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950/1, 954/1
MATHEMATICS S
Paper 1
MATHEMATICS T
Paper 1
2006
Three hours

PERSIDANGAN KEBANGSAAN PENGETUA-PENGETUA
SEKOLAH MENENGAH MALAYSIA
CAWANGAN MELAKA.

PENILAIAN PENGESANAN PEPERIKSAAN
SIJIL TINGGI PELAJARAN MALAYSIA 2006

MATHEMATICS S
PAPER 1
MATHEMATICS T
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Three hours

Instructions 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.

(This question paper consists of 5 printed pages .)

*This question paper is CONFIDENTIAL until the examination is over.
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1. A line is drawn starting from the point A(1, 2) to cut the first line $2y = 3x - 5$ at P and the second line $x + y = 12$ at Q. If P is the mid-point of AQ, find the coordinates of P and Q.

[6 marks]

2. A finance loan of RM500 is arranged to be repaid in 24 months by equal monthly instalments. Interest, calculated monthly, is charged at 11% per annum on the balance of the loan. The first instalment is paid one month after the loan is made. Calculate the monthly payment.

[6 marks]

3. M is a matrix given by

$$M = \begin{pmatrix} 3 & 1 & -2 \\ 4 & 0 & -2 \\ 4 & 1 & -1 \end{pmatrix}$$

(a) Find M^2

(b) Given $M^3 = 2M^2 + M - 2I$ where I is an identity matrix.
Show that $2M^{-1} = 2M + I - M^2$. Hence, find M^{-1}.

[6 marks]

4. Find the solution set of the inequality

$$\frac{2}{x-3} > \frac{3}{x-2}$$

where $x \in R$, $x \neq 2$, $x \neq 3$ [4 marks]

5. The function f is defined by $f(x) = 1 + 2\sqrt{x+2}$ for $x \geq -2$.

(a) Find $f^{-1}(x)$ and state the domain of f^{-1}. [3 marks]

(b) State the line of symmetry for the graph of f and the graph of f^{-1}.
Hence, or otherwise, find the value of x for which $f(x) = f^{-1}(x)$.

[4 marks]

6. By using substitution $t = e^x$, find $\int \frac{1}{e^x - e^{-x}} dx$. [4 marks]

7. The equation of a close curve is $(x + y)^2 + 2(x - y)^2 = 24$.
Show, by using differentiation, that the gradient of the curve at the point (x, y) may be expressed in the form $\frac{3x - y}{x - 3y}$.

Hence, find the x-coordinates of all the points on the curve where the tangent is parallel to the x-axis.

[5 marks]

8. The function g is defined as

$$g(x) = \begin{cases} ax + 2, & -3 \le x \le 1 \\ x^2 + x + a, & 1 < x < 2 \\ 1 - \frac{1}{x}, & 2 \le x \le 5 \end{cases}$$

(a) Show that g is continuous at $x = 1$. [3marks]

(b) Find the value of a if g is continuous in the interval [-3, 5].

[2 marks]

9. The polynomial $x^5 - 3x^4 + 2x^3 - 2x^2 - 3x + 1$ is denoted by f(x).

(a) Show that $(x - 1)$ and $(x + 1)$ are not factors of f(x). [2 marks]

(b) By substituting $x = 1$ and $x = -1$ in the identity
$f(x) \equiv (x^2 - 1)q(x) + ax + b$,
where q(x) is a polynomial and a and b are constants, find the remainder when f(x) is divided by $(x^2 - 1)$.

[3 marks]

(c) By carrying out division, find the remainder when f(x) is divided by $(x^2 + 1)$

[3 marks]

(d) Find all the real roots of the equation $f(x) = 2x$.

[6 marks]

10. (a) Express $\frac{1}{(1+x)(2+x)}$ in partial fractions. [2 marks]

Hence or otherwise, expand the function as a series of ascending powers of x up to and including the term in x^2.

[4 marks]

(b) Show that the first four non-zero terms in the expansion of

$$(1-\tfrac{1}{n})^{\frac{1}{n}}$$

in ascending powers of $\frac{1}{n}$ are $1 - (\frac{1}{n})^2 - \frac{1}{2}(\frac{1}{n})^3 + \frac{1}{6}(\frac{1}{n})^4$

[5 marks]

By substituting n with a suitable value , use the first four non-zero terms of the series to estimate the value of $(0.9)^{\frac{1}{10}}$, giving your answer correct to five decimal places.

[3 marks]

11. (a) Sketch the graph of $y = \frac{1-x}{x-2}$.

State the equations of the asymptotes. [4 marks]

(b) On separate axes, sketch the graph of

$$y = \left|\frac{1-x}{x-2}\right|$$ [2 marks]

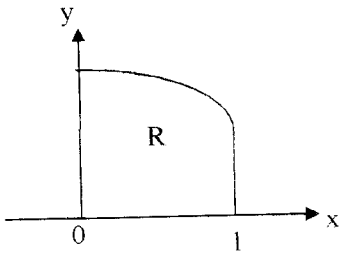
(c) On the same axes as part (a) above, sketch and label clearly the graph of $y = -x^3$. Hence state the number of positive real roots, and the number of negative real roots of the equation, $x^4 - 2x^3 - x + 1 = 0$

[3 marks]

Starting with x = 2, use the Newton-Raphson method to find the largest positive root of the equation, $x^4 - 2x^3 - x + 1 = 0$. Give your answer correct to one decimal place.

[5 marks]

12. (a)



The diagram shows the region R bounded by the axes, the curve $y = (x^2 + 1)^{-\frac{1}{2}}$ and the line $x = 1$. By using the trapezium rule, with ordinates $x = 0$, $x = \frac{1}{2}$ and $x = 1$, estimate the volume of the solid formed when R is rotated completely about the x-axis. Give your answer correct to two significant figures.

[5 marks]

(b) Given that

$$f(x) = x^2 \text{ for } 0 < x \leq 1,$$
$$f(x) = 3 - 2x \text{ for } 1 < x \leq 3,$$

and $f(x + 3) = f(x)$ for all values of x.

Sketch $f(x)$ for the range $-3 < x \leq 7$.

Evaluate (i) $f(23)$

(ii) $\int_{-3}^{7} f(x)dx$ [10 marks]