Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper 2

3 hours

INSTRUCTIONS TO CANDIDATES:

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

Any additional question (s) answered will **not** *be marked.*

Silent non – programmable electronic scientific calculators may be used.

Mathematical tables with a list of formulae and squared papers are to be provided.

All *necessary calculations* **must** *be shown clearly on the answer sheet provided as the rest of the answers, therefore* **no** *paper should be provided for rough work.*

Begin each question on a **fresh** *page of the sheet of the answer booklet.*

Indicate the degree of accuracy at the end of each question attempted using **Cal** *for calculator or* **Tab** *for mathematical tables.*

In numerical work, take acceleration due to gravity g to be = 9.8ms^{-2}.

Turn Over

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

1. A bag contains 5 white, 3 red and 2 green counters. 3 counters are drawn at random one after another without replacement. What is the probability that there

    (i)   is no green counter,   *(02 marks)*

    (ii) are 2 white counters and a green counter?   *(03 marks)*

2. Given below is a table of corresponding values of X and Y.

X:	0	8	12	20
Y:	9.2	6.0	4.4	1.5

    Use linear interpolation to find;

    (i) Y when $X = 15$,   *(03 marks)*

    (ii) $f^{-1}(Y)$ when $Y = 5.0$.   *(02 marks)*

3. A particle with a position vector $10\boldsymbol{i} + 3\boldsymbol{i} + 5\boldsymbol{k}$ moves with constant speed of $6ms^{-1}$ in the direction $\boldsymbol{i} + 2\boldsymbol{j} + 2\boldsymbol{k}$. Find its distance from the origin after 5 seconds.   *(05 marks)*

4. Particles of mass 4, 5 and $6kg$ are placed at $(0,0)$, $(4,3)$ and $(5,-2)$ respectively in the $x - y$ plane. Find the co-ordinates of their centre of mass.
                                                                                      (05 marks)

5. The yields of 13 plots in $100's$ of kg, were 16, 7, 10, 3, 11, 5, 8, 14, 18, 4, 11, 14 and 9.

    Find the;

    (i)   mean,   *(02 marks)*

    (ii) standard deviation of this data.   *(03 marks)*

6. A box of mass $2kg$ is at rest on a plane inclined at 25° to the horizontal. The coefficient of friction between the box and the plane is 0.4. What minimum force applied parallel to the plane would move the box up the plane?   *(05 marks)*

7. The probability of winning a game is $^4/_5$. Ten games are played. What is the

    (i)   mean number of success   *(01 marks)*

    (ii)   variance   *(02 marks)*

    (iii)   probability of atleast 8 successes in the ten games?   *(02 marks)*

8. A mass of $3kg$ is at rest on a smooth horizontal table. It is attached by a light inextensible string passing over a smooth fixed pulley at the edge of the table to another mass of $2kg$, which is hanging freely. The system is released from rest. Determine the resulting acceleration and the tension in the string.   *(05 marks)*

SECTION B: (60 marks)

Answer any **five** *questions from this section.*

All *questions carry* **equal** *marks.*

9.   (a)   The table below shows the likelihood of where **A** and **B** spend Saturday evening.

	A	B
Goes to dance	$^1/_2$	$^2/_3$
Visiting neighbour	$^1/_3$	$^1/_6$
Stays at home	$^1/_6$	$^1/_6$

    (i)   Find the probability that both go out.   *(03 marks)*

    (ii)   If we know that they both go out, what is the probability that both went to dance?   *(02 marks)*

  (b)   Four competitors throw a die in turn. What is the probability the;

    (i)   they all score more than 4,   *(03 marks)*

    (ii)   two get less than a 3,   *(02 marks)*

    (iii)   the total score is 23?   *(02 marks)*

Turn Over

10. The probability density function of a random variable X is given by

$$f(x) = \begin{cases} k(x+2) & ; & -1 < x \le 0 \\ 2k(1-x) & ; & 0 < x \le 1 \\ 0 & ; & \text{elsewhere} \end{cases}$$

(a) Sketch the function. *(04 marks)*

(b) Find k and the mean of x. *(05 marks)*

(c) Find the probability $P(0 < x < ½ \,/\, x > 0)$ *(03 marks)*

11. The heights of students in S.1 were according to the following frequency table.

Heights	Frequency (f)
$151 - 153$	2
$154 - 156$	14
$157 - 159$	13
$160 - 162$	13
$163 - 165$	2
$166 - 168$	1

(a) Estimate the mean and standard deviation of the height of students.
(06marks)

(b) Determine and plot the cumulative frequency distribution for the students' heights. Hence estimate the median, lower and upper quartiles for the heights of the students. *(06 marks)*

12. Using the iterative formular show that the fourth root of the number N is

$$\frac{3}{4}X_n + \frac{N}{4X_n^3}; n = 0, 1, 2, \ldots\ldots\ldots$$

Hence show that $(45.7)^{¼} \simeq 2.600$ (correct to three decimal places). *(12 marks)*

