IYGB GCE

Mathematics FP1

Advanced Level

Practice Paper R

Difficulty Rating: 3.50/1.6000

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.

Question 1

$$x^3 - 2x^2 - 8x + 11 = 0.$$

The roots of the above cubic equation are α, β and γ.

Find a cubic equation, with integer coefficients, whose roots are

$$\alpha + 1, \quad \beta + 1, \quad \gamma + 1. \qquad (7)$$

Question 2

It is given that $z = 2$ and $z = 1 + 2\text{i}$ are solutions of the equation

$$z^4 - 3z^3 + az^2 + bz + c = 0.$$

where a, b and c are real constants.

Determine the values of a, b and c. **(8)**

Question 3

The points $A(3,1,0)$, $B(0,2,2)$ and $C(3,3,1)$ form a plane Π.

a) Show that $\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ is a normal to Π. **(3)**

b) Find a Cartesian equation for Π. **(2)**

The straight line L passes through the point $P(3,1,3)$ and meets Π at right angles at the point Q.

c) Determine the distance PQ. **(6)**

Question 4

Find the value of x and the value of y in the following equation, given further that $x \in \mathbb{R}$, $y \in \mathbb{R}$.

$$\frac{x}{1+\mathrm{i}} = \frac{1-5\mathrm{i}}{3-2\mathrm{i}} + \frac{y}{2-\mathrm{i}}.$$

(8)

Question 5

Find the sum of the first n terms of the series

$$1\cdot 2\cdot 3 + 2\cdot 3\cdot 5 + 3\cdot 4\cdot 7 + 4\cdot 5\cdot 9 + \dots.$$

Express the answer as a product of linear factors. **(8)**

Question 6

Find in Cartesian form the image of the straight line with equation

$$\frac{x-2}{3} = \frac{y+2}{4} = \frac{1-z}{2},$$

under the transformation represented by the 3×3 matrix $\mathbf{A}$, shown below.

$$\mathbf{A} = \begin{pmatrix} 1 & 0 & 1 \\ 2 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix}.$$

(9)

Question 7

The straight lines l_1 and l_2 have the following vector equations

$$\mathbf{r}_1 = 12\mathbf{i} + 7\mathbf{j} + 3\mathbf{k} + \lambda(2\mathbf{i} + \mathbf{j} + \mathbf{k})$$

$$\mathbf{r}_2 = \mathbf{i} + 3\mathbf{j} + \mu(3\mathbf{i} - \mathbf{k}),$$

where λ and μ are scalar parameters.

a) Show that l_1 and l_2 intersect at some point A, further finding its coordinates. **(4)**

b) Calculate the acute angle between l_1 and l_2. **(3)**

The point $B(16,9,5)$ lies on l_1 and the point D lies on l_2.

c) If BD is perpendicular to l_2 find the coordinates of D. **(6)**

d) Find the coordinates of a point C so that the triangle ABC is isosceles. **(2)**

Question 8

Prove by induction that

$$\sum_{r=1}^{n} \frac{2r^2-1}{r^2(r+1)^2} = \frac{n^2}{(n+1)^2}, \quad n \geq 1, \ n \in \mathbb{N}.$$ **(9)**
