External assessment 2021

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

QUESTION 1

Which of the following is a population parameter?

(A) s

(B) μ

(C) $\overline{x}$

(D) z

QUESTION 2

When the polynomial $P(z) = z^3 - iz^2 - z - i$ is divided by $z - i$, the remainder is

(A) $-2i$

(B) 0

(C) $2i$

(D) $4i$

QUESTION 3

An object has a velocity $\boldsymbol{v}(t) = e^{-2t}\hat{\boldsymbol{i}} + \left(\frac{1}{t}\right)\hat{\boldsymbol{k}}$, where t represents time $(t > 0)$.

The displacement $\boldsymbol{r}(t)$ of the object could be

(A) $-2e^{-2t}\hat{\boldsymbol{i}} + \ln(t)\hat{\boldsymbol{k}}$

(B) $-2e^{-2t}\hat{\boldsymbol{i}} - \frac{1}{t^2}\hat{\boldsymbol{k}}$

(C) $-\frac{1}{2}e^{-2t}\hat{\boldsymbol{i}} + \ln(t)\hat{\boldsymbol{k}}$

(D) $-\frac{1}{2}e^{-2t}\hat{\boldsymbol{i}} - \frac{1}{t^2}\hat{\boldsymbol{k}}$

QUESTION 4

The number of sunflower seeds in each packet produced by a company is known to be normally distributed with a standard deviation of 100. A worker counts the number of seeds in a random sample of four packets and calculates the sample mean.

Based on this sampling, the standard deviation of the distribution of the sample mean is

(A) 25

(B) 50

(C) 75

(D) 100

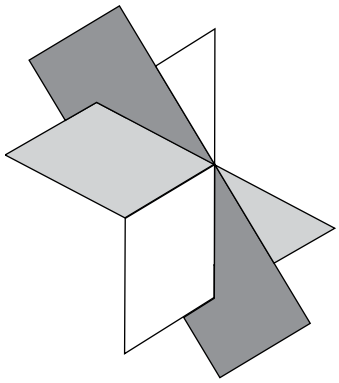
QUESTION 5

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

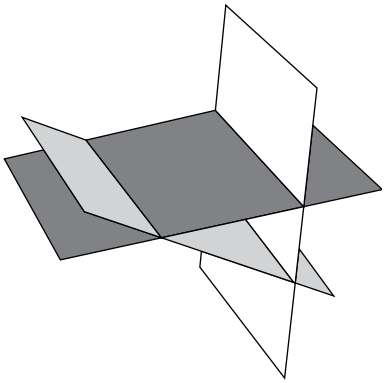
$$\left[\begin{array}{ccc|c} 1 & 1 & -3 & 4 \\ 0 & -1 & 5 & -6 \\ 0 & 0 & 1 & 0 \end{array}\right]$$

The geometric interpretation of the solution to this system of equations is best represented by

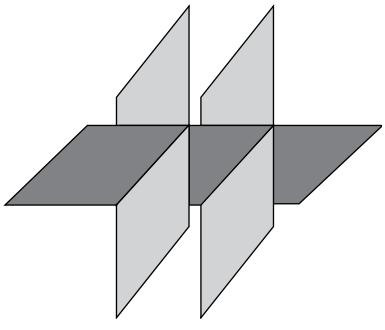
(A)



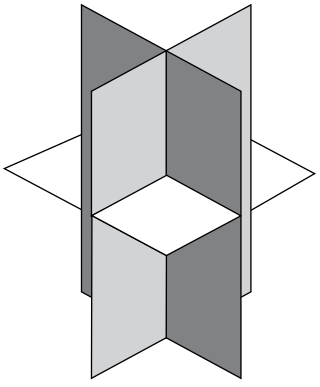
(B)



(C)



(D)

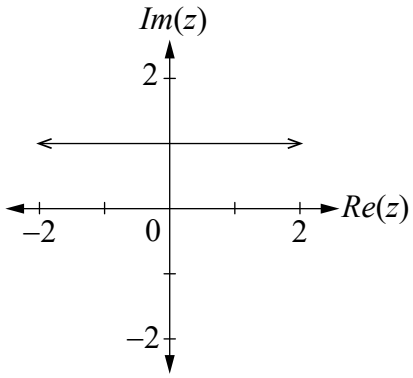


Note: For copyright reasons, an alternative representation of the diagrams published in the 2021 paper has been provided above.

