IYGB GCE

Mathematics MP1

Advanced Level

Practice Paper X

Difficulty Rating: 4.2400/1.5909

Time: 2 hours 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 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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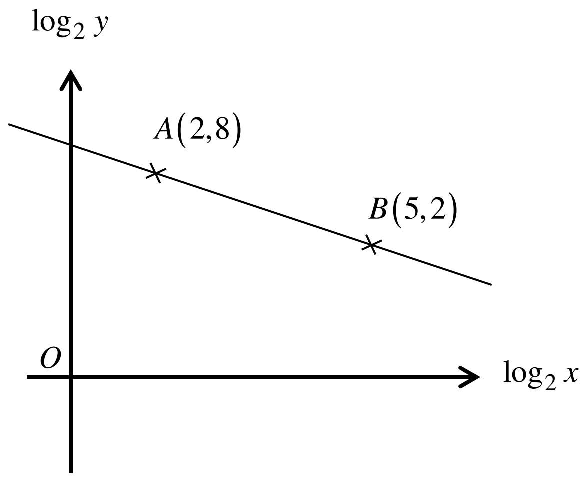
Question 1

$$f(x) = \left(2 + \tfrac{1}{4}x\right)^8.$$

a) Find the first four terms in ascending powers of x in the expansion of $f(x)$. **(3)**

b) Use the expansion found in part (a) to find an approximation, to 3 significant figures, for $\left(\frac{81}{40}\right)^8$. **(3)**

Question 2



The figure above shows a set of axes where $\log_2 y$ is plotted against $\log_2 x$.

A straight line passes through the points $A(2,8)$ and $B(5,2)$.

Determine the value of y at the point where $y = x$. **(7)**

Question 3

Calculate in **degrees**, correct to one decimal place, the solution of the following trigonometric equation

$$\frac{1-\cos\theta}{\sin\theta} = \sqrt{3}\sin\theta, \quad 0 < \theta < 180. \qquad \textbf{(7)}$$

Question 4

The functions f and g are defined for all x and are defined by

$$f(x) = \left(1+\tfrac{1}{2}x\right)^4 \quad \text{and} \quad g(x) = (1+3x)^4.$$

a) Describe the geometrical transformation which maps the graph of $f(x)$ onto the graph of $g(x)$. **(2)**

The graph of $f(x)$ is translated by the vector $\begin{bmatrix} 2 \\ 0 \end{bmatrix}$ to give the graph of $h(x)$.

b) Find an expression for $h(x)$ in its simplest form. **(3)**

Question 5

A curve has equation

$$y = x^2 - 6x\sqrt[3]{x} + 2, \qquad x \in \mathbb{R}, \qquad x \geq 0.$$

Find the coordinates of the stationary points of the curve and classify them as local maxima, local minima or points of inflexion. **(11)**

Question 6

A quadratic curve has equation

$$f(x) \equiv 2x^2 + (4k+3)x + (2k-1)(k+2), \ x \in \mathbb{R},$$

where k is a constant.

a) Evaluate the discriminant of $f(x)$. **(3)**

b) Express $f(x)$ as the product of two linear factors. **(5)**

Question 7

A circle has centre at $C(6,2)$ and radius of 4 units.

The point $P\left(6+2\sqrt{2},k\right)$ lies on this circle, where k is a positive constant.

a) Determine the exact value of k. **(4)**

The straight line T_1 is the tangent to the circle at the point P.

The straight line T_2 is another tangent to the circle so that T_2 is parallel to T_1.

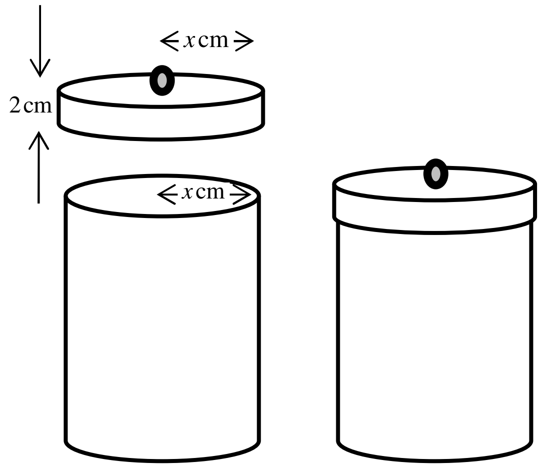
b) Determine the equations of T_1 and T_2. **(7)**

Question 8

$$f(a) = a^3 + 5a, \ a \in \mathbb{N}.$$

Without using proof by induction, show that $f(a)$ is a multiple of 6. **(5)**

Question 9



The figure above shows the design of coffee jar with a "push on" lid.

The jar is in the shape of a right circular cylinder of radius x cm. It is fitted with a lid of width 2 cm, which fits tightly on the top of the jar, so it may be assumed that it has the same radius as the jar.

The jar and its lid is made of sheet metal and there is no wastage.

The total metal used to make the jar and its lid is $190\pi \text{ cm}^2$.

(*This figure does not include the handle of the lid which is made of different material.*)

a) Show that volume of the jar, V cm^3, is given by

$$V = \pi\left(95x - 2x^2 - x^3\right). \qquad (5)$$

b) Determine by differentiation the value of x for which V is stationary. **(4)**

c) Show that the value of x found in part **(b)** gives the maximum value for V. **(2)**

d) Hence determine the maximum volume of the jar. **(1)**

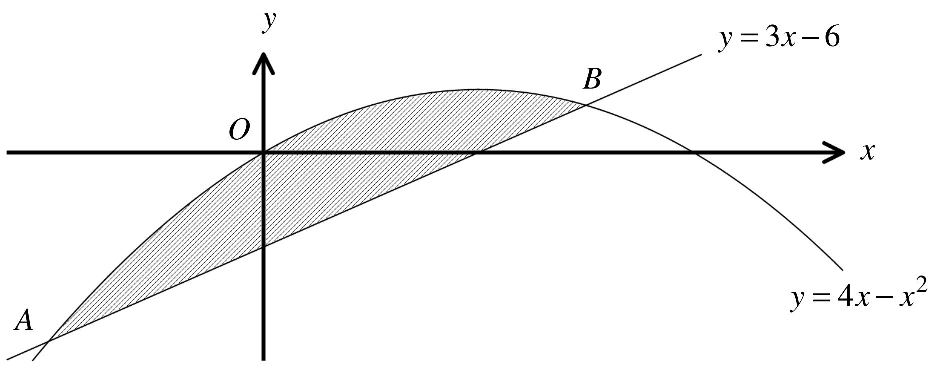
Question 10

$$2\log_2 x - \log_2 y = 1$$

$$\log_2\left(4x\sqrt{y}\right) = 1\,.$$

Solve the above simultaneous logarithmic equations, giving the final answers as exact powers of 2. **(8)**

Question 11



The figure above shows the graph of the curve C with equation

$$y = 4x - x^2,$$

intersected by the straight line L with equation

$$y = 3x - 6\,.$$

The finite region R is bounded by C and L.

Show that the area of R, shown shaded in the above figure, is $\frac{125}{6}$. **(10)**

Question 12

The straight lines l_1 and l_2, with respective equations

$$y = 3x \qquad \text{and} \qquad 3x + 2y = 13,$$

intersect at the point P.

The points A and B, are the points of intersection of the straight line with equation $y = -1$ with l_1 and l_2, respectively.

Show that the area of the triangle ABP is $\frac{128}{9}$ square units. **(10)**