P425/2
APPLIED MATHEMATICS
PAPER 2
July/August 2015
3hours

WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper 2

3 hours

INSTRUCTIONS TO CANDIDATES:

- *Attempt* **all***questions in section* **A** *and any***five** *questions from section* **B**.
- *Any additional question(s) answered will* ***not*** *be marked.*
- **All** *working must be shown clearly.*
- *Begin each answer on a fresh sheet of paper.*
- *Silent non programmable scientific calculators and mathematical tables with a list of formulae may be used.*
- *In numerical work, take g to be* $9.8ms^{-2}$.

Turn Over

SECTION A (40 MARKS)

1. Given that $P(B/A) = {}^{1}/_{3}$, $P(B/A^{1}) = {}^{5}/_{8}$
and $P(A^{1} \cap B^{1}) = {}^{3}/_{20}$
Find:
(i) P(A)
(ii) $P(A \cap B^{1})$ (5 marks)

2. Point A, B and C lie a long a straight line. A particle accelerating uniformly at $0.5ms^{-2}$ is projected from A towards C with a velocity of $2ms^{-1}$ and after 1 second another particle is projected from C towards A with a velocity of 6 ms^{-1} and a constant retardation of $2ms^{-2}$. Given that the particles passed each other at B in tile moving with the same speed, find the distance BC.

3. The height sample of seedlings when 200gram 300gm, 350 grams and 450grams of fertilizers when applied on similar seedlings of the same initial heights were 1.6cm, 1.9cm, 2.4cm and 2.8cm respectively. Use linear interpolation or linear extrapolation to estimate the;
(i) Lent of a seeding when 272 grams of fertilizer is applied,
(ii) Amount of fertilizer required if the height of the seedling is to be 3.1cm.

4. A batch of 10 nails is drawn from machine output which is 40% defective.
Find the probability that the batch contains:
(i) No defective nails.
(ii) More than half defective nails. (5marks)

5. Initially a particle is projected with a velocity 2i ms^{-1} from a point with position vector $\left(10\underset{\sim}{i} + 90\underset{\sim}{j}\right)$m. Find the distance of the particle from the origin after 4 seconds. (5 marks)

6. The table below shows the number of children in 100 families a certain village during the 2014 Uganda National population census.

No. of children	1	2	3	4	5	6	7	8
No. of families	8	9	16	25	20	12	6	4

Calculate the (i) mean number of children per family.
(ii) Standard deviation.

7. Estimate the value of $\int_0^1 \frac{dx}{1+x^2}\,dx$
By trapezium rule using 6 ordinated (give your answer correct to 3 decimal places.)
(5 marks)

8. A rod AB 1m long has a weight of 20N acting at a point 60cm from A. It rests horizontally with A against a rough vertical wall. A string BC is fastened to the wall at C, 75cm vertically about A find the;
(i) Tension in the sling
(ii) Frictional force at A

(12 marks)

SECTION B: (60 MARKS)

9. (a) The dimensions of a rectangle are 8cm and 4.26.
   (i) State the maximum possible error in each dimension.
   (ii) Find the range within which the area of the rectangle lies. (correct to 2 decimal places) (05marks)

   (b) The radius r and height h of a cylinder are measured with corresponding errorsΔr and Δh respectively. Show that the maximum possible error in the volume is

$$\left|\frac{\Delta h}{\mathrm{h}}\right| + 2\left|\frac{\Delta r}{\mathrm{r}}\right|$$

10. A smooth hollow cylinder of radius a and centre O is fixed with its axis horizontal. A particle P of mass M is projected from the point on the inside surfaceof the cylinder, level with O, with speed $\sqrt{14ga}$ vertically down ward. When P reaches the lowest point of the surface it collides with and adhere to a stationary particle Q also of mass M. Find the height above the centre of the cylinder at when the combined mass leaves the surface of the cylinder. (12 marks)

