

P425/2  
APPLIED MATHEMATICS  
Paper 2  
Nov./Dec. 2025  
3 hours



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper 2

3 hours

**INSTRUCTIONS TO CANDIDATES:**

*This paper consists of two Sections; A and B.*

*Section A is compulsory.*

*Answer any five questions from Section B.*

*Any additional questions answered will **not** be marked.*

*Begin each answer on a fresh page.*

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

*Graph paper is provided.*

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

*In numerical work, take acceleration due to gravity,  $g$ , to be  $9.8 \text{ ms}^{-2}$ .*

## SECTION A (40 MARKS)

Answer all the questions in this section.

1. In a packet of pens, 30% are black. Ten (10) pens are picked at random from the packet. Find the probability that;  
(a) three of the pens are black. (02 marks)  
(b) less than four are black. (03 marks)
2. Three particles of mass 3 kg, 2 kg and  $m$  kg act at points whose position vectors are  $i + 2j$ ,  $-i - 3j$  and  $2i - j$  respectively. If the centre of gravity of the masses lies at a point  $(n, -0.5)$ , find the values of  $m$  and  $n$ . (05 marks)
3. Use the trapezium rule with six ordinates to approximate the value of

$$\int_2^3 \left( \frac{2}{x} + x^2 \right) dx$$

correct to three significant figures. (05 marks)

4. A continuous random variable,  $X$ , is uniformly distributed on the interval  $a \leq x \leq b$ . The mean of the distribution is 12 and the variance is 3. Find the values of  $a$  and  $b$ . (05 marks)
5. A particle projected vertically upwards with a speed of  $v \text{ ms}^{-1}$  takes  $t$  seconds to travel the first 70 m. It then takes  $t$  seconds to travel the next 50 m. Determine the;  
(a) value of  $v$ . (03 marks)  
(b) maximum height attained by the particle. (02 marks)
6. The table below shows the values of a function  $f(x)$ .

|        |     |     |      |      |
|--------|-----|-----|------|------|
| $x$    | 5   | 12  | 19   | 26   |
| $f(x)$ | 6.6 | 2.9 | -0.1 | -2.9 |

Use linear interpolation/extrapolation to estimate

- (a)  $f(x)$  when  $x = 15$ . (03 marks)
- (b)  $x$  when  $f(x) = -3.9$ . (02 marks)

7. The table below shows the grades obtained by eight students in Mathematics and Physics examinations.

| Student              | Ben | Ali | Ann | Musa | John | Joy | Sarah | Betty |
|----------------------|-----|-----|-----|------|------|-----|-------|-------|
| Grade in Mathematics | E   | A   | C   | B    | O    | B   | B     | D     |
| Grade in Physics     | D   | B   | A   | A    | E    | O   | C     | F     |

Compute the rank correlation coefficient for the performance of the students.  
(05 marks)

8. A particle moving with Simple Harmonic Motion (SHM) has speeds  $3 \text{ ms}^{-1}$  and  $5 \text{ ms}^{-1}$  at distances 7 m and 6 m respectively. Show that the period of the SHM is  $\frac{1}{2}\pi\sqrt{3}$ .  
(05 marks)

### SECTION B (60 MARKS)

Answer any five questions from this section.

9. The table below shows scores in an aptitude test by seventy workers.

| Scores             | 2.5 – 2.6 | 2.7 – 3.2 | 3.3 – 3.5 | 3.6 – 3.7 | 3.8 – 4.1 | 4.2 – 4.5 |
|--------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Number of workers. | 6         | 18        | 20        | 4         | 12        | 10        |

- (a) Calculate the median score. (05 marks)
- (b) Draw a histogram for the data and use it to estimate the modal score. (07 marks)
10. (a) Show by graphical method that there are three roots to the equation:  $2x^3 - 5x + 2 = 0$  in the range  $-2 < x < 2$ . (06 marks)
- (b) Use the Newton Raphson's iterative formula to find, correct to two decimal places, the root of the equation:  $2x^3 - 5x + 2 = 0$ , which lies between 1 and 2. (06 marks)
11. A uniform ladder  $AB$  of mass 20 kg and length 5 metres rests in equilibrium against a rough vertical wall and a rough horizontal ground. The end  $B$  of the ladder rests against the wall while end  $A$  rests on the ground. The ladder makes an angle of  $50^\circ$  with the ground. The coefficients of friction at the wall and ground are 0.8 and 0.4 respectively. A man of mass 50 kg climbs the ladder.

