P425/2

APPLIED MATHEMATICS

Paper 2

JULY 2016

3 hours

UGANDA ADVANCED CERTIFICATE OF EDUCATION

RESOURCEFUL MOCK EXAMINATIONS 2016

APPLIED MATHEMATICS

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3 hours

INSTRUCTIONS TO CANDIDATES

Answer **all** the questions in section **A** and **only five (5)** from section **B**.

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

Begin each question on a fresh page.

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

For numerical work, take $g = 9.8ms^{-2}$.

Turn over

SECTION A (40 MARKS)

Attempt all questions in this section

1. Given that events A and B are independent such that P(A) = $\frac{3}{8}$ and P(AUB) = $\frac{3}{4}$, find the:

(i) P(B) **(03 marks)**

(ii) P(AUB) **(02 marks)**

2. To an observer on a bus travelling due east at 60kmh^{-1}, wind appears to be blowing at a speed of 40kmh^{-1} from the North - West. Determine the true speed of the wind. **(05 marks)**

3. A function $y = f(x)$ is tabulated for various values of x as shown below.

x	1.0	1.2	1.4	1.6	1.8
y	3.70	3.82	4.5	4.51	5.07

Using linear interpolation or extrapolation estimate the;

(i) Value of y at $x = 1.15$ **(03 marks)**

(ii) Value of x for which $y = 6.23$ **(02 marks)**

4. A random variable T has a density function given by;

$$f(t) = \begin{cases} (2k)^{-1} & ; \quad 0 \le t \le 2k \\ 0 & ; \quad \text{elsewhere} \end{cases}$$

Calculate the:

(i) Mean of T in terms of k **(02 marks)**

(ii) Variance as a function of k **(03 marks)**

5. A brick of mass 3kg slides in a straight line on a horizontal floor. The brick is brought to rest after moving 12m by the constant friction force between the brick and the floor. If the initial speed of the brick is 8ms^{-1}, find the:

(i) Kinetic energy lost by the brick in coming to rest. **(02 marks)**

(ii) Coefficient of friction between the brick and the floor. **(03 marks)**

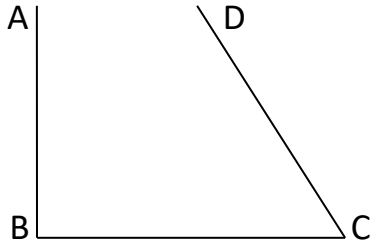
6. The marks scored by 10 students in a French and German examinations were;

French	56	50	72	67	31	50	65	40	80	61
German	60	50	67	75	64	56	73	48	76	62

Calculate a rank correlation coefficient for the two subjects. Comment on your result. **(05 marks)**

7. Locate each of the three roots of the equation $x^5 = 3x^2 - 1$ **(05 marks)**

8. A uniform wire ABCD is bent into the shape shown;



If the sections AB, BC and CD are straight and of length 3m, 10m and 5m respectively and AD is parallel to BC, find the distances of centre of mass of bent wire from:

(i) AB **(03 marks)**

(ii) BC **(02 marks)**

SECTION B (60 MARKS)

Attempt only five (5) questions from this section

9. (i) Show that the equation $x^3 - 5x + 1 = 0$ has a root between 0 and 1. **(03 marks)**

(ii) Use linear interpolation to estimate this root correct to 2 decimal places. **(02 marks)**

(iii) Using the Newton Raphson process, find the root of the equation in (i) giving your answer correct to 3 decimal places. **(07 marks)**

10.(a) Records from a health facility show that two in every 20 patients are found with a strange disease. If a sample of 500 patients is checked, find the probability that between 48 and 61 patients are found with the disease. **(06 marks)**

(b) A box P contains 1 red, 3 green and 1 blue beads. Box Q contains 2 red, 1 green and 2 blue beads. A balanced die is thrown and if the throw shows a six, box P is chosen otherwise box Q is chosen. A bead is drawn at random from the chosen box. Given that a green bead is drawn, find the probability that it came from box P. **(06 marks)**

11.(a) A ladder AB, of weight W and length 4m, has one end A on rough horizontal ground. The other end B rests against a smooth vertical wall. A load of weight 4W is placed at the point C on the ladder, where AC = 3m. If the ladder makes an angle θ with the horizontal, where $\tan\theta = 2$ and the system is in limiting equilibrium, calculate the coefficient of friction between the ladder and the ground. **(06 marks)**

(b) A second load of weight KW is now placed on the ladder at A while the load of weight 4W is removed from C and placed on the ladder at B. Given that the ladder and the loads are in equilibrium, find the value of K.

(06 marks)

12. The table below show the ages of people who attended a certain function.

Age (yrs)	**Frequency**
10 – 19	6
20 – 34	16
35 – 44	27
45 – 64	39
65 – 79	18
80 – 89	8

(a) Draw a cumulative frequency curve and use it to estimate the semi – inter quartile range. **(06 marks)**

(b) Calculate the:

(i) mean age **(03 marks)**

(ii) standard deviation **(03 marks)**

13.(a) Using the trapezium rule with 3 strips, estimate $\int_0^{\pi/2} \frac{1}{\sqrt{1+\cos x}} dx$

Correct to 3 decimal places. **(06 marks)**

(b) Determine the percentage error made in your estimation in (a) above.

(06 marks)

14.(a) A particle accelerates uniformly at $0.25ms^{-2}$ from rest to a velocity Vms^{-1} It maintains the constant velocity for a while and then decelerates uniformly at $1ms^{-2}$ to rest. If the particle covers 2.5km in 2.5 minutes during this motion, calculate the value of V. **(10 marks)**

(b) Sketch the velocity time graph for the motion of the particle

(02 marks)

15.(a) A car of mass 800kg moved with a constant acceleration of $0.4ms^{-2}$ along a horizontal straight road against a resistance to motion of 250N.
Find the power developed at the instant when car moved at 10 ms^{-1}.

(04 marks)

(b) A car of mass 1200kg pulls a trailer of mass 300kg up a slope of 1 in 100 against a constant resistance of 0.2 N per kg. Given that the car moved at a constant speed of $1.5ms^{-1}$ for 5minutes. Calculate the:

(i) tension in the tow bar. **(05 marks)**

(ii) work done by the car engine during this time. **(03 marks)**

16.(a) The random variable X has a normal distribution with mean 20 and standard deviation 4. Find the value of d such that $P(20 < X < d) = 0.4641$.

(05 marks)

(b) The lengths of certain trees in a given forest were normally distributed with a standard deviation of 5.5m. A sample of 100 such trees checked on a particular day had a mean length of 5.6m. Determine:

(i) a 97.5 % confidence interval for the mean length of all such trees in the forest.

(03 marks)

(ii) The probability that the trees were of mean length between 5.4m and 5.8 m.

(04 marks)

END