## P425/2

Applied mathematics
Paper 2
July/August
3Hours

# RESOURCEFUL MOCK EXAMINATIONS, 2017 <br> Uganda Advanced Certificate of Education APPLIED MATHEMATICS 

## (P425/2)

TIME: 3HOURS

## INSTRUCTIONS TO CANDIDATES

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

## SECTION A

1. A particle moves in the $x-y$ plane such that its position vector at any time, $t$ is given by
$r=\left(3 t^{2}-1\right) i+\left(4 t^{2}+t-1\right) j$, find
a) Its speed after $t=2$
b) The magnitude of the acceleration after $t=2$
2. The probability distribution for the number of heads that show up when a coin is tossed three times is given by;

$$
p(\times=x)=\left\{\begin{array}{l}
\frac{1}{k}\binom{3}{x}, x=0,1,2,3 \\
0, \\
\text { elsewhere }
\end{array}\right.
$$

Find;
(i) The value of $K$.
(ii) $\mathrm{E}(\mathrm{x})$
(5mrks)
3. Use the trapezium rule with 7 ordinates to estimate $\int_{0}^{3} \frac{1}{1+x} d x$, correct to 3 decimal places
4. A particle moves in a straight line with S.H.M of period 5 seconds. The greatest speed is $4 \mathrm{~ms}^{-1}$. Find the;
(i) Amplitude
(ii) Speed when it is $\frac{6}{\pi} m$ from the centre
5. If $A$ and $B$ are independent events,
(i) Show that the events $A$ and $B^{1}$ are also independent.
(ii) Find $p(B)$ given that $P(A)=0.4$ and $P(A u B)=0.8$
6. A light elastic string of natural length 75 cm has one end fixed and a mass of 0.8 kg freely suspended on its other end. Find the modulus of elasticity of the string if the total length of the string in equilibrium is 95 cm .
7. The resistance to the motion of a lorry of mass, Mkg is $\frac{1}{200}$ of its weight. When travelling at $108 \mathrm{kmh}^{-1}$ on a level road and a sends 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
a) In (1.66) (correct to 3 decimal places)
b) $x$ 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 $\quad X_{n+1}=1 / 2\left(X^{2} n-1\right)$, for $n=0,1,2$
II $\quad X_{n+1}=1 / 2\left(\frac{X_{n+1}^{2}}{X_{n-1}}\right)$ for $n=0,1,2 \cdots \cdots \cdots \cdots \cdots$.
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.
(5mrks)
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 $1 / 2\left(\frac{N}{a}+a\right)$.
Hence, taking $a=4$ estimate $\sqrt{17}$ correct to three decimal places. (7mrks)
10. a) A mass oscillates with SHM of period one second. The amplitude of the oscillation is 5 cm . 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 3 cm from its end position. (6mrks) 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 2 MgN respectivelyto points $A$ and $B$ on a smooth table. The particle is released from the midpoint of $\overline{A B}$, where $\overline{A B}=3 \mathrm{am}$. Show that the motion of the particle is S.H.M with period, $\mathrm{T}=\left(\frac{4 \pi^{2} a}{3 g}\right)^{\frac{1}{2}}$.
(6mrks)
11. A continuos random variable X is defined by the p.d.f

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

Give that $p(x>1)=0.8$, find the
a) Values of $a$ and $k$ (6mrks)
b) Probability that $x$ lies between 0.5 and 2.5 (3mrks)
c) Mean of $x$.
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
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?
13. an elastic string of length, a metres is fixed at one end $P$ and carries a particle of mass 3.0 kg at it other end Q . the particle is describing a horizontal circle of radius 80 cm with an angular speed of $5 \mathrm{rad} \mathrm{s}^{-1}$. Determine the;
a(i) Angle the string makes with the horizontal.
(ii) tension in the string
b) Value of a
c) linear speed of the particle
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 semiinterquartile 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 $10 \mathrm{~ms}-1$ up a rough plane of inclination 30 o to the horizontal. If the coefficient of friction between the particle and a plane is $1 / 4$, calculate how far up the plane the particle travels.
(8mrks)
b) A drive of a car travelling at $72 \mathrm{kmh}^{-1}$ notices a tree which has fallen a cross the road 800 m a head and suddenly reduces the speed to $36 \mathrm{kmh}^{-1}$ by Appling the brakes. For how long did the driver apply the brakes?
16. a) Show graphically that there is only one positive real root of the equation $x^{3}+2 x-2=0$
b) Using the Newton Raphson formula thrice, estimate the root of the equation. Give your answer correct to 2 decimal places

