WELSH JOINT EDUCATION COMMITTEE
General Certificate of Education
Advanced Subsidiary/Advanced

WJEC
CBAC

CYD-BWYLLGOR ADDYSG CYMRU
Tystysgrif Addysg Gyffredinol
Uwch Gyfrannol/Uwch

973/01

# MATHEMATICS C1

## Pure Mathematics

P.M. WEDNESDAY, 10 January 2007

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

## ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a 12 page answer book;
- a Formula Booklet.

## INSTRUCTIONS TO CANDIDATES

Answer **all** questions.

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

## INFORMATION FOR CANDIDATES

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 $A$, $B$, $C$, $D$ have coordinates $(-5, 0)$, $(0, 5)$, $(3, 4)$ $(4, -3)$, respectively.

*(a)* Show that $AC$ is perpendicular to $BD$. [4]

*(b)* Show that $AD$ is parallel to $BC$. [3]

*(c)* Show that the equation of $AC$ is

$$x - 2y + 5 = 0$$

and find the equation of $BD$. [3]

*(d)* The lines $AC$ and $BD$ intersect at $E$.

(i) Show that the coordinates of $E$ are $(1, 3)$. [2]

(ii) Find the length of $AE$. [2]

**2.** Simplify **each** of the following expressions, expressing your answers in surd form.

*(a)* $2\sqrt{32} + 3\sqrt{8} - \sqrt{18}$ [3]

*(b)* $\dfrac{6 + \sqrt{30}}{6 - \sqrt{30}}$ [4]

**3.** When $9x^3 + 6x^2 - 5x + p$ is divided by $x - 1$, the remainder is 8.

*(a)* Show that $p = -2$. [2]

*(b)* Factorise $9x^3 + 6x^2 - 5x - 2$. [5]

**4.** *(a)* Expand $(a + b)^4$, simplifying your coefficients as much as possible. [2]

*(b)* Solve $(2 + x)^4 = 14 + 33x + 25x^2 + 8x^3 + x^4$. [4]

**5.** *(a)* Given that $y = 2x^2 - 5x + 3$, find $\dfrac{dy}{dx}$ from first principles. [5]

*(b)* Find the equation of the normal to the curve $y = 2x^2 - 5x + 3$ at the point $(2, 1)$. [3]

**6.** Differentiate **each** of the following with respect to $x$.

*(a)* $2x^5 + \frac{24}{x^2} - 3\sqrt{x}$ [3]

*(b)* $x^2(3x+1)$ [2]

**7.** Given that the equation

$$kx^2 - 4x + (k-3) = 0$$

has real roots, show that

$$k^2 - 3k - 4 \leqslant 0.$$

Find the range of values of $k$ satisfying this inequality. [7]

**8.** *(a)* Express $x^2 + 4x + 9$ in the form $(x + a)^2 + b$, where the values of $a$ and $b$ are to be determined.
Deduce the maximum value of

$$\frac{1}{x^2 + 4x + 9}.$$

[4]

*(b)* Show that the line $y = x + 2$ touches the curve $y = x^2 - 5x + 11$, and find the coordinates of the point of contact. [4]

**9.** The curve $C$ has equation

$$y = 4x^3 - 12x + 3.$$

*(a)* Find the coordinates of the stationary points of $C$ and determine the nature of each of these points. [7]

*(b)* Sketch $C$, indicating the coordinates of the stationary points. [3]

*(c)* Given that $f(x) = 4x^3 - 12x + 3$, sketch the curve $y = f(x - 1)$, indicating the coordinates of **each** of the stationary points. [3]