

P425/2

Mathematics (Principal)

Paper 2

July/August 2023

3 hours

BUGANDA EXAMINATION COUNCIL MOCKS

Uganda advanced certificate of education

MATHEMATICS (Principal)

Paper 2

3 Hours

INSTRUCTIONS TO CANDIDATES

- Attempt all 8 questions in Section A and **ONLY** any 5 questions from B.
- Mathematical tables and list of formulae will be provided.
- Use silent, non programmable calculators
- Take $g = 9.8 \text{ m/s}^2$.
- State degree of accuracy at end of each solution reached using tables and/or calculators by showing (Tab) for tables and (cal) for calculator.

SECTION A (60 MARKS)

1. A particle of weight 20N rests on rough horizontal ground and coefficient of friction between particle and ground is μ . A force P acting upwards at 30° to the horizontal, is just enough to move the particle, show that

$$P = \frac{40\mu}{\sqrt{3} + \mu}$$

(05 marks)

2. The numbers $x = 2.65$, $y = 4.806$, $z = 15.4$ and $q = 0.092$ are all rounded off to the indicated place values.

State the range of values in which the exact value of P lies

Where $P = x\left(y - \frac{z}{q}\right)$

Hence find the exact P to 4 decimal places.

(05 marks)

3. Use trapezium rule of 5 sub intervals to evaluate

$$\int_0^1 x e^{2x} dx \text{ to 4 decimal places.}$$

Give one way of increasing the accuracy of your solution in this case. (05 marks)

4. A discrete random variable x has the following distribution:

X	1	2	3	4	5
P(x=x)	K	2k	3k	4k	5k

- i) Determine the constant K and evaluate $P(x \leq 3)$
 ii) Calculate the expectation of x.

(05 marks)

5. A paint manufacturer wants to determine the average drying time of a new type of interior wall paint. If for a random normal population of 12 areas (surfaces) of equal size, he obtained the mean drying time of 66.3 minutes and 8.4 minutes as standard deviation, construct 95% confidence interval for the true average (mean) time μ for drying.

(05 marks)

6. A uniform rod AB of length 3m and weight 50N rests horizontally on smooth supports at A and B. A load of 24N is attached to the load at C where $AC = 1m$. Find the reactions at supports A and B respectively.

(05 marks)

7. The marks (x) obtained in DIT and marks obtained in PE(y) by seven students are recovered in the table shown below.

Students	A	B	C	D	E	F	G
x(%)	23	35	18	36	41	43	48
y(%)	24.5	23.6	23.8	23.2	25	24.7	25.2

Compute spearman's rank correlation coefficient and use it comment on performance of the students.

(05 marks)

8. The table shows the diameter of sample of tomatoes to the nearest cm.

Diameter (cm)	8	9	10	11	12	13	14
Frequency	5	15	21	32	19	13	11

Determine mean and standard deviation of diameter of the tomatoes in the sample given above. (05 marks)

SECTION B (60 MARKS)

9. a) Events A and B are such that $P(A \cup B) = \frac{9}{10}$, $P(A/B) = \frac{1}{3}$ and $P(B/A) = \frac{2}{5}$.
Find (i) $P(A)$ (ii) $P(\bar{A}/\bar{B})$ (iii) $P(A/A \cup B)$. (06 marks)
- b) Probability of winning a game is $\frac{4}{5}$. Ten games are played. What is
i) Mean number of success
ii) Variance
iii) Probability of at least 8 successes in the ten games. (06 marks)
10. A continuous random variable x has a pdf.

$$f(x) = \begin{cases} kx(9 - x^2); & 0 \leq x \leq 3 \\ 0; & \text{elsewhere} \end{cases}$$

- Determine: (a) the constant K (04 marks)
(b) the median (04 marks)
(c) $P(x > 1/x \leq 2)$ (04 marks)

11. i) Using the iterative formular of Newton's Raphosons method, show that the fourth root of a number N is given by the formular.

$$X_{nH} = \frac{1}{4} \left(3x_n + \frac{N}{x_n^3} \right) \quad (06 \text{ marks})$$

- ii) Hence show that $(45.7)^{1/4} \simeq 2.600$ (3 decimal places).
The knowledge of interpolation may be used to get the first approximation. (06 marks)

12. The weight of 10,000 cows on government farm is normally distributed with mean weight of 115kg and standard deviation of 3kg.
i) If a cow is selected at random from the farm, find the probability that its mass would be between 115 kg and 118 kg. (04 marks)
ii) Determine the number of cows that would weigh between 109 kg and 121 kg from the same farm. (04 marks)

- iii) The Minister of Agriculture found out that 10% of the cows were rejected in the market due to overweight. State to the nearest kg, the minimum weight at which they were rejected. (04 marks)

