



22087213

**MATHEMATICS
HIGHER LEVEL
PAPER 1**

Wednesday 7 May 2008 (afternoon)

2 hours

Candidate session number

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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 of Section A in the spaces provided.
- Section B: answer all of Section B on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the number of sheets used in the appropriate box on your cover sheet.
- Unless otherwise stated in the question, all numerical answers must be given exactly or correct to three significant figures.



2. [Maximum mark: 6]

The polynomial $P(x) = x^3 + ax^2 + bx + 2$ is divisible by $(x+1)$ and by $(x-2)$.

Find the value of a and of b , where $a, b \in \mathbb{R}$.

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SECTION A

1. (a) Using $\sum P(X = x) = 1$ (M1)
 $4c + 6c + 6c + 4c = 1$ ($20c = 1$) (A1)
 $c = \frac{1}{20}$ ($= 0.05$) (A1) (NI)
- (b) Using $E(X) = \sum xP(X = x)$ (M1)
 $= (1 \times 0.2) + (2 \times 0.3) + (3 \times 0.3) + (4 \times 0.2)$ (A1)
 $= 2.5$ (A1) (NI)

Notes: Only one of the first two marks can be implied.
 Award *MIAIAI* if the x values are averaged only if symmetry is explicitly mentioned.

[6 marks]

2. METHOD 1

- As $(x+1)$ is a factor of $P(x)$, then $P(-1) = 0$ (M1)
 $\Rightarrow a - b + 1 = 0$ (or equivalent) (A1)
 As $(x-2)$ is a factor of $P(x)$, then $P(2) = 0$ (M1)
 $\Rightarrow 4a + 2b + 10 = 0$ (or equivalent) (A1)
 Attempting to solve for a and b (M1)
 $a = -2$ and $b = -1$ (A1) (NI)

[6 marks]

METHOD 2

- By inspection third factor must be $x-1$. (M1)A1
 $(x+1)(x-2)(x-1) = x^3 - 2x^2 - x + 2$ (M1)A1
 Equating coefficients $a = -2, b = -1$ (M1)A1 (NI)

[6 marks]

METHOD 3

- Considering $\frac{P(x)}{x^2 - x - 2}$ or equivalent (M1)
 $\frac{P(x)}{x^2 - x - 2} = (x + a + 1) + \frac{(a + b + 3)x + 2(a + 2)}{x^2 - x - 2}$ (A1)A1
 Recognising that $(a + b + 3)x + 2(a + 2) = 0$ (M1)
 Attempting to solve for a and b (M1)
 $a = -2$ and $b = -1$ (A1) (NI)

[6 marks]