13. (a) Two particles are moving towards each other, along a straight line. The first particle has a mass of $0.2kg$ and moving with a velocity of $4ms^{-1}$ and the second has a mass of $0.4kg$ moving with a velocity of $3ms^{-1}$. On collision, the first particle reverses its direction and moves with a velocity of $2.5ms^{-1}$.
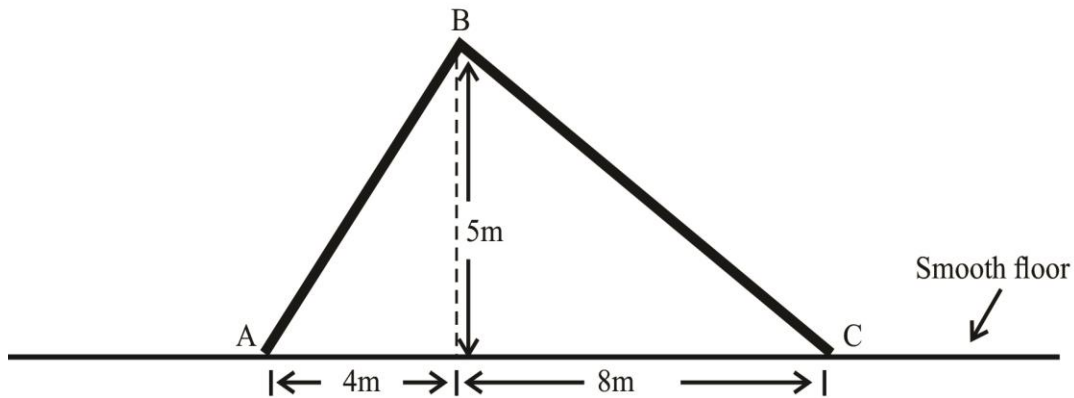
Find the;

(i) velocity of the second particle after collision, *(02 marks)*

(ii) percentage loss in kinetic energy. *(03 marks)*

(b) The diagram shows particle A of mass $0.5kg$ attached to one end of a light inextensible string passing under a movable pulley **B**. The other end of the string is fixed as shown below.
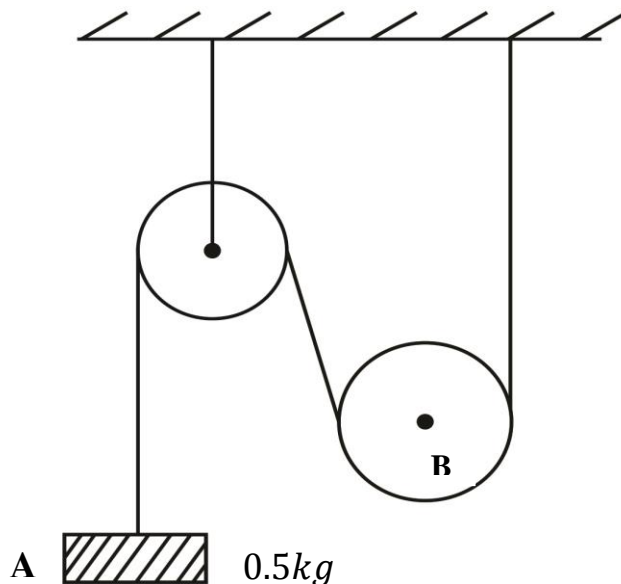
(i) What should be the mass of the pulley **B** for the system to be in equilibrium? *(03 marks)*

(ii) If the mass of **B** was $0.8kg$, what would be acceleration of the particle **A** and the pulley **B**?

(04 marks)

14. A particle of mass ½ g is released from rest and slides down a rough plane inclined at 30° to the horizontal. It takes 6 seconds to go 3 metres.

(a) Find the coefficient of friction between the particle and the plane (correct to 2 decimal places). *(06 marks)*

(b) What minimum horizontal force is needed to prevent the particle from moving? *(06 marks)*

Turn Over

15. Two uniform rods **AB**, **BC** of masses $4kg$ and $6kg$ respectively are hinged at **B** and rest in a vertical position on a smooth floor as shown. **A** and **C** are connected by a rope.

(a) Find the magnitudes of the reactions between the rods at **B** and at the floor at **A** and **C**, when the rope is taut. *(08 marks)*

(b) If now a body is attracted a quarter of the way up **CB**, and the reactions are equal, find the mass of the body. *(04 marks)*

16. Given that $x = 5, y = 14$ and $z = 8$ all to the nearest integers, find the maximum value, minimum value, absolute error and percentage error in

(i) $\dfrac{x + z}{yx}$

(ii) $\dfrac{xyz}{x - y}$

(iii) $\dfrac{xz}{y} - \dfrac{y}{zx}$ *(12 marks)*

END