SECTION A (40 marks)
Answer ALL the questions from this section

1. A projected particle achieves the greatest range of 120m. Find the;
   (i) speed of projection, (03 marks)
   (ii) greatest height attained. (02 marks)

2. Find the maximum possible error made in the expression: $6.23 - \dfrac{2.5 \times 4.1}{5}$,
   correct to three significant figures. (Given that the values are rounded to the given number of decimal places). (05 marks)

3. In a certain secondary school, the salary of teachers depends on the time one has spent in the school. Mr. Otim has worked for 4 years and earns shs. 400,000; while Mr. Okot has worked for 10 years and earns shs. 800,000. Estimate; (i) Abonga's salary who worked for 7 years, (03 marks)
   (ii) the number of years Mr. Bonni has worked in the school if he earns shs. 1,000,000. (02 marks)

4. Two events M and N are such that P(M'n N) = 3x, P(M n N') = x and $P(M) = \dfrac{6}{7}$. Use a Venn diagram to find the values of;

   (i) x, (03 marks)
   (ii) P(M n N). (02 marks)

5. A car of mass 1450Kg initially moving at 144Kmh^{-1} decelerated uniformly to rest when the brakes were applied. If the car came to rest after covering a distance of 40m, calculate the braking force. (05 marks)

6. Given that $\overline{X} \sim N\left(30, \dfrac{1}{15625}\right)$, find the value of $P(29.99 < \overline{X} < 30.02)$.

   (05 marks)

7. The table below gives the grades of Senior Six candidates in mid-term and end of term examinations in chemistry.

Mid term	E	C	B	O	D	A
End of term	O	A	D	F	C	C

Calculate the rank correlation coefficient between the performance of the two examinations. Hence, comment on your result. (05 marks)

8. A non-uniform rod AB of length 4m and mass 9Kg is suspended from two vertical strings attached to the ends A and B rest horizontally when a block of mass 12Kg is attached at a point 1.5m from B. If the tension in the string attached at A is P and that at B is 3P, calculate the distance from A where the weight of the rod acts. (05 marks)

SECTION B (60 marks)
Answer any FIVE questions from this section

Question 9:

The table below shows the time intervals between successive arrivals of telephone calls at an office.

Time (minutes)	Number of Calls
$0 < X$ 0.5	23
$0.5 < X$ 1.0	39
$1.0 < X$ 2.0	23
$2.0 < X$ 3.0	9
$3.0 < X$ 6.0	6

(a) Calculate the; (i) mean, (04 marks)
(ii) standard deviation, of the time intervals. (04 marks)
(b) Draw a histogram to illustrate the above information and use it to estimate the modal time interval. (04 marks)

Question 10:

(a) Use trapezium rule with five strips to estimate $\int_0^4 3^{2x}\, dx$, correct to two decimal places. (06 marks)

(b) Find the exact value of $\int_0^4 3^{2x}\, dx$, correct to two decimal places. (04 marks)

(c)   Calculate the relative error made in (a) above and state how you can reduce on such error.   (02 marks)

Question 11:
An experiment consists of removing 2 sweets, one at a time without replacement from the box containing 3 red and 4 blue sweets.

(a)   If A is the event that both sweets picked are of the same colour, find the probability that event A has occurred.   (04 marks)

(b)   If the experiment is repeated 70 times, find the probability that event A occurred;   (i) between 20 and 35 times,   (04 marks)

(ii) at least 25 times.   (04 marks)

Question 12:
The random variable X has a probability function given by:

$$f(x) = \begin{cases} kx\,(1 - x^2) \; ; \; 0 \quad x \quad 1 \\ \\ 0 \quad ; \; \text{Elsewhere} \end{cases}$$

(a)   Find the cumulative probability function $F(x)$ and hence, calculate the value of;   (i) k,   (05 marks)

(ii) median of X   (03 marks)

(b)   Calculate the mean of X.   (04 marks)

Question 13:
Two ships are observed from a coast guard station at 10:00 hrs and 11:00 hrs respectively. They have the following displacements ($\mathbf{x}$) and velocity ($\mathbf{V}$):

$$\mathbf{x_1} = \begin{pmatrix} 1 \\ 3 \end{pmatrix} \text{Km}, \; \mathbf{V_1} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} \text{Km h}^{-1} \text{ at 10:00 hrs}$$

$$\mathbf{x_2} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} \text{Km}, \; \mathbf{V_2} = \begin{pmatrix} 5 \\ 6 \end{pmatrix} \text{Km h}^{-1} \text{ at 11:00 hrs}$$

If they continue with the same velocities, determine the;

(i) least distance between the two ships in the subsequent motion. (06 marks)

(ii) time it takes place.   (06 marks)

Question 14:
(a)   Show that there is real root of the equation $x^3 + 2x = 1$ between x =0 and x = 1.   (04 marks)

(b)   Use linear interpolation once to find the first estimation of the equation above, correct to one decimal place. Hence, by Newton – Raphson method, find the root of the equation, correct to two decimal places.   (08 marks)

Question 15:
(a)   The radii of a frustum of heights 30cm are 14cm and 20cm. Find the distance of centre of gravity of the frustum from the larger base. (06 marks)
(b)   If a conical hole of radius 2cm and height 24cm is centrally drilled from the smaller face of the frustum, find the distance of centre of gravity of the new body from the base.   (06 marks)

Question 16:
(a)   A car of mass 960Kg has a maximum speed of $50ms^{-1}$ on a horizontal road. If the power output of the engine is 40kW, calculate the frictional resistance to the motion of the car, assuming it's constant.   (04 marks)

(b)   The car now ascends a slope which is 1 in 6 with the same power output but the frictional resistance to its motion is 900N. Calculate the;
       (i) maximum speed of the car up the slope.   (04 marks)
       (ii) acceleration of the car when its speed is $10ms^{-1}$.   (04 marks)