

P425/2
APPLIED
MATHEMATICS
Paper 2
July, 2016
3 hours

RESOURCEFUL MOCK EXAMINATIONS

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 questions from section B.

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 use $g = 9.8\text{ms}^{-2}$

Turn Over

SECTION A (40 MARKS)

1. X is a continuous random variable whose cdf is;

$$F(x) = \begin{cases} \lambda x^3; & 0 \leq x \leq 3 \\ 1 & ; x \geq 3 \end{cases}$$

- Find; (i) the value of the constant λ . *(02 marks)*
(ii) $P(X > 1 / X < 2)$ *(03 marks)*

2. A body of mass 0.4kg is at rest on a rough horizontal surface. If the coefficient of friction is 0.5. Find the;

- (i) angle of friction
(ii) magnitude of the least force that will move the body against the surface. *(05 marks)*

3. A weighing machine is corrupted such that a mass of 2 kg is recorded as a 1.5 kg and a 5 kg mass is recorded as a 4 kg. Estimate using linear approximation.

- (i) what mass is recorded as 2.25 kg. *(02 marks)*
(ii) the mass that is recorded accurately. *(03 marks)*

4. The resultant of a system of forces is $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$ N, the point (3, 2) lies on the line of

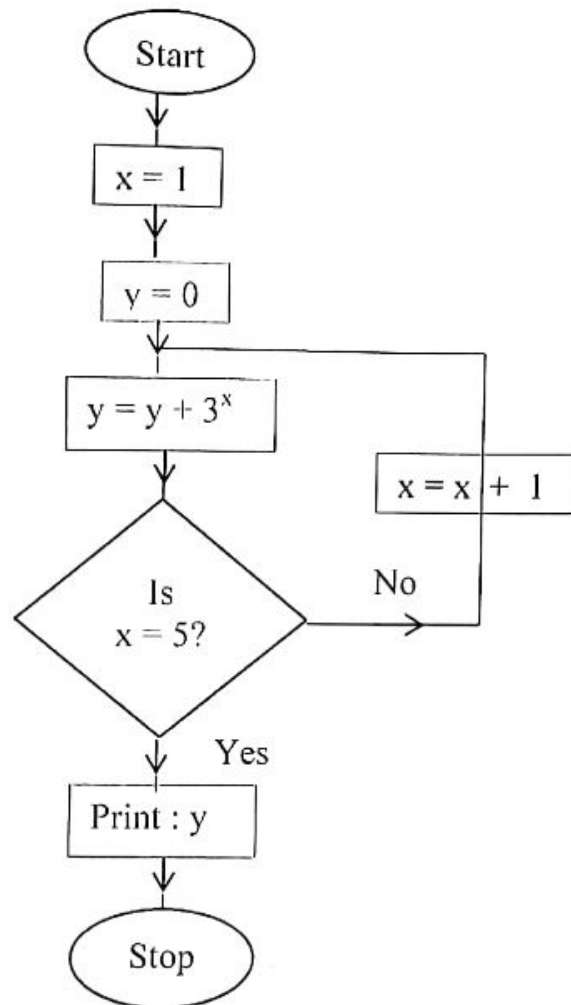
action of the resultant force. Find the;

- (i) equation of the line of the resultant
(ii) value of the moment that when added to the system the line of the resultant will pass through the point (0, 0). *(05 marks)*

5. In a frequency table, it was recorded that $\sum fx^2 = 10000$, $\sum fx = 600$ and the standard deviation was calculated as 5. Calculate $\sum f$.

6. A particle P is projected vertically upwards with a speed of $u \text{ ms}^{-1}$ from a point O on the ground; while at its highest point a second particle is projected vertically upwards with a speed $2u \text{ ms}^{-1}$ from point O. The particles collide at a point which is at a distance $x \text{ m}$ from the highest point of P. prove that $u^2 = 32gx$. *(05 marks)*

7. Study the flow chart below;



Perform a dry run for the flow chart and suggest its purpose. (05 marks)

8. The probability that a star player of a football team will play in any game is 0.8. the probability that the team wins a game when the star player is in the team is 0.75, otherwise it is 0.5.

Find the probability that the;

- (i) team will win a game
- (ii) star player is in the team if they lose the game.

(05 marks)

SECTION B (60 MARKS)

9. (a) Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ correct to 3 dpls. (04 marks)

(b) Use the trapezium rule with 6 ordinates to estimate $\int_0^1 \frac{x}{x^2+1} dx$ correct to 3 dpls; hence state the absolute error in your answer. (08 marks)

10. **X** is a discrete random variable such that;

$$P(X = x) = \begin{cases} kx & ; \quad x = 3, 4, 5 \\ k2^x & ; \quad x = 1, 2 \\ 0 & ; \quad \text{elsewhere} \end{cases}$$

(a) Find the value of the constant **k**, hence find;

(i) $P(X \geq 2)$

(ii) The variance of **X**. (09 marks)

(b) Sketch the graph of $P(X = x)$. (03 marks)

11. Relative to an observer in a motor boat travelling at 10 kmh^{-1} due south, a steamer appears to travel at $40\sqrt{2} \text{ kmh}^{-1}$ due north west;

(a) Find the magnitude and direction of the actual velocity of the steamer.

(07 marks)

(b) If initially the boat was 50 km north of the steamer; find the shortest distance between the vessels, and calculate the time that elapses before this occurs. (05 marks)

12. Study the table below;

Marks	20 - 24	25 - 34	35 - 38	39 - 44	45 - 49	50 - 54
Frequency density	1.2	1	2	1.5	1	0.4

(a) (i) Construct a histogram using this data

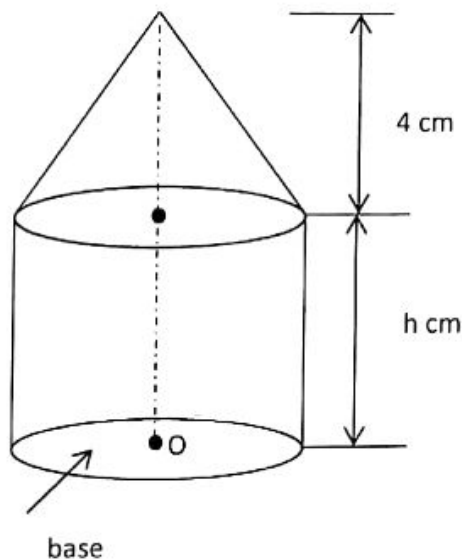
(ii) Use the histogram to estimate the mode.

(06 marks)

(b) Calculate the mean mark.

(06 marks)

13. (a) Use a graphical method to find the two roots of the equation;
 $x^2 + x - 4 = 0$ correct to 1 dpt. (06 marks)
- (b) Use the Newton – Raphson method to find the negative root of the equation
in (a) above correct to 4 decimal places. (06 marks)
14. (a) The figure below shows a uniform solid consisting of a right circular cone
and a cylinder.



Show that the distance of the centre of gravity of the solid from O is
 $\frac{3h^2 + 8h + 8}{6h + 8}$ cm, where h is the height of the cylinder. (07 marks)

- (b) When the solid in (a) above is placed with its base on a rough plane
inclined at 45° to the horizontal it will be at the point of toppling. If the
radius of the cylinder is $2\frac{2}{3}$ cm, find the value of **h**. (05 marks)
15. A particle of mass 0.5kg acted upon by an accelerating force of $(12t^2\mathbf{i} - 6t\mathbf{j})$
Newtons passes through point P (-2, 3) with a speed of $3\mathbf{i} - 4\mathbf{j} \text{ ms}^{-1}$.
- (a) Find the velocity and position vector of the particle **t** seconds after passing
through point P(-2, 3). (06 marks)
- (b) Calculate; (i) the average speed of the particle in the time interval
 $t = 1$ to $t = 3$ s.
(ii) the power developed at $t = 2$ s. (06 marks)

16. The marks of all the candidates from a certain school in a national examination were normally distributed with a mean of 52% and a standard deviation of 16%. The lowest mark for a distinction was 68%.
- (a) Given that 20 candidates scored below 40% estimate the number of candidates in the school, hence find the number of candidates who got distinctions. *(06 marks)*
- (b) Sixteen candidates of this school were picked at random. Find the probability that their mean score was between 46% and 58%. *(06 marks)*

END

P425/2

Applied Mathematics

Paper 2

JUNE, 2018

3 hours

EDEN INTERNATIONAL SCHOOL

B.O.T II EXAMINATIONS, 2018

APPLIED MATHEMATICS

Paper 2

3 hours

INSTRUCTIONS TO CANDIDATES:

Answer all the eight questions in section A and any five from section B.

All necessary working must be clearly shown.

Begin each answer on a fresh sheet of paper.

Graph papers are 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 9.8ms^{-2} .

SECTION A

1. Two events A and B are such that $P(A) = 0.7$, $P(A \cup B) = 0.45$ and $P(A^1 \cap B^1) = 0.18$. find;

(a) $P(B^1)$

3rnks

(b) $P(A \text{ or } B \text{ but not both } A \text{ and } B)$

2rnks

2. A particle starting from rest traverses a distance of 52m in the seventh second. Find the distance the particle traversed in the tenth second.

5mks

3. A biased coin is tossed four times. The probability that it shows only heads in the four tosses is 0.0256. Find the probability of obtaining exactly two heads when the coin is tossed four times.

5mks

4. A random variable x is normally distributed with mean 50 and standard deviation 10. Find the probability that x lies between 45 and 62.

5mks

5. The table below shows delivery charges by a courier company.

Mass (g)	200	400	600
Charges (shs)	700	1200	3000

Use linear interpolation or extra polation to find,

(a) Delivery charges of a parcel weighing 352g.

3rnks

(b) Mass of a parcel whose delivery charges is shs 3360.

2rnks

6. A carton of mass 5kg rests on a rough inclined plane inclined at 30° to the horizontal. If the coefficient of friction between the carton and the plane is 0.2, find a horizontal force that should be applied to make the carton first about to move up the plane.

5mks

7. Using graphical method, find the first approximation to the real root

of $x^3 - 3x + 4 = 0$.

5mks

8. A particle moving with simple harmonic motion has speeds of 6ms^{-1} and 8ms^{-1} at distances 16m and 12m respectively from the equilibrium position. Find the amplitude and the period of the motion.

5mks

SECTION B

9. The heights (in cm) of senior six candidates in a certain school were recorded as in the frequency of table below.

Height (cm)	Frequency (f)
149 - 152	5
153 - 156	17
157 - 160	20
161 - 164	25
165 - 168	15
169 - 172	6
173 - 176	2

- (a) Estimate the mean height and standard deviation of the candidates.
 (b) Plot a cumulative frequency curve (O-give).
 (c) Use your o-give in (b) above to estimate the;

- (i) Median height.
 (ii) Range of the height of the middle 60% of the candidates. 12mks

10. (a) Use the trapezium rule to estimate the area of $y = 52x$ between the x-axis, $x = 0$ and $x = 1$, using five sub-intervals. Give your answer correct to 3 decimal places.

