

**MATEMATIK**  
**Tambahan**  
**Kertas 2**  
**September**  
**2004**  
2 1/2 jam



**MAKTAB RENDAH SAINS MARA**

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***PEPERIKSAAN PERCUBAAN SPM 2004***

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**Matematik Tambahan**

Kertas 2

Dua jam tiga puluh minit

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU**

- 1. Kertas soalan ini adalah dalam Bahasa Inggeris*
- 2. Calon dibenarkan menjawab keseluruhan atau sebahagian soalan dalam Bahasa Melayu atau Bahasa Inggeris*

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Kertas solan ini mengandungi 11 halaman bercetak  
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**Section A**

[40 marks]

*Answer all questions from this section.*

- 1 Solve the simultaneous equations  $2x + y - 1 = 0$  and  $x^2 + y^2 + 5xy + 17 = 0$ .  
[5 marks]
- 2 It is given that nine numbers  $16, p, 2, q, r, 9, 7, s$  and  $17$  have a mean of  $11$  and a variance of  $25$ . Calculate the mean and variance for  $p, q, r$  and  $s$ .  
[6 marks]
- 3 Given that  $2k + 9, 2k$  and  $12$  are the first three terms of a geometric progression, where  $k$  is a constant.
- (a) Find the values of  $k$  and the corresponding common ratio of the geometric progression.  
[4 marks]
- (b) Hence, find the sum to infinity of the geometric progression.  
[3 marks]
- 4 (a) Prove the identity  $\operatorname{cosec} 2y + \cot 2y = \cot y$ .  
[3 marks]
- (b) It is given that  $\tan x = \frac{1}{p}$ , where  $p > 0$  for  $0^\circ \leq x \leq 360^\circ$ .
- (i) Express  $\sec x \operatorname{cosec} x$  in terms of  $p$ .
- (ii) Hence, or otherwise solve the equation  $\sec x \operatorname{cosec} x = 2$ .  
[4 marks]

- 5 (a) The gradient function for a curve is  $px - 2$ . It is given that the curve has a minimum point  $(1, 4)$ .

- (i) Find the value of  $p$ .  
(ii) Hence, find the equation of the curve.

[4 marks]

- (b) Diagram 1 shows a shaded region bounded by the curve  $y = x^2 + 1$ , the  $y$ -axis and the line  $y = k$ .

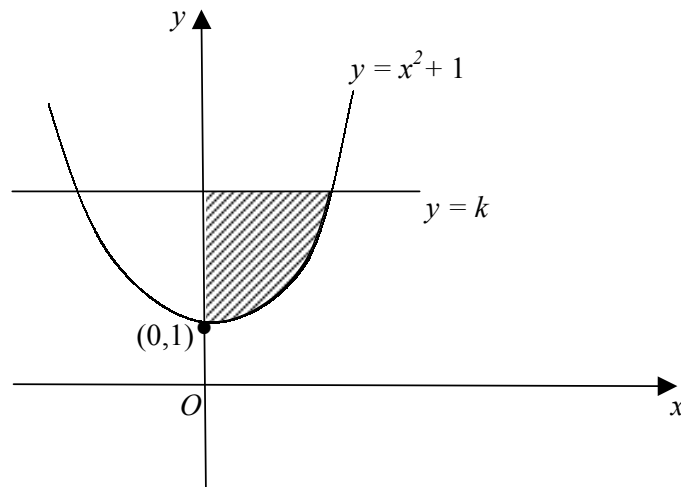


DIAGRAM 1

Given that the volume of revolution when the shaded region is revolved  $360^\circ$  about the  $y$ -axis is  $2\pi \text{ unit}^3$ , find the value of  $k$ .

[3 marks]

- 6 Solution by scale drawing is not acceptable.

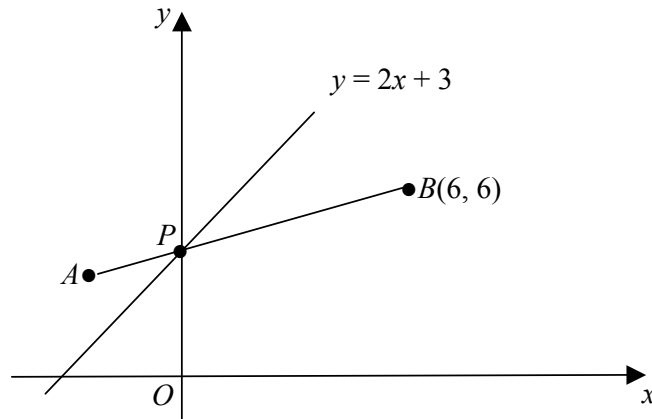


DIAGRAM 2

In Diagram 2, the straight line  $y = 2x + 3$  and the straight line  $AB$  intersect the  $y$ -axis at  $P$ .

