

**Mathematics: analysis and approaches**  
**Higher level**  
**Paper 1 Practice Set C**

Candidate session number

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2 hours

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**Instructions to candidates**

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- You are not permitted access to any calculator for this paper.
- Section A: answer all questions. Answers must be written within the answer boxes provided.
- Section B: answer all questions in an answer booklet.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A copy of the mathematics: analysis and approaches formula book is required for this paper.
- The maximum mark for this examination paper is **[110 marks]**.























Do **not** write solutions on this page

### Section B

Answer **all** questions in an answer booklet. Please start each question on a new page.

**11** [Maximum mark: 18]

- a** Points  $A$ ,  $B$  and  $D$  have coordinates  $A(1, -4, 3)$ ,  $B(2, 1, -1)$  and  $D(-1, 3, 3)$ .
- Find the equation of the line  $l_1$  through  $A$  and  $B$ .
  - Write down the equation of the line  $l_2$  which passes through  $D$  and is parallel to  $AB$ . [5]
- b**
- Find the exact distance  $AB$ .
  - Find the coordinates of two possible points  $C$  on the line  $l_2$  such that  $CD = 2AB$ .
  - Denote the two possible points  $C$  by  $C_1$  and  $C_2$ . Determine whether angle  $C_1AC_2$  is acute, right or obtuse. [8]
- c**
- Find  $\vec{AB} \times \vec{AD}$ .
  - Hence find the equation of the plane containing the points  $A$ ,  $B$  and  $D$ . [5]

**12** [Maximum mark: 16]

- a** Use compound angle identities to express  $\cos 3\theta$  in terms of  $\cos \theta$ . [4]
- b** Consider the equation  $8x^3 - 6x + 1 = 0$ .
- Given that  $x = \cos \theta$ , for  $0 \leq \theta \leq \pi$ , find the value of  $\cos 3\theta$ .
  - Hence find the possible values of  $x$  and show that they are all distinct. [7]
- c** Show that  $8 \cos\left(\frac{2\pi}{9}\right) \cos\left(\frac{4\pi}{9}\right) = -\sec\left(\frac{8\pi}{9}\right)$ . [3]
- d** State, with a reason, the value of  $\cos\left(\frac{2\pi}{9}\right) + \cos\left(\frac{4\pi}{9}\right) + \cos\left(\frac{8\pi}{9}\right)$ . [2]

**13** [Maximum mark: 21]

Let  $f(x) = \frac{x}{1+x^2}$  for  $x \in \mathbb{R}$ .

- a** Determine algebraically whether  $f$  is an even function, an odd function or neither. [3]

The continuous random variable  $X$  has probability density function given by

$$g(x) = \begin{cases} \frac{kx}{1+x^2} & \text{for } 0 \leq x \leq \sqrt{3} \\ 0 & \text{otherwise} \end{cases}$$

- b** Show that  $k = \frac{1}{\ln 2}$ . [4]
- c** Find the median of  $X$ . [4]
- d** Find the mode of  $X$ . [5]
- e** Find the mean of  $X$ . [5]