- (b) Find the exact value of,

$$\int_0^1 5^{2x} dx$$

- (c) Determine the percentage error in the two calculations in (a) and (b) above. 12mks

11. The continuous random variable x has the probability density function (p.d.f) given by,

$$f(x) = \begin{cases} K_1 x & 1 \leq x \leq 3 \\ k_2 (4 - x) & 3 < x \leq 4, \\ 0 & \text{otherwise} \end{cases}$$

Where K_1 and k_2 are constants, given that $f(3.5) = \frac{3}{11}$, find;

- (a) The values of k_1 and k_2 . 5mks
 (b) The median of x . 4mks
 (c) $E(x)$, the expectation of x . 3mks

12. (a) Three points A, B and C lie along a straight line. The distance between A and B is 95m and between B and C is 80m. A particle travelling along the straight line towards C passes point A with speed U . The particle is travelling with constant acceleration. If it covers the distance between A and B in 5 seconds and the distance between B and C in two seconds, find the distance beyond C, the particle covers in the next 3 seconds. 7mks

(b) A stone is projected vertically upwards with a speed of $20\text{m}\cdot\text{s}^{-1}$ from a tower of height 25m. Find the;

(i) Time taken by the stone to reach the maximum height. 2mks

(ii) Velocity with which the stone hits the ground. 3mks

13. A particle of mass $4m$ is attached to the mid-point of a light string of modulus $2mg$ whose ends are attached to two fixed points distant $8a$ apart in a vertical length $2a$, find the depth below the upper fixed point A, of the position of equilibrium of the particle. When the particle is slightly disturbed from rest in a vertical direction, show that it performs single harmonic motion of period $2\pi\sqrt{a/g}$.

14. A pair of dice is tossed 180 times and the sum of the outcomes recorded. Find the probability that a sum of 7 occurs.

(a) Atleast 26 times.

(b) Between 20 times and 35 times inclusive.

(c) Less than 19 times. 12mks

15. Six forces, 9N, 5N, 7N, 3N, 1N and 4N act along the sides AB, BC, CD, DE, EF and FA of a regular hexagon of side 2m, their directions being indicated by the order of the letters. Taking AB as the reference axis, express each of the forces in vector forms. Hence find the;

(i) Magnitude and direction of the resultant of the forces. 6mks

(ii) Distance from A, where the line of action of the resultant cuts AB. 6mks

16. The table below shows the percentage of sand, y , in the soil at different depths x (in cm).

Soil x (cm) depth	35	65	55	25	45	75	20	90	51	60
% of sand (y)	86	70	84	92	79	68	96	58	86	77

- (a) (i) Plot a scatter diagram for the data. Comment on the relationship between the depth of soil and the percentage of sand in the soil.
- (ii) Draw a line of best fit through the points of the scatter diagrams. Use your results to estimate the percentage of the sand in the soil at depth of 31cm, and depth of the soil with 54% sand.
- (b) Calculate the rank correlation coefficient between the percentage of sand in the soil and the depth of the soil. *12mks*

END

P425/2
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July/Aug. 2018
3 HOURS



ACEITEKA JOINT MOCK EXAMINATIONS 2018
MOCK EXAMINATIONS 2018
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 additional question (s) answered will **not** be marked
- All necessary working **must** be shown clearly
- Begin each answer on a fresh sheet of paper
- Graph paper is provided
- Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.
- In numerical work, take g to be 9.8 ms^{-2} .

SECTION A (40 MARKS)

- Events A and B are such that
 $P(A) = 0.8$, $P(A/B) = 0.8$ and $P(A \cap B) = 0.5$.
Find;
(i) $P(B)$ (02 marks)
(ii) $P(A \cap B / A \cup B)$ (03 marks)
- A particle of mass **2kg** moves with velocity $e^t i + 2e^{-2t} j - \sin t k$.
Find the power developed after 4 seconds. (05 marks)
- If $p = 4.7$, $q = 80.00$ and $r = 15.900$ are rounded off with corresponding percentage errors of 0.5, 0.5 and 0.05, calculate the relative error in the expression $\frac{pq}{r}$ correct to 2 significant figures. (05 marks)
- In a survey, 200 people were asked the length of time that they spent in the shower, the last time that they took one. The results were as follows:
 $\Sigma x = 909$, $\Sigma x^2 = 4555$.
(a) Find an unbiased estimate of the population variance. (02 marks)
(b) Determine the 97.5% confidence interval for the mean time spent in the shower. (03 marks)
- A particle of weight **78.4N** is released from rest at the top of a plane inclined at 30° to the horizontal. If the coefficient of friction between the particle and the plane is **0.2**, find the
(i) acceleration (03 marks)
(ii) velocity after covering 10m. (02 marks)
- The following scores were obtained during the sports day competition by different students' houses in a certain school;
42.2, 44.6, 47.5, 42.6, 51.4, 53.7, 56.8, 42.2, 59.2 and 61.7.
Find the;
(i) mean score (02 marks)
(ii) variance (03 marks)
- By using the Newton Raphson formula and $x_0 = \pi/2$ as the initial approximation to the root of the equation $3\sin x - 2x = 0$, show that the second approximation to the root is **1.5**. (04 marks)

8. A non uniform rod **AB** of mass **20kg** and length **4m** is suspended horizontally from the ends of the strings **AC** and **BD** of 60° and 45° respectively with the vertical. If the tension in **AC** is **60N**, calculate the:
- tension in the string **BD** (03 marks)
 - Distance from **A** where the weight of the rod acts. (03 marks)

SECTION B (60 MARKS)

9. The germination time of a certain species of beans is known to be normally distributed. In a given bath of these beans, **20%** take more than **6 days** to germinate and **10%** take less than **4 days**.

- Determine the mean and standard deviation of the germination time. (08 marks)
- Find the **99.5%** confidence limits of the germination time. (04 marks)

- 10.(a) To a pilot of a plane flying at 180kmh^{-1} on a bearing of **S 30° W**, the wind appears to blow from **S 40° W** at 190kmh^{-1} . Find the true speed of the wind. (04 marks)

- (b) Two birds, A and B are initially at points with position vectors $(5\mathbf{i} + 8\mathbf{j} + 12\mathbf{k})\mathbf{m}$ and $(2\mathbf{i} - 4\mathbf{j} + 15\mathbf{k})\mathbf{m}$ respectively. if they are respectively flying with constant velocities of $(2\mathbf{i} + \mathbf{j} + \mathbf{k})\text{ms}^{-1}$ and $(\mathbf{i} + 2\mathbf{j} + 2\mathbf{k})\text{ms}^{-1}$, find the;

- time at which they are closest together (06 marks)
- Distance that then separates them. (02 marks)

11. Show that the simplest iterative formula based on Newton Raphson method for solving the equation $2x^3 + 5x = 8$ is

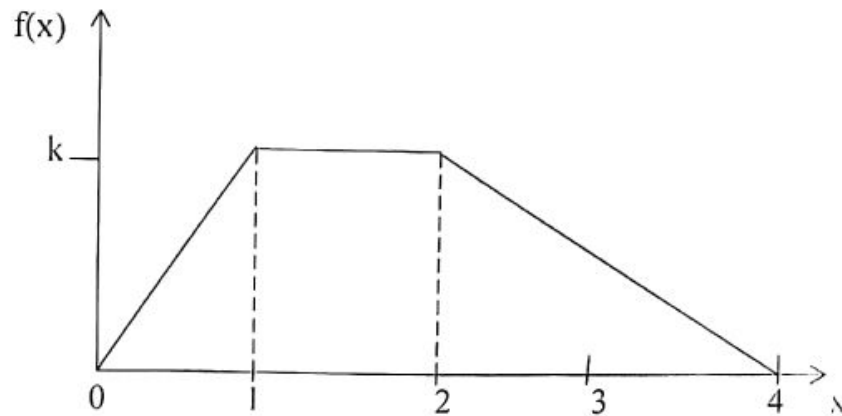
$$x_{n+1} = \frac{4x_n^3 + 8}{6x_n^2 + 5}, n = 0, 1, 2, \dots \quad (03 \text{ marks})$$

- (a) Draw a flow chart that:

- Reads the initial approximation.
- Computes and correct to three decimal places together with the number of iterations. (05 marks)

- (b) Taking **1.5** as the initial approximation perform a dry of the flow chart. (04 marks)

12. The probability distribution function of a continuous random variable X is represented as shown.



Find the;

- (i) Value of k (03 marks)
 - (ii) Expression for the distribution (03 marks)
 - (iii) $P(2.5 < x < 3)$ (03 marks)
 - (iv) Mean of X . (03 marks)
13. Forces of magnitudes **7N, 6N, 10N, 13N and 15N** act along the lines **BA, BC, DC, DA and AC** respectively of the rectangle **ABCD** whose sides **AB = 3a** and **BC = 4a** units. Find the;
- (a) The magnitude and direction of the resultant force. (09 marks)
 - (b) Distance from **A** at which its line of action cuts **AD**. (03 marks)
- 14.(a) Locate each of the two roots of the equation $e^x - 4 \sin x = 0$ in the interval $x = 0$ and $x = 1.5$. (04 marks)
- (b) A motorist rides from Mbarara to Kyazanga, a distance of **80km**. If he leaves Mbarara at 8:00am and reaches distances **20km, 50km, 70km** at **8:30am, 9:00am, 9:40am** respectively.
- (i) Find the approximate time he arrives at Kyazanga. (03 marks)
 - (ii) One day, at **9:35am** his car tyres burst and had to hire a lorry to carry the car to Kyazanga and was charged shs. **1000/=** per km. Find how much he paid for the hire. (05 marks)

15. The table below shows the ages of people who attended a certain function.

Age (years)	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 interquatile range. (06 marks)
- (b) Calculate the;
- (i) mean and (03 marks)
 - (ii) standard deviation (03 marks)
16. A car of mass **1200kg** pulls a trailer of mass **300kg** up a slope of **1 in 100** against a constant resistance of **0.2N** per kg. Given that the car moved at a constant speed of **1.5ms⁻¹** for **5 minutes**, calculate the;
- (i) tension in the tow bar. (05 marks)
 - (ii) work done by the car engine during this time (03 marks)
 - (iii) a car has an engine that can develop **15kw**. If the maximum speed of the car on a level road is **120kmh⁻¹**, calculate the total resistance at this speed. (04 marks)

END

P425/2
Applied Mathematics
July/August 2018
3 hours

BUGANDA EXAMINATIONS COUNCIL MOCKS 2018

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

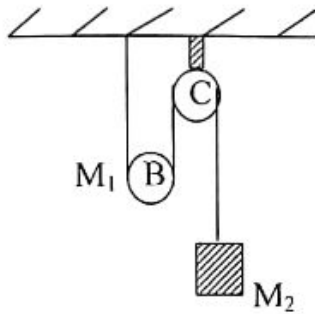
PAPER 2

3HOURS

Instructions:

- *Answer eight questions in Section A and ONLY 5 from Section B.*
- *All working **MUST** be clearly shown.*
- *Mathematical tables with a list of formulars and graph paper will be provided.*
- *Use a silent non programmable calculator.*
- *State the level of accuracy for answers got and indicate (tab) for Maths tables and (cal) for calculator used.*
- *Begin each answer on a fresh paper and use $g = 9.8 \text{ m/s}$ for numerical work.*

7. The numbers $x = 2.678$ and $y = 0.8765$ are measured to the nearest number of decimal places shown. Determine the maximum and minimum values of $P = xy$ to four decimal places. Hence what is the exact value of P ? *(05 marks)*
8. A light string passes over smooth pulleys B and C and carries mass M_2 at end D. End A is fixed as shown in the figure and B is a movable pulley of mass M_1 .



