IYGB GCE

Mathematics MP1

Advanced Level

Practice Paper Z

Difficulty Rating: 4.3200/1.6667

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.

Question 1

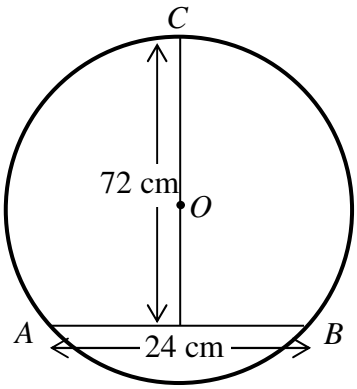
The positive constants p and q satisfy the following equation

$$\frac{\sqrt{p}}{2p+\sqrt{p}} = \frac{2\sqrt{p}-q}{3p+q}.$$

Show by a detailed method that

$$q = \frac{p+2\sqrt{p}}{2+2\sqrt{p}}. \qquad (\mathbf{7})$$

Question 2



The figure above shows a circle with centre at O and radius r.

The straight line AB is a chord to the circle.

The perpendicular bisector of AB passes through O and meets the circle at the point C, as shown in the figure.

Given that $|AB| = 24$ cm and the length of the perpendicular bisector is 72 cm, determine the value of r. $(\mathbf{4})$

Question 3

$$(2+ax)^2(1+bx)^6 = 4+44x+85x^2+\ldots,$$

where a and b are integers.

Find the possible values of a and the possible values of b. **(8)**

Question 4

It is given that

$$f(x) = x^2+2x-m\left(x^2-2x+2\right)-2,$$

where m is a constant such that $m \neq 1$.

The equation $f(x)=0$ has distinct real roots.

Determine the range of values of m. **(7)**

Question 5

The points A, B and P lie on the x-y plane, where the point O is the origin.

It is further given that

$$|OA| = 4, \quad |OB| = 6 \quad \text{and} \quad \measuredangle AOB = 40°.$$

If $\overrightarrow{OP} = 2\left(\overrightarrow{OA}\right) - 3\left(\overrightarrow{OB}\right)$ determine the distance of P from the origin and the angle between $\overrightarrow{OP}$ and $\overrightarrow{OA}$. **(7)**

Question 6

$$f(x) = 2\log_4 x,\ x \in \mathbb{R},\ x > 0.$$

$$g(x) = 1 + 2\log_4 x,\ x \in \mathbb{R},\ x > 0.$$

a) State the translation vector that maps the graph of $f(x)$ onto the graph of $g(x)$. **(2)**

It is given that the graph of $g(x)$ can also be obtained from the graph of $f(x)$ by a single transformation, but this transformation is **not** a translation.

b) Describe this transformation geometrically. **(3)**

Question 7

The straight line l passes through the point $P(4,5)$ and has gradient 3.

The point Q also lies on l so that the distance PQ is $3\sqrt{10}$.

Determine the coordinates of the **two** possible positions of Q. **(7)**

Question 8

When a tree of a certain species was planted it was 2 metres in height and after 2 years its height was measured at 3.81 metres.

The height, h metres, of this tree, t years after it was planted, is modelled by the equation

$$h = A - B\mathrm{e}^{-kt},$$

where A, B and k are positive constants.

Given that this species of tree will reach in its lifetime a maximum height of 12 metres, find the value of t when $h = 10$. **(10)**

Question 9

A cubic curve C_1 has equation

$$y = (2x-3)^3.$$

A quadratic curve C_2 has equation

$$y = (2x-1)^2 - 4.$$

a) Sketch on separate set of axes the graphs of C_1 and C_2.

The sketches must contain the coordinates of the points where each of the curves meet the coordinate axes. **(5)**

b) Hence, find in exact form, the solutions of the following equation.

$$(2x-1)^2 + (3-2x)^3 = 4. \quad \textbf{(7)}$$

Question 10

The circles C_1 and C_2 have respective equations

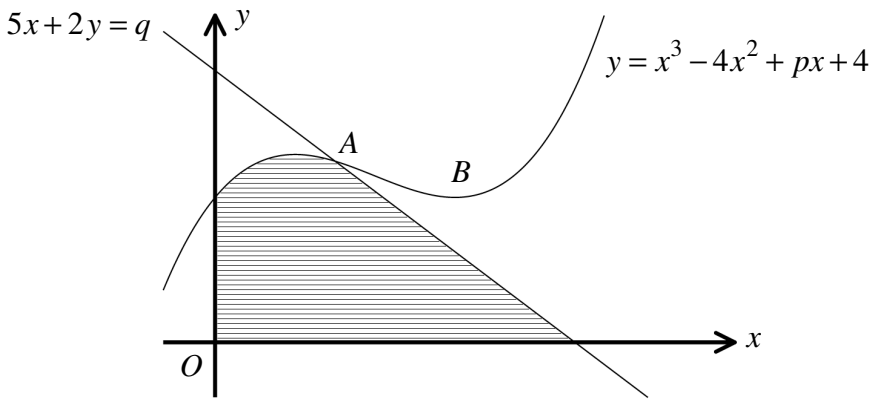
$$x^2 + y^2 - 6x = 16$$

$$x^2 + y^2 - 18x + 16y = 80.$$

a) By solving these equations simultaneously show that C_1 and C_2 touch at a point P and determine its coordinates. **(8)**

b) Determine further whether C_1 and C_2 touch internally or externally. **(7)**

Question 11



The figure above shows a curve C and a straight line L, with respective equations

$$y=x^3-4x^2+px+4 \qquad \text{and} \qquad 5x+2y=q\,,$$

where p and q are constants.

C and L intersect at the point A. The point B is a turning point C.

Given that the respective x coordinates of A and B are 1 and 2, determine …

a) … the value of p and the value of q **(6)**

b) … the area of the shaded region bounded by C, L and the coordinate axes. **(7)**

Question 12

Use a **calculus method** to prove that if $x\in\mathbb{R}$, $x>0$, then

$$x^4+x^{-4}\geq 2\,.$$ **(5)**