

## 2021 ELECTIVE MATHEMATICS PAPER 2

1.

The polynomial  $f(x) = 2x^3 + px + qx - 5$  has  $(x-1)$  as a factor and a remainder of 27 when divided by  $(x + 2)$ , where  $p$  and  $q$  are constants. Find the values of  $p$  and  $q$ .

2.

Evaluate:  $\int_1^9 \frac{x(2x-3)}{\sqrt{x}} dx$

3.

Given that  $(p + 1/2\sqrt{3})(1 - \sqrt{3})^2 = 3 - \sqrt{3}$ ,

find the value of  $p$ .

4.

$5yC_2 = 190$ , find the value of  $y$

5.

The table shows the distribution of monthly income (in thousands of naira) of workers in a factory

Monthly Income (GHC1000)	135-139	140-149	150-154	155-164	165-169
Number of workers	20	42	28	38	22

(a) Draw a histogram for the distribution.

(b) Use your graph to estimate the mode of the distribution.

6.

A bag contains 24 mangoes out of which six are bad. If 6 mangoes are selected randomly from the bag with replacement, find the probability that not more than 3 are bad.

7.

(a) The speed of a moving bus reduced from 45m/s to 5m/s with a uniform retardation of  $10\text{m/s}^2$ . Calculate the distance covered.

(b) A bucket full of water with mass 16kg is pulled out of a well with a light inextensible rope. Find its acceleration when the tension in the rope is 240N. [Take  $g = 10\text{m/s}^2$ ]

8.

Given that  $x = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$  and  $y = \begin{pmatrix} -9 \\ 15 \end{pmatrix}$  calculate, correct to the nearest degree, the angle between the vectors

9.

(a) A jogger is training for 15km charity race. He starts with a run of 500 metres, then he increases the distance he runs daily by 250 metres.

(i) How many days will it take the jogger to reach a distance of 15km in training?

(ii) Calculate the total distance he would have run in the training.

(b) The second term of a Geometric Progression (GP) is -3. If its sum to infinity is  $25/2$ , find its common ratios.

10.

P and Q are two linear transformations in the X-Y plane defined by

P:  $(x, y) \rightarrow (-3x + 6y, 4x + y)$  and

Q:  $(x, y) \rightarrow (2x - 3y, -4x - 6y)$ .

(a) Write down the matrices of P and Q. (b) What is the image of  $(-2, -3)$  under the transformation Q?

(c) Obtain a single transformation representing the transformation Q followed by P.

(d) Find the image of  $(1, 4)$  when transformed by Q followed by P.

(e) Find the image  $P^1$  of the point  $(-\sqrt{2}, 2\sqrt{2})$  under an anticlockwise rotation of  $225^\circ$  about the origin.

11.

(a) Find the equation of the normal to the curve  $y = (x^2 - x + 1)(x - 2)$  at the point where the curve cuts the X - axis.

(b) The coordinates of the points P, Q and R are  $(-1, 2)$ ,  $(5, 1)$  and  $(3, -4)$  respectively. Find the equation of the line joining Q and the midpoint of line PR.

12.

A box contains 5 red, 7 blue and 4 green identical bulbs. Two bulbs are picked at random from the box without replacement.

Calculate the probability of picking: (a) same color of bulbs; (b) different color of bulbs (c) at least one red bulb.

13.

The table shows the frequency distribution of heights (in cm) of pupils in a certain school.

Heights	100-109	110-119	120-129	130-139	140-149	150-159	160-169
Frequency	27	58	130	105	50	25	5

(a) (i) Construct a cumulative frequency table.

(ii) Use the table to draw a cumulative frequency curve.

(b) Using the curve, estimate the:

(i) median height;

(ii) inter quartile range

(iii) percentage of students whose heights are most 130cm.

14.

The position vectors of P, Q and R with respect to the origin are  $(4i-5j)$ ,  $(i+3j)$  and  $(-5i+2j)$  respectively. If PQRM is a parallelogram, find:

(a) the coordinates of M;

(b) the acute angle between P<sup>-</sup>M and P<sup>-</sup>Q, correct to the nearest degree.

15.

(a) A girl threw a stone horizontally with a velocity of 30m/s from the top of a cliff 50m high. How far from the foot of the cliff does the stone strike the ground? [Take  $g= 10\text{m/s}^2$

(b) A body A, of mass 2kg is held in equilibrium by means of two strings AP and AR. AP is inclined at  $56^\circ$  to the upward vertical and AR is horizontal.

Find the tensions  $T_1$ , and  $T_2$ , in the strings [Take  $g= 10\text{ms}^2$ ]