Show that B moves downwards with an acceleration given by

$$\left(\frac{M_2 - 2M_1}{M_1 + 4M_2} \right) g \quad (05 \text{ marks})$$

SECTION B (60 MARKS)

9. The probability density function of a random variable x is given by

$$f(x) = \begin{cases} 2kx & , 0 \leq x < 1 \\ k(3-x) & , 1 \leq x \leq 2 \\ 0 & , \text{otherwise} \end{cases}$$

- a) Sketch the function $f(x)$.
- b) Find: i) Constant K
 ii) $P(0.5 \leq x \leq 1.5)$
 iii) Mean of x .
 iv) $F(x)$ the cumulative distribution function *(12 marks)*

10. The table below shows the number of bags of coffee produced by farmers in the central region of the country.

Harvest (bags)	Number of farmers
31 – 40	12
41 – 50	18
51 – 60	14
61 – 70	08
71 – 80	06
81 – 90	02

- i) Draw a histogram to represent the harvest and use it to estimate the mode.
- ii) Compute the mean, median and standard deviation for the harvest, using suitable formulae.

11. i) Show that the function $f(x) = 3x^3 + x - 5$ has one of its roots between $x = 1$ and $x = 2$.
- ii) Use linear interpolation to estimate this root.
 - iii) Show by using Newton Raphson's formula that this root can be got from the formula.

$X_{n+1} = \frac{6x_n^3 + 5}{9x_n^2 + 1}$ hence use the approximation got in (ii) above to find this root (perform the iterations twice). Give your solution to 2 decimal places.

(12 marks)

12. Two uniform rods AB of weight W_1 and AC of weight W_2 and of equal length each $2L$ are smoothly hinged at A and rest in equilibrium with B and C on smooth horizontal floor when a non-elastic and light string is connected to B and C. Angle $BAC = 2\theta$.

Also a weight W_0 is suspended from a point on AC at a distance $\frac{3}{4}$ of AC from A. In terms of W_0 , W_1 and W_2 ,

- i) Find the reactions at A and C.
- ii) Show that the tension in the string is given by formula.

$$T = \frac{1}{4} \left(\frac{W_0}{2} + W_1 + W_2 \right) \tan \theta \quad (12 \text{ marks})$$

13. a) A certain company sells maize flour in bags of mean mass of 40kg and standard deviation of 2kg. Given that the mass of bags is normally distributed. Find:

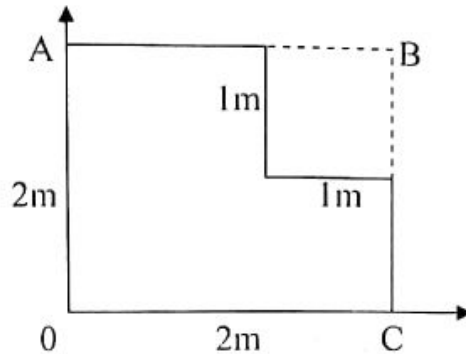
- i) Probability that any bag chosen at random has its mass between 41 and 42.5 kg.
- ii) Percentage of bags whose mass is greater than 43.
- iii) Number of bags rejected out of a 500 bags purchased by retailer whose customers cannot accept a bag whose mass is below 38.5kg.

(08 marks)

- b) The mean and standard deviation for a random sample of size 100 is 900 and 60 respectively. If the population is normally distributed, find the 95% confidence interval for the population mean.

(04 marks)

14. a) Masses 3, 2, 5 and 1kg are at points with position vectors $\mathbf{a} = 2\mathbf{i} - \mathbf{j}$, $\mathbf{b} = 3\mathbf{i} + 5\mathbf{j}$, $\mathbf{c} = -2\mathbf{i} - \mathbf{j}$, $\mathbf{d} = \mathbf{i} - 3\mathbf{j}$ respectively. Determine the position vectors for the centre of mass. (04 marks)
- b) A thin uniform square plate originally of mass 12kg has a square cut off as shown in the figure.



- i) Taking OC and OA as axes.
- ii) Find the centre of mass of the remaining part.
- iii) Determine the angle AC makes with the vertical if the remaining plate is suspended at A. (08 marks)

15. a) To a cyclist riding due north at 40km/h a wind appears to be blowing eastwards. On reducing his speed to 30km/h but in same direction (kept fixed), the wind appears to come from south-west. Find the true velocity of the wind.
- b) Particle P has constant velocity $\mathbf{j} + \mathbf{k}$ and initial point $2\mathbf{i} + 2\mathbf{k}$. the second particle Q has constant velocity $2\mathbf{i} + \mathbf{j} + 2\mathbf{k}$ and also initially at $11\mathbf{i} - 2\mathbf{j} - 7\mathbf{k}$. They started their motion at once (seconds and metres are used for time and distance respectively). Determine:
- i) The time when the two particles P and Q are closest together.
- ii) Shortest distance between them. (12 marks)

16. a) The table below shows marks obtained by 8 students in Mathematics and Physics tests. The marks are in terms of percentage.

Students:	A	B	C	D	E	F	G	H
Maths (x):	60	80	75	85	68	90	95	78
Physics (y):	70	75	80	78	85	90	96	83

- i) Plot the scatter diagram for the above data and comment on the trend
- ii) Compute spearman's rank correlation coefficient and comment the performance.

- b) The table below shows the items, amount of items and prices of items in the years 2010 and 2017 that were purchased by a hotel keeper.

Item	Price per kg	Quantity(kg)	
		2010	2017
Rice	3000	5	4
Beans	2000	4	6
Posho	1000	5	3
Sugar	2500	2	5

Compute the weighted aggregate price index taking 2010 as a base year. (12 mks)

END

P425/2
APPLIED
MATHEMATICS
PAPER 2
JUNE, 2018
3 HOURS

GAYAZA HIGH SCHOOL

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**.

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

Begin each answer on a fresh page.

In numerical work, take **g** to be 9.8ms^{-2} .

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

SECTION A: (40 MARKS)

Answer **all** the questions in this section.

1. Events **A** and **B** are such that $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{2}$ and $P(B/A) = \frac{2}{5}$.

Find the probability that:

(i) both events occur

(ii) only one of the events occurs

(05 marks)

2. At **10:30 am**, the position vector of ship **P** relative to ship **Q** at time t hours is ${}_p r_q = (14 - 3t)i + (12 - 5t)j$ km

(i) Write down the velocity of P relative to Q

(01 mark)

(ii) Find the time at which the ships are closest together.

(04 marks)

3. Given that $f(3.0) = 5.65$, $f(3.4) = 6.32$ and $f(3.8) = 7.04$, Use linear interpolation or extrapolation to find the value of:

(i) $f(3.3)$

(ii) $f^{-1}(4.7)$ (05 marks)

4. The marks of **6** students in **French** and **Biology** were as follows:

French	90	60	80	54	86	70
Biology	48	72	60	78	50	65

Calculate a rank correlation coefficient for the scores in the two tests.

Comment on your result.

(05 marks)

5. A car of mass **500kg** travels along a level road with the engine

working at **28kW**. If the frictional resistance to its motion is **650N**,

find the acceleration of the car when its speed is 72 kmh^{-1} . (05 marks)

6. Use the trapezium rule with five ordinates to estimate $\int_1^2 \frac{x^2}{1+x^2} dx$

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

7. A discrete r.v X has the following probability distribution:

$P(1) = \beta$, $P(2) = 2\beta$, $P(3) = 3\beta$, $P(4) = 4\beta$, and $P(5) = 5\beta$.

Find the:

- (i) value of β
- (ii) probability distribution of $Y = 3X - 7$
- (iii) $E(Y)$ (05 marks)

8. A horizontal force P acts on a box of weight $10N$ resting on a rough plane inclined at an angle of 30° to the horizontal. The friction coefficient between the box and the plane is μ . If the box is at the point of sliding up the plane when the normal reaction of the plane on the box is $16N$, find the values of P and μ . (05 marks)

SECTION B: (60 MARKS)

Answer any **five** questions from this section. All questions carry equal marks.

9. The lengths (h) in inches of **40** nails were as follows:

Lengths (h)	Frequency
$3.0 \leq h < 3.5$	8
$3.5 \leq h < 4.0$	5
$4.0 \leq h < 5.5$	12
$5.5 \leq h < 6.0$	9
$6.0 \leq h < 6.5$	6

- (a) Display the data on a histogram and use it to estimate the mode
- (b) Calculate the standard deviation of the distribution (12 marks)

10. (a) A particle executes S.H.M about centre O, with period 3π s and amplitude 10m. Find its speed when 8m from O (04 marks)

(b) A particle of mass m is suspended from a fixed point O by a light elastic string of natural length l and modulus of elasticity λ . The particle is then slightly vertically displaced from its equilibrium position and then released. Show that it moves with S.H.M of

period $2\pi\sqrt{\frac{ml}{\lambda}}$. (08 marks)

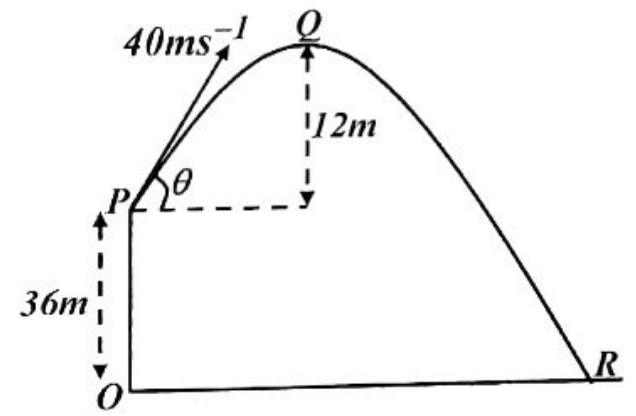
11. (a) The mass m and velocity v of a car were estimated with errors Δm and Δv respectively. Show that the maximum relative error in

its kinetic energy is $\left|\frac{\Delta m}{m}\right| + 2\left|\frac{\Delta v}{v}\right|$. (07 marks)

(b) Find the range within which the exact value of $\frac{4 \cdot 250}{4 \cdot 250 - 2 \cdot 14}$ lies.