11. A random variable X has a cumulative distribution function given below.

$$\mathrm{F} = \begin{cases} 0, & x \leq 0 \\ ax, & 0 \leq \times \leq 1 \\ \frac{x+b}{3} & 1 \leq \times \leq 2 \\ 1, & \times \geq 2 \end{cases}$$

   Find;
   (a) the value of a and b
   (b) $\mathrm{P}(\mathrm{X} < 1.5/X > 1)$
   (c) Mean of X (12 marks)

12. Obtain graphically the not of the equation $X^3 = 4$.
   (a) Derive the simplest iterative formula based on Newton Raphson method that can be used to find a better approximation to the fast of the equation above.
   (b) Using the value from graph as initial approximation, find the root of the equation correct to four significant figures.

13. (a) A lorry of mass 800kg is pulling a trailer of mass 200kg up a hill of 1 in 14. When the total force of 1KNis exerted by the engine, the car and the trailer move up the hill at a steady speed. Find the total frictional resistance to the motion of the car and the trailer during the motion.

   (b) When the car and the trailer are traveling at a speed of $10\mathrm{m}^{-1}$ up the hill, the power exerted by the engine is instantaneously changed to 2kw. Calculate the:
   (i) Instantaneous acceleration.
   (ii) Instantaneous tension in the coupling between the trailer and the car given that the total frictional resistance on the trailer is 70N.

   (12 marks)

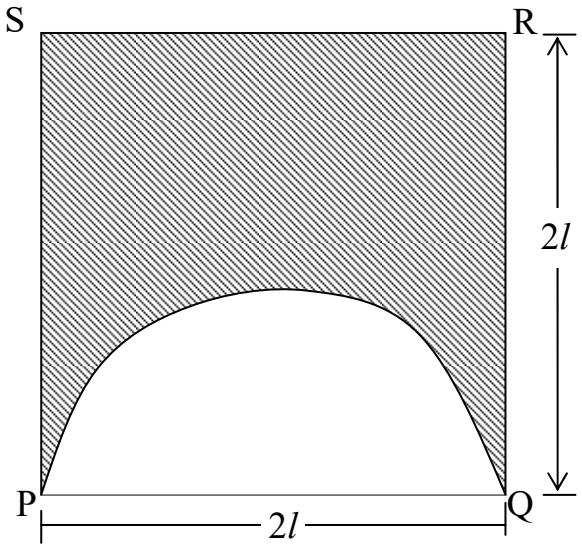
14. The mock examination and average final examination marks of a certain school are given in the following table.

Mock Marks	28	34	36	42	52	54	60
AV. Final Marks	54	62	68	70	76	66	74

(a) (i) Plot the marks on the scatter diagram and comment on the relationship between the two marks.
(ii) Draw a line of best fit and use it to predict the average final mark of a student whose mock mark is 50. (08 marks)

(b) Calculate the rank correlation coefficient between the marks and comment on your result. (04 marks)

15. The figure below shows a uniform square lamine PQRS of side 2*l* with a semicircular cut off.



(a) Show that the distance of Centre of gravity of the figure from PQ is $\frac{20l}{3(8-\pi)}$

(b) The figure is freely suspended from the point R. Find the Engle that RS makes with the vertical.

$$f(x) = x^{2^1} - \frac{2}{x}$$

$$f^{l}(x) = \frac{2}{\sqrt[2]{2}} + \frac{2}{x^2}$$

16. (a) A random sample of ten packets is taken. These have masses (Measured in kg) of x_1 , x_2, ……, x_{10} such that;

$\sum_{i=1} xi = 2.57$ and $\sum_{i=1} x^2 i = 0.6610$
Calculate a 95% confidence limits for the mean. (08 marks)

(c) The weights of ball bearings are normally disturbed with mean 25gram and standard demotion 4 grams. If a random sample of 16 ball bearings is taken, find the probability that the mean of the sample his between 24.12 grams and 26.73 grams.

END