External assessment

Multiple choice question book

Specialist Mathematics

Paper 2 — Technology-active

General instruction

- Work in this book will not be marked.

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

Section 1

QUESTION 1

The position x (m) at time t (s) of a 7 kg particle moving in a straight line is given by

$$x = 3t^3 - 5t^2 + 2t - 4 \text{ for } 0 \leq t \leq 10$$

Determine the time when the particle has a momentum of 620 kg m s^{-1}.

(A) 1.73 s

(B) 2.60 s

(C) 3.66 s

(D) 3.71 s

QUESTION 2

The Leslie matrix for a certain endangered species is given.

$$\mathbf{L} = \begin{bmatrix} 0.8 & 2.4 & 0.3 \\ 0.4 & 0 & 0 \\ 0 & 0.55 & 0 \end{bmatrix}$$

A group of the species was moved into a secure property at the start of 2018. The initial female population is given.

$$\mathbf{N}_0 = \begin{bmatrix} 150 \\ 80 \\ 40 \end{bmatrix}$$

The best estimate of the total female population at the start of 2025 is

(A) 3000

(B) 4000

(C) 5000

(D) 6000

QUESTION 3

The masses of packages of cheese produced by a company are assumed to be normally distributed with a known mean of μ grams and a standard deviation of 7.37 grams.

The packages of cheese are labelled to contain 500 grams.

Given there is a 25% probability that the mean mass of 20 randomly selected packages will be less than the labelled amount, the value of μ is

(A) 498.89

(B) 500.25

(C) 501.11

(D) 504.98

QUESTION 4

A particle is moving with simple harmonic motion described by the equation $x = 1.32\cos\left(\frac{\pi t}{2}\right)$ where x (m) is the displacement of the particle from a central position over time $t\,(\text{s})$, $t \geq 0$

The maximum speed of the particle is

(A) 2.07 m s^{-1}

(B) 4.15 m s^{-1}

(C) 4.30 m s^{-1}

(D) 5.28 m s^{-1}

QUESTION 5

The gradient of the tangent at point A on the curve $y^2 = 4x$ is 1.36

The x-coordinate of A is

(A) 0.12

(B) 0.46

(C) 0.54

(D) 1.47

QUESTION 6

Solve the matrix equation for **X**.

$$\begin{bmatrix} 0 & 1 \\ 2 & 3 \end{bmatrix} \mathbf{X} \begin{bmatrix} 4 & 5 \\ 6 & 7 \end{bmatrix} = \begin{bmatrix} 8 & 9 \\ 0 & 1 \end{bmatrix}$$

(A) $\begin{bmatrix} -9 & -9 \\ 4 & 4 \end{bmatrix}$

(B) $\begin{bmatrix} 3 & -4 \\ -1 & 2 \end{bmatrix}$

(C) $\begin{bmatrix} 13 & -14 \\ -11 & 12 \end{bmatrix}$

(D) $\begin{bmatrix} 54 & 56 \\ -28 & -29 \end{bmatrix}$

QUESTION 7

The heights of all students at a school were measured. A mean height of 157.0 cm was calculated from this data.

A random sample of 35 students from this school was selected. The mean height of this sample was 159.7 cm with a standard deviation of 8.7 cm.

The smallest confidence level that could be used to produce a confidence interval that contains μ, based on this sample, is

(A) 85%

(B) 90%

(C) 95%

(D) 99%

QUESTION 8

Let $u = 1 + i$ and $v = -12 + 5i$

$Re\left(u^5 - |v|\right)$ is

(A) –17

(B) –4

(C) 8

(D) 9

QUESTION 9

Two objects, P and Q, move in three-dimensional space such that their positions, $\boldsymbol{r}$, over time, t, are described by the following vectors until they collide.

$$\boldsymbol{r}_P = (t^2 - 4t)\hat{\boldsymbol{\imath}} + (2t^2 - t + 3)\hat{\boldsymbol{\jmath}} - (6 - 5t)\hat{\boldsymbol{k}}$$

$$\boldsymbol{r}_Q = (-t^2 + 2t)\hat{\boldsymbol{\imath}} + (3t + t^2)\hat{\boldsymbol{\jmath}} + t^2\hat{\boldsymbol{k}}$$

The objects will collide at

(A) $t = 0$

(B) $t = 1$

(C) $t = 2$

(D) $t = 3$

QUESTION 10

The time taken by the Year 7 students at a particular school to complete a standardised test is known to be normally distributed. A researcher claims that the population mean is 8.2 minutes.

The mean time taken to complete this test by a sample of 10 of these students is 8.1 minutes with a standard deviation of 1.2 minutes.

The 95% confidence interval for μ based on this sample is

(A) (7.36, 8.84) minutes

(B) (7.46, 8.94) minutes

(C) (7.86, 8.33) minutes

(D) (7.96, 8.44) minutes

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