IYGB GCE

Mathematics FP1

Advanced Level

Practice Paper P

Difficulty Rating: 3.52/1.6129

Time: 1 hour 30 minutes

Candidates may use any calculator allowed by the regulations of this examination.

Information for Candidates

This practice paper follows closely the Pearson Edexcel Syllabus, suitable for first assessment Summer 2018.

The standard booklet "Mathematical Formulae and Statistical Tables" may be used.
Full marks may be obtained for answers to ALL questions.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 8 questions in this question paper.
The total mark for this paper is 75.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.
Non exact answers should be given to an appropriate degree of accuracy.
The examiner may refuse to mark any parts of questions if deemed not to be legible.

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Question 1

$$z = (2-\mathrm{i})^2 + \frac{7-4\mathrm{i}}{2+\mathrm{i}} - 8.$$

Express z in the form $x+\mathrm{i}y$, where x and y are real numbers. **(5)**

Question 2

Find, in fully factorized form, an expression for the sum

$$\sum_{r=1}^{2n}\left(3r^2 - \tfrac{1}{2}\right).$$ **(7)**

Question 3

The matrices $\mathbf{A}$ and $\mathbf{B}$ are defined as

$$\mathbf{A} = \begin{pmatrix} 1 & 1 \\ -1 & 1 \\ 0 & 0 \end{pmatrix} \quad \text{and} \quad \mathbf{B} = \begin{pmatrix} 1 & 0 & 1 \\ 2 & 2 & k \end{pmatrix},$$

where k is a scalar constant.

a) Without calculating $\mathbf{AB}$, show that $\mathbf{AB}$ is singular for all values of k. **(2)**

b) Show that $\mathbf{BA}$ is non singular for all values of k. **(3)**

When $k=-2$ the matrix $\mathbf{BA}$ represents a combination of a uniform enlargement with linear scale factor $\sqrt{a}$ and another transformation T.

c) Find the value of a and describe T geometrically. **(6)**

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Question 4

The cubic equation

$$2z^3 - z^2 + 4z + p = 0, \quad p \in \mathbb{R},$$

is satisfied by $z = 1 + 2\mathrm{i}$.

a) Find the other two roots of the equation. **(5)**

b) Determine the value of p. **(2)**

Question 5

Three planes have the following Cartesian equations.

$$x - 3y - 2z = 2$$
$$2x - 2y + 3z = 1$$
$$5x - 7y + 4z = k$$

where k is a constant.

Find the intersection of the three planes, stating any restrictions in the value of k. **(10)**

Question 6

The three roots of the equation

$$x^3 + 2x^2 + 10x + k = 0,$$

where k is a non zero constant, are in geometric progression.

Determine the value of k. **(10)**

Question 7

The straight line L passes through the points $B(1,4,0)$ and $D(2,2,6)$.

a) Find a vector equation of L. **(3)**

The point $A(1,0,p)$, where p is a scalar constant, is such so that $\measuredangle BAD = 90°$.

b) Find the possible values of p. **(6)**

The rectangle $ABCD$ has an area of $12\sqrt{2}$ square units.

c) Find the coordinates of C. **(6)**

Question 8

Prove by induction that

$$\sum_{r=1}^{n}\left[r(r+1)\left(\tfrac{1}{2}\right)^{r-1}\right]=16-\left(\tfrac{1}{2}\right)^{n-1}\left(n^{2}+5n+8\right),\ \ n\geq 1,\ n\in\mathbb{N}.$$ **(10)**
