ERUVIO MENTORING · EXTERNAL-STYLE EXAMINATION

Specialist Mathematics

Units 3 and 4 · Induction, vectors, matrices and complex numbers; integration, differential equations and statistical inference

Paper 2 · Section 1

MULTIPLE CHOICE · 10 MARKS

STUDENT DETAILS

GIVEN NAME(S) _____ FAMILY NAME _____

SCHOOL _____ DATE _____ BOOK OF _____

DO NOT WRITE ON THIS PAGE

Structure of this examination

PAPER	SECTION	QUESTION TYPE	TIME	MARKS
Paper 1 TECHNOLOGY-FREE	Section 1	Multiple choice, 10 questions	5 min perusal 90 min working	10
	Section 2	Short response, 9 questions		55
Paper 2 TECHNOLOGY-ACTIVE	Section 1	Multiple choice, 10 questions	5 min perusal 90 min working	10
	Section 2	Short response, 9 questions		55
Total		**38 questions**	**190 minutes**	**130**

Degree of difficulty

Every question in this examination is tagged with its degree of difficulty. The tag appears in brass beside the marks.

DEGREE OF DIFFICULTY	MARKS	PROPORTION
Simple familiar SF	78	60%
Complex familiar CF	26	20%
Complex unfamiliar CU	26	20%
Total	**130**	**100%**

Instructions

- **Perusal time: 5 minutes. Working time: 90 minutes.**
- **This is the technology-active paper.** A QCAA-approved graphics calculator or CAS may be used, and the QCAA formula book is provided.
- Write using black or blue pen. Planning paper will not be marked.
- All questions are drawn from Unit 3 (mathematical induction, and further vectors, matrices and complex numbers) and Unit 4 (integration, differential equations and statistical inference).
- **Each question is tagged with its degree of difficulty** in brass beside the marks: SF simple familiar, CF complex familiar, CU complex unfamiliar.
- **Section 1 contains 10 multiple choice questions.** Choose the best answer for each and record it on the response grid provided.

Answers must be recorded on the response grid on the final page. Marks are not deducted for incorrect answers, so attempt every question.

Paper 2 · Section 1

Multiple choice · 10 questions · 10 marks · technology-active

1 Correct to two decimal places, the **acute** angle between the lines with direction vectors $2\boldsymbol{i} - \boldsymbol{j} + 3\boldsymbol{k}$ and $\boldsymbol{i} + 4\boldsymbol{j} - 2\boldsymbol{k}$ is

A 62.19°

B 117.81°

C 125.26°

D 145.00°

2 Correct to three decimal places, $\int_0^1 xe^x \, dx =$

A 0.359

B 0.718

C 1.000

D 1.718

3 A random sample of 36 measurements has a mean of 52.4. The population standard deviation is 6. An approximate 95% confidence interval for the population mean is

A (51.40, 53.40)

B (46.40, 58.40)

C (52.24, 52.56)

D (50.44, 54.36)

4 An object cools so that $dT/dt = -k(T - 20)$. If $T = 90$ when $t = 0$, then

A $T = 90e^{-kt}$

B $T = 20 + 70e^{-kt}$

C $T = 20 + 90e^{-kt}$

D $T = 70 + 20e^{-kt}$

5 The region under $y = x^2 + 1$ from $x = 0$ to $x = 2$ is rotated about the x axis. Correct to two decimal places, the volume generated is

A 43.14

B 50.27

C 67.02

D 86.28

6 One of the cube roots of $27i$ is

A $3 \operatorname{cis}(\pi/2)$

B $9 \operatorname{cis}(\pi/6)$

C $3 \operatorname{cis}(\pi/6)$

D $27 \operatorname{cis}(\pi/6)$

7 A vector equation of the line through the points (1, 0, 3) and (3, 1, 1) is

A $\mathbf{r} = (\boldsymbol{i} + 3\boldsymbol{k}) + t(3\boldsymbol{i} + \boldsymbol{j} + \boldsymbol{k})$

B $\mathbf{r} = (\boldsymbol{i} + 3\boldsymbol{k}) + t(2\boldsymbol{i} + \boldsymbol{j} - 2\boldsymbol{k})$

C $\mathbf{r} = (2\boldsymbol{i} + \boldsymbol{j} - 2\boldsymbol{k}) + t(\boldsymbol{i} + 3\boldsymbol{k})$

D $\mathbf{r} = (\boldsymbol{i} + 3\boldsymbol{k}) + t(4\boldsymbol{i} + \boldsymbol{j} + 4\boldsymbol{k})$

8 Expressed in partial fractions, $(3x + 1)/((x + 1)(x - 2))$ is

A $1/(x + 1) + 2/(x - 2)$

B $7/(3(x + 1)) + 2/(3(x - 2))$

C $2/(x + 1) - 7/(x - 2)$

D $2/(3(x + 1)) + 7/(3(x - 2))$

9 A population has standard deviation 6. Samples of size 36 are taken repeatedly and the sample mean recorded. The standard deviation of the distribution of sample means is

A 1.00

B 6.00

C 12.00

D 36.00

10 A population has standard deviation 8. The smallest sample size for which a 95% confidence interval for the mean has a margin of error no greater than 1.5 is

A 88

B 98

C 110

D 218

Response grid

Shade or cross the box for your chosen answer

Question	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

END OF SECTION 1