	$P_B = (7i + 5j - 2k) \text{ km}$	$V_B = (-3i - 15j + 18k) \text{ kmhr}^{-1}$

- (a) Find the position vector A relative to B at any time (t) hence show that they collide, and find the time of collision.
(b) Determine the position of collision.

(12 marks)

11. (a) A building society gives compound interest on P_n shs worth of shares at a rate of $r\%$ per annum, write down an algorithm for computing the amount accumulated (A_n shs) on shares for n years.

- (b) Construct a flow chart that;
 (i) A_1 , P_1 and r
 (ii) limits to $n = 4$ years
 (iii) Prints A_5
 (c) If $P_1 = 120,000/=$ and interest rate (r) is 5%, perform a dry run for the flow chart above.

(12 marks)

12. The table below shows marks for Mathematics (x) and History (y) obtained by a certain student.

Maths (x)	35	65	55	25	45	75	20	90	51	60
Hist (y)	86	70	84	92	79	68	90	58	86	77

- (a) Construct a scatter diagram, draw line of best fit and comment. Hence estimate the Mathematics mark where history mark is 84.

- (b) Calculate the rank correlation coefficient and comment at 5% level of significance.

(12 marks)

13. The displacement of a particle at any time (t) is given by

Displacement (x) = $a \cos(wt) + b \sin(wt)$, if $a = 3$, $b = 4$, and $w = 2$, show that it is a S.H.M, hence determine the;

- (a) Period and amplitude.

- (b) Maximum velocity and maximum acceleration.

(12 marks)

14. (a) By drawing on the same axes the line $y = 10 - x$ and the curve $y = e^x$, show that they have a root between $x = 2$ and $x = 3$, from it state the initial approximation (x_0) to 1 decimal place.

- (b) Using initial approximation (x_0) above and the Newton Raphson method, find the root, correct to 3 decimal places.

(12 marks)

15. (a) A random sample of 81 oranges is taken from a large consignment of oranges such that $\sum x = 176.7$ and $\sum x^2 = 424.51$, assuming they are randomly distributed, find the:

- (i) mean and unbiased estimate of variance

- (ii) 98% confidence interval around the mean

- (b) A random sample of 24 students are selected at random. 40% of the students own personal computers. Find the probability that between 8 and 15 students own personal computers.

(12 marks)

16. A regular hexagon ABCDEF of side 4m has forces of magnitude 2N, 6N, 5N, 8N and 3N acting along the sides $\overrightarrow{AB}$, $\overrightarrow{BC}$, $\overrightarrow{CD}$, $\overrightarrow{ED}$, and $\overrightarrow{EF}$ respectively. Determine the:

- (a) magnitude of the resultant force and its direction.

- (b) line of action and where the resultant cuts $\overrightarrow{AB}$

(12 marks)

End