**P425/2**

**APPLIED MATHEMATICS**

**Paper 2**

**Jul/ Aug 2016**

**3 Hours**

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**MUKONO EXAMINATIONS COUNCIL**

**Uganda Advanced Certificate of Education**

**APPLIED MATHEMATICS**

**Paper 2**

**3 Hours**

**INSTRUCTIONS TO CANDIDATES**

* *Answer all the eight questions in section A and any five from section B*
* *Any addition question(s) answered will not be marked*
* *All necessary working must be clearly shown*
* *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.*

**SECTION A: (40 MARKS)**

1. For a particular sample of size 10, the sample mean, , was 0.5 and the sample variance , , was 4.8. Find  for the sample. ***(05marks)***
2. Show graphically that the equations  and  have a common root, stating the interval of integers within which it lies. Hence estimate the root of the equation ,correct to 2 decimal places. ***(05marks)***
3. Two particles of masses 1kg and kg hang vertically, one at either end of an inextensible string passing over a smooth fixed pulley. When the particles are released from rest, the 1kg mass moves upwards with an acceleration of 4.9.

Determine the:

(i) tension in the string;

(ii) value of ***(05marks)***

1. The score in a certain amplitude test for employment had a normal distribution with mean 20.95% of the interviewees scored between 13 and 17.

(i) Find the standard deviation of the scores.

(ii) A company requires a standard score of 1.5 for employment. What is the minimum

score one should obtain in order to get employment in this company? ***(05marks)***

1. The position vectors of two moving particles are given by  and ; where is time in seconds. Given that the particles collide, find the:

(i) Position vector of the point of collusion;

(ii) Velocity of the first particle relative to the second particle at the instant of collision.

***(05marks)***

1. In a certain gambling game, a player nominates an integer , from 1 to 6 inclusive and then he throws three fair dice. The player pays shs 1000 per play of the game and receives shs 9600 if the number of ’s is 3, shs 3000 if the number of ’s is 2, shs 1000 if the number of ’s is one and zero otherwise. Calculate the player’s expected gain or loss. ***(05marks)***
2. A snow cone vendor notices that his sales, S, varies linearly with the daily high term temperatures; T°C. On a day when the high temperature is 75°C, he sells 50 snow cones while a day when the high temperature is 85°C, he sells 150 cones.
3. Find how many cones of snow he will be able to sell on a day when the high temperature is 90°C.
4. Estimate the temperature on a day the vendor makes 100 sales. ***(05marks)***

30°

ᶿ0°

F m

A force FN, maintains a particle of masskg in equilibrium on a smooth plane of angle 30° to the horizontal. If the force acts at an angle θ to the plane and the normal reaction of the plane on the particle is 1.5mg, find the values of θ and F. ***(05marks)***

SECTION B: ( 60MARKS )

9. a) Study the flow chart below and answer the questions which follow:

x = 1

K = 0

N = N + 14

x = x + 1

Print: y

START

N = 7

K = 0

S = 0

N = N + 14

K = K + 1

S = S + N

IS

N > 100

?

PRINT: S, K

i) Perform a dry run for the flow chart. ***(02marks)***

ii) State the purpose of the flow chart. ***(01mark)***

b) (i) Show that the Newton Raphson formula for finding the root of the equation 

is given by 

1. Taking the initial approximation to the root to be , construct a flow chart that can be used to compute and print a close approximation to the root. Correct to 4 decimal places. ***(06mark)***
2. Perform a dry run for your flow chart in (ii) above using . ***(03marks)***

10. The intelligence quotient (IQ) of 100 pupils were tested and recorded as in the table

below.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IQ | 10 - | 20 - | 30 - | 40 - | 50 - | 60 - | 70 - | 80 - | 90 - <100 |
| No. of pupils | 1 | 1 | 2 | 6 | 21 | 29 | 24 | 12 | 4 |

a) Calculate the mean and standard deviation of the IQ for the pupils. ***(06marks)***

b) Draw a cumulative frequency curve and use it to estimate the:

1. number of pupils who have IQs within 1 standard deviation of the mean.
2. standard deviation of the IQ and compare it with the calculate value. ***(06marks)***

11. a) A uniform rod AB of length 2a and weight W rests with one end A on a rough

horizontal floor, with coefficient of friction μ. Another point C of the rod, where touches a smooth peg. If the rod is inclined at an angle θ to the vertical, show that;

 ***(06marks)***

b) A particle of mass 2kg executes simple harmonic motion about 0. When the particle is

1.5M from 0, its speed is 4ms-1 and the resultant force acting on it is 12N. Find the:

1. Period and amplitude of motion; ***(04marks)***
2. Least time the particle takes to reach 0. ***(02marks)***

12. a) Using the trapezium rule with five subinterval, estimate .

Correct to 4 decimal places. ***(05marks)***

b) (i) Find the exact value of  ***(05marks)***

(ii) Determine the percentage error in your estimate in (a) above. ***(02marks)***

13. a) A discrete random variable X has the following probability distribution.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1 | 5 | 9 |
| P | a | b | c |

Given that P = 2P and P = P(), find the:

(i) values of a, b, and c; ***(03marks)***

(ii) variance of X. ***(03marks)***

b) A family plans to have three children.

Let M, F, A and B be the events.

M : A male child is born.

F : A female child is born.

A : All the children are of the same sex.

B : At least two children are boys.

(i) Write down the sample space for the ways children could be born in a family.

(ii) Determine the probability distribution for the number of boys X in the family.

(iii) Find P(A/B) and state the relationship between A and B.

Assume the children are equally likely to be born. ***(06marks)***

14. a) Masaka is South west of Kampala. To a passenger in a Kampala – Masaka bound bus,

travelling at 120kmh-1, a steady wind appears to blow from the west. When the speed of the bus reduces to 90kmh-1, the wind appears to the passenger to be blowing from W30°N. Find the true direction and speed of the wind. ***(05marks)***

b) A body A is travelling with a constant velocity of 20kmh-1 due west and body B is

travelling in the direction of the vector at 16kmh-1. At a certain instant A is

1.2km due north of B. Taking A as the origin at this instant, show that the position

vector  of A relative to B at any time  is given by 6 (-6) ; where  is

in hours. Hence show that the minimum distance between A and B is 0.72km.

***(07marks)***

15. a) The duration of a trouble free operation of a new vacuum cleaner is normally

distributed with a mean of 530 days and a standard deviation of 100 days.

(i) Determine the probability that a randomly selected vacuum cleaner will work for at

least 730days without fail.

(ii) A random sample of 25 vacuum cleaners is selected. Find the limits within which one

would expect the sample average to lie symmetrically with probability 0.95.

***(05marks)***

b) Of the students who sit for A’ level mathematics examination, 60% are able to

complete paper 2. 600 students are selected at random. Find the probability that:

(i) at least 348 but less than 375 complete the examination.

(ii) more than 390 will be able to complete the examination. ***(07marks)***

16. a) Forces of 5N, 3N, 4N and 6N act along the sides AB, BC, CD and DA of a square of side

2m.

(i) Find the distance from A at which the line of action of the resultant cuts AB.

(ii) Two additional forces of N and 2N act respectively along diagonals AC

and BD. Show that the system reduces to a couple and find it moment. ***(09marks)***

b) . S 4m R

4cm

1m

P Q

The figure above show a lamina in the shape of a trapezium. The centre of gravity of the

lamina is a distance of 1.5m from side PS and its mass is 1.8kg. Find the least force which

must be applied at point R for the lamina to be in equilibrium. ***(03marks)***

***End -***