IYGB GCE

Mathematics FP1

Advanced Level

Practice Paper K

Difficulty Rating: 3.4133/1.5464

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 10 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

The straight line l_1 passes through the points with coordinates $(5,1,6)$ and $(2,2,1)$.

a) Find a vector equation of l_1. **(2)**

A different straight line l_2 passes though the point $C(6,6,-4)$ and is parallel to the vector $4\mathbf{i}-2\mathbf{j}+3\mathbf{k}$.

b) Show clearly that l_1 and l_2 are skew. **(5)**

Question 2

A non invertible transformation in three dimensional space is defined by the following 3×3 matrix, where a is a scalar constant.

$$\mathbf{A}=\begin{pmatrix} a & 1 & 2 \\ 2 & -1 & a \\ 3 & a & 4 \end{pmatrix}$$

Determine the possible values of a. **(7)**

Question 3

Sketch on a standard Argand diagram the locus of the points z which satisfy

$$|z-4-4\text{i}|=2\sqrt{2},$$

and use it to prove that

$$\frac{1}{12}\pi \le \arg z \le \frac{5}{12}\pi.$$

No credit will be given to solutions based on a scale drawing. **(7)**

Question 4

Use standard results on summations to show that

$$\sum_{n=1}^{k}\left(18n^2+28n+5\right) \equiv k(k+2)(6k+11).$$ **(7)**

Question 5

The equation of a plane Π is given by

$$\mathbf{r}=\begin{pmatrix}1\\2\\1\end{pmatrix}+\lambda\begin{pmatrix}2\\1\\0\end{pmatrix}+\mu\begin{pmatrix}1\\0\\2\end{pmatrix},$$

where λ and μ are parameters.

The plane Π is transformed to the plane Π' by the matrix

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

Find a Cartesian equation of Π'. **(8)**

Question 6

Solve the following equation.

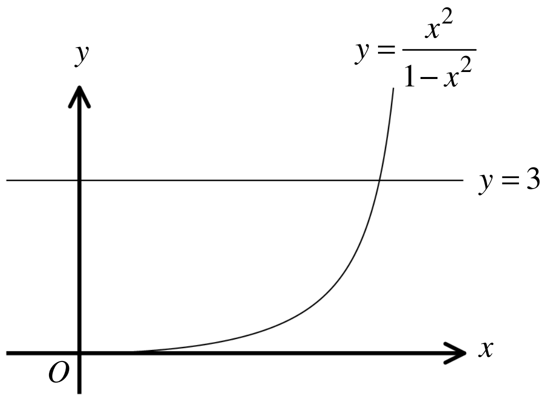
$$z^2=21-20\text{i}, \quad z\in\mathbb{C}.$$

Give the answers in the form $a+b\text{i}$, where $a\in\mathbb{R}$ and $b\in\mathbb{R}$. **(8)**

Question 7

Prove by mathematical induction that if n is a positive integer then $5^{n-1}+11^{n}$ is always divisible by 6. **(7)**

Question 8



The figure above shows part of the graph of the curve with equation $y=\frac{x^2}{1-x^2}$, which passes through the origin O.

The finite area bounded by the curve, the y axis and the straight line with equation $y=3$, is to be revolved in the $\boldsymbol{y}$ **axis** by $360°$ to form a solid of revolution S.

Find an exact value for the volume of S. **(8)**

Question 9

Find the image of the circle with equation

$$x^2+y^2=4,$$

under the transformation represented by the 2×2 matrix $\begin{pmatrix} 2 & 3 \\ 2 & 4 \end{pmatrix}$. **(7)**

Question 10

The roots of the cubic equation

$$x^3 - 4x^2 + 2x - 5 = 0$$

are denoted in the usual notation by α, β and γ.

Show that the cubic equation whose roots are

$$\frac{\beta\gamma}{\alpha}, \ \frac{\gamma\alpha}{\beta} \text{ and } \frac{\alpha\beta}{\gamma},$$

is given by

$$5x^3 + 36x^2 + 60x - 25 = 0.$$ **(9)**

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