- (a) If  $AP : PB = 1 : 3$ , calculate the coordinate of  $A$ . [3 marks]
- (b) Find the equation of a straight line which is perpendicular to  $AB$  and passes through  $P$ . [3 marks]
- (c) The point  $Q(x, y)$  moves such that its distance to the point  $B$  is two times its distance to the point  $O$ . Find the equation of the locus of  $Q$ .

[2 marks]

## Section B

[40 marks]

Answer **four** questions from this section.

7 Use the graph paper provided to answer this question.

Table 1 shows the values of two variables,  $x$  and  $y$ , obtained from an experiment. It is known that  $x$  and  $y$  are related by the equation  $x = \frac{20}{q - py}$ , where  $p$  and  $q$  are constants.

$x$	2	5	8	11	14	17
$y$	27	12.2	8.5	6.77	5.79	5.21

TABLE 1

(a) Plot  $xy$  against  $x$ .  
Hence, draw the line of best fit.

[4 marks]

(b) Use the graph in (a) to find the value of  
(i)  $y$  when  $x = 9$ ,  
(ii)  $p$ ,  
(iii)  $q$ .

[6 marks]

8 It is given that  $\overrightarrow{AB} = 4\mathbf{i} - 6\mathbf{j}$  and  $\overrightarrow{AC} = 2\mathbf{i} + 4\mathbf{j}$ .  $T$  is on the line  $BC$  such that  $BT = 3TC$ .

(a) Find the unit vector in the direction of  $\overrightarrow{AB}$ .

[2 marks]

(b) (i) Find, in terms of  $\mathbf{i}$  and  $\mathbf{j}$  vector  $\overrightarrow{BT}$  and vector  $\overrightarrow{AT}$   
(ii) Hence, if  $\overrightarrow{AP} = 2\overrightarrow{AT}$  find  $|\overrightarrow{AP}|$ .

[6 marks]

(c) If  $D$  is a point such that  $T$ ,  $C$  and  $D$  are collinear and  $\overrightarrow{TD} = h\mathbf{i} - 2\mathbf{j}$ , find the value of  $h$ .

[2 marks]

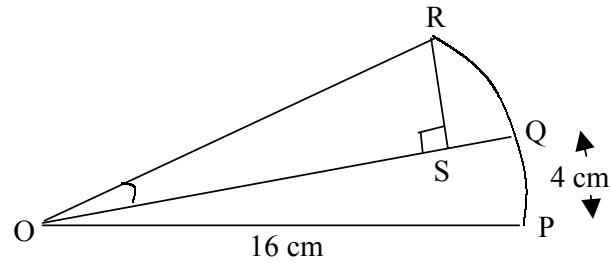


DIAGRAM 3

- 9 In Diagram 3,  $OPR$  is a sector of the circle with centre  $O$ .  $Q$  is a point of the arc  $PR$  such that the length of the arc  $PQ$  is 4 cm.

(a) Calculate the area of sector  $OPQ$ . [3 marks]

(b) It is given that the area of sector  $OPQ$  is equal to the area of triangle  $OSR$  and  $RS < OS$ .

(i) Express  $OS$  and  $RS$  in terms of  $\theta$  and hence, show that

$$\theta = \frac{\pi}{12} \text{ radian.}$$

(iii) Find the length of the arc  $RQ$ .

[7 marks]

- 10 (a) Given that  $y = \frac{20}{2-x}$ . By using differentiation, calculate the approximate change in  $x$  when  $y$  decreases from 40 to 39.2.

[4 marks]

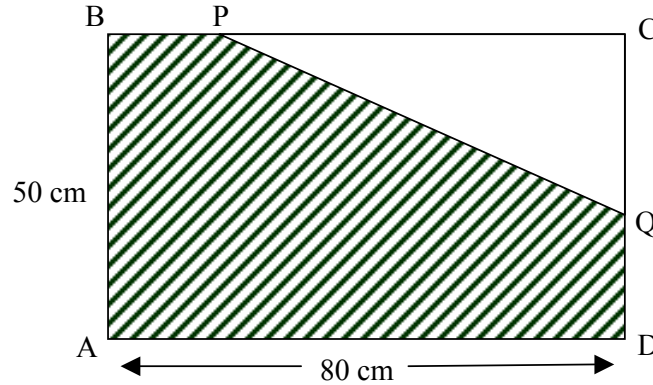


DIAGRAM 4

- (b) Diagram 4 shows a rectangle  $ABCD$ . The line  $PQ$  divides the rectangle into two sections such that  $PC = 3QD$ . It is given that  $QD = x$  cm and the area of the shaded region is  $A$  cm<sup>2</sup>.
- (i) Show that  $A = \frac{3x^2}{2} - 75x + 4000$ .
- (ii) Find the perimeter of the shaded region when  $A$  is minimum.