(05 marks)

12. A ball is projected from the top of a vertical cliff $36m$ high with speed $40ms^{-1}$ at an angle of elevation θ as shown:



The ball passes horizontally through point Q which is 12m above the level of point P and hits the ground at point R. Find the:

- (i) value of θ (03 marks)
- (ii) minimum speed of the ball during its flight (02 marks)
- (iii) distance OR (03 marks)
- (iv) speed and direction of the ball as it hits point R (04 marks)

13. A biased coin is thrice as likely to show heads as tails. If it is tossed **48** times, find the probability of obtaining:

(i) between **30** and **40** heads.

(ii) at least **28** but less than **42** heads. (12 marks)

14. Locate the ranges where the roots of the equation $x^2 - x - 3 = 0$ lie. Hence use:

(i) linear interpolation method to find the largest root.

(ii) Newton Raphson's method to find the least root correct to **three** decimal places. (12 marks)

15. A continuous r.v **X** has the following p.d.f:

$$f(x) = \begin{cases} \lambda \cos x & , \quad 0 \leq x \leq \frac{\pi}{4} \\ \lambda \sin x & , \quad \frac{\pi}{4} \leq x \leq \frac{\pi}{2} \\ 0 & , \quad \text{otherwise} \end{cases}$$

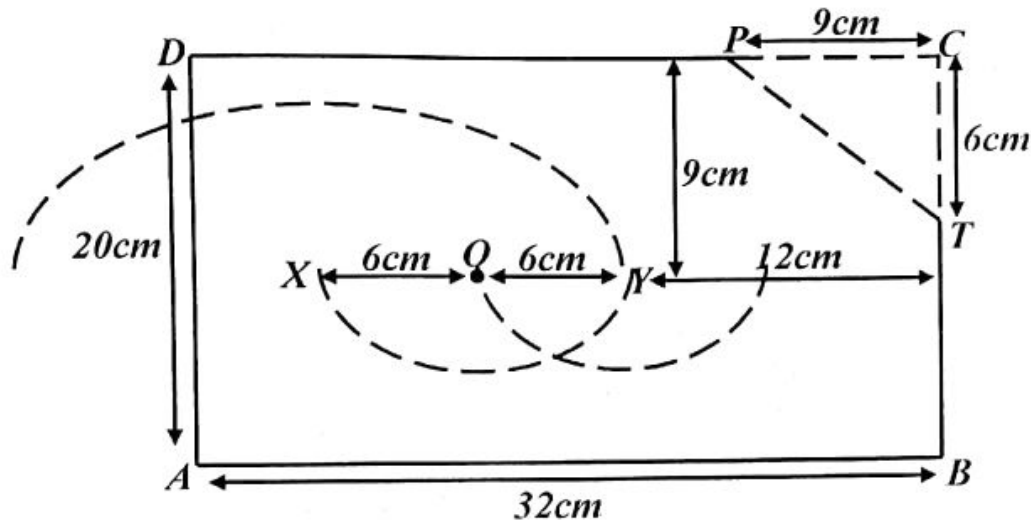
Find:

(i) the value of λ (03 marks)

(ii) the cumulative distribution function of **X**. (07 marks)

(iii) $P\left(X \leq \frac{\pi}{3}\right)$ (02 marks)

16. **ABCD** is a uniform rectangular lamina in which **AB = 32cm** and **AD = 20cm**. **P** and **T** are points on **DC** and **BC** respectively such that **PC = 9cm** and **TC = 6cm**. A triangular portion **PCT** and semi-circular portions with diameters **OX = 6cm**, **OY = 6cm** and **XY = 12cm** are removed from the lamina as shown.



Find the:

- (i) distances of the **c.o.g** of the remaining lamina from **AD** and **AB**.
- (ii) angle **AB** makes with the horizontal when the remaining lamina is hung from **B**. (12 marks)

****END****

RESOURCEFUL MOCK EXAMINATIONS, 2017

Uganda Advanced Certificate of Education

PURE MATHEMATICS

(P425/1)

TIME: 3HOURS

INSTRUCTIONS TO CANDIDATES

- ✓ Attempt all the questions in section A and five from section B.
- ✓ Working must be shown clearly
- ✓ Silent non programmable calculator may be used.
- ✓ Any additional question(s) answered will not be marked.

SECTION A

1. Prove that
$$\tan^{-1}x + \cot^{-1}x = \frac{\pi}{2}$$
2. The first term of an AP and G.P are each $\frac{2}{3}$ their common difference and common ratio are x and the sum of their first 3 terms is equal. Find the possible values of x .
3. $\int 2^{\sqrt{3x-1}} dx$.
4. Solve $3\sin(2x + \pi/6) - \cos(2x + \pi/6) = 2$
5. Find the equation of the normal to the curve $\frac{y}{x+\sin y} = 3$ at the point where $y = \dots$
6. Show that when the quadratic expression.
 $x^2 + bx + c = 0$ and $x^2 + px + q = 0$ have a common root then
$$(c - q)^2 = (b - p)(pc - bq)$$
7. Given that
 $P = \log_2 3$ and $q = \log_4 5$, show that $\log_{45} 2 = \frac{1}{2(p+q)}$

8. Use the substitution.

$$y = x + \frac{1}{x} \text{ to solve the equation } 2x^4 - 9x^3 + 14x^2 - 9x + 2 = 0$$

SECTION B

9. Describe the locus of the complex number z which moves in the argand diagram.

$$\text{Arg} \left(\frac{z-3}{z-2i} \right) = \frac{\pi}{2}$$

b) Find the fourth roots of $-16i$

10. If A , B and C are angles of a triangle prove that

$$\sin^2 A + \sin^2 B + \sin^2 C = 2 + 2\cos A \cos B \cos C$$

b) By expressing $6\cos^2\theta + 8\sin\theta\cos\theta$ in the form $R\cos(2\theta - \alpha)$. Find the maximum and minimum value of $6\cos^2\theta + 8\sin\theta\cos\theta = 4$

11. The curve with the equation $y = \frac{ax+b}{x(x+2)}$ where a and b are constants has a turning point at $(1, -2)$. Find the values of a and b .

Find the equation of all the asymptotes.

Sketch the curve.

12. Differentiate

$$y = 2x^{\cos x}$$

$$y = \frac{e^{\sin x}}{\tan x}$$

b) Prove that $\int_1^3 \left(\frac{3-x}{x-1} \right)^{\frac{1}{2}} dx = \pi$. Use the substitution $x = 3\sin^2\theta + \cos^2\theta$.

c) The displacement of a particle at time t is x measured from a fixed point and $\frac{dx}{dt} = \frac{c(e^{2act}-1)}{e^{2act}+1}$, prove that $x = \frac{c(e^{2act}-1)}{e^{2act}+1}$, if $x = 3$ when $t = 1$ and $x = \frac{75}{17}$, prove that $c = 5$

13. Show that the lines

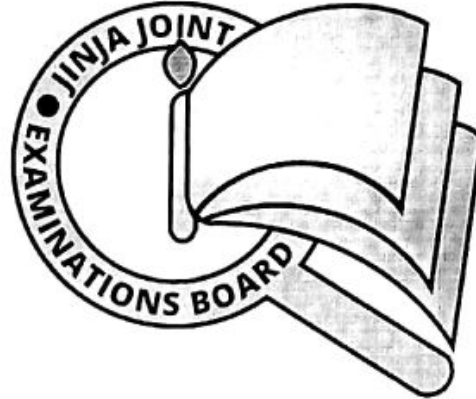
$r = 2i - 3j + 4k + \lambda(3i - 2j + k)$ and $r = i + 3j + k + \mu(-i - 2j + k)$ intersect. Find the point of intersection.

b) OAB is a triangle with $OA = \underline{a}$, $OB = \underline{b}$, c is a midpoint of OB , D is the midpoint of AB and E is a midpoint of OA . OD and AC intersect at F . if $AF = hAC$ and $OF = kOD$. Find the values of h & k . show that B , F & E are collinear.

14. a) Solve $\frac{dy}{dx} + 2y \tan x = \cos^2 x$
 $y(0) = 2$
- b) A radioactive substance disintegrates at a rate proportional to its mass. One half of the given mass of a substance disintegrates in 136 days, calculate the time required for $\frac{5}{8}$ of a substance to disintegrate. If the original mass of a substance was 100gm. Calculate the mass after 34 days.
15. Find the equation of the tangents to the curve $y = x^3$ at (t, t^3) . Prove that this tangent meets the curve again at $Q(-2t - 8t^3)$. Find the locus of the midpoint of PQ .
- b) Given that $y = mx + c$ is a tangent to the circle $(x - a)^2 + (y - b)^2 = r^2$. Show that $(1 + m^2)r^2 = (c - b + am)^2$.
16. a) $\int_1^2 \frac{8x+6}{(2x-1)^2(x+2)^2} dx$
- b) $\int_0^{\pi/2} \frac{1}{2 + \cos^2 x} dx$

END

P425/2
APPLIED
MATHEMATICS
Paper 2
AUGUST 2018
3 HOURS



JINJA JOINT EXAMINATIONS BOARD
Uganda Advanced Certificate of Education
APPLIED MATHEMATICS

AUGUST 2018

Paper 2

3 hours

INSTRUCTIONS TO CANDIDATES:

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

SECTION A (40 MARKS)

1. A student may travel to school by car, by bicycle or on foot. The probability of using a car is $\frac{1}{3}$, of riding a bicycle is $\frac{1}{2}$ and of going on foot is $\frac{1}{6}$, when he uses a car, the probability of arriving in time is $\frac{3}{4}$, by bicycle is $\frac{2}{5}$, on foot is $\frac{1}{10}$. Calculate the probability that the student went on foot given that he did not arrive in time. (05marks)
2. An object performs Simple Harmonic Motion (S.H.M) at rate of 20 oscillations per second between two points A and B which are 12cm. If C is the midpoint of AB, calculate the time taken to travel directly from C to the midpoint of CB. (05marks)
3. Given the numbers $x = 15.2$, $y = 0.45$ and $z = 8.6$, all measured to the nearest number of decimal places as indicated.
 - (i) State the maximum possible errors in each of the numbers. (01mark)
 - (ii) Find the percentage error in $\frac{xy}{z}$. (04marks)
4. Given that $A \sim N(28,9)$. Find the $P(22 < A < 26)$. (05marks)
5. The diagram in figure 1 below shows a body which may be modelled as a uniform lamina.

