SECTION A (40 MARKS)

1. Given that A and B are events in the same sample space such that $P(A \cap B) = \frac{3}{8}$ and $P(A' \cup B) = \frac{3}{4}$, find;
   (a) $P(A \cap B')$
   (b) $P(A)$ *(05 marks)*

2. A body falls from rest from the top of a vertical tower, and in its last second it falls $\frac{9}{25}$ of the whole height of the tower. Calculate the height of the tower. *(05 marks)*

3. The marks of students in a Mathematics test are uniformly distributed between 40 and 80. The pass mark is 55.
   (a) Calculate their mean mark. *(02 marks)*
   (b) Three students are picked at random, calculate the probability that all three failed to attain the pass mark. *(03 marks)*

4. At a car hire service centre the amounts paid to travel to given distances (measured from the centre) are shown in the table above.

Distance (km)	10	15	25
Charge (shs)	30,000	40,000	60,000

Use linear estimation to calculate the;
(a) Distance travelled at a cost of 70,000 shillings. *(03 marks)*
(b) Basic fee each passenger pays before leaving the station. *(02 marks)*

5. The position vector of a particle, t seconds into motion is;
$r = 4t^2i + (6t + 10)j$ metres.
Calculate the average speed of the particle in the time interval $t = 0$ *to* $t = 2$ *seconds.* *(05 marks)*

6. Given that $x = 2.4$, $y = 1.80$ are corrected to the given number of decimal places; compute to maximum error in $x^2 - y$. *(05 marks)*

7. X is a discrete random variable. Study the table below;

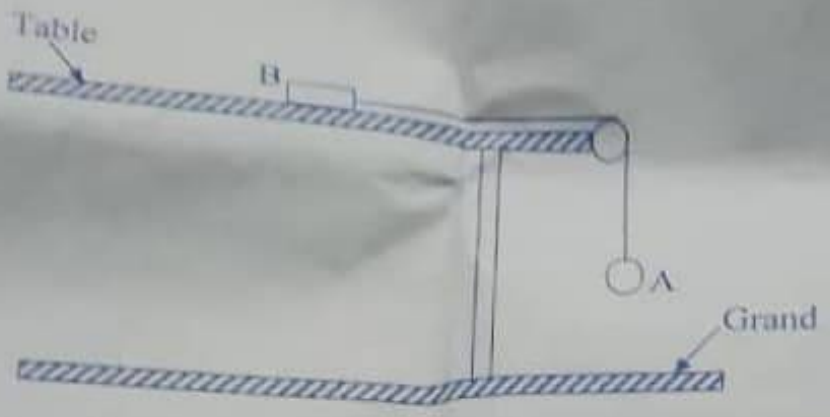
x	1	2	3	4	5
$P(X \leq x)$	0.1	0.25	0.55	0.7	1

Use the table to;

(a) Calculate the mean of X. *(04 marks)*

(b) Find the 80^{th} percentile. *(01 mark)*

8.



A and B are particle of mass 2kg and 3kg respectively.

(a) If particle B is in limiting equilibrium on a horizontal table. Calculate the coefficient of friction at the table and the tension in the string. *(05 marks)*

SECTION B

Answer FIVE questions only from this section

9. (a) Derive the iteration formula based on the Newton – Raphson Method for computing the root of the equation $2x = cosx$. *(04 marks)*

(b) Construct a flow chart for the process in (a) above.

Using $x_o = 0.2$; perform a dry run of your flow chart hence find the root correct to 3 dps. *(08 marks)*

10. In a certain school the ratio of boys to girls is 2:3. Students are picked at random, one at a time with replacement.

(a) Ten students are picked at random. Calculate the probability that at least 6 are boys. *(05 marks)*

(b) One hundred and fifty students are picked at random; calculate the probability that at least 78 but less than 96 are girls. *(07 marks)*

AB, BC, CD and AD are uniform rods whose weight per metre is 10N. the rods are joined to make a rigid frame work as shown above.

(a) Calculate the length of the rod AD. *(02 marks)*

(b) Taking A as the origin and AB as the x – axis, find coordinates of the centre of gravity of the framework. *(06 marks)*

(c) The framework is suspended from point B, calculate the angle rod AB will make with the vertical. *(04 marks)*

Number of cars	–10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Number of days	2	10	6	10	4	0

The table represents the number of cars passing through a check point, recorded over a period of 32 days.

(a) Construct a histogram for this data, and use it to estimate the modal number of cars passing through the check point.

(b) Calculate the mean and the variance of the number of cars passing through the point in the given period. Construct a 95% confidence interval for the mean number of cars passing through this point.

13. (a) Calculate the exact value of the integral; *(05 marks)*

$$\int_{-1.5}^{0} \frac{1}{\sqrt{4-2x}}\,dx$$

(b) Use the trapezium rule with 7 ordinates to evaluate $\int_{-1.5}^{0} \frac{1}{\sqrt{4-2x}}\,dx$ to 3 dpls.

Hence compute the absolute error in your answer. *(07 marks)*

14. X is a continuous random variable whose C.D.F is given as;

$$F(x) = \begin{cases} 0 & ; \quad x \leq 0 \\ bx^2 & ; \quad 0 \leq x \leq 1 \\ c\,(10x - x^2 - 5) & ; \quad 1 \leq x \leq 5 \\ 1 & ; \quad x \geq 5 \end{cases}$$

(a) Find the constants b and c hence compute the median. *(07 marks)*

(b) Calculate the expectation of X. *(05 marks)*

15. (a) The forces $\begin{pmatrix} 6 \\ +5 \end{pmatrix}, \begin{pmatrix} -4 \\ 2 \end{pmatrix}, \begin{pmatrix} 5 \\ 0 \end{pmatrix}$ *and* $\begin{pmatrix} 1 \\ -1 \end{pmatrix} N$ act at the points (2,2), (-2, 2), (-2, -2) and (2, -2) respectively. Find the equation of the line of action of the resultant force. *(06 marks)*

(b) To a cyclist travelling southwards at $6ms^{-1}$ a wind appears to blow in the direction S030°W; and when he doubles his speed the wind appears to blow in the direction S060°W. Calculate the actual velocity of the wind. *(06 marks)*

16. A particle of mass 2kg initially at rest is acted upon by a force of $(8t^2 i + (24 - 8t) j\ N$ at any time t seconds. Calculate the;

(a) magnitude of the initial acceleration of the particle

(b) velocity after ts.

(c) work done by the force in the time interval $t = 0$ to $t = 2$ seconds. *(12 marks)*

END