IYGB GCE

Mathematics FP2

Advanced Level

Practice Paper Q

Difficulty Rating: 3.26/1.4599

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.

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Question 1

$$\frac{dy}{dx}+\frac{4y}{x}=6x-5,\ x>0.$$

Determine the solution of the above differential equation subject to the boundary condition is $y=1$ at $x=1$.

Give the answer in the form $y=f(x)$. **(6)**

Question 2

Indicating clearly the limiting processes used, show that

$$\int_0^{\mathrm{e}} x^2\ln x\ dx\ =\ \frac{2}{9}\mathrm{e}^3.$$ **(7)**

Question 3

$$f(x)\equiv\frac{\mathrm{e}^x+1}{2\mathrm{e}^{\frac{1}{2}x}},\ x\in\mathbb{R}.$$

Use standard results to determine the Maclaurin series expansion of $f(x)$, up and including the term in x^6. **(6)**

Question 4

Solve the following equation, giving the solutions as exact simplified natural logarithms.

$$2\tanh^2 w=1+\operatorname{sech} w,\ w\in\mathbb{R}.$$ **(7)**

Question 5

Find a solution of the differential equation

$$\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=10\sin x,$$

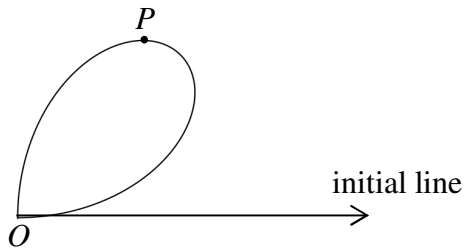
subject to the boundary conditions $y=6$ and $\frac{dy}{dx}=5$ at $x=0$. **(8)**

Question 6

Find a simplified expression for

$$\frac{d}{dx}\left[\arctan\left(\frac{x}{\sqrt{4-x^2}}\right)\right] \quad \textbf{(7)}$$

Question 7



The figure above shows the polar curve with equation

$$r=\sin 2\theta,\ 0\le\theta\le\frac{\pi}{2}.$$

a) Find the exact value of the area enclosed by the curve. **(7)**

The point P lies on the curve so that the tangent at P is parallel to the initial line.

b) Find the **Cartesian** coordinates of P. **(8)**

Question 8

$$z^3-3z^2+3z-65=0,\ z\in\mathbb{C}.$$

By considering the binomial expansion of $(a-1)^3$, or otherwise, find in exact form where appropriate the three solutions of the above equation. **(10)**

Question 9

$$f(r)=\frac{1}{(r+1)(r-1)},\ r\in\mathbb{N}.$$

a) Express $f(r)$ into partial fractions. **(1)**

b) Hence show that

$$\sum_{r=2}^{n}\frac{1}{r^2-1}=\frac{3}{4}-\frac{1}{2n}-\frac{1}{2(n+1)}.$$ **(7)**

c) State the value of

$$\sum_{r=2}^{\infty}\frac{1}{r^2-1}$$ **(1)**
