

2
SECTION A
[48 marks]

Answer all the questions in this section. All questions carry equal marks.

1. Two independent events K and L are such that $p(K) = x$, $p(L) = (x + \frac{1}{5})$ and $p(K \cap L) = \frac{3}{20}$. Find the value of x .

2. Seven participants in an art contest were ranked by two judges as follows:

Participant	A	B	C	D	E	F	G
1st Judge	3	4	1	6	5	7	2
2nd Judge	3	6	2	5	7	4	1

- (a) Calculate, correct to **three** decimal places, the Spearman's rank correlation coefficient for the scores of the judges.
- (b) Comment on your results.
3. F_1 (3 N, 030°), F_2 (4 N, 090°), F_3 (6 N, 135°) and F_4 (7 N, 240°) act on a particle. Find, correct to **two** decimal places, the magnitude of the resultant force.
4. A uniform pole, PQ , 30 m long and of mass 4 kg is carried by a boy at P and a man 8 m away from Q . Find the distance from P where a mass of 20 kg should be attached so that the man's support is twice that of the boy, if the system is in equilibrium.
[Take $g = 10 \text{ ms}^{-2}$]
5. Solve: $3x^{\frac{1}{2}} + 5 - 2x^{-\frac{1}{2}} = 0$.
6. A point P divides the straight line joining $X(1, -2)$ and $Y(5, 3)$ internally in a ratio 2 : 3. Find the:
(a) coordinates of P ;
(b) equation of the straight line that passes through $N(3, -5)$ and P .
7. (a) Find the sum of the series: $32 + 8 + 2 + \dots$
(b) Simplify: $\frac{1-\sqrt{2}}{\sqrt{5}-\sqrt{3}} - \frac{1+\sqrt{2}}{\sqrt{5}+\sqrt{3}}$.
8. Without using Mathematical tables or calculator, find, in surd form (radicals), the value of $\tan 22.5^\circ$.

Answer **four** questions **only** from this section with **at least one** question from **each** part.

All questions carry equal marks.

PART I
PURE MATHEMATICS

9. (a) Find the range of values of x for which $2x^2 \geq 9x + 5$.
- (b) (i) Write down in ascending powers of x the binomial expansion of $(2+x)^6 - (2-x)^6$.
(ii) Using the result in (b)(i), evaluate $(2.01)^6 - (1.99)^6$, correct to **four** decimal places.
10. A circle $x^2 + y^2 - 2x - 4y - 5 = 0$ with centre O is cut by a line $y = 2x + 5$ at points P and Q . Show that \overline{QO} is perpendicular to \overline{PO} .
11. (a) Given that $M = \begin{pmatrix} 3 & -5 \\ 4 & 2 \end{pmatrix}$, find:
(i) M^{-1} , inverse of M .
(ii) the image of $(1, -1)$ under M^{-1} .
- (b) Two linear transformations P and Q , are defined by $P: (x, y) \rightarrow (5x + 3y, 6x + 4y)$ and $Q: (x, y) \rightarrow (4x - 3y, -6x + 5y)$.
(i) Write down the matrices P and Q .
(ii) Find the matrix R defined by $R = PQ$.
(iii) Deduce Q^{-1} , the inverse of Q .

PART II

STATISTICS AND PROBABILITY

12. A box contains 5 blue, 7 green and 4 red identical balls. **Three** balls are picked from the box one after the other without replacement. Find, the probability of picking:
(a) **two** green balls and **a** blue ball;
(b) **no** blue ball;
(c) **at least** one green ball;
(d) **three** balls of the same colour.
13. The ages, x (in years), of a group of 18 adults have the following statistics:
 $\Sigma x = 745$ and $\Sigma x^2 = 33951$.
(a) Calculate the:
(i) mean age;
(ii) standard deviation of the ages of the adults, correct to **two** decimal places.

- (b) One person leaves the group and the mean age of the remaining 17 is 41 years. Find the:
- (i) age of the person who left;
 - (ii) standard deviation of the remaining 17 adults, correct to **two** decimal places.

PART III

VECTORS AND MECHANICS

14. Three forces $0\mathbf{i} - 63\mathbf{j}$, $32.14\mathbf{i} + 38.3\mathbf{j}$ and $14\mathbf{i} - 24.25\mathbf{j}$ act on a body of mass 5 kg. Find, correct to the **nearest** whole number, the:
- (a) magnitude of the resultant force;
 - (b) direction of the resultant force;
 - (c) acceleration of the body.
15. Two particles **P** and **Q** move towards each other along a straight line MN , 51 metres long. **P** starts from M with velocity 5 m s^{-1} and constant acceleration of 1 m s^{-2} . **Q** starts from N at the same time with velocity 6 m s^{-1} and at a constant acceleration of 3 m s^{-2} . Find the time when the:
- (a) particles are 30 metres apart;
 - (b) particles meet;
 - (c) velocity of **P** is $\frac{3}{4}$ of the velocity of **Q**.

END OF PAPER