Find;

- (a) the reactions at  $A$  and  $B$ . (08 marks)
- (b) how far up the ladder the man climbs without the ladder slipping. (04 marks)



12. (a) A random sample of size 25 is taken from a normal population with mean 28 and standard deviation 3. Find the probability that sample mean,  $\bar{x}$ , lies between 26.8 and 28.3. (06 marks)
- (b) The heights of seedlings in a nursery bed are normally distributed with variance 0.24. A random sample of five seedlings has heights 25.4 cm, 26.6 cm, 25.8 cm, 26.0 cm and 26.2 cm. Determine the 98 % confidence interval for the mean height of all seedlings in the nursery bed. (06 marks)
13. ✓ The numbers  $x = 6.81$ ,  $y = 13.182$  and  $z = 5.1$  are all rounded off correct to the given number of decimal places.
- (a) State the maximum possible errors in  $x$ ,  $y$  and  $z$ . (02 marks)
- (b) Find the relative error in  $xz$  correct to **three** decimal places. (03 marks)
- (c) Determine the interval within which the exact value of  $(xy - z)$  can be expected to lie. Give the answer correct to **two** decimal places. (07 marks)
14. At 12:00 noon, ship  $A$  has position vector of  $(18\hat{i} + 6\hat{j})$  km and velocity  $(\hat{i} + 4\hat{j})$  kmh<sup>-1</sup>. At the same time, ship  $B$  has a position vector of  $(4\hat{i} + 10\hat{j})$  km and velocity of  $(3\hat{i} + 2\hat{j})$  kmh<sup>-1</sup>.
- Find the:
- (a) displacement of ship  $A$  relative to  $B$  at any time  $t$ , hours. (04 marks)
- (b) (i) time when the two ships are closest to each other. (06 marks)
- (ii) distance when the two ships are closest to each other. (02 marks)
15. ✓ The number,  $X$  of traffic offences committed per day by drivers on a particular road is a random variable with probability distribution given by  $P(x) = c(5 - x)$ ,  $x = 0, 1, 2, 3, 4$  where  $c$  is a constant.
- Determine the:
- (a) value of  $c$ . (02 marks)
- (b) probability that the number of offences committed per day is between 1 and 4. (03 marks)
- (c) mean number of offences committed per day. (04 marks)
- (d) variance for the distribution. (03 marks)

16. (a) A particle of mass 3 kg is moving with a speed of  $8 \text{ ms}^{-1}$ . Another particle of mass,  $m$  kg is moving in the opposite direction with a speed of  $4 \text{ ms}^{-1}$ . The two particles collide directly. After collision, their initial directions of motion reverse, with the 3 kg mass moving at  $5 \text{ ms}^{-1}$  and the  $m$  kg mass moving at  $5.75 \text{ ms}^{-1}$ .

Determine the:

- (i) value of  $m$ . (03 marks)
  - (ii) loss in kinetic energy due to collision. (02 marks)
- (b) A carpenter strikes a nail of mass 0.025 kg with a hammer of mass 1 kg into a block of wood. The nail is driven a distance of 0.03 m into the block. If the speed of the hammer just before impact is  $9 \text{ ms}^{-1}$ , find the:
- (i) resistance of the wood to the motion of the nail. (04 marks)
  - (ii) time taken by the nail to move the distance of 0.03 m into the wood. (03 marks)