

954/2

PERCUBAAN
STPM 2009**MATHEMATICS T (MATEMATIK T)****PAPER 2 (KERTAS 2)****Three hours (Tiga jam)****PEPERIKSAAN PERCUBAAN BERSAMA
SIJIL TINGGI PERSEKOLAHAN MALAYSIA (STPM) 2009****ANJURAN
PERSIDANGAN KEBANGSAAN PENGETUA-PENGETUA
SEKOLAH MENENGAH MALAYSIA (PKPSM) KEDAH****Instructions to candidates**

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

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, 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 Malaysia.

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 **11** printed pages
(Kertas soalan ini terdiri daripada **11** halaman bercetak)

954/2

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

*Kertas soalan ini SULIT sehingga peperiksaan kertas ini tamat

**[Lihat sebelah
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1. The length of the sides PR, RQ and PQ of triangle PQR are x , $(x + y)$ and $(x + 2y)$ respectively. Show that $\cos \angle PRQ = \frac{x - 3y}{2x}$. [2 marks]

Hence, find the range of values of $\frac{y}{x}$ for which $\angle PRQ$ lies between 120° and 180° .

[3 marks]

2. Two variables t and v , are connected by the differential equation $\frac{dv}{dt} = 2v(1 - v)$, where

$$t \geq 0, 0 < v < 1, K = \frac{V_0}{1 - V_0} \text{ and } v = V_0 \text{ when } t = 0.$$

$$\text{Show that } v = \frac{Ke^{2t}}{1 + Ke^{2t}}.$$

[6 marks]

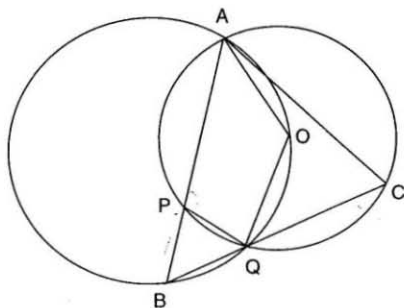
3. Prove that $\cot \theta - \tan \theta = 2 \cot 2\theta$. [3 marks]

Hence, or otherwise, find the values of θ that satisfies the equation

$$\cot \theta - \tan \theta = 2\sqrt{3}, \text{ for } 0^\circ \leq \theta \leq 360^\circ$$

[4 marks]

4.



The diagram above shows a circle APQC intersects with the circle ABQO at points A and Q. Given that APB and BQC are two straight lines and O is the centre of the circle APQC. Prove that

- (a) $\triangle PBQ$ is an isosceles triangle, [5 marks]
 (b) $CQ = AP$. [3 marks]

- 5 The position vectors of the points A, B and C relative to an origin O, are \mathbf{a} , \mathbf{b} and $\mathbf{a} + 2\mathbf{b}$ respectively. AB and OC meet at D where $\frac{AD}{AB} = p$ and $\frac{OD}{OC} = q$.

Express \overrightarrow{OD} in terms of

- (a) \mathbf{a} , \mathbf{b} and p , [2 marks]
 (b) \mathbf{a} , \mathbf{b} and q . [1 mark]
 Hence, evaluate p and q . [3 marks]

Given $\mathbf{a} = 4\mathbf{i} + k\mathbf{j}$, and $\mathbf{b} = 7\mathbf{i} + \mathbf{j}$, find the positive value of k if $\angle ODA = 90^\circ$. [4 marks]

6. In an ecological research, it was found that the rate of decrease of the population of a certain species of frogs, y , is represented by the equation $\frac{dy}{dt} = -ky$, where t is the time measured in weeks and k is the reproductive constant.

- (a) Given that the initial population was 500, solve the differential equation. [3 marks]
- (b) Two weeks later, the population had dropped to 300, find k and show that

$$y = 500 \left(\frac{3}{5} \right)^{\frac{t}{2}}. \quad [4 \text{ marks}]$$

- (c) If the population was reduced to just one quarter of the initial population in T weeks, find the value of T . [2 marks]

When the population had reduced to half of its initial population, water pollution further decreased the population at a constant rate, W . Show that

$$ky + W = Ae^{-kt}, \text{ where } A \text{ is a constant.}$$

By assuming that the reproductive constant, k , never changed, calculate W if the frogs became extinct after another 4 weeks. [6 marks]

7. 0.5% of the population suffers from a rare disease. There is a test for this disease; it gives a positive result with 99% of people who have the disease and with 2% of people who do not have the disease.
- (a) Find the probability that a randomly selected individual will test positive for the disease. [2 marks]
- (b) Ahmad has just tested positive for the disease. Find the probability he actually has the disease. [2 marks]
- (c) Comment on your answer to part (b). [1 mark]

8. Five people, of whom three are women and two are men, are to form a queue. Find the probability that

- (a) no two people of the same sex are to stand next to each other, [3 marks]
(b) the first and last people in the queue are both women. [3 marks]

9. The continuous random variable X is normally distributed with mean μ and variance μ^2 . If $P(X \leq 10) = 0.9332$, find the value of μ . [3 marks]

Hence, find the value of k if $P(|x - \mu| \leq k) = 0.95$ [3 marks]

10. The continuous random variable X has a cumulative distribution function, $F(x)$, given by

$$F(x) = \begin{cases} 0, & x < 1, \\ \frac{5}{4} \left(1 - \frac{1}{x} \right), & 1 \leq x \leq 5, \\ 1, & x > 5 \end{cases}$$

- (a) Find the median of X . [2 marks]
(b) Find the probability density function of X , $f(x)$ and sketch its graph. [3 marks]
(c) Find $E(X)$. [3 marks]

11. On average, 95% of the bulbs produced by a factory have lifespan of more than six months.
- (a) If the bulbs are packed in a packet of 10 bulbs each, show that the probability a packet of bulbs selected at random contains at least 9 bulbs which have lifespan of more than six months, is 0.914. [4 marks]
- (b) An electrical shop ordered 50 packets of bulbs from the factory, find the probability, by using a suitable approximation, that at least 47 packets which contain at least 9 bulbs which have lifespan of more than six months. [4 marks]
12. The lengths of twenty one leaves from a certain type of tree are measured to the nearest mm. The results are as follow :

51 45 31 43 97 16 18 23 34 35 35
85 62 20 22 51 57 49 22 18 27

- (a) Display the above data in an ordered stemplot. [2 marks]
- (b) Find the mean and standard deviation. [5 marks]
- (c) Find the median and interquartile range. [4 marks]
- (d) Draw a box plot to represent the data. [3 marks]
- (d) State whether the mean or the median is more suitable as a measure of central tendency for the above data. Give reason for your answer. [2 marks]