Multiple choice question book

Specialist Mathematics

Paper 2 — Technology-active

General instruction

- Work in this book will not be marked.

Section 1

QUESTION 1

A solution of the equation $z^2 = ai$, where $a \in R$, is $z = -2 - 2i$.

The other solution is

- (A) $-8i$

- (B) $-2 + 2i$

- (C) $2 + 2i$

- (D) $8i$

QUESTION 2

The win/draw/loss results after a netball competition involving five teams is represented in matrix $\mathbf{M}$.

$$\mathbf{M} = \begin{array}{c} \text{Winning teams} \end{array} \begin{array}{c} \\ P \\ Q \\ R \\ S \\ T \end{array} \overset{\begin{array}{ccccc} & & \text{Losing teams} & & \\ P & Q & R & S & T \end{array}}{\left[\begin{array}{ccccc} 0 & 1 & 2 & 0 & 2 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 2 & 0 & 0 & 0 \\ 2 & 1 & 2 & 0 & 2 \\ 0 & 1 & 2 & 0 & 0 \end{array}\right]}$$

Key: Team P drew with Team Q, defeated Team R and Team T, and lost to Team S

The model $\mathbf{M} + \mathbf{M^2} + \mathbf{M^3}$ is used to rank the teams. The final positions from first to fifth are

- (A) S, Q, P, R, T

- (B) S, Q, P, T, R

- (C) S, P, Q, T, R

- (D) S, P, Q, R, T

QUESTION 3

Determine the solution of the differential equation $\dfrac{dy}{dx} = \dfrac{\sin(2x)}{\cos(2x)}$ given $y = 0$ when $x = \dfrac{\pi}{5}$.

(A) $y = -2\ln|\cos(2x)| - 2.35$

(B) $y = -2\ln|\cos(2x)| + 2.35$

(C) $y = -\dfrac{1}{2}\ln|\cos(2x)| - 0.59$

(D) $y = -\dfrac{1}{2}\ln|\cos(2x)| + 0.59$

QUESTION 4

The time taken for students to answer questions in a class is assumed to be a random variable X with an exponential distribution that has the probability density function

$$f(x) = \begin{cases} \lambda e^{-\lambda x}, & x \geq 0 \\ 0 & , \ \text{otherwise} \end{cases}$$

The mean of X is $\dfrac{1}{\lambda}$.

The mean length of time taken for students to answer questions in this class is 15 seconds.

The probability that the next question in this class is answered between 8 seconds and 17 seconds is

(A) 0.05

(B) 0.12

(C) 0.22

(D) 0.26

QUESTION 5

A random sample of the petrol price per litre at 50 petrol stations produced a sample mean of $1.52 and a standard deviation of $0.14.

Based on this sample and using a z-value of 1.5, an approximate confidence interval for μ is

(A) ($1.47, $1.57)

(B) ($1.48, $1.56)

(C) ($1.49, $1.55)

(D) ($1.50, $1.54)

A 4 kg object moves in a straight line over time, $t\,(\text{s})$, where $0 \le t \le 5$ with velocity $v = 9 + 8t - t^2 \left(\text{m s}^{-1}\right)$.

Determine the momentum of the object when $t = 3$.

(A) 24 kg m s^{-1}

(B) 27 kg m s^{-1}

(C) 96 kg m s^{-1}

(D) 100 kg m s^{-1}

QUESTION 7

Given $\boldsymbol{a} = (3n+2)\hat{\boldsymbol{i}} + 2\hat{\boldsymbol{j}}$, $\boldsymbol{b} = (n-2)\hat{\boldsymbol{j}}$ and $\boldsymbol{a} \times \boldsymbol{b} = (1-2n)\hat{\boldsymbol{k}}$, the possible values of n are

(A) -5 and $\dfrac{1}{3}$

(B) -1 and $\dfrac{5}{3}$

(C) 1 and $-\dfrac{5}{3}$

(D) 5 and $-\dfrac{1}{3}$

QUESTION 8

Determine the gradient of the tangent to the curve $y^2 - 3x = 5$ at the point $\left(1,\ 2\sqrt{2}\right)$.

(A)   0.41

(B)   0.53

(C)   1.06

(D)   8.49

QUESTION 9

Consider the matrix equation.

$$\mathbf{X}\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$$

Matrix **X** is

(A) $\begin{bmatrix} 0 & 1 & 1 \\ 1 & -1 & 2 \\ -1 & 0 & 2 \end{bmatrix}$

(B) $\begin{bmatrix} 0 & 1 & -1 \\ 1 & -1 & 0 \\ 1 & 2 & 2 \end{bmatrix}$

(C) $\begin{bmatrix} 2 & 2 & 1 \\ 4 & 3 & 3 \\ 5 & 5 & 5 \end{bmatrix}$

(D) $\begin{bmatrix} 2 & 4 & 5 \\ 2 & 3 & 5 \\ 1 & 3 & 5 \end{bmatrix}$

QUESTION 10

In a town, the mean number of residents per household is 3.79 people with a standard deviation of 1.47 people.

Using a random sample of 45 households from the town, determine the probability that the mean number of residents per household will be more than 4.

(A) 0.17

(B) 0.33

(C) 0.83

(D) 0.96

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