13. A particle of mass 5kg moves so that its position vector at any time t seconds is given by

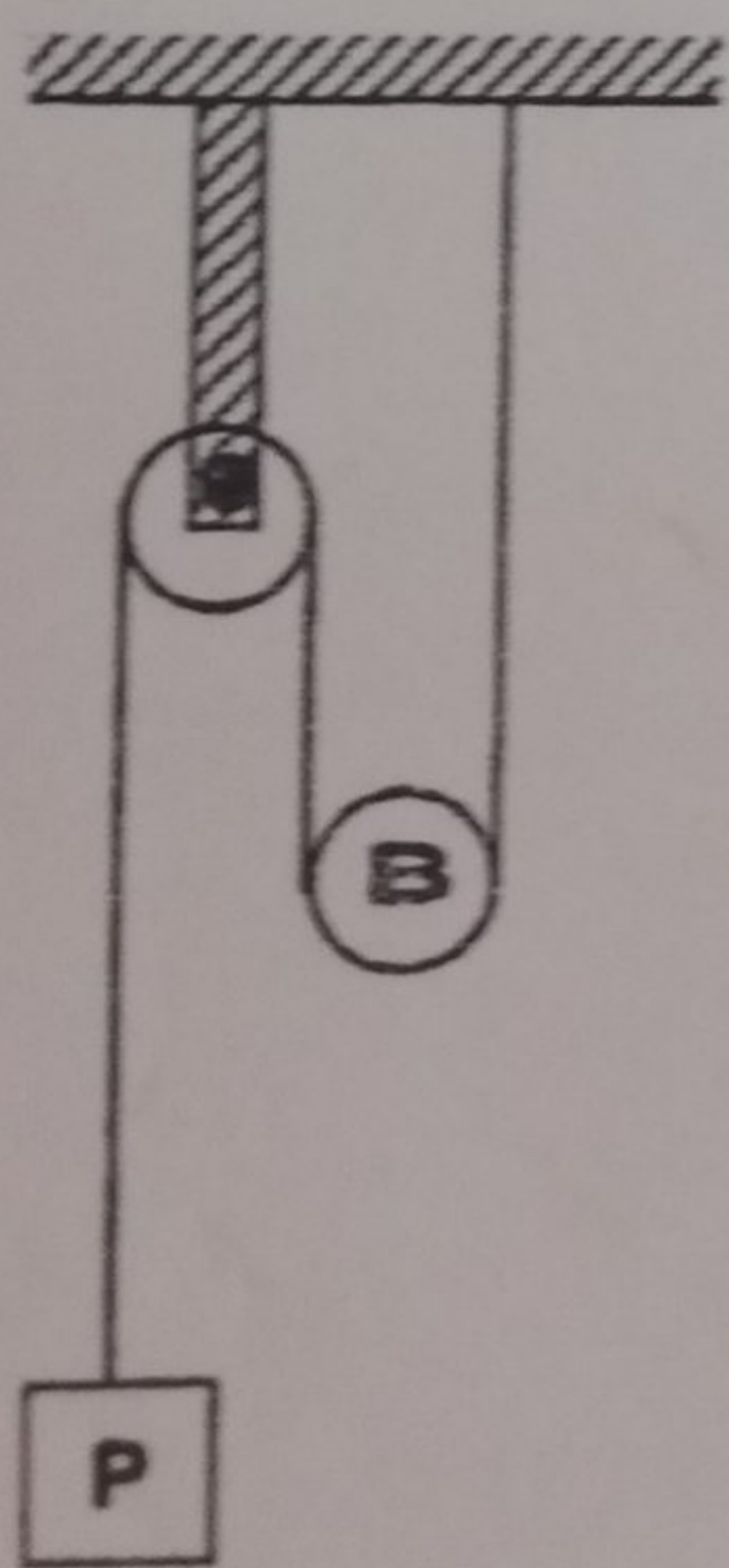
$$\mathbf{r} = (\cos 2t)\mathbf{i} + (4\sin 2t + 3)\mathbf{j}$$

- Find: i) the speed of the when $t = \frac{\pi}{3}$ s
 ii) the force acting on the particle when $t = \frac{\pi}{2}$
 iii) The rate of doing work at $t = \frac{\pi}{2}$. (12 marks)

- 14a) A uniform pole of length $2a$ and mass M rests in equilibrium at an angle α to the horizontal, with one end against a smooth vertical wall and the other end against a rough horizontal floor. Show that the force exerted by the wall on pole and coefficient of friction between pole and floor are respectively given by

$$\frac{Mg}{2} \cot \alpha \text{ and } \frac{\cot \alpha}{2} \quad (06 \text{ marks})$$

- b) The diagram shows particle P of mass 0.5kg attached to one end of a light non elastic string passing over fixed pulley and under light movable pulley B. The other end of the string is fixed as shown below.



- i) What mass should be attached to B for system to be in equilibrium.
 ii) If an extra mass of 0.8kg, show that the accelerations of P and B will be $\frac{8}{19}g$ and $\frac{4}{19}g$ respectively. (06 marks)

15. At noon ships A and B have position vectors $3\mathbf{i} + 2\mathbf{j}$ and $\mathbf{i} - 4\mathbf{j}$ respectively and constant velocities $4\mathbf{i} + 3\mathbf{j}$ and $3\mathbf{i} + 5\mathbf{j}$ distances recorded in km and time in hours.
 Find: a) velocity of A relative to B (magnitude and direction) (04 marks)
 b) position vectors of A and B, t hours after noon. (02 marks)
 c) Show that the least distance between A and B is $2\sqrt{5}$ and determine also the time taken for A and B to be as close as possible. (06 marks)

END