QUESTION 6

The subset of the complex plane that represents $|z| = |z - 2|$ for $z \in C$ is

(A)



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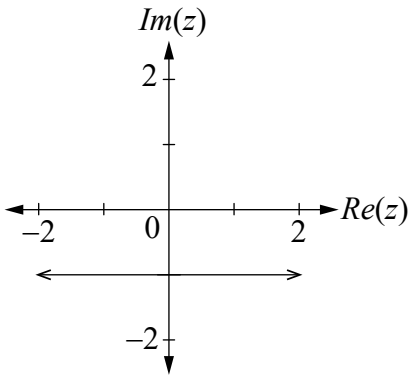
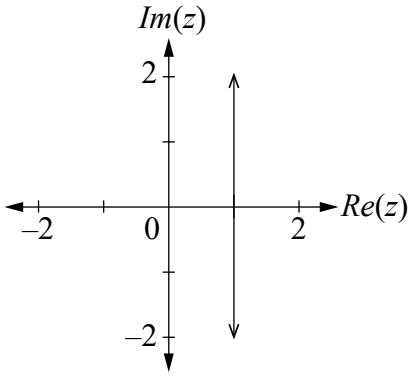
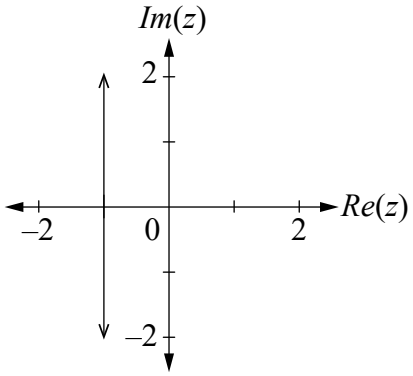


(C)



(D)

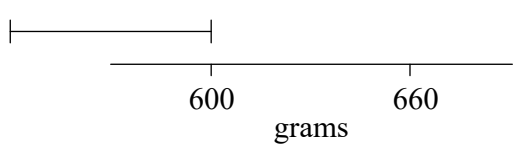


QUESTION 7

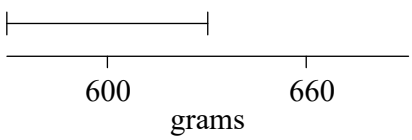
The mass of a particular variety of cake is claimed to be normally distributed with a mean of 660 grams. A random sample of five of these cakes is found to have a mean mass of 600 grams.

Which option represents an approximate confidence interval for μ based on this sample?

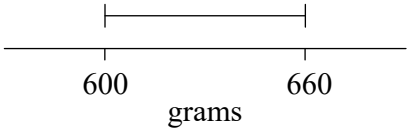
(A)



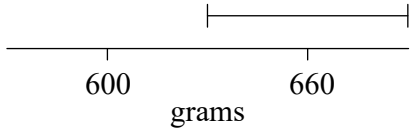
(B)



(C)



(D)



QUESTION 8

Let $P(n)$ be the proposition that

$$\sum_{r=1}^{n}(r+1)3^{r-1} = n \times 3^n \ \forall n \in Z^+$$

Which option represents a correct formulation of the assumption that $P(k)$ is true $\forall k \in Z^+$ in a proof using mathematical induction?

(A) $\sum_{r=1}^{k}(k+1)3^{k-1} = k \times 3^k$

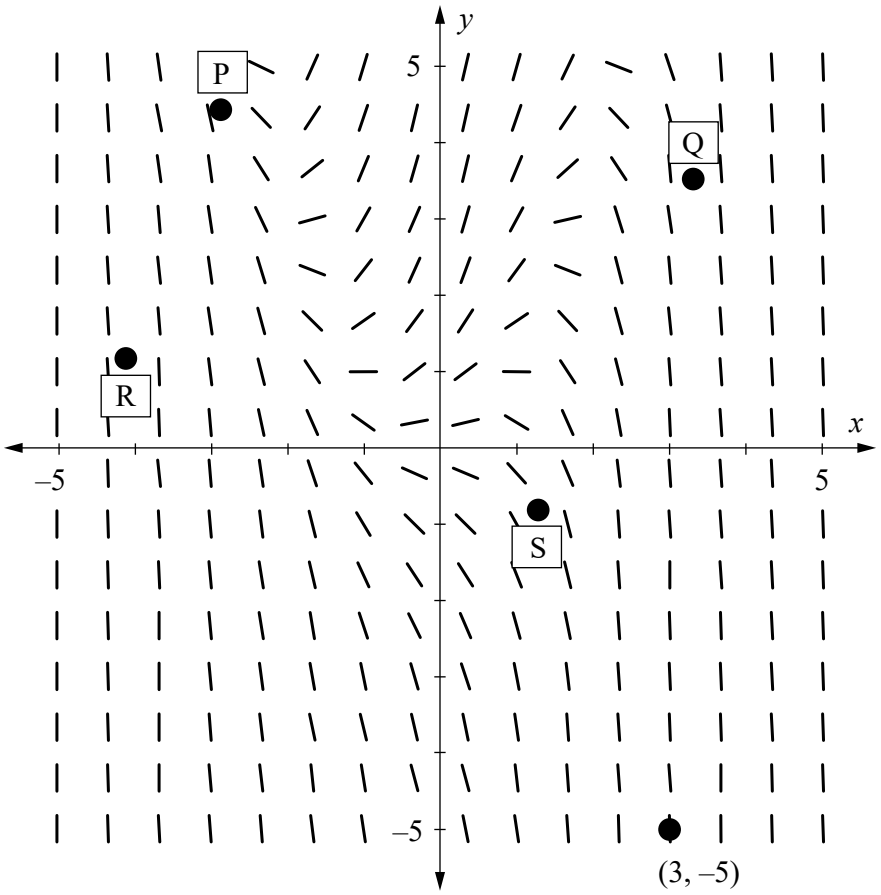
(B) $\sum_{r=1}^{k}(k+1)3^{k-1} = n \times 3^n$

