IYGB GCE

Mathematics MP2

Advanced Level

Practice Paper L

Difficulty Rating: 3.92/1.3462

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 12 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.

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Question 1

With respect to a fixed origin, the points A and B have position vectors $2\mathbf{i}+4\mathbf{j}+7\mathbf{k}$ and $-4\mathbf{i}+\mathbf{j}+\mathbf{k}$, respectively.

The point P lies on the straight line through A and B.

Find the possible position vectors of P if $\left|\overrightarrow{AP}\right| = 2\left|\overrightarrow{PB}\right|$. **(5)**

Question 2

A curve is defined by the following parametric equations

$$x = 4at^2, \quad y = a(2t+1), \quad t \in \mathbb{R},$$

where a is non zero constant.

Given that the curve passes through the point $A(4,8)$, find the possible values of a. **(6)**

Question 3

Find the solutions of the trigonometric equation

$$6 + 13\sin(2\theta + \alpha)° = 5\cos 2\theta°, \ 0 \le \theta < 360$$

where $\tan\alpha° = \frac{5}{12}$, $0 < \alpha < 90$. **(7)**

Question 4

The curve C has equation

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

The curve has a single turning point at M.

a) Show that x coordinate of M is a solution of the equation

$$x = \arctan\left(\frac{1}{x}\right).$$ **(5)**

b) Show further that the equation

$$x = \arctan\left(\frac{1}{x}\right)$$

has root α between 0.8 and 1. **(2)**

The iterative formula

$$x_{n+1} = \arctan\left(\frac{1}{x_n}\right) \text{ with } x_1 = 0.9$$

is to be used to find α.

c) Find, to 3 decimal places, the value of x_2, x_3 and x_4. **(1)**

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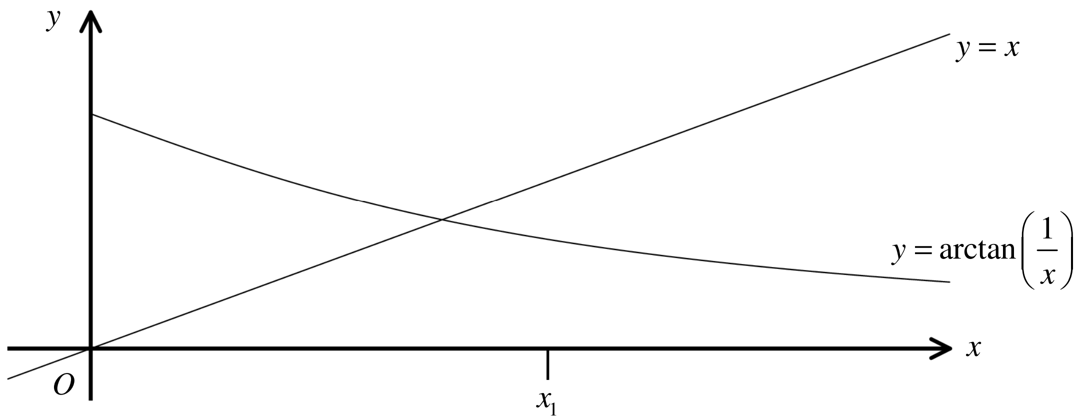
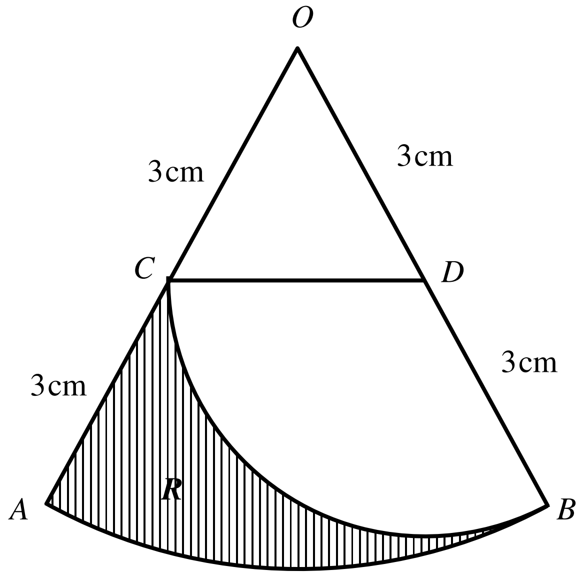
The diagram below shows the graphs of $y = x$ and $y = \arctan\left(\frac{1}{x}\right)$.



d) Use a copy of the above diagram to show how the convergence to the root α takes place, by constructing a staircase or cobweb pattern.

