IYGB GCE

Core Mathematics C2

Advanced Subsidiary

Practice Paper X

Difficulty Rating: 4.1000/2.1053

Time: 2 hours

Candidates may use any calculator allowed by the Regulations of the Joint Council for Qualifications.

Information for Candidates

This practice paper follows the Edexcel Syllabus.
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 9 questions in this question paper.
The total mark for this paper is 75.

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

$$f(x) \equiv 10x^3 - 21x^2 - x .$$

a) Find the remainder when $f(x)$ is divided by $(x-2)$. **(2)**

b) Hence express $10x^3 - 21x^2 - x + 6$ as a product of three linear factors. **(3)**

Question 2

A circular sector has radius r cm and subtend an angle θ radians at its centre.

The perimeter of the sector is 23 cm and its area is 15 cm^2.

Find the value of r and the value of θ. **(7)**

Question 3

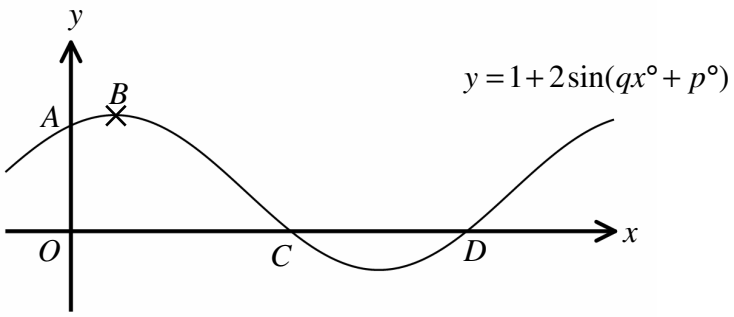
A circle has centre at $C(3,-8)$ and radius of 10 units.

The tangent to the circle at the point A has gradient -1.

Determine, as exact surds, the possible x coordinates of A. **(8)**

*You **may not** use a calculus method in this question*

Question 4



The figure above shows part of the graph of

$$y = 1 + 2\sin(qx° + p°),\ x \in \mathbb{R},$$

where q and p are positive constants with $0° < p < 90°$, $0 < q < 5$.

The graph crosses the y axis at the point $A\left(0, 1+\sqrt{3}\right)$, and the x axis at the points $C(50, 0)$ and D.

The point B is a maximum point on the curve.

a) Determine the value of q and the value of p. **(5)**

b) Find the coordinates of B and D. **(5)**

Question 5

$$\left(1 + x - x^2\right)^6 = 1 + Ax + Bx^2 + Cx^3 + \ldots$$

Determine the value of each of the constants A, B and C. **(7)**

Question 6

The radioactive decay of a phosphorus isotope is modelled by the equation

$$m = m_0 \times 2^{-0.2t}, \ t \geq 0$$

where m is the mass of phosphorus left, in grams, and t is the time in days since the decay started. The initial mass of phosphorus is m_0.

a) Find the mass of the phosphorus left, when an initial mass of 20 grams is left to decay for 10 days, according to this model. **(2)**

An initial mass, m_0 grams, of this type of phosphorus decays to $\frac{m_0}{64}$ grams in T days.

b) Find the value of T. **(3)**

After N days have elapsed, less than 1% of this type of phosphorus remains from its initial mass m_0.

c) Find the smallest integer value of N. **(3)**

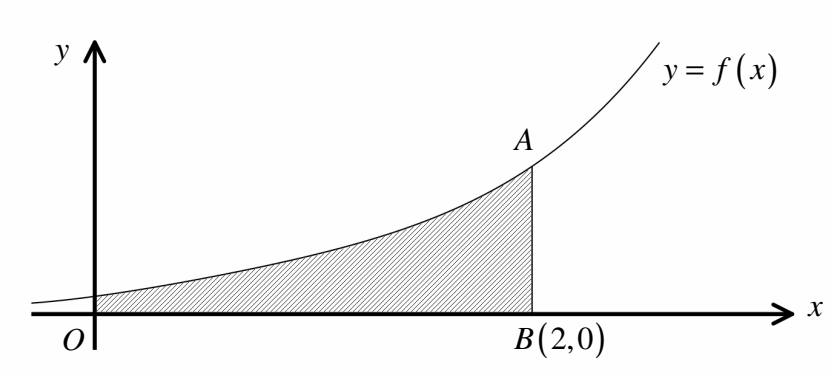
Question 7

The sum of the first 2 terms of a geometric progression is 40.

The sum of the first 4 terms of the same geometric progression is 130.

Determine the two possible values of the sum of the first 5 terms of the geometric progression. **(9)**

Question 8



The figure above shows part the curve C with equation $y = f(x)$.

The gradient function of this curve is given by

$$\frac{dy}{dx} = 12x^2 - 12x + 6.$$

The point A lies on C and the point $B(2,0)$ lies on the x axis, so that the straight line segment AB is parallel to the y axis.

The area of the finite region bounded by C, the coordinate axes and the straight line segment AB, shown shaded in the figure, is 22 square units.

Find an equation of C. **(10)**

Question 9

The profit of a small business, £P is modelled by the equation

$$P = \frac{(54x + 6y - xy - 324)^2}{3x},$$

where x and y are positive variables associated with the running of the company.

It is further known that x and y constrained by the relation

$$3x + y = 54.$$

a) Show clearly that

$$P = 108x - 36x^2 + 3x^3. \quad \textbf{(3)}$$

b) Hence show that the stationary value of P produces a maximum value of £96. **(6)**

The owner is very concerned about the very small profit and shows the calculations to a mathematician. The mathematician agrees that the calculations are correct but he asserts that the profit is substantially higher.

c) Explain, by calculations, the mathematician's reasoning. **(2)**