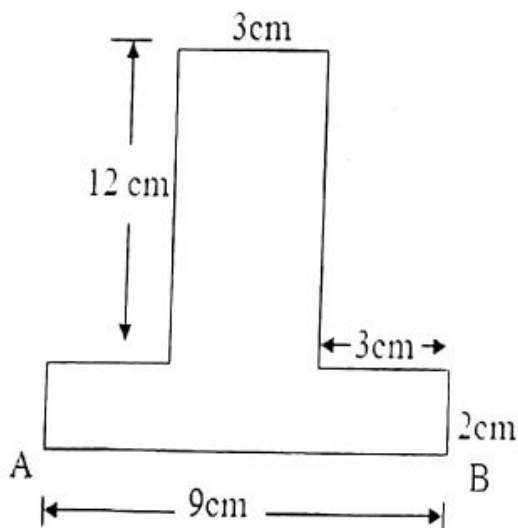


Figure 1

If the body is suspended from the point marked A and rests in equilibrium, calculate the angle which the edge AB makes with the vertical. (05marks)

6. The sizes of shoes sold in a certain shop in a given week are shown in table 1 below.

Size	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0
Number of pairs of shoes sold.	4	9	11	8	10	7	2	3

Find the:

- (i) Mean. (02marks)
 (ii) Standard deviation of the sizes of shoes sold. (03marks)
7. Table 2 below shows the values of x and the corresponding values of $f(x)$.

x	50.24	48.11	46.93	44.06
$f(x)$	4.116	7.621	9.043	11.163

Use linear interpolation/extrapolation to find the value of

- (i) x when $f(x) = 8.614$. (03marks)
 (ii) $f(51.07)$. (02marks)
8. A particle projected from a point O at angle of 50° above the horizontal passed through the point P, with position vector $70\mathbf{i} + 28\mathbf{j}$. Find the
- (i) initial velocity (03marks)
 (ii) time taken to reach P. (02marks)

SECTION B (60MARKS)

Answer any *five* questions from this section. All questions carry equal marks

9. The probability density function of a continuous random variable X is given as

$$f(x) = \begin{cases} \frac{2}{13}(x+1); & 0 \leq x \leq 2 \\ \frac{2}{13}(5-x); & 2 \leq x \leq 3 \\ 0; & \text{otherwise} \end{cases}$$

- (a) Calculate the
- $P(X < 2.5)$.
(03marks)
 - Mean of X .
(03marks)
- (b) Determine the cumulative distribution function, $F(x)$.
(06marks)
10. (a) A block of mass 12kg is placed on a rough plane, inclined at 30° to the horizontal. The coefficient of friction between the block and the plane is 0.5 . If the block is kept in equilibrium by the horizontal force of magnitude P Newtons, find the range of possible values of P . (06marks)
- (b) A non uniform rod AB of mass 20kg and length 4m is suspended horizontally from the ends of strings AC and BD such that AC and BD make an angle of 60° and 45° respectively with the vertical. If the tension in AC is 60N ,
Calculate the
- tension in string BD .
(03marks)
 - distance from A where the weight of the rods acts.
(03marks)
11. (a) Show that the equation $xe^x = x + 1$, has a root between 1 and 2. (3marks)
- (b) Use the Newton Raphson Method to find the root of the equation in (a) above correct to 2 decimal places.
(09marks)
12. (a) The chance of a goat being infected on a farm is 0.4 . If there are 150 goats on the farm, find the probability that
- more than 55 goats will be infected.
(04marks)
 - between 60 and 70 goats are infected.
(04marks)

- (b) The heights of students in a certain school are normally distributed with mean 164cm and standard deviation 7.2cm.
Calculate the probability that the mean height of a sample of 40 students will be between 162 and 166cm. (04marks)

13. The diagram in figure 2 below shows the velocities and initial positions of particles A and B.

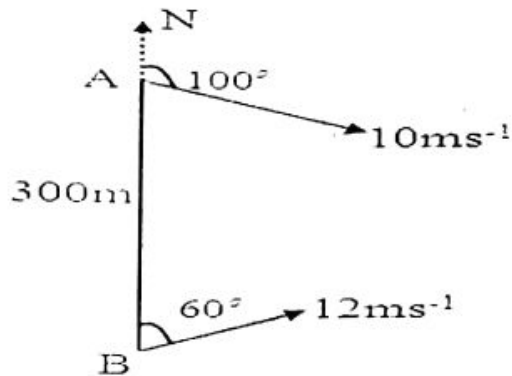


Figure 2

Calculate the

- (a) shortest distance between the two particles. (08marks)
- (b) time taken to reach that position. (04marks)
14. (a) Use the trapezium rule with six ordinates to estimate

$$\int_0^{\frac{\pi}{2}} \frac{1}{\sqrt{1+\cos x}} dx,$$
correct to three decimal places. (06marks)
- (b) Study the flow chart in figure 3 below and answer the questions that follow

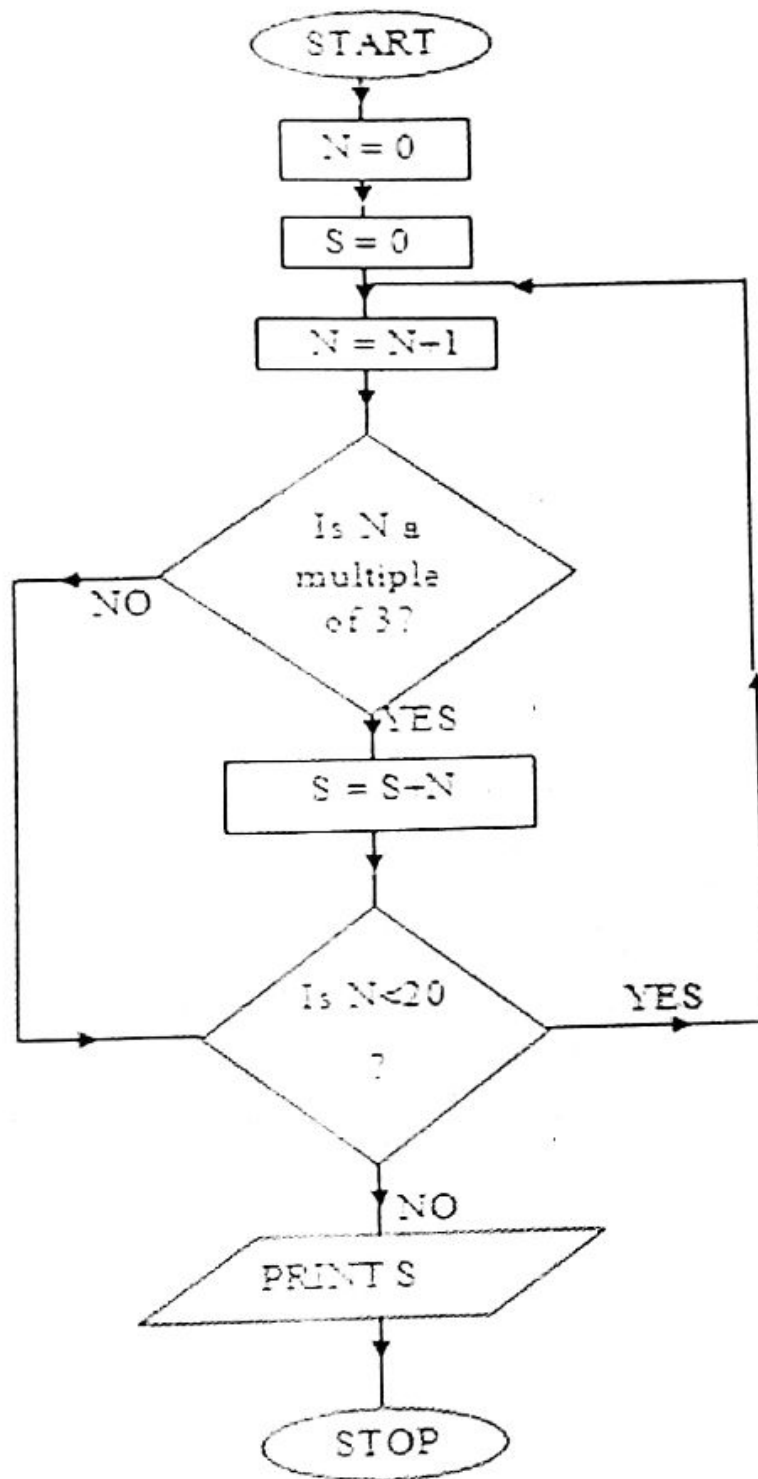


Figure 3

- (i) Perform a dry run for the flow chart.
- (ii) State the purpose of the flow chart.

(06marks)

15. A company took a survey of the ages of its employees. The results are shown in the frequency table below.

Ages (yrs)	18 –	20 –	30 –	40 –	50 –
frequency	8	22	15	7	2

- (a) Calculate the
- (i) mean age. (03mark)
 - (ii) modal age. (03marks)
 - (iii) standard deviation. (02marks)
- (b) Draw a cumulative frequency curve and use it to estimate the middle 60% age range. (04marks)
16. (a) A bus of mass 18tonnes travels up a slope inclined at $\sin^{-1}\left(\frac{1}{50}\right)$ against a resistance of $0.1N$ per kilogram. Find the tractive force required to produce an acceleration of $0.05ms^{-2}$ and the power which is developed when the speed is $10ms^{-1}$. (06marks)
- (b) A second bus of mass 25tonnes experiencing the same resistance and with a maximum power of $120KW$ follows the first bus up the slope. If the first bus maintains the same power while on the slope, find the maximum speed of the second bus. (06marks)

P425/2
APPLIED MATHEMATICS
Paper 2
Jul/ Aug 2018
3 Hours



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 additional 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.

In numerical work, Take $g = 9.8ms^{-2}$

SECTION A (40MARKS)

Attempt all questions

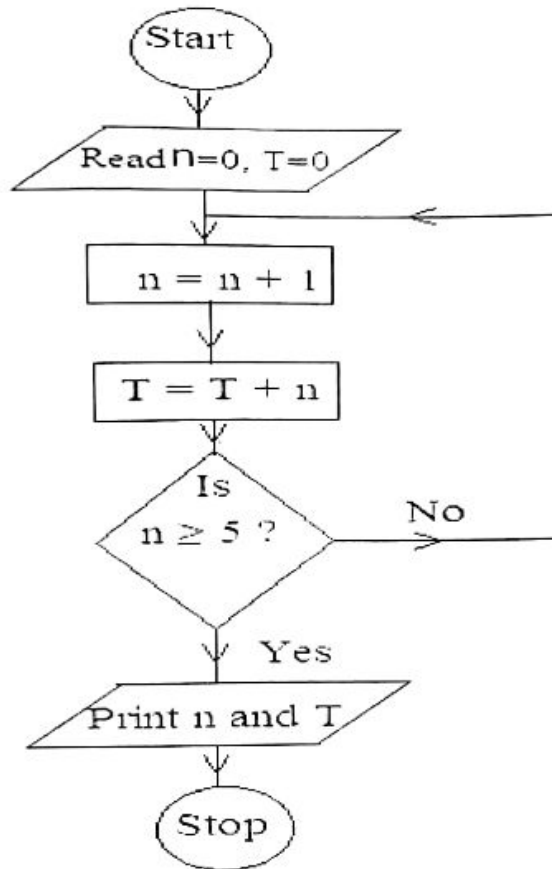
1. A random variable X is normally distributed and is symmetrical about $x = 25$.
If $P(X \leq 20) = 0.1750$, find $P(25 \leq X \leq 32)$. *(5 marks)*
2. A stone is thrown from the edge of a cliff with a velocity of 50ms^{-1} at an angle of $\tan^{-1}\left(\frac{7}{24}\right)$ above the horizontal. The stone strikes the sea at a point 240m from the foot of the cliff. Find the,
i. time for which the stone is in air.
ii. height of the cliff. *(5 marks)*
3. Show that the equation $x^3 + 2x^2 - 4x - 4 = 0$ has three roots in the interval $x = -3$ to $x = 2$. Hence use linear interpolation once to find the positive root correct to one decimal place. *(5 marks)*
4. The table below shows the amount of money in millions (A) given to some districts in Uganda for "Entandikwa" scheme.

