IYGB GCE

Mathematics MP1

Advanced Level

Practice Paper K

Difficulty Rating: 3.365/1.0626

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.

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Question 1

$$y=\frac{8}{x}+3\sqrt{x}\,,\ x>0\,.$$

Find the value of $\frac{dy}{dx}$ at the point where $x=4$. **(4)**

Question 2

$$f\left(x\right)=4x^2+4x-1,\ x\in\mathbb{R}\,.$$

a) Express $f\left(x\right)$ in completed the square form. **(3)**

b) Hence find, as exact surds, the roots of the equation $f\left(x\right)=0$. **(2)**

Question 3

$$f\left(x\right)\equiv x^{\frac{3}{2}}-8x^{-\frac{1}{2}},\ x>0$$

Show clearly that

$$f\left(3\right)=k\sqrt{3}\,,$$

where k is a constant. **(4)**

Question 4

a) Find the binomial expansion of $\left(2x+4\right)^3$, in descending powers of x. **(3)**

b) Hence determine the expansion of

$$\left(2x-1\right)\left(2x+4\right)^3.$$ **(3)**

Question 5

The following information is given for four points which lie on the same plane.

$$\overrightarrow{OA} = \mathbf{i} + 4\mathbf{j}, \qquad \overrightarrow{OB} = 5\mathbf{i} + 5\mathbf{j} \qquad \text{and} \qquad \overrightarrow{CB} = -\mathbf{i} + 6\mathbf{j},$$

a) Find the vector $\overrightarrow{AB}$ and hence state its length **(3)**

b) Determine the length of $\overrightarrow{AC}$. **(2)**

c) Calculate the size of the angle ABC. **(4)**

Question 6

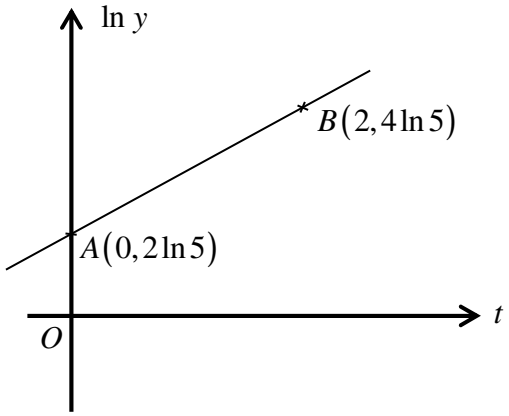
A cubic graph is defined as

$$f(x) \equiv x^3 + x^2 - 10x + 8, \ x \in \mathbb{R}.$$

a) By considering the factors of 8, or otherwise, express $f(x)$ as the product of three linear factors. **(5)**

b) Sketch the graph of $f(x)$.
The sketch must include the coordinates of any points where the graph of $f(x)$ meets the coordinate axes. **(3)**

Question 7



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

A straight line passes through the points $A(0,2\ln 5)$ and $B(2,4\ln 5)$.

Express y in terms of t. **(6)**

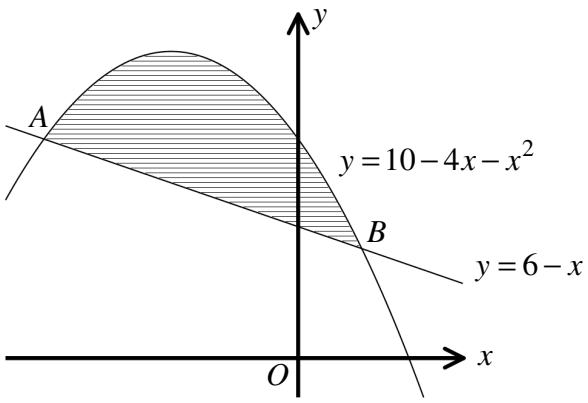
Question 8

Find, as exact simplified surds, the solution interval that satisfies both the following inequalities.

$$(x+2)(x+4) > 10x+7$$

$$x\sqrt{3} < 2+\frac{2(2x-1)}{\sqrt{3}}. \qquad \textbf{(10)}$$

Question 9



The figure above shows a quadratic curve and a straight line with respective equations

$$y = 10 - 4x - x^2 \qquad \text{and} \qquad y = 6 - x \, .$$

The points A and B, are the points of intersection between the quadratic curve and the straight line.

Calculate the exact area of the finite region bounded by the quadratic curve and the straight line, shown shaded in the above figure. **(12)**

Question 10

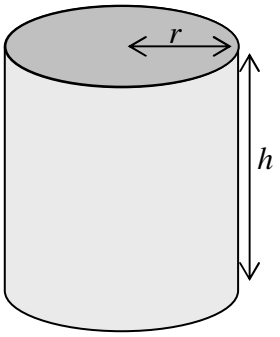
Two curves C_1 and C_2 are defined for all values of x and have respective equations

$$y_1 = 9^x \quad \text{and} \quad y_2 = 6 \times 5^x \, .$$

Show that the x coordinate of the point of intersection of the two curves is given by

$$\frac{1 + \log_3 2}{2 - \log_3 5} \, . \qquad \textbf{(7)}$$

Question 11



The figure above shows a **closed** cylindrical can of radius r cm and height h cm.

a) Given that the surface area of the can is 192π cm^2, show that the volume of the can, V cm^3, is given by

$$V = 96\pi r - \pi r^3 . \qquad (\mathbf{4})$$

b) Find the value of r for which V is stationary. $(\mathbf{5})$

c) Justify that the value of r found in part **(b)** gives the maximum value for V. $(\mathbf{2})$

d) Calculate the maximum value of V. $(\mathbf{1})$

Question 12

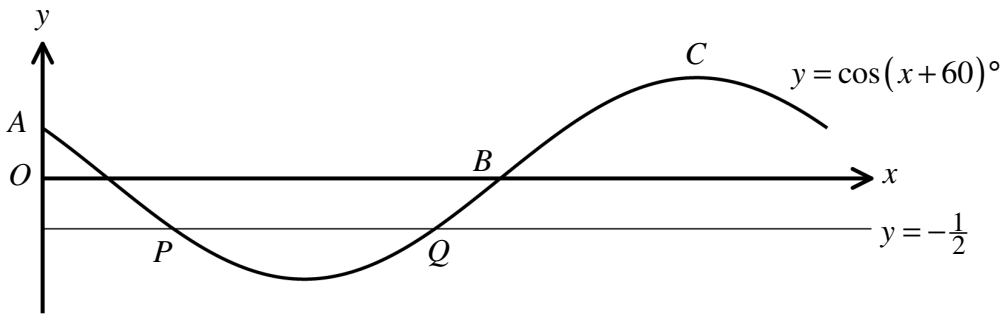
Relative to a fixed origin O, the points A and B have coordinates $(0,1)$ and $(6,5)$, respectively.

a) Find an equation of the perpendicular bisector of AB. $(\mathbf{5})$

A circle passes through the points O, A and B.

b) Determine the coordinates of the centre of this circle. $(\mathbf{4})$

Question 13



The figure above shows the graph of

$$y = \cos(x + 60)^\circ,\ 0 \le x \le 360.$$

The graph meets the y axis at the point A and the point B is one of the two x intercepts of the curve. The point C is the maximum point of the curve.

a) State the coordinates of A, B and C. **(3)**

The straight line with equation $y = -\frac{1}{2}$ meets the graph of $y = \cos(x + 60)^\circ$ at the points P and Q.

b) Determine the coordinates of P and Q. **(5)**