IYGB GCE

Mathematics FP1

Advanced Level

Practice Paper O

Difficulty Rating: 3.1733/1.4151

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 9 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

A transformation where $\mathbb{R}^2 \mapsto \mathbb{R}^2$ is defined by

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

a) Find the elements of the matrices $\mathbf{A}^2$ and $\mathbf{A}^3$. **(2)**

b) Write down a suitable form for $\mathbf{A}^n$ and use the method of proof by induction to prove it. **(5)**

Question 2

$$z^4 - 8z^3 + 33z^2 - 68z + 52 = 0,\ z \in \mathbb{C}.$$

One of the roots of the above quartic equation is $2 + 3\mathrm{i}$.

Find the other roots of the equation. **(7)**

Question 3

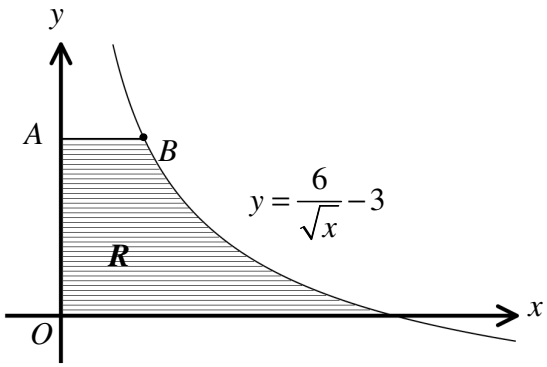
A curve has equation

$$y = 2x^2 + 5x + c,$$

where c is a non zero constant.

Given that the roots of the equation differ by 3, determine the value of c. **(6)**

Question 4



The figure above shows part of the graph of the curve with equation

$$y = \frac{6}{\sqrt{x}} - 3\,,\ x > 0\,.$$

The point B lies on the curve where $x = 1$.

The shaded region R is bounded by the curve, the coordinate axes and a straight line segment AB, where AB is parallel to the x axis . The region R is rotated through 2π radians in the y axis to form a solid of revolution.

Show that the volume of this solid is 14π. **(8)**

Question 5

A transformation in the x-y plane consists of ...

- ...a reflection about the line with equation $y = x$
- ... followed by an anticlockwise rotation about the origin by $90°$
- ... followed by a reflection about the x axis.

Use matrices to describe geometrically the resulting combined transformation. **(8)**

Question 6

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

$$\frac{1}{x+\mathrm{i}y}+\frac{1}{1+2\mathrm{i}}=1. \qquad (7)$$

Question 7

The points $A(1,-3,1)$, $B(-1,-2,0)$ and $C(0,-1,-4)$ define a plane Π.

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

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

The straight line L has equation

$$\mathbf{r}=2\mathbf{i}+\mathbf{k}+\lambda(5\mathbf{i}+\mathbf{j}+2\mathbf{k}),$$

where λ is a scalar parameter.

c) Find the coordinates of the point of intersection between Π and L. **(4)**

d) Calculate the size of the acute angle between Π and L. **(3)**

Question 8

The sum, S_n, of the first n terms of a series whose general term is denoted by u_n is given by the following expression.

$$S_n = n^2(n+1)(n+2).$$

a) Find the first term of the series. **(1)**

b) Show clearly that …

i. … $u_n = n(n+1)(4n-1)$ **(4)**

ii. … $\sum_{r=n+1}^{2n} u_r = 3n^2(n+1)(5n+2)$. **(4)**

Question 9

The 3×3 matrix $\mathbf{C}$ is defined by

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

Find, in Cartesian form, the image of the plane with Cartesian equation

$$2x + y - z = 12$$

under the transformation defined by $\mathbf{C}$. **(11)**
