External assessment 2024

Multiple choice question book

Specialist Mathematics

Paper 1 — Technology-free

General instruction

- Work in this book will not be marked.

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

Section 1

Instruction

- Respond to these questions in the question and response book.

QUESTION 1

Repeated random samples will be used to calculate a large number of 90% confidence intervals for a population mean μ.

Which statement **best** describes the possible outcomes?

(A) Approximately 90% of the intervals will contain μ.

(B) More than 90% of the intervals will contain μ.

(C) Less than 90% of the intervals will contain μ.

(D) Exactly 90% of the intervals will contain μ.

QUESTION 2

Given that $\frac{A}{x-2}+\frac{3}{x}=\frac{x-6}{x(x-2)}$, determine the value of A.

(A) -4

(B) -2

(C) 2

(D) 4

QUESTION 3

Consider a proof of the proposition $\sum_{j=1}^{n}(2j-1)=n^2\ \forall n\in Z^+$ using mathematical induction.

Within the proof of the inductive step, the proposition for $n=k+1$ could be expressed as

(A) $\sum_{j=1}^{k+1}(2j-1)=k^2+2k+1$

(B) $\sum_{j=1}^{k+1}(2k+1)=k^2+2k+1$

(C) $\sum_{j=1}^{k+1}(2j-1)=k^2+1$

(D) $\sum_{j=1}^{k+1}(2k+1)=k^2+1$

QUESTION 4

A plane contains the point (1, 3, 1) and is normal to the vector $\hat{\boldsymbol{i}}+\hat{\boldsymbol{j}}+2\hat{\boldsymbol{k}}$.

The vector equation of the plane is

(A) $\begin{pmatrix}x\\y\\z\end{pmatrix}\cdot\begin{pmatrix}1\\3\\1\end{pmatrix}=\begin{pmatrix}1\\1\\2\end{pmatrix}\cdot\begin{pmatrix}1\\3\\1\end{pmatrix}$

(B) $\begin{pmatrix}x\\y\\z\end{pmatrix}\cdot\begin{pmatrix}1\\1\\2\end{pmatrix}=\begin{pmatrix}1\\3\\1\end{pmatrix}\cdot\begin{pmatrix}1\\1\\2\end{pmatrix}$

(C) $\begin{pmatrix}x\\y\\z\end{pmatrix}\times\begin{pmatrix}1\\3\\1\end{pmatrix}=\begin{pmatrix}1\\1\\2\end{pmatrix}\times\begin{pmatrix}1\\3\\1\end{pmatrix}$

(D) $\begin{pmatrix}x\\y\\z\end{pmatrix}\times\begin{pmatrix}1\\1\\2\end{pmatrix}=\begin{pmatrix}1\\3\\1\end{pmatrix}\times\begin{pmatrix}1\\1\\2\end{pmatrix}$

QUESTION 5

The augmented matrix shown is produced when a Gaussian elimination technique is used to solve a certain system of equations with three variables.

$$\left[\begin{array}{ccc|c} 1 & 4 & 2 & -10 \\ 0 & 2 & 0 & 5 \\ 0 & 0 & 3 & 2 \end{array}\right]$$

Given that row 1 values of the matrix represent $x + 4y + 2z = -10$, the unique solution for y is

(A) $\frac{2}{5}$

(B) $\frac{2}{3}$

(C) $\frac{3}{2}$

(D) $\frac{5}{2}$

QUESTION 6

Players P, Q, R and S played each other once in a competition where there were no draws.

Only the following results are known.

- Player P defeated players Q and R.
- Player Q defeated two players.
- Players R and S each defeated one player.

Based on these results, a dominance matrix ***N*** was partially constructed as shown.

$$\boldsymbol{N} = \begin{array}{c} \\ P \\ Q \\ R \\ S \end{array} \begin{array}{c} \begin{array}{cccc} P & Q & R & S \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 0 \\ \square & \square & \square & \square \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

The completed matrix ***N*** is

(A) $\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

(B) $\begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

(D) $\begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

QUESTION 7

A, B and C are points in three-dimensional space.

If $2\overrightarrow{AB} = \overrightarrow{BC}$, then

(A) $\left|\overrightarrow{AB}\right|$ is twice the value of $\left|\overrightarrow{BC}\right|$.

(B) $\overrightarrow{AB}$ and $\overrightarrow{BC}$ are perpendicular.

(C) only one plane contains A, B and C.

(D) a straight line passes through A, B and C.

QUESTION 8

Given $z = 2\operatorname{cis}\left(\frac{\pi}{3}\right)$, determine z^3.

(A) -8

(B) -6

(C) 6

(D) 8

QUESTION 9

Use a suitable double-angle identity to determine $\int 2\sin^2(x)\, dx$.

(A) $x - 2\sin(2x) + c$

(B) $x + 2\sin(2x) + c$

(C) $x - \dfrac{\sin(2x)}{2} + c$

(D) $x + \dfrac{\sin(2x)}{2} + c$

QUESTION 10

The polynomial $P(z) = z^3 - 2iz^2 + z - 2i$ can be expressed in factorised form as $P(z) = (z - i)(z^2 + biz + 2)$, where $b \in Z$.

Determine the value of b.

(A) 2

(B) 1

(C) –1

(D) –2