(C) $\sum_{r=1}^{k}(r+1)3^{r-1} = k \times 3^k$

(D) $\sum_{r=1}^{k}(r+1)3^{r-1} = r \times 3^r$

QUESTION 9

The slope field for the differential equation $\frac{dy}{dx} = y - x^2$ is shown.



The solution curve to the differential equation that passes through the point $(3,-5)$ also passes through point

(A) P

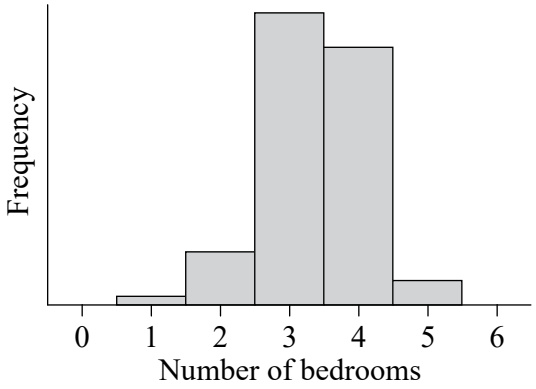
(B) Q

(C) R

(D) S

QUESTION 10

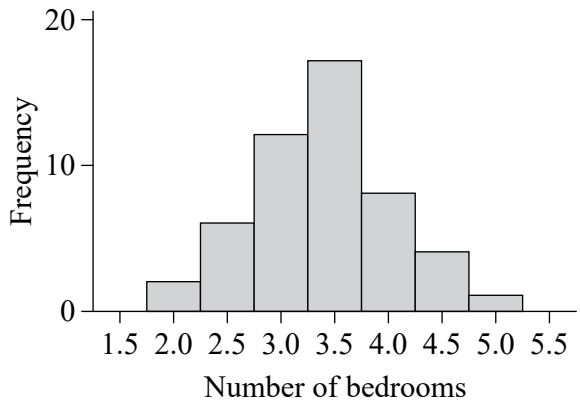
The 2016 Australian census recorded the number of bedrooms per household. The results are summarised in the histogram, as shown. Based on this data, the mean number of bedrooms per household was calculated to be 3.5.



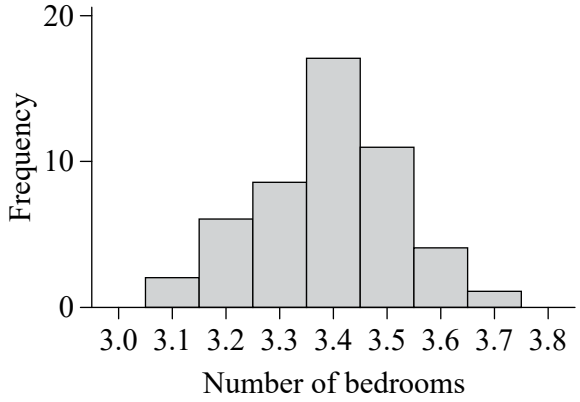
Fifty samples of size 40 were randomly selected from the census data and the sample means recorded.

The histogram that most likely represents the distribution of the sample means is

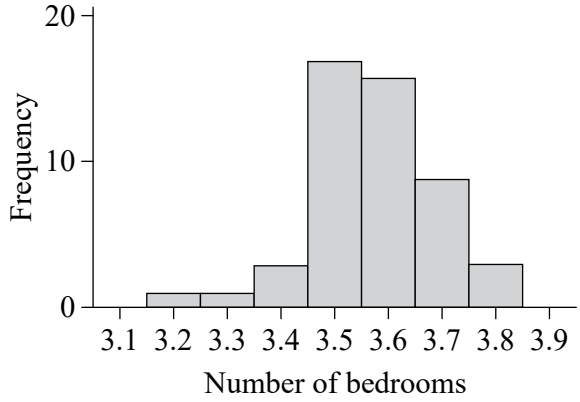
(A)



(B)



(C)



(D)