WELSH JOINT EDUCATION COMMITTEE **CYD-BWYLLGOR ADDYSG CYMRU**

General Certificate of Education **Tystysgrif Addysg Gyffredinol**

Advanced Level/Advanced Subsidiary **Safon Uwch/Uwch Gyfrannol**

MATHEMATICS C1

Pure Mathematics

Specimen Paper 2005/2006

($1\frac{1}{2}$ hours)

INSTRUCTIONS TO CANDIDATES

Answer **all** questions.

Calculators are **not** allowed for this paper.

INFORMATION FOR CANDIDATES

A formula booklet is available and may be used.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

1. The points A, B, C have coordinates $(4, -2)$, $(-12, 10)$, $(10, 6)$, respectively.

(a) Find the gradients of the lines

AB, BC, CA. [3]

(b) Show that one of the angles of triangle ABC is a right-angle. [2]

(c) Show that the equation of the line AB is $3x + 4y - 4 = 0$. [2]

(d) The mid-point of BC is D. Find the length of AD. [4]

2. Simplify

$$\frac{2\sqrt{5} + \sqrt{2}}{\sqrt{5} - \sqrt{2}}$$

expressing your answer in the form $a + \sqrt{b}$, where a and b are integers. [4]

3. Use an algebraic method to solve the simultaneous equations

$$y = x^2 - 3x + 2,$$
$$y = 3x - 7.$$

Interpret your answer geometrically. [6]

4. Given that the equation

$$2kx^2 + 4x + k - 1 = 0$$

has two distinct real roots, show that

$$k^2 - k - 2 < 0.$$

Find the range of values of k satisfying this inequality. [6]

5. *(a)* Express $2x^2 - 12x + 25$ in the form $a(x - b)^2 + c$, where a, b, c are constants to be determined. [3]

(b) Find the least value of $2x^2 - 12x + 25$ and the corresponding value of x. [2]

(c) Sketch the curve $y = 2x^2 - 12x + 25$. [2]

6. *(a)* Given that $x + 2$ is a factor of

$$kx^3 + 8x^2 + 3x - 2,$$

show that $k = 3$. [3]

(b) Solve the equation

$$3x^3 + 8x^2 + 3x - 2 = 0.$$ [4]

(c) Find the remainder when $3x^3 + 8x^2 + 3x - 2$ is divided by $x - 3$. [2]

7. *(a)* Using the binomial theorem, expand $(2x + 3)^4$, simplifying each term of the expansion. [4]

(b) In the binomial expansion of $(1 + 3x)^n$ the coefficient of x^2 is 54.

Given that $n > 0$, find the value of n. [4]

8. *(a)* Given that $y = x^2 - 4x + 2$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$ from first principles. [5]

(b) Differentiate $\frac{3}{x^4} + 4\sqrt{x}$ with respect to x. [4]

9. The curve C has equation

$$y = x^4 + x + 1.$$

Find the equation of the tangent to C at the point (1, 3). [4]

10. The curve C has equation

$$y = x^3 - 3x^2 - 9x + 3.$$

(a) Find the coordinates and nature of the stationary points of C. [8]

(b) Sketch C. [3]