I.Y.G.B. www.madasmaths.com

IYGB GCE

Mathematics FP2

Advanced Level

Practice Paper R

Difficulty Rating: 3.60/1.6667

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.

I.Y.G.B. www.madasmaths.com

I.Y.G.B. www.madasmaths.com

Question 1

$$\frac{dy}{dx} + y\tan x = e^{2x}\cos x, \quad y(0) = 2.$$

Show that the solution of the above differential equation is

$$y = \frac{1}{2}\left(e^{2x} + 3\right)\cos x. \qquad \textbf{(7)}$$

Question 2

$$y = (1+x)^2 \cos x.$$

Show clearly that …

a) … $\dfrac{d^3y}{dx^3} = \left(x^2 + 2x - 5\right)\sin x - 6(x+1)\cos x$. **(6)**

b) … $y \approx 1 + Ax + Bx^2 + Cx^3$, where A, B and C are constants to be found. **(3)**

Question 3

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = 6e^{-2x},$$

with $y = 3$ and $\dfrac{dy}{dx} = -2$ at $x = 0$.

Show that the solution of the above differential equation is

$$y = 2e^{x} + (1-2x)e^{-2x}. \qquad \textbf{(8)}$$

I.Y.G.B. www.madasmaths.com

Question 4

Use the method of differences to show that

$$\frac{1}{1\times2\times3}+\frac{1}{2\times3\times4}+\frac{1}{3\times4\times5}+\dots+\frac{1}{n(n+1)(n+2)} = \frac{n(n+3)}{4(n+1)(n+2)}.$$ **(8)**

Question 5

a) Sketch a detailed graph of the curve with equation

$$y = \text{artanh}\,x,$$

defined in the largest real domain. **(3)**

b) Obtain a simplified expression for $\frac{dy}{dx}$, in terms of x only. **(4)**

c) Use integration and the answer of part **(b)** to show that

$$\text{artanh}\,x = \frac{1}{2}\ln\left[\frac{1+x}{1-x}\right].$$

No credit will be given for any alternative methods used in part **(c)**. **(7)**

Question 6

$$z^3 + 4 = 4\sqrt{3}\,\text{i}.$$

By considering the sum of the three roots of the above cubic equation show that

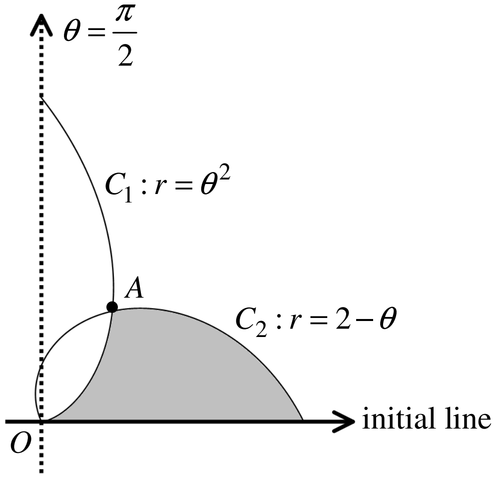
$$\cos\frac{2\pi}{9}+\cos\frac{4\pi}{9}+\cos\frac{8\pi}{9}=0.$$ **(10)**

I.Y.G.B. www.madasmaths.com

I.Y.G.B. www.madasmaths.com

I.Y.G.B. www.madasmaths.com

Question 7



The diagram above shows the curves with polar equations

$$C_1 : r = \theta^2, \; 0 \le \theta \le \frac{\pi}{2}$$

$$C_2 : r = 2 - \theta, \; 0 \le \theta \le 2.$$

The curves intersect at the point A.

a) Find the polar coordinates of A. **(2)**

b) Show that the area of the shaded region is $\frac{16}{15}$. **(7)**

I.Y.G.B. www.madasmaths.com

Question 8

$$\int \frac{\ln x^2}{x^3}\,dx\,,\ \ x \neq 0\,.$$

a) Show that the substitution $y = \dfrac{1}{x}$ transforms the above integral into

$$\int 2y \ln y \; dy\,.$$ **(4)**

b) Hence evaluate

$$\int_1^{\infty} \frac{\ln x^2}{x^3}\; dx\,,$$

showing clearly the limiting process used. **(6)**

I.Y.G.B. www.madasmaths.com