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PERCUBAAN STPM 2010

**MATHEMATICS T (MATEMATIK T)****PAPER 2 (KERTAS 2)****Three hours (Tiga jam)****PEPERIKSAAN PERCUBAAN BERSAMA  
SIJIL TINGGI PERSEKOLAHAN MALAYSIA (STPM) 2010****ANJURAN BERSAMA****JABATAN PELAJARAN KEDAH DARUL AMAN****DAN****PERSIDANGAN KEBANGSAAN PENGETUA-PENGETUA  
SEKOLAH MENENGAH MALAYSIA (PKPSM) KEDAH****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, 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 perpuhuan, 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 9 printed pages and 1 blank page.  
(Kertas soalan ini terdiri daripada 9 halaman bercetak dan 1 halaman kosong.)**

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\*Kertas soalan ini SULIT sehingga peperiksaan kertas ini tamat.

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SULIT\*

1. By first writing  $\sin \theta$  as  $\cos \left( \frac{1}{2} \pi - \theta \right)$ , solve the equation  $\cos 3\theta = \sin \theta$ ,  $0 < \theta < \pi$ .  
Give your answers as multiples of  $\pi$ .

[4 marks]

2. Three points P, Q, and R have position vectors  $6\mathbf{i} + 7\mathbf{j}$ ,  $4\mathbf{j}$  and  $4\mathbf{i} + 3\mathbf{j}$  respectively. A is the point lying on the line QR between Q and R such that  $\frac{QA}{AR} = \frac{3}{2}$ , and B is the point on QR produced such that  $\frac{QB}{BR} = \frac{3}{2}$ . Find the position vectors of A and B and evaluate the scalar product  $\vec{PA} \cdot \vec{PB}$ . Hence, deduce the relationship between  $\vec{PA}$  and  $\vec{PB}$ .

[7 marks]

3. P, Q, and R are three points on the horizontal ground with Q lies to the north of P and the bearing of R from P is  $060^\circ$ . The angle of elevation of the point T at the top of a vertical tower located at Q from P and R are  $\beta$  each. Point S lies on PR such that  $PS : SR = 1 : 2$ . If the angle of elevation of T from S is  $\theta$ , show that  $\tan \theta : \tan \beta = 3 : \sqrt{7}$

[7 marks]

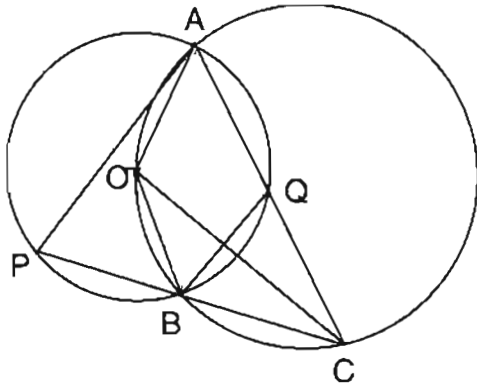
4. Find the particular solution of the differential equation

$$e^y \frac{dy}{dx} - 1 = \ln x,$$

given that  $y = \ln 2$  when  $x = 1$ .

[8 marks]

5. Two intersecting circles AOBC and APBQ are shown in the diagram below.



Given that O is the centre of the circle APBQ and  $\angle ACO = 30^\circ$ .

- (a) Find  $\angle APC$ . [4 marks]
- (b) Show that  $\triangle APC$  is an equilateral triangle. [3 marks]
- (c) Prove that BQ is parallel to PA. [3 marks]

6. Two boats P and Q are able to give light signal to one another. The light signal can be seen at a maximum distance of 10 km. Initially, boat P is at a distance of 2.5 km due east of boat Q. At 1200 noon, the two boats start to move with boat P moves towards east with a speed of  $5 \text{ km h}^{-1}$  and boat Q moves in the direction north-east with a speed of  $10 \text{ km h}^{-1}$ .

- (a) Find the magnitude and direction of the velocity of boat Q relative to boat P. [4 marks]
- (b) Calculate the shortest distance between the two boats and the time, to the nearest minutes, when the two boats are at the shortest distance. [5 marks]
- (c) Find the time after which the two boats are unable to see the light signal from one another. [5 marks]

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7. Two bags each contains 8 discs which are indistinguishable apart from their colour. The first bag contains 3 red and 5 black discs whereas the second bag has 6 red and 2 black discs. A disc is chosen at random from the first bag and placed into the second bag. After mixing thoroughly, a disc is taken from the second bag and placed into the first. Find the probability that the first bag still contains exactly 3 red discs. [4 marks]

8. A continuous random variable  $X$  is distributed normally with mean  $\mu$  and variance  $\sigma^2$ . Find the value of  $\sigma$  if the probability that  $X$  lies within the range of 9.8 from the mean is 0.95. [4 marks]

9. The mean and variance of the four numbers 2, 3, 6, 9 are 5 and 7.5 respectively. Two numbers  $m$  and  $n$  are added to this set of four numbers, such that the mean is increased by 1 and the variance is increased by 2.5. Find the values of  $m$  and  $n$ . [7 marks]

10. The binomial variable  $X$  represents the number of eggs laid each year by a certain species of birds where  $E(X) = 4$  and  $\text{Var}(X) = \frac{4}{3}$ . Find  $P(X = 6)$ .

Hence, find the probability that four or more eggs hatched in a year given that the probability that any egg hatched is  $\frac{3}{5}$ . [9 marks]

11. The following data shows the number of books borrowed from a school library for the past 26 days.

61 72 83 57 78 80 67 20 85 70 54 62 76 60 48 75  
52 62 72 52 46 83 54 74 82 69

- (a) Display the above data in an ordered stemplot. [2 marks]  
(b) Find the median and interquartile range. [4 marks]  
(c) Draw a boxplot to represent the above data. [3 marks]  
(d) State the type of distribution of the above data. Justify your answer. [2 marks]
12. The continuous random variable  $X$  has probability density function given by

$$f(x) = \begin{cases} k(1 + x^2), & \text{for } -1 < x \leq 1, \\ 0, & \text{otherwise} \end{cases}$$

where  $k$  is a constant.

- (a) Find the value of  $k$ . [3 marks]  
(b) Sketch the graph of  $f(x)$  and hence state the value of  $E(X)$ . [2 marks]  
(c) Determine  $\text{Var}(X)$ . [3 marks]

If  $A$  and  $B$  are the events represented by  $X > \frac{1}{2}$  and  $X > \frac{3}{4}$  respectively, find  $P(B)$  and

$P(B|A)$ . [7 marks]