IYGB GCE

Mathematics MP1

Advanced Level

Practice Paper O

Difficulty Rating: 3.6300/1.1814

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.

Question 1

Find the range of the possible values of the constant p, given that the equation

$$x^2 + 5px + 2p = 0$$

has real roots. **(4)**

Question 2

The straight line L passes through the points $(2,5)$ and $(-2,3)$, and meets the coordinate axes at the points P and Q.

Find the area of a square whose side is PQ. **(6)**

Question 3

A cubic curve is given by

$$f(x) \equiv 4x^3 - 8x^2 - x + k,$$

where k is a non zero constant.

a) If $(x-2)$ is a factor of $f(x)$, show that $(2x-1)$ is also a factor of $f(x)$. **(4)**

b) Express $f(x)$ as the product of three linear factors. **(1)**

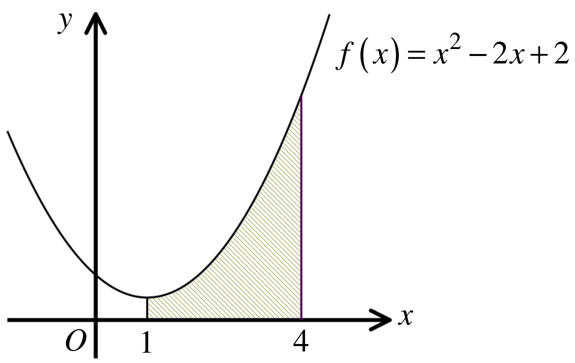
c) Hence solve the following trigonometric equation

$$4\sin^3 y - 8\sin^2 y - \sin y + k = 0,$$

for $0° \le y < 360°$. **(4)**

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

Question 4



The curve C has equation

$$f(x) = x^2 - 2x + 2, \quad x \in \mathbb{R}.$$

a) Find the area of the finite region bounded by C, the x axis and the straight lines with equations $x = 1$ and $x = 4$, shown shaded in the figure above. **(4)**

b) Hence evaluate

$$\int_1^4 2f(5-x)\ dx.$$ **(2)**

Question 5

Relative to a fixed origin O on a horizontal plane, the points A and B have respective position vectors $3\mathbf{i} - 2\mathbf{j}$ and $5\mathbf{i} + 4\mathbf{j}$.

The point C lies on the same plane as A and B so that $\overrightarrow{AB} : \overrightarrow{BC} = 2 : 5$.

a) Find the position vector of C. **(3)**

The point D lies on the same plane as A and B so that A, B and D are collinear.

b) Given that $|BD| = 6\sqrt{10}$, determine the possible position vectors of D. **(5)**

Question 6

$$f(x) = x^4, \ x \in \mathbb{R}.$$

Use the formal definition of the derivative as a limit, to show that

$$f'(x) = 4x^3.$$ **(6)**

Question 7

During a chemical process the mass of a substance, m kg, at time t hours grows exponentially according to the formula

$$m = 20e^{0.02t}, \ t \geq 0.$$

a) Find the time taken for the substance to increase to three times its initial mass. **(4)**

b) Calculate the rate of change of m, when $m = 100$. **(6)**

Question 8

A curve has equation

$$y = x\left(x^2 - 128\sqrt{x}\right), \qquad x \in \mathbb{R}, \qquad x > 0.$$

The curve has a single stationary point with coordinates $\left(2^{\alpha}, -2^{\beta}\right)$, where α and β are positive integers.

Find the value of β and justify that the stationary point is a local minimum. **(8)**

Question 9

The circles C_1 and C_2 have respective equations

$$x^2 + y^2 - 6x - 2y = 15$$

$$x^2 + y^2 - 18x + 14y = 95.$$

a) By considering the coordinates of the centres and the lengths of the radii of C_1 and C_2, show that C_1 and C_2 touch internally at some point P. **(7)**

b) Determine the coordinates of P. **(3)**

c) Show that the equation of the common tangent to the circles at P is given by

$$3x - 4y + 20 = 0.$$ **(4)**

Question 10

The following table shows some experimental data.

x	5	10	15	20	25	30
y	1.7	4.5	11.0	26.0	70.0	160.0

It is assumed that the two variables x and y are related by the formula

$$y = ab^x,$$

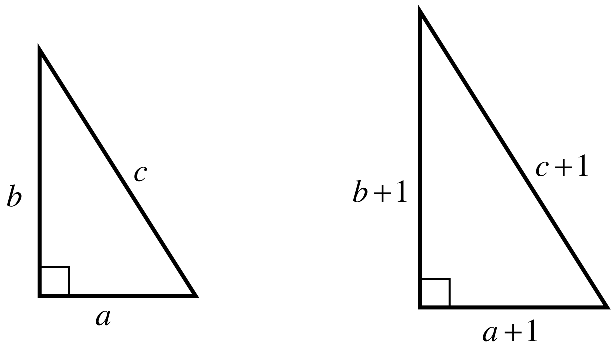
where a and b are non zero constants.

a) Use a graphical method to show that the above data is consistent with this assumption. **(6)**

b) Find estimates for the values of a and b, correct to one decimal place. **(4)**

c) Use the estimated values of a and b, to find an estimate for the value of y when $x = 60$. **(2)**

Question 11



The figure above shows two right angled triangles.

- The triangle, on the left section of the figure, has side lengths of

$$a, \ b \text{ and } c,$$

where c is the length of its hypotenuse.

- The triangle, on the right section of the figure, has side lengths of

$$a+1, \quad b+1 \quad \text{and} \quad c+1,$$

where $c+1$ is the length of its hypotenuse.

Show that a, b and c cannot all be integers. **(4)**

Question 12

A cubic curve has the following equation.

$$f(x) \equiv x^3 - 6x^2 + 12x + B, \quad x \in \mathbb{R},$$

where B is a non zero constant.

a) If $f(x)$ can be written in the form $(x-A)^3 - 4$, where A is also a non zero constant, find the value of A and the value of B. **(5)**

A quadratic curve has the following equation.

$$g(x) \equiv x^2 - 4x + 5, \quad x \in \mathbb{R}.$$

b) Sketch the graph of $f(x)$ and the graph of $g(x)$ in the same set of axes.

The sketch must include the coordinates of any points where each of the graphs meets the coordinate axes, the coordinates of the point of inflexion of $f(x)$ and the coordinates of the minimum point of $g(x)$. **(5)**

c) Hence, state with full justification the number of real roots of the equation

$$x^3 - 7x^2 + 16x + B = 5. \quad \mathbf{(3)}$$