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954/1,950/1 STPM 2006

MATHEMATICS T (MATEMATIK T)
PAPER 1 (KERTAS 1)

Three hours (Tiga jam)

JOHOR BAHRU
(Johore Bahru)

PEPERIKSAAN PERCUBAAN STPM 2006
(STPM Trial Examination 2006)

Instruction to candidates:

Answer **all** *questions. Answers may be written in either English or Malay.*

All necessary working should be shown clearly.

Non-exact numerical answers may be given correct to three significant figures, or one decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

Mathematical tables, a list of mathematical formulae and graph paper are provided.

Arahan kepada calon:

Jawab **semua** *soalan. Jawapan boleh ditulis dalam bahasa Inggeris atau bahasa Melayu.*

Semua kerja yang perlu hendaklah ditunjukkan dengan jelas.

Jawapan berangka tak tepat boleh diberikan betul hingga tiga angka bererti, atau satu tempat perpuluhan dalam kes sudut dalam darjah, kecuali aras kejituan yang lain ditentukan dalam soalan.

Sifir matematik, senarai rumus matematik, dan kertas graf dibekalkan.

This question paper consists of 3 printed pages.
Kertas soalan ini terdiri daripada 3 halaman bercetak.

* This question paper is confidential until the examination is over.

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1. The function $f(x)$ is defined by $f(x) = \begin{cases} (x-3)^2, & x \le 3 \\ 1-\frac{a}{x}, & x > 3 \end{cases}$.

If $f(x)$ is continuous at $x = 3$, determine the value of a. [4]

2. Solve the equation $\log_4 x + 15 \log_x 4 = 8$ [5]

3. An arithmetic sequence has the first term a and the common difference d. The tenth term is 69 and the sum of the first 30 terms is four times the sum of the first 10 terms. Find the values of a and d. [5]

4. Show that $\int_1^e x^2 \ln x dx = \frac{1}{9}(2e^3 + 1)$. [5]

5. Sketch the graph of $y = | x^2 - 4 |$. [2]

Hence, find the solution set of the inequality $| x^2 - 4 | < 3x$. [4]

6. (a) Given that $A = \int_{-1}^{1} \left(\frac{1}{1+e^{-x}} \right) dx$, show that the estimate of A obtained by using the trapezium rule with three ordinates is 1. [4]

(b) By means of the substitution, $u = e^x$, show that the estimate obtained in (i) is correct. [4]

7. The functions f and g are defined as

$$f : x \to 3\ln x, x > 0$$

$$g : x \to \sqrt{x}, x \quad 0.$$

(i) Sketch the graph of f, and give a reason why the inverse function exists. [3]

(ii) Find f^{-1}, and state its domain. [3]

(iii) Find the composite function gf^{-1}, and state its range. [3]

8. One of the factors of the polynomial $p(x) = 8x^4 - 4x^3 + ax^2 + bx - 3$ is $2x - 1$.

When $p(x)$ is divided by $(x + 2)$, the remainder is 135. Determine the values of the constant a and b. [3]

Factorise $p(x)$ completely. Show that the equation $p(x) = 0$ has only two real roots, and find both these real roots. [7]

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9. Find the equation of the locus of $P(x,y)$ such that it is equidistant from the lines $4y = 3x + 8$ and $y = 2$. [3]

The straight line l_1 is perpendicular to $4y = 3x + 8$ and passes through $A(0,12)$. If l_1 cuts the locus of P at M, show that $AM:OM = 5:\sqrt{13}$ where O is (0,0) [4]

Find the angle between the line l_1 and the locus of P. [3]

10. (a) Find the possible values of k if the matrix $\begin{pmatrix} 2 & k+3 & 1 \\ 2k & 4 & -3 \\ 2 & 5 & 1 \end{pmatrix}$ is singular. [3]

(b). Given the matrices $\mathbf{A} = \begin{pmatrix} 1 & 1 & 2 \\ 2 & 3 & 4 \\ 3 & 4 & 3 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 7 & -6 & 1 \\ -5 & 3 & 1 \\ 2 & 0 & -1 \end{pmatrix}$.

Find $\mathbf{AB}$ and deduce $\mathbf{A}^{-1}$.

Hence, solve the following simultaneous equations using matrces.

$$x + 2y + 3z = 15$$
$$x + 3y + 4z = 21$$
$$2x + 4y + 3z = 15$$

[8]

11. Given that $f(x) = \dfrac{2}{(x-1)(x+3)}$, express $f(x)$ in partial fractions. [3]

Hence, expand $f(x)$ in ascending powers of x up to and including the term in x^3. [7]

Determine the set of values of x for which the expansion is valid. [2]

12. (a) If $y = (1-x)(e^{-x}) - 8$, show that $\dfrac{d^2y}{dx^2} + 2\dfrac{dy}{dx} + y + 8 = 0$ [4]

(b) Sketch, on the same coordinate axes, the graphs $y = e^{-x}$ and $y = \dfrac{8}{1-x}$.

Show that the equation $(1 - x)(e^{-x}) - 8 = 0$ has a root that lies between -2 and -1. [5]

Use the Newton-Raphson method with the initial estimate $x_1 = -1$ to estimate the root correct to three decimal places. [6]

*****END OF QUESTION PAPER*****

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