A	25 - <30	30 - <40	40 - <50	50 - <60	60 - <80
f	4	10	4	3	5

Determine the mean and standard deviation of the money given out in the scheme. *(5 marks)*

5. A string with one end fixed, passes under a movable pulley of mass 2kg, over a fixed pulley and carries a 5kg mass at its other end. If the system is released from rest, find the
a) tension in the string.
b) acceleration of the movable pulley. *(5 marks)*

6. Study the flow chart below



- Perform a dry run for the flow chart.
- State the purpose of the flow chart.

(5 marks)

7. An elastic string of natural length 60cm is stretched to 70cm by a stone of mass 1.5kg hanging on it. Find the,

- modulus of elasticity of the string.
- energy stored in the stretched string at equilibrium.

(5 marks)

8. The probability that Blessing goes for work using a taxi is $\frac{2}{3}$ and her probability of arriving early for work when she use a taxi is $\frac{3}{4}$. If she uses a private means, her chance of arriving late is $\frac{1}{3}$.

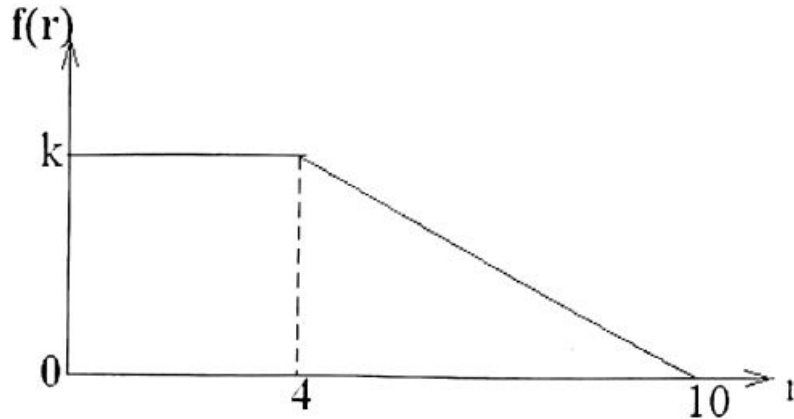
- What is the probability that that she arrives early for work on a given day.
- If she arrives early, what is the probability that she used a private mean?

(5 marks)

SECTION B (60 MARKS)

Attempt any five questions

9. A continuous random variable R has a probability density function (pdf), $f(r)$ shown graphically below



- a) Find the,
i) value of k
ii) expression of the pdf, $f(r)$
b) determine the distribution function (c.d.f) of R and sketch it.
c) Calculate $P(3 \leq R < 7)$ *(12 marks)*

10. Two cars A and B are proceeding one on each road, towards the point of intersection of two roads which meet at an angle of 60° . If the speeds of A and B are 20kmh^{-1} and 32kmh^{-1} and are 70m and 40m respectively from the cross road, and the cars maintain their speeds, determine the

- i) speed of B relative to A.
ii) time when they are nearest to each other.
iii) the distance of B from the cross road when they are nearest to each other. *(12 marks)*

11. (a) Use the trapezium rule with equal width of $\frac{\pi}{6}$ to estimate

$\int_0^{\frac{2\pi}{3}} (x - \sin x) dx$. Give your answer correct to 3 decimal places.

- (b) Determine the percentage error made in the estimation. *(12 marks)*

12. The table below shows marks scored by 8 students in UNEB final examination mock examination.

UNEB	79	67	52	71	97	55	41	86
Mock	75	60	45	55	85	43	30	70

- a) (i) Draw a scatter diagram for the data.
 (ii) On the same diagram draw a line of best fit.
 (iii) Use the line of best fit to estimate the mark that a student who scored 68 in Mock will score in UNEB.
- b) Calculate the rank correlation coefficient for the marks in Mock and UNEB and comment on your result. **(12 marks)**

13. (a) Forces of magnitude 4, 1, 2 and 3 N act along sides AB, BC, CD and AD respectively of a rectangle ABCD in which $AB = 4\text{m}$ and $BC = 3\text{m}$. Given that the direction of the forces are indicated by the order of the letters, determine the,

- i) Magnitude of the resultant force.
 ii) Length AT, where T is a point on AB where the line of action of the resultant force cuts AB.

(b) A non-uniform ladder AB of weight 78.4 N and length 5 m is freely suspended

horizontally by two light inelastic strings AC and BD that make angles of 30° and 40° respectively with the upward vertical. Find the distance from A where the weight of the ladder acts. **(12 marks)**

14. (a) The height of the top of a ladder of length l resting against a vertical wall making an angle of θ° with the horizontal is given by $h = l \sin \theta$.

- i. Show that the maximum relative error made in estimating the height h is given by $\left| \frac{\Delta l}{l} \right| + \left| \frac{\Delta \theta}{\tan \theta} \right|$, where Δl and $\Delta \theta$ are the respective errors in l and θ .
- ii. Find the maximum relative error in h if l and θ are measured to be 3.96 m and 59° respectively.

(b) The length and width of a rectangle are measured as 4.5 m and 2.4 m with percentage errors of 5% and 2% respectively.

Determine the,

- i) range within which its area lie.
 ii) maximum possible error made in estimating its perimeter. **(12 marks)**

15. (a) Mariam's probabilities of passing Physics, Economics and Mathematics are 0.6, 0.75, and 0.80 respectively.
- Find the probability that she passes at least two subjects.
 - If it is known that she passed at least two subjects, what is the probability that she failed Economics?
- (b) At a certain fuel station, 30% of the customers buy Super (S), 60% buy Regular (R) and the remainder Diesel (D). Of those who buy S, 25% fill their tank, 20% fill their tank with D and 30% do not fill their tank with R.
- Find the probability that when a vehicle leaves the station, it has a full tank
 - Given that a vehicle has full tank, what is the probability that the tank contains Diesel? *(12 marks)*
16. (a) A car of mass 750kg is travelling along a horizontal road. If the resistance to the motion total to 240N and the car's engine is working at a constant rate of 12kW, find
- the acceleration of the car when travelling at velocity of 20ms^{-1} .
 - the maximum velocity of the car up a hill inclined at $\sin^{-1}\left(\frac{1}{25}\right)$ to the horizontal assuming the resistance remains constant.
- (b) A brick of mass 0.8kg slides 6 metres down a plane inclined at $\sin^{-1}\left(\frac{3}{5}\right)$ to the horizontal. If at the top of the plane, the brick is given an initial speed of 0.4ms^{-1} , and at the bottom it has speed of 5.4ms^{-1} . Calculate
- work done against resistive force.
 - Magnitude of the resistive force *(12 marks)*

END

P425/2

APPLIED MATHEMATICS

PAPER 2

JULY/AUGUST 2019

3HRS



WESTERN JOINT MOCK EXAMINATIONS 2019

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**
- All necessary working must be shown clearly
- Graph paper is provided
- **Any** additional question(s) answered will not be marked
- Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.
- In numerical work where necessary use $g = 9.8ms^{-2}$

SECTION A (40 MARKS)

1. The probability that Jane eats matooke is 0.60 and the probability that she eats matooke and not rice is 0.45. The probability that she eats neither of the foods is 0.25. Find the probability that she eats rice. (5marks)

2. Use the trapezium rule with 6 strips to estimate $\int_0^{2\pi} x \tan x dx$ correct to 3 decimal places (5marks)

3. A particles move with Simple Harmonic Motion about a mean position O. When the particle is 40cm from O, its speed is $4ms^{-1}$ and when it is 150cm from O, its speed is $2.5ms^{-1}$. Find the periodic time of the motion. (5marks)

4. The probability that a student is awarded a pass in the examination is 0.70. Find the probability that in a group of 10 students more than six pass the exam. (5marks)

5. A particle of mass 10 kg is placed on a rough plane inclined at $\tan^{-1} \left(\frac{1}{\sqrt{3}} \right)$ to the horizontal. Find the magnitude of the horizontal force required to keep the particle in equilibrium if the coefficient of friction is 0.2. (5marks)

6. The table below shows distances in meters a person can run in a given time in minutes

Distance (kilometers)	20	28	33	42
Time (minutes)	10	13	21	24

Use linear interpolation or extrapolation to estimate

(i) The distance he runs in 22 minutes.

(2marks)

(ii) The time taken to run 18 metres.

(3marks)

7. The table below shows marks for 8 students obtained in math and physics in a certain school.

Students	A	B	C	D	E	F	G	H
Math	30	45	60	40	45	60	42	65
Physics	57	60	50	60	50	40	45	62

Calculate the spearman's rank co-efficient of the student's performance in the two papers and comment at 5% level of accuracy.

(5marks)

8. Three particles of masses 2 kg, 1 kg and 3 kg are situated at (4, 3), (1, 0) and (x, y) respectively. If the centre of gravity of the system lies at (1, 2). Find the values of x and y. (5marks)

SECTION B (60 MARKS)

9. In an agricultural experiment, the gains in mass in kg of 100 pigs during a certain period were recorded as follows.

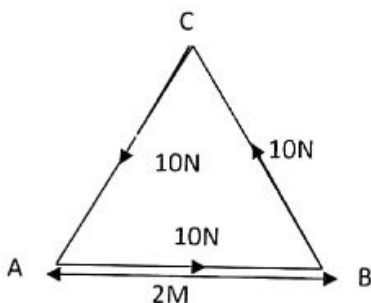
GAIN IN MASS (kg)	FREQUENCY
30-34	2
25-29	14
20-24	16
15-19	37
10-14	29
5-9	2

- (a) Construct a frequency distribution and use it to calculate
 (i) mean
 (ii) standard deviation

- (b) Draw an Ogive and use it to find the median.

(12marks)

10. (a) The figure below shows a triangle acted upon by forces of magnitude 10N.



Show that the system of forces reduces to a couple.

(4marks)

- (b) ABCD is a rectangle with AB= 2m and AD = 1.5m. Forces of 4N, 1N, 2N, and 3N act along AB, BC, DC and AD respectively. Calculate the magnitude and direction of the resultant force and find where its line of action cuts AB.

