

2023 SUPER MOCK ELECTIVE MATHS 2

PAPER 2

Section A

Answer all questions in this section

1. Given that α and β are the roots of $2x^2 + 11x + 9 = 0$, find the value $8(\beta^3 + \alpha^3)$.
2. Find, from the first principles, the derivative of $x^2 + \frac{3}{x}$ with respect to x .
3. If $x^2 + x - 2$ is a factor of the polynomial $f(x) = 2x^3 + 9x^2 + mx - n$ where m and n are constants, find the value of m and n .
4. The gradient of a curve is $2px + 3$, where p is a constant. If the curve passes through the point $(-2, 0)$ and $(\frac{1}{2}, 0)$ find p .
5. Given that the angle between $p = 4i + 3j$ and $q = -2i + mj$ is $\cos^{-1}\left(-\frac{4}{5}\right)$ find the constant m .
6. The velocity $V \text{ ms}^{-1}$, of a body moving in a straight line from a point O at any time t seconds, is given by $v = 24t - 3t^2$.
 - a. Find the acceleration at any time t .
 - b. Calculate the distance from O at the end of 3 seconds.
7. The deviation a set of given numbers from 6 are $-3, -1, 1, 0, 3, -5, 4, -2$. Find correct to two decimal places.
 - a. The mean
 - b. The variance of the numbers
8. Two out of every 3 teachers in Aburi Girls SHS are females. If 5 teachers are chosen at random from the school, what is the probability that
 - a. Exactly 3 are females?
 - b. At least 4 are females?

SECTION B

Answer four (4) questions from this section at least one from each part

PART ONE (1)

PURE MATHEMATICS

9. Two linear transformations P and T are defined by:

$$P: (x, y) \rightarrow (3x - 2y, x + 4y);$$

$$T: (x, y) \rightarrow (3x + y, -2x + 3y)$$

- Write down the matrices of P and T
- Find the matrix PT
- Find the image of (0,3) under the transformation P
- The inverse of T
- Determine the co-ordinates of the point whose image under T is $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$

10. a. Using the trapezium rule with six ordinates, find, correct to three decimal places, the value of

$$\int_0^5 \frac{dx}{\sqrt{x+1}}$$

b) Given that $y = x^3 - 4x^2 + 5x - 2$ and P is point on the curve where $x = 3$ calculate the

- gradient at P
- equation of the tangent at P
- equation of the normal at P
- values of x for which the gradient of the tangent to the curve is 5

11. a. Solve the following equations for values of θ , $0^\circ \leq \theta \leq 360^\circ$;

- $\cos(\theta + 30^\circ) + \cos(\theta - 30^\circ) = \cos 30$
- $\cos 2\theta - \cos \theta = 0$

b. The sum of the first n terms of a series is $8n^2 - 4n$.

- find the first three terms of the series
- show that the series is a linear sequence
- find the nth term of the series

PART TWO (2)

STATISTICS AND PROBABILITY

12. An examination was conducted for 100 students and the results are given in the table below.

Marks scored	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99
No of students	5	15	20	28	12	9	5	3	2	1

- Draw the histogram for the distribution
- From your histogram, estimate correct to one decimal place, the modal mark
- Using an assumed mean of 67, calculate correct to one decimal place
 - The mean of the distribution
 - The standard deviation of the distribution

13. a. If $\frac{{}^nC_5}{{}^nP_4} = \frac{1}{4}$
- c. how many numbers between 3000 and 7000 can be formed using the digits 1,3,6, 8, without repetition?
 - d. In how many ways can 15 soldiers be divided into 3 equal groups
 - e. Eight boys are to be seated on a bench. If two particular boys are to occupy the ends, in how many ways can this be done?

PART THREE (3)

VECTOR AND MECHANICS

14. The position vectors of points A, B, and D are $a = i + j$, $b = 2i + 3j$ and $d = -3i + 2j$. Find
- a. A unit vector parallel to $(a+b)$;
 - b. The cosine of the angle between $(a+b)$ and $(a+b)$;
 - c. The position vector of the point C such that ABCD is parallelogram
15. a. A body of mass 10kg, moving in a straight line at 5m/s, is acted upon by a force of magnitude 60N at point P for 3seconds. The body comes to rest at point Q, after another 10 seconds. Find the
- i. Speed of the body at 3 seconds
 - ii. Magnitude of its acceleration
 - iii. Magnitude of its retardation
 - iv. The distance between P and Q
- c. Two forces $F_1 = 3i - 4j$ and $F_2 = -14i - 3j$ act on a particle. Find the third force F_3 that will keep the particle in equilibrium

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