Indicate clearly the positions of x_2, x_3 and x_4. **(2)**

Question 5



The figure above shows a circular sector OAB, of radius 6 cm, centred at O.

The points C and D are the midpoints of OA and OB, respectively.

The triangle OCD is equilateral.

Another circular sector CDB, centred at D and of radius 3 cm, is drawn inside the circular sector OAB.

The finite region R bounded by the circular arcs AB and CB, and the straight line segment AC, is shown shaded in the figure above.

a) Show that the perimeter of R is $(3+4\pi)$ cm. **(4)**

b) Determine an exact value for the area of R. **(5)**

Question 6

The surface area A, of a metallic cube of side length x, is increasing at the constant rate of $0.45 \text{ cm}^2 \text{s}^{-1}$.

Find the rate at which the volume of the cube is increasing, when the cube's side length is 8 cm. **(7)**

Question 7

$$x\frac{dy}{dx} = y(y+1), \ x > 0, \ y > 0$$

Show that the solution of the above differential equation subject to the boundary condition $y = \frac{1}{2}$ at $x = \frac{1}{3}$, is given by

$$y = \frac{x}{1-x}.$$ **(11)**

Question 8

The first three terms of a geometric series are

$$u_1 = q(4p+1), \qquad u_2 = q(2p+3) \qquad \text{and} \qquad u_3 = q(2p-3).$$

a) Find the possible values of p. **(7)**

The sum to infinity of the series is 250.

b) Find the value of q. **(4)**

Question 9

The functions f and g are defined by

$$f(x) = 2x+3, \ x \in \mathbb{R}, \ x \leq 8$$

$$g(x) = x^2 - 1, \ x \in \mathbb{R}, \ x \geq 0.$$

Find the domain and range of $fg(x)$. **(6)**

Question 10

$$y = \frac{4x+3}{3x+4}, \quad x \neq -\frac{4}{3}.$$

a) Calculate the five missing values of x and y in the following table.

x	0				32
y	$\frac{3}{4}$	$\frac{35}{29}$	$\frac{67}{52}$		

(2)

b) Use the trapezium rule with all the values from the completed table of part **(a)** to find an estimate for

$$\int_0^{32} \frac{4x+3}{3x+4}\, dx.$$

(3)

c) Use the substitution $u = 3x+4$ to find the exact value of

$$\int_0^{32} \frac{4x+3}{3x+4}\, dx.$$

(7)

Question 11

The equation of a curve is given implicitly by

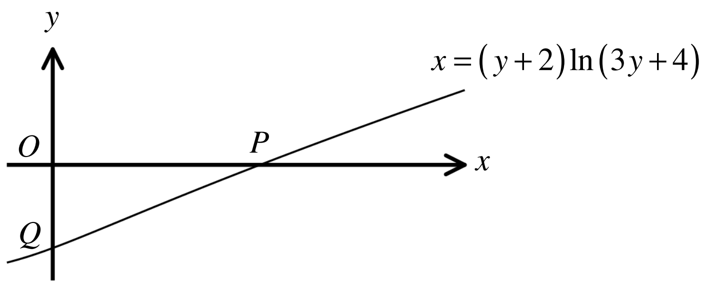
$$y^2 - x^2 = 1, \quad |y| \geq 1 \quad .$$

Show clearly that

$$\frac{d^2y}{dx^2} = \frac{1}{y^3}.$$

(8)

Question 12



The figure above shows the graph of the curve with equation

$$x = (y+2)\ln(3y+4).$$

The curve meets the coordinate axes at the point P and at the point Q.

Determine the gradient, in exact from where appropriate, at P and at Q. **(8)**