(8marks)

11. A continuous random variable X has a cumulative function defined as

$$F(x) = \begin{cases} 0 & 0 \leq x \leq 1 \\ \frac{1}{2}x - \frac{1}{6}x^2 & 0 \leq x \leq 1 \\ \alpha + \frac{1}{4}x & 1 \leq x \leq 2 \\ \beta + \frac{1}{8}x^2 - \frac{1}{4}x & 2 \leq x \leq 3 \\ 1 & x > 3 \end{cases}$$

Find the,

(i) Values of α and β . (3marks)

(ii) $f(x)$ (2marks)

(iii) Mean (3marks)

(iv) Standard deviation (4marks)

12. If $X \sim N(80, 36)$, find the

(i) $P(83 < X < 92)$ (4marks)

(ii) Value of y such that $P(|x - 80| < y) = 0.9$ (8marks)

13. (a) Using graphical method, show that the equation $2x + \log_e x^2 = 1$ has a root between 0.1 and 1 (5marks)

(b) Derive the iterative formula based on Newton Raphson method to find the root of the equation in (a) above and use it to estimate the root of the equation. (7marks)

14. Two ships A and B are 20 km apart with B on a bearing of 120° from A. Ship A is sailing at 10 kmh^{-1} due North - East and B is sailing due $N20^\circ W$ at 15 kmh^{-1} . Find the;

(i) Time that elapses before they are closest to each other.

(ii) Closest distance between them in subsequent motion (12marks)

15. (a) Given that $X = 2.21$, $Y = -3.5$ and $Z = 4.30$ have been rounded off to the nearest decimal point, Find the range within which the expression $\frac{XY}{Z}$ lies. Hence find the absolute error in the expression. (6marks)

(b) Show that the maximum relative error in approximating X^p by x^p is given by

$$\left| p \right| \left| \frac{\Delta x}{x} \right| \text{ Where } \Delta x \text{ is the absolute error in } x. \text{ (6marks)}$$

16. A particle is projected from a point on a horizontal plane with an initial speed of 42 ms^{-1} . If the particle passes through a point above the plane, 70m vertically and 60m horizontally from the point of projection.

Find the

(i) Possible angles of projection

(ii) Velocity and direction of the particle at that point. (12marks)

END

P425/2

Applied

Mathematics

Paper 2

July/August 2016

3 hours

Uganda Advanced Certificate of Education

RESOURCE MOCK EXAMINATIONS 2016

Applied Mathematics

Paper 2

3 hours

INSTRUCTIONS

- *Attempt all the eight questions in Section A and five from Section B.*
- *Extra numbers will not be marked.*
- *All working must be shown clearly.*
- *Begin each answer on a fresh sheet of paper.*
- *Mathematical tables with a list of formulae and squared papers are provided.*
- *Silent non-programmable calculators may be used.*
- *State the degree of accuracy at the end of the answer to each question attempted using a calculator or tables and indicate "Cal" for Calculator or "Tab" for Mathematical tables.*
- *In numerical work, take acceleration due to gravity, g to be 9.8 ms^{-2} .*

SECTION A (40 MARKS)

Answer all questions in this Section

1. A thin uniform wire is bent to form an isosceles triangle ABC in which $AB = AC = 30$ cm and $BC = 48$ cm. Find the distance of its centre of gravity from BC. (05 marks)
2. The numbers a and b are approximated with possible errors of Δa and Δb respectively. Show that the maximum possible relative error in the expression $P = (ab)^{1/2}$ is given by:
$$\frac{1}{2} \left(\left| \frac{\Delta a}{a} \right| + \left| \frac{\Delta b}{b} \right| \right)$$
 (05 marks)
3. If events U and V are independent events.
 - (a) Show that events U' and V' are also independent where U' and V' are compliments. (03 marks)
 - (b) Find $P(U \cap V')$, given that $P(U') = 3/4$ and $P(V) = 2/5$. (02 marks)
4. A cyclist passes point A, and accelerates uniformly at a rate of $a \text{ ms}^{-2}$. If the cyclist covers distances of 3.5 m and 4.5 m in the third and in the fourth second respectively, determine the value of a . (05 marks)

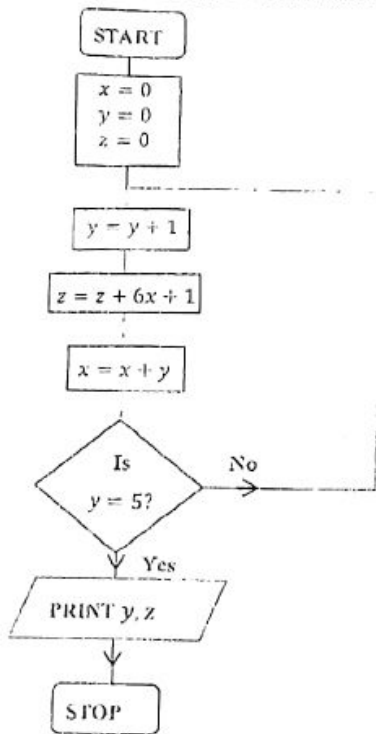
5. Eight houses got the following results in Drama by two judges.

House	A	B	C	D	E	F	G	H
Judge 1	63	65	55	63	63	55	60	58
Judge 2	77	70	60	75	68	58	54	68

Calculate the rank correlation coefficient of the judges. Comment on your result.

(05 marks)

Given the flow chart below:



- (i) Perform a dry run for the chart above.
 (ii) State the purpose of the flow chart. (05 marks)

7. A continuous random variable T has a probability distribution given as;

$$P(T > t) = 1 - \frac{t^3}{64} \quad ; \quad 0 \leq t \leq 4$$

Find the expectation of T . (05 marks)

8. A block of mass 5 kg resting a horizontal surface is attached by a string to a mass of 2 kg hanging freely in air. If the coefficient of friction between the block and the surface is 0.05, find the acceleration of the block. (05 marks)

SECTION B (60 MARKS)

Answer only five questions from this section.

9. (a) Use the trapezium rule with six ordinates to find the approximate value of;

$$\int_0^1 \frac{1}{\sqrt{3-2x}} dx, \text{ correct to three decimal places.} \quad (06 \text{ marks})$$

(b) Find the exact value of $\int_0^1 \frac{1}{\sqrt{3-2x}} dx$, correct to three decimal places. Hence determine the percentage error in your calculation in (a) above. (06 marks)

10. The table below represents the masses of donkeys and their respective frequency densities.

Mass (kg)	12 – 20	20 – 24	24 – 30	30 – 32	32 – 38	38 – 48	48 – 60
Frequency density	1	6	4	8	2	1	0.5

- (a) Draw a histogram and use it to estimate the modal mass. (04 marks)
- (b) Calculate the:
- (i) median mass (04 marks)
 - (ii) number of donkeys with a mass less than 33 kg. (02 marks)
 - (ii) 60th percentile of the distribution. (02 marks)

11. ABCDEF is a regular hexagon of side 2m. Forces of magnitude p , 3, 5 and q Newtons act along AB, DC, EF and AE respectively.

- (a) Show that this system of forces is not in equilibrium. (04 marks)
- (b) If the system of the forces is equivalent to:
- (i) a couple, find the values of p and q . (04 marks)
 - (ii) a single force through E, find p . (02 marks)

12. (a) Dickens' probabilities of passing Biology, Chemistry and Mathematics are 0.6, 0.75 and 0.8 respectively.

- (i) Find the probability that he will pass at least two subjects. (04 marks)
- (ii) If it is known that he passed at least two subjects, what is the probability that he failed Chemistry? (02 marks)

(b) The components produced by a particular machine are tested by taking samples containing 5 components and noting the number of rejects in each sample. The table below shows results for 100 samples.

Number of rejects	0	1	2	3	4	5
Number of samples	10	27	31	20	9	3

Determine the probability that:

- (i) a component selected at random is a reject. (03 marks)
- (ii) out of five randomly selected components, exactly three are rejects (03 marks)

13. (a) Two particles A of mass 3 kg and B of mass 2 kg are moving with velocities $(4i - 4j)$ ms⁻¹ and $(2i + 7j)$ ms⁻¹ respectively, when they collide. Immediately after impact A moves in the same direction as before but with half its original speed. Find the velocity of B just after collision. (05 marks)

(b) A particle of mass 3 kg moves in a straight line with simple harmonic motion about a point O. The velocity of the particle is zero at point A and 1 ms⁻¹ at O, OA = 2m, find the:

- (i) greatest force exerted on the particle, (04 marks)
- (ii) time the particle takes to move from A to B where AB = 0.59 m. (03 marks)

- (a) Show that the Newton Raphson Method iterative formula for finding the reciprocal of the cube of root of a number N is given as:

$$x_{r+1} = \frac{x_r}{3} (4 - Nx_r^3), \quad r = 0, 1, 2, \dots$$

Hence find the second approximation for the reciprocal of the cube of 15, using a first approximation of 0.9, correct your answer to 2 decimal places. (05 marks)

- (b) (i) Show that the equation $\sin x = \cos^{-1} x$ has a root in the neighbourhood of $x = \frac{1}{4}\pi$, (03 marks)
- (ii) Taking $x_0 = 0.5$ use the iteration $x_{n+1} = \cos(\sin x_n)$ thrice to determine whether it is a suitable formula for solving the equation $\sin x = \cos^{-1}(x)$, giving the root to two decimal places. Suggest how the process can be improved to lead to an accurate root. (04 marks)

5. The weights of oranges are approximately normally distributed with a mean of 96 g and standard deviation 25 g. Oranges are divided into first class, second class and third class. First class are more than 126 g, third class oranges weigh less than 60 g. All remaining oranges are in second class.

