IYGB GCE

Mathematics FP3

Advanced Level

Practice Paper J

Difficulty Rating: 3.0733/1.3667

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

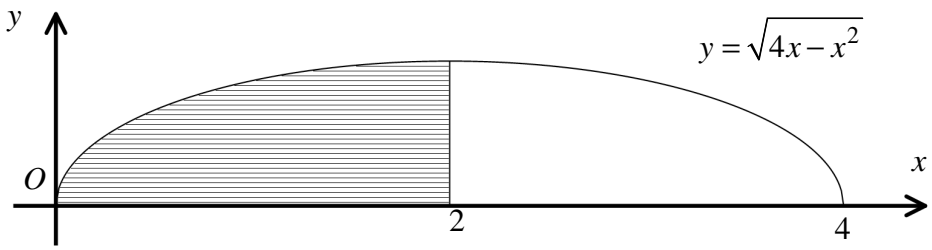
You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.
Non exact answers should be given to an appropriate degree of accuracy.
The examiner may refuse to mark any parts of questions if deemed not to be legible.

Question 1

Find the set of values of x, that satisfy the following inequality.

$$\frac{5x}{x^2+4} < x. \qquad (\mathbf{6})$$

Question 2



The figure above shows part of the curve C with equation

$$y = \sqrt{4x - x^2}\ .$$

a) Use Simpson's rule with 4 equally strips to estimate, to three significant figures, the area bounded by C, the x axis and the vertical straight line with equation $x = 2$. $(\mathbf{5})$

b) Hence find an estimate for

$$\int_0^2 3 + \sqrt{4x - x^2}\ \ dx\,. \qquad (\mathbf{2})$$

Question 3

Find the value of the following limit

$$\lim_{x \to 0}\left[\frac{x\cos x}{x + \arcsin x}\right]. \qquad (\mathbf{5})$$

Question 4

Referred to a fixed origin the coordinates of the following points are given

$$A(1,1,1),\ B(5,-2,1),\ C(3,2,6) \text{ and } D(1,5,6).$$

a) Find a Cartesian equation for the plane containing the points A, B and C. **(5)**

b) Determine the volume of the tetrahedron $ABCD$. **(3)**

Question 5

The differential equation

$$\frac{d^2y}{dx^2} = \frac{x}{y^2} + \frac{1}{y},\ y \neq 0,$$

is to be solved numerically subject to the conditions $y(0.5) = 1$ and $y(0.6) = 1.3$.

Use the approximation

$$y_n' \approx \frac{y_{n+1} - 2y_n - y_{n-1}}{h^2},\quad h = 0.1,$$

to find, correct to 4 decimal places the value of y at $x = 0.8$. **(6)**

Question 6

$$\frac{dy}{dx} = \frac{x^2 + 3y^2}{xy},\ x > 0,\ y > 0.$$

Use the substitution $y = xv$, where $v = f(x)$, and the boundary condition $y = \frac{1}{\sqrt{2}}$ at $x = 1$, to show that

$$y^2 = x^6 - \frac{1}{2}x^2.$$ **(12)**

Question 7

$$y = \tan x .$$

a) Show that

$$\frac{d^3y}{dx^3} = 2y\frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right)^2 . \qquad (\mathbf{4})$$

b) Determine the first four terms in the Taylor expansion of $\tan x$, in ascending powers of $\left(x - \frac{\pi}{4}\right)$. $(\mathbf{5})$

c) Hence deduce that

$$\tan\frac{5\pi}{18} \approx 1 + \frac{\pi}{18} + \frac{\pi^2}{648} + \frac{\pi^3}{17496} . \qquad (\mathbf{2})$$

Question 8

The point $P\left(4p^2, 8p\right)$, $p \geq 0$, lies on the parabola with equation

$$y^2 = 16x , \; x \geq 0 .$$

a) Show that the equation of the tangent to the parabola at P is given by

$$yp = x + 4p^2 . \qquad (\mathbf{4})$$

The tangent to the parabola at P meets the directrix of the parabola at the point A and the x axis at the point B. The point F is the focus of the parabola.

b) Given that the y coordinate of A is $\frac{42}{5}$, find the area of the triangle FBP. $(\mathbf{8})$

Question 9

Use the substitution $t = \tan\left(\frac{x}{2}\right)$ to find the value of

$$\int_0^{\frac{\pi}{2}} \frac{1}{1+\sin x}\ dx\,. \qquad \textbf{(8)}$$