IYGB GCE

Mathematics MP1

Advanced Level

Practice Paper E

Difficulty Rating: 3.665/1.1991

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 10 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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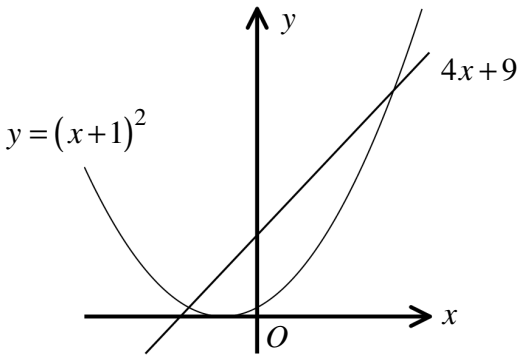
Question 1



The figure above shows the graphs of $y=(x+1)^2$ and $y=4x+9$. **(5)**

a) Find the coordinates of the points of intersection between the two graphs.

b) Hence solve the inequality

$$(x+1)^2 \geq 4x+9,$$

fully justifying the answer. **(2)**

Question 2

A circle has centre at the origin and radius R.

This circle fits wholly inside the circle with equation

$$x^2+y^2-10x-24y=231.$$

Determine the range of possible values of R. **(7)**

Question 3

$$f(x) = x^3 - 9x^2 + 13x + 2, \ x \in \mathbb{R}.$$

a) Show, by using the factor theorem, that $(x-2)$ is a factor of $f(x)$ and hence express $f(x)$ as a product of a linear and a quadratic factor.

$$g(x) = x(x-2)(x-4), \ x \in \mathbb{R}. \qquad \textbf{(3)}$$

b) Sketch the graph of $g(x)$, indicating clearly the coordinates of any points where the graph of $g(x)$ meets the coordinate axes. **(3)**

c) Determine the exact coordinates, where appropriate, of the points of intersection between the graph of $f(x)$ and the graph of $g(x)$. **(5)**

Question 4

a) Sketch the graph of $y = 2\sqrt{x}$ in its largest real domain. **(2)**

b) Describe a **single** geometric transformation which maps the graph of $y = 2\sqrt{x}$ onto the graph of $y = 3\sqrt{2x}$. **(3)**

c) Describe a **single** geometric transformation which maps the graph of $y = 2\sqrt{x}$ onto the graph of $y = 3\sqrt{2x}$, other than the one described in part **(b)**. **(3)**

Question 5

Solve the following trigonometric equation.

$$\sin(3\theta + 72)^\circ = \cos 48^\circ, \quad 0 \le \theta < 180. \qquad \textbf{(7)}$$

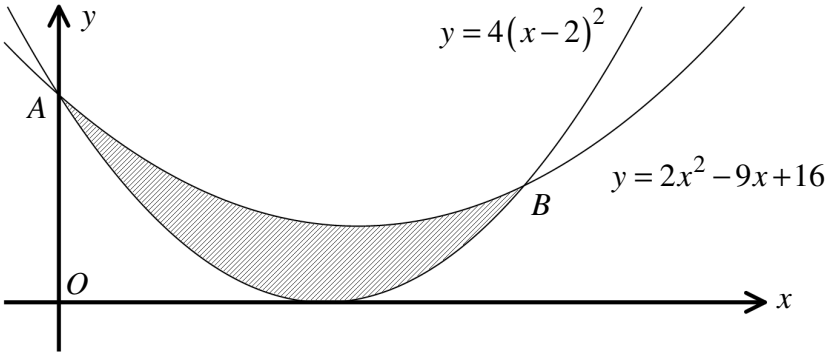
Question 6

$$f(x)=(1-2x)^6, \qquad g(x)=(2+x)^7, \qquad h(x)=f(x)g(x).$$

a) Find the first four terms in ascending powers of x in the binomial expansion of $f(x)$ and in the binomial expansion of $g(x)$. **(7)**

b) Hence determine the coefficient of x^2 in the binomial expansion of $h(x)$. **(3)**

Question 7



The figure above shows the graph of the curves with equations

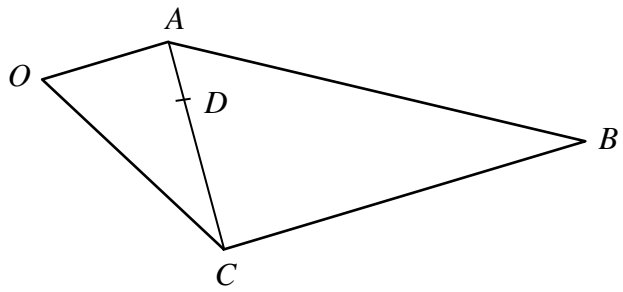
$$y=4(x-2)^2 \quad \text{and} \quad y=2x^2-9x+16.$$

The curves meet each other at the points A and B.

a) Determine the coordinates of A and B. **(5)**

b) Find the exact area of the finite region bounded by the two curves, shown shaded in the above figure. **(6)**

Question 8



The figure above shows a trapezium $OABC$, where O is a fixed origin.

The position vectors of A and C are $12\mathbf{i}+4\mathbf{j}$ and $18\mathbf{i}-21\mathbf{j}$, respectively.

CB is parallel to OA, so that $\left|\overrightarrow{CB}\right|=2\left|\overrightarrow{OA}\right|$.

The point D lies on AC so that $AD:DC=1:2$.

a) Find a simplified expression, in terms of $\mathbf{i}$ and $\mathbf{j}$, for the position vector of D.

(4)

b) Show that that O, D and B are collinear and state the ratio of $OD:DB$.

(5)

Question 9

Solve each of the following equations, giving the final answers correct to three significant figures, where appropriate.

a) $4\times 3^{x+2}=3\times 4^{x}$. **(7)**

b) $\log_a\left(1+\sqrt{x}\right)=\frac{1}{2}\log_a\left(9+\sqrt{16x}\right)$. **(7)**

Question 10

A circle has equation

$$(x-2)^2+(y+2)^2=20\,.$$

a) Write down the coordinates of its centre the size of its radius. **(2)**

b) Sketch the circle.

The sketch must include the coordinates of any points where the graph meets the coordinate axes. **(5)**

The straight line with equation $y=2x+k$, where k is a constant, meets the circle.

c) Show that the coordinates of any points of intersection between the line and the circle satisfies the equation

$$5x^2+4(k+1)x+k^2+4k-12=0\,.$$ **(4)**

d) Hence, find the two values of k for which the line $y=2x+k$ is a tangent to the circle. **(5)**