TAYLOR'S UNIVERSITY COLLEGE
Wisdom · Integrity · Excellence

CAMBRIDGE 'A' LEVEL PROGRAMME

AS TRIAL EXAMINATION MARCH/APRIL 2007

(June 2006 Intake)

Friday **30 March 2007** **8.30 am – 10.15am**

MATHEMATICS 9709/1

PAPER 1 Pure Mathematics 1 (P1) 1 hour 45 minutes

Additional materials: Answer Booklet/Paper
List of formulae (MF9)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your name and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total marks for this paper is 75.
Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

This document consists of 5 printed pages.

[Turn over

1. Find the term in the expansion of $(3+\sqrt{x})^{11}$ that contains x^4. [3]

2. A curve with equation $y = f(x)$ has $\dfrac{dy}{dx} = kx(3x+2)$ for each x, where k is a constant.
The curve passes through the point $(-1, 1)$ and has gradient 2 at this point.

(i) Find the value of k. [2]

(ii) Find the equation of the curve. [2]

3. The equation of a curve is $y = (3x+1)^{\frac{1}{3}} + 1$.

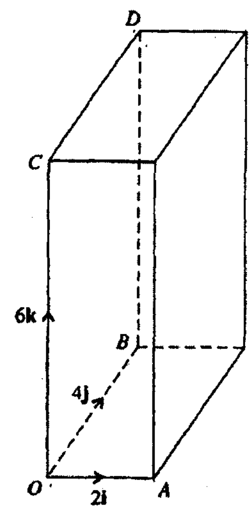
(i) Find $\displaystyle\int \left((3x+1)^{\frac{1}{3}} + 1 \right) dx$. [2]

(ii) Hence find the area of the region enclosed by the curve, the x-axis and the lines $x = 0$ and $x = 1$. [3]

4. If $x+1$, $x-2$, $\dfrac{1}{2}x$ are three successive terms of a geometric progression, calculate the possible values of x and the corresponding values of the common ratio. [5]

5. A conical paper cup is constructed by removing the major sector from a circle of radius 10 cm and attaching radii. Find the angle subtended at the centre of the circle by the major arc length so that the cup has a depth of 8 cm.(Leave your answer in π.) [6]

6.



The three edges of a rectangular box that have common vertex O are OA, OB and OC. The position vectors of A, B, C relative to O are $2\boldsymbol{i}$, $4\boldsymbol{j}$, $6\boldsymbol{k}$ respectively. The vertex opposite to A is D.

(i) Find the position vector of the mid-point M of BD. [2]

(ii) The point P inside the box has position vector $\boldsymbol{i} + 3\boldsymbol{j} + 3\boldsymbol{k}$. Find the angle CPA. [5]

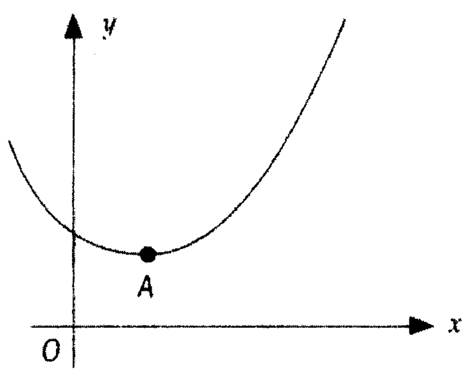
7. The function f is defined for all real values of x by $f(x) = x + \dfrac{1}{x}$.

(i) Find $f'(x)$ and $f''(x)$. [2]

(ii) Find the coordinates of the stationary points on the graph of f and identify whether these points are maximum or minimum. [6]

[Turn over

8.



The diagram shows the graph of $y = x^2 - 2px + p$, where p is a positive constant. The point A is the lowest point on the graph which lies above the x-axis.

(i) Using completing the square, express the coordinates of A in terms of p. Hence find the set of possible values for p. [5]

(ii) Given that A lies on the line with equation $y = 2x - 1$, find the exact value of p. [3]

9. The vertex A of a triangle ABC has coordinates (3, 7) and the equation of the side BC is $4x - 3y = 11$. Show that the length of the perpendicular from A to BC is 4 units. [4]

(i) Given that the area of the triangle is 40 unit^2, find the length of BC. [1]

(ii) If the coordinates of the mid-point of BC are (5, 3), find the coordinates of B and C. [4]

10. (i) Sketch the graph of the equation $y = -2\sin\frac{1}{2}x$ for $-\pi \leq x \leq \pi$. State the period. [3]

(ii) Prove the identity $\tan^2\alpha - \sin^2\alpha = \tan^2\alpha\sin^2\alpha$. [3]

(iii) Find the solutions of the equation $\tan^2 x\sin x = \sin x$ in the interval $0° \leq x < 360°$. [3]

11. A function is defined by $f(x) = \sqrt{(6+x)}$, $x \geq k$.

(i) State the value of k. [1]

(ii) Write an equation for the inverse function. [2]

(iii) State the domain and range of f^{-1}. [2]

(iv) Find the value of $[f^{-1}(1)]^{-1}$. [2]

(v) Graph f and f^{-1} on the same axes and find x when $f = f^{-1}$. [4]