IYGB GCE

Mathematics MP2

Advanced Level

Practice Paper M

Difficulty Rating: 3.8750/1.3176

Time: 2 hours

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 13 questions in this question paper.
The total mark for this paper is 100.

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

$$f(x) \equiv \frac{2-x}{\sqrt{1+x}}, \ |x|<1.$$

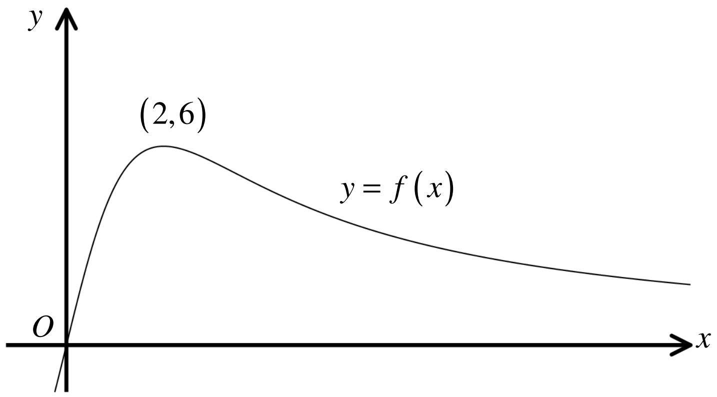
a) Show that the first four terms in the binomial expansion of $f(x)$ are

$$2-2x+\frac{5}{4}x^2-x^3. \qquad \textbf{(5)}$$

b) Use the answer of part **(a)** to find the first four terms in the expansion of

$$g(x)=\frac{2-2x}{\sqrt{1+2x}}. \qquad \textbf{(2)}$$

Question 2



The figure above shows part of the curve with equation $y=f(x)$, which has a local maximum at $(2,6)$.

The graph $y=f(x)$ is transformed onto the graph of $y=g(x)$, so that the graph of $y=g(x)$ has a **local minimum** at the origin.

Express $g(x)$ in terms of $f(x)$. **(3)**

Question 3

Prove by **contradiction** that for all real x

$$(13x+1)^2 + 3 > (5x-1)^2 .$$ **(4)**

Question 4

The obtuse angles A and A, satisfy the following relationships.

$$\cos 2A = \sin B = \frac{1}{3} .$$

Determine the exact value of $\tan(A+B)$. **(8)**

Question 5

The curve C has equation

$$y = x\sqrt{\ln x}, \quad x > 1 .$$

Find an equation of the tangent to the curve at the point where $x = e^4$ giving the answer in the form $ay = bx - e^4$, where a and b are integers. **(7)**

Question 6

Each of the terms of an arithmetic series is added to the corresponding terms of a geometric series, forming a new series with first term $\frac{3}{8}$ and second term $\frac{13}{16}$.

The common difference of the arithmetic series is four times as large as the first term of the geometric series. The common ratio of the geometric series is twice as large as the first term of the arithmetic series.

Determine the possible values of the first term of the geometric series. **(8)**

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Question 7

Use the substitution $t = 3 + \sqrt{x}$ to find the value of the following integral

$$\int_{1}^{36} \frac{1}{\sqrt{x^{\frac{3}{2}} + 3x}} \, dx . \qquad \textbf{(8)}$$

Question 8

A curve C has equation

$$y = \mathrm{e}^{-x} \ln x , \ x > 0 .$$

a) Show that the x coordinate of the stationary point of C lies between 1 and 2 . **(6)**

b) Use an iterative formula based on the Newton Raphson method to find the x coordinate of the stationary point of C, correct to 8 decimal places. **(6)**

Question 9

A curve is defined by the parametric equations

$$x = 2\cos t , \ y = 4\sin t , \ 0 \le t \le \frac{\pi}{2} .$$

a) Show that an equation of the tangent to the curve at the point P where $t = \theta$ can be written as

$$y \sin\theta + 2x\cos\theta = 4 . \qquad \textbf{(5)}$$

The tangent to curve at P meets the coordinate axes at the points A and B .

The triangle OAB, where O is the origin, has the least possible area.

b) Find the coordinates of P . **(4)**

Question 10

During a chemical reaction a compound is formed, whose mass y grams in time t minutes satisfies the differential equation

$$\frac{dy}{dt} = k(1-2y)(1-3y), \ t \geq 0,$$

where k is a positive constant.

a) Solve the differential equation to show that

$$\ln\left|\frac{1-2y}{1-3y}\right| = kt + C,$$

where C is a constant. **(7)**

When the chemical reaction started there was no compound present, and when $t = \ln 4$ the mass of the compound has risen to 0.25 grams.

b) Show further that

$$y = \frac{1-e^{-\frac{1}{2}t}}{3-2e^{-\frac{1}{2}t}}.$$

(5)

c) State, with justification, the limiting value of y as t gets large. **(1)**

Question 11

A function f is defined in a restricted real domain and has equation

$$f(x) \equiv x^2 - 6x + 13.$$

It is further given that the equations $f(x) = 8$, $f(x) = 13$ and $f(x) = 20$ have 2 distinct solutions, 1 solution and no solutions, respectively.

Determine the possible domain of f. **(6)**

Question 12

Use a trigonometric identity to integrate

$$\int \frac{1}{1+\cos 2x}\,dx \,. \qquad (3)$$

Question 13

A function f is defined in the largest real domain by the equation

$$f(x) \equiv \frac{50x^2 - 142x + 95}{2x-5} \,.$$

a) State the domain of f. **(1)**

b) Evaluate $f(1)$, $f(2)$ and $f(3)$, and hence briefly discuss the number of possible intersections of f with the coordinate axes, ...

i. ... in the interval $[1,2]$.

ii. ... in the interval $[2,3]$. **(3)**

c) Express $f(x)$ in the form $Ax + B + \dfrac{C}{2x-5}$, where A, B and C are constants. **(3)**

d) Calculate, correct to 3 decimal places, the x coordinates of the stationary points of f. **(5)**
