Question 1

QUESTION 6

Simple Familiar
Technology Active
2020

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 2

QUESTION 10

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2020

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

Question 3

QUESTION 6

Simple Familiar
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2022

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

QUESTION 8

Simple Familiar
Technology Active
2022

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 5

QUESTION 12 (6 marks)

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The life span of batteries manufactured by a company is assumed to be normally distributed with an unknown mean and standard deviation.

A supervisor at the company randomly selects n batteries and uses the life spans from this sample to calculate an approximate 95% confidence interval for the population mean of $(2321.4, 2423.6)$ hours.

a) Determine the mean life span for this sample of batteries.   [1 mark]

The standard deviation of the life spans of batteries in this sample is 125 hours.

b) Determine n.   [3 marks]

c) Use the result from Question 12b) to explain whether the assumption that the life span of batteries is normally distributed is required to support the supervisor's calculations.   [2 marks]

Question 6

QUESTION 14 (5 marks)

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Technology Active
2022

An object is moving in a straight line with an acceleration represented by the differential equation

$\dfrac{dv}{dt} = -\left(4 + v^2 \right)$, where v is the object's velocity $\left(m\, s^{-1} \right)$ over time, $t(s)$, where $t \ge 0$, until it comes to rest.

a) Determine the general solution of the differential equation.   [3 marks]

The initial velocity of the object is 1.5 m s^{-1}.

b) Determine the time when the particle comes to rest.   [2 marks]

Question 7

QUESTION 16 (6 marks)

Complex Familiar
Technology Active
2020

Consider the identity

$$\cos(4\theta) = A\cos^4(\theta) + B\sin^2(\theta) + C \text{ where } A, B \text{ and } C \in Z$$

a) Determine the values of A, B and C using De Moivre's theorem.   [5 marks]

b) State an appropriate method of verifying your results from 16a).   [1 mark]