- (a) Calculate the percentage of oranges in each grade. (07 marks)
- (b) First class, second class and third class oranges sell respectively Ush 120/= Ush 100/= and Ush 50/= each. Calculate Mr. Matovu's expected income from the sale of 80,000 oranges. (05 marks)

6. A ship A is travelling on a course of 060° at a speed of $30\sqrt{3} \text{ kmh}^{-1}$ and ship B is travelling in the direction $N30^\circ E$ at 20 kmh^{-1} . At 2:45 pm, B is 260 km due east of A. Using unit base vectors i and j pointing east and north respectively, find the:

- (a) velocity of B relative to A, (06 marks)
- (b) position vector of B relative to A in terms of time t hours after 2:45 pm, hence calculate the time at which they are nearest to one another. (06 marks)

End

Mock Examinations 2018
S.6 APPLIED MATHEMATICS P425/2
TIME: 3HOURS

INSTRUCTIONS

- Answer **all** the **eight** questions in **SECTION A** and any **FIVE** from **SECTION B**
- *Untidy work may lead to loss of marks*

SECTION A (40marks)

Answer all the questions in this section

1. A sample of eight contrast indices was such that, the sum of their squares was 44622 and the square of their sum was 341056. Find the average index and their standard deviation. (5marks)
2. Two independent events A and B are such that A is twice more likely to occur than B. The probability that the two events occur together is 0.18. Find the probability that
 - (i) at least one of them occurs (3marks)
 - (ii) only one of them occurs (2marks)
3. Find the mean and the semi-interquartile range of the data below (5marks)
56 45 57 48 72 50 60 45 53 67
4. From a group of 6 men and 8 girls, five people are chosen at random, find the probability that (i) all the five are men (ii) there are more men than women (5marks)
5. Given that 8 students got the following grades in Maths and Economics

Mathematics	A	C	B	E	C	F	B	E
Economics	B	D	E	F	F	B	C	A

- Calculate the rank correlation coefficient for the data. (5marks)
6. The events A and B are such that $P(A/B) = 0.75$, $P(B/A) = 0.5$, $P(A \cap B) = 0.3$
 - (a) Calculate the value of (i) $P(B)$ (ii) $P(A \cap B')$
 - (b) Show that A and B are not independent (5marks)
 7. An inelastic string passes over a fixed pulley and carries masses of 200g and 500g at extreme ends. If the masses are hanging freely and the system is set in equilibrium, find the acceleration of the system and the tension in the string (5marks)
 8. A particle accelerates uniformly for a distance of 50m from a speed of $15ms^{-1}$ to a speed $25ms^{-1}$. Find the magnitude of acceleration and the time taken to cover the distance. (5marks)

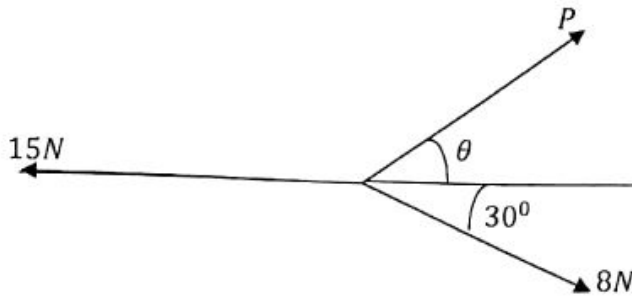
SECTION B (60Marks)

answer any five from this section

9. A box contains 4 red, 7 green and 9 white balls. Three balls are selected at random, one after the other without replacement. Find the probability that
- All the three are of the same colour
 - All the three are of different colours
 - Two of them are white
10. The marks of 1000 candidates were approximately normally distributed with a mean of 48 marks and standard deviation of 15 marks.
- Given that the pass mark was 43 marks, estimate the number of candidates who passed the exam. (4marks)
 - Find the minimum mark for a distinction if 80 of the candidates got distinctions (4marks)
 - Find the probability that a candidate chosen at random, got between 32 and 81 marks. (4marks)
11. Thirty students tried to estimate the length of a line. The following were their results in millimeters
- | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|
| 60 | 57 | 60 | 60 | 58 | 60 | 58 | 58 | 60 | 62 |
| 58 | 60 | 60 | 63 | 60 | 57 | 60 | 60 | 57 | 60 |
| 62 | 60 | 63 | 60 | 60 | 58 | 57 | 62 | 60 | 63 |
| 63 | 65 | 58 | 59 | 62 | 60 | 63 | 63 | 65 | 60 |
- Construct a frequency distribution table for the data (3marks)
 - draw a bar graph for the data (3marks)
 - calculate the (i) standard deviation (ii) eightieth percentile (6marks)
12. Vehicles went for refilling at a fuel station. It was observed that of the vehicles which left the station, 20% refilled with Unleaded, 65% with Diesel and the rest with Super. Of those refilled with Super, 8% had a full tank, of those with Unleaded, 16% had no full tank and of those with Diesel, 10% had a full tank. Find the probability that
- a vehicle left the station with a full tank (4marks)
 - a vehicle which had no full tank, was refilled with Diesel (5marks)
 - a vehicle left the station with a full tank and refilled with Super (3marks)
13. A string whose one end is fixed, passes under a moveable pulley of mass 5kg, over a fixed pulley and carries a mass of 8kg at its other end. All the free parts of the string are vertical. If the system is released from rest, find the
- acceleration of the 8kg mass (5marks)
 - tension in the string (3marks)
 - extra mass that must be added on the moveable pulley for the system to be at equilibrium (4marks)

14. (a) A particle initially at a point $(2, -1, -1)m$ moves at a constant speed of $14ms^{-1}$ in the direction of the vector $2\mathbf{i} - 3\mathbf{j} + 6\mathbf{k}$. Find its distance from origin after 3 seconds. (6 marks)

- (b) Find the values of P and θ if the forces below are in equilibrium



(6 marks)

END

P425/2

Applied mathematics

Paper 2

July/August

3Hours

RESOURCEFUL MOCK EXAMINATIONS, 2017

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

(P425/2)

TIME: 3HOURS

INSTRUCTIONS TO CANDIDATES

- ✓ *Attempt all the questions in section A and five from section B.*
- ✓ *All working must be shown clearly*
- ✓ *Begin each answer on a fresh sheet of paper.*
- ✓ *In numerical working $g = 9.8\text{ms}^{-2}$.*
- ✓ *No paper should be given for rough work.*
- ✓ *Mathematical tables with list of formulae and squared paper are provided.*
- ✓ *Silent non programmable calculator may be used.*

SECTION A

- A particle moves in the $x - y$ plane such that its position vector at any time, t is given by
$$r = (3t^2 - 1)i + (4t^2 + t - 1)j$$
, find
 - Its speed after $t = 2$
 - The magnitude of the acceleration after $t = 2$ (5mrks)
- The probability distribution for the number of heads that show up when a coin is tossed three times is given by;
$$p(X = x) = \begin{cases} \frac{1}{k} \binom{3}{x}, & x = 0, 1, 2, 3 \\ 0, & \text{elsewhere} \end{cases}$$
Find;
 - The value of K .
 - $E(X)$ (5mrks)
- Use the trapezium rule with 7 ordinates to estimate $\int_0^3 \frac{1}{1+x} dx$, correct to 3 decimal places (5mrks)
- A particle moves in a straight line with S.H.M of period 5 seconds. The greatest speed is 4ms^{-1} . Find the;
 - Amplitude
 - Speed when it is $\frac{6}{\pi}m$ from the centre (5mrks)
- If A and B are independent events,
 - Show that the events A and B^c are also independent.
 - Find $p(B)$ given that $P(A) = 0.4$ and $P(A \cup B) = 0.8$ (5mrks)
- A light elastic string of natural length 75cm has one end fixed and a mass of 0.8kg freely suspended on its other end. Find the modulus of elasticity of the string if the total length of the string in equilibrium is 95cm. (5mrks)
- The resistance to the motion of a lorry of mass, $M\text{kg}$ is $\frac{1}{200}$ of its weight. When travelling at 108kmh^{-1} on a level road and as it goes up a hill, its engine fails to work. Find how far up the hill (in km) the lorry moves before it comes to rest. Give your answer correct to one decimal place.

8. By the method of linear interpolation, use the table below to find the value of
- $\ln(1.66)$ (correct to 3 decimal places)
 - x corresponding to $\ln(x) = 0.4000$

x	1.4	1.5	1.6	1.7
$\ln x$	0.3365	0.4055	0.4700	0.5306

SECTION B (60 MARKS)

9. a) Given two iterative formulae I and II, shown below for calculating the positive real root of the quadratic equation $f(x) = 0$ as

I $X_{n+1} = \frac{1}{2}(X_n^2 - 1)$, for $n = 0, 1, 2, \dots$

II $X_{n+1} = \frac{1}{2}\left(\frac{X_n^2 + 1}{X_{n-1}}\right)$ for $n = 0, 1, 2, \dots$

Taking $X = 2.5$, use each formula thrice to two decimal places to decide which is the most suitable formula. Give a reason for your answer. (5marks)

b) If a is an approximation of the root of the equation $X^2 = N$, show that the iterative formula for finding the root reduces to $\frac{1}{2}\left(\frac{N}{a} + a\right)$.

Hence, taking $a = 4$ estimate $\sqrt{17}$ correct to three decimal places. (7marks)

10. a) A mass oscillates with SHM of period one second. The amplitude of the oscillation is 5cm. Given that the particle begins from the centre of the motion. State the relationship between the displacement X of the mass and time, t . Hence, find the first times when the mass is 3cm from its end position. (6marks)

b) A particle of mass M is attached by means of a light strings. AP and BP of the same natural length, a m and moduli of elasticity MgN and $2MgN$ respectively to points A and B on a smooth table. The particle is released from the midpoint of \overline{AB} , where $\overline{AB} = 3am$. Show that the motion of the particle is S.H.M with period

$$T = \left(\frac{4\pi^2 a}{3g}\right)^{\frac{1}{2}}. \quad (6marks)$$

11. A continuous random variable X is defined by the p.d.f

$$f(x) = \begin{cases} k\left(x - \frac{1}{a}\right), & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$$

Give that $p(x > 1) = 0.8$, find the

a) Values of a and k (6marks)

b) Probability that x lies between 0.5 and 2.5 (3marks)

c) Mean of x .

(3mrks)

12. a) A pupil has 10 multiple choice questions answer. There are four alternative answers to choose from. If a pupil answers the questions randomly, find the probability

(i) that at least four answers are correct

(ii) of the most likely number of correct answers (6mrks)

b) Otim's chances of passing physics are 0.60, of chemistry 0.75 and of mathematics 0.80.

(i) Determine the chance that he passes atleast two subjects

(ii) If it is know that he passed atleast two subjects what is the probability that he failed chemistry? (6mrks)

13. an elastic string of length, a metres is fixed at one end P and carries a particle of mass 3.0kg at it other end Q. the particle is describing a horizontal circle of radius 80cm with an angular speed of 5 rad s^{-1} . Determine the;

a(i) Angle the string makes with the horizontal. (8mrks)

(ii) tension in the string

b) Value of a

c) linear speed of the particle (2mrks)

14. The table below is the distribution of weights of a group S.1 students.

Mass (Kg)	21- 25	26-30	31-35	36-40	41-50	51-65	66-75
Frequency	10	20	15	10	30	45	5

a) Draw a cumulative frequency curve and use it to estimate the semi-interquartile range

b) Find the;

(i) Mode

(ii) Standard deviation of the weights.

15. a) A particle of mass M kg is projected with a velocity of 10ms^{-1} up a rough plane of inclination 30° to the horizontal. If the coefficient of friction between the particle and a plane is $\frac{1}{4}$, calculate how far up the plane the particle travels.

(8mrks)

b) A driver of a car travelling at 72kmh^{-1} notices a tree which has fallen across the road 800m ahead and suddenly reduces the speed to 36kmh^{-1} by Applying the brakes. For how long did the driver apply the brakes? (4mrks)

16. a) Show graphically that there is only one positive real root of the equation
 $x^3 + 2x - 2 = 0$
- b) Using the Newton Raphson formula thrice, estimate the root of the equation.
Give your answer correct to 2 decimal places (12mrks)

END