[6 marks]

- 11 (a) The probability of getting a **poor** quality durian from Pak Mat's orchard is  $\frac{1}{6}$ . Cik Yati bought a durian everyday for 5 days from Pak Mat's orchard.

Calculate the probability (correct to 4 decimal places) that Cik Yati got

- (i) 3 **poor** quality durians,
- (ii) at least 2 **good** quality durians.

[4 marks]

- (b) The height of students of a certain school is normally distributed with a mean of 160 cm and a standard deviation of  $\sigma$  cm. It is given that 80% of the students are of height less than 176.84 cm.

- (i) Calculate the value of  $\sigma$ .
- (ii) If the number of students of this school is 1000, calculate the number of students with heights between 150 cm and 170 cm.

[6 marks]

## Section C

[20 marks]

*Answer two questions from this section.*

- 12** Two particles,  $X$  and  $Y$ , move in a straight line and passes through a fixed point  $O$ , at the same time. Particle  $X$  moves with a constant acceleration of  $4 \text{ m s}^{-2}$  and passes through  $O$  with a velocity of  $-18 \text{ m s}^{-1}$ . The displacement of particle  $Y$ ,  $s_Y$  m from  $O$ ,  $t$  s after passing through  $O$  is given by  $s_Y = t^2 - 6t$ .

Find,

- (a) the velocity of particle  $Y$  when particle  $X$  passes through  $O$  again, [4 marks]
- (b) the distant between particle  $X$  and particle  $Y$  when  $t = 10$ , [3 marks]
- (c) the time when particle  $X$  and particle  $Y$  begin to move in opposite directions. [3 marks]

Machine	Maintenance Cost (RM) (2002)	Maintenance Cost (RM) (2003)	Index Number (2003)	Number of Machines
<i>P</i>	12,000	15,000	125	2
<i>Q</i>	7,000	<i>y</i>	150	3
<i>R</i>	5,000	5,500	<i>z</i>	10

TABLE 2

13 Table 2 shows the maintenance cost for three types of machines in a factory for the year 2002 and 2003. The index number obtained is based on the year 2002.

(a) Calculate

- (i) the values for *y* and *z*,
- (ii) the composite index for maintenance of the machines for this factory in 2003 based on 2002.

[5 marks]

(b) The composite index for maintenance of the machines increases at the same rate from 2003 to 2004.

- (i) Calculate the composite index for maintenance of the machines in 2004 based on 2002.
- (ii) Hence, if the maintenance cost of the machines for this factory in 2002 is RM 450,000, find the average maintenance cost per year from 2002 to 2004.

[5 marks]

14 Use the graph paper provided to answer this question .

A Mathematics competition is divided into two categories, that is, the Olympia category and the National category. All schools are invited to send teams for this competition. Each team must have exactly 5 participants. The registration fee for each team in the Olympia category and the National category are RM50 and RM30 respectively.

A school wants to send  $x$  teams for the Olympia category and  $y$  teams for the National category and the number of participants is at most 40. The school decided that the number of teams in the Olympia category can exceed that of the National category by at most 2. The school limits RM300 for the registration fees.

(a) Write down three inequalities, other than  $x \geq 0$  and  $y \geq 0$ , that satisfy all of the above conditions.

[3 marks]

(b) Hence, using a scale of 2 cm to 1 team for both axes, construct and shade the region  $R$  that satisfies all the above conditions.

[3 marks]

(c) Based on the graph drawn, answer the following questions :

(i) If the school wants to send at least 2 teams for the Olympia category and at least 4 teams for the National category, list down the possible total number of teams.

(ii) If each participant is given a food allowance of RM10 for the Olympia category and RM8 for the National category, calculate the maximum amount of food allowance needed.

[4 marks]

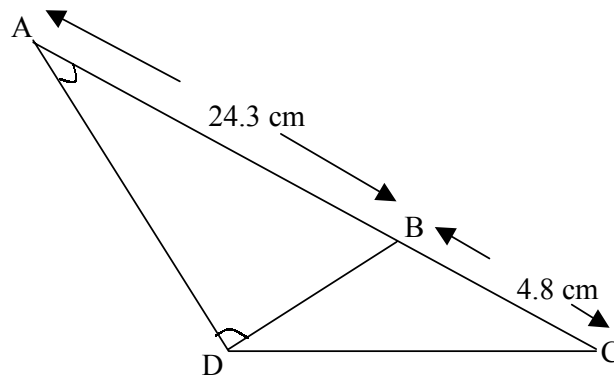


DIAGRAM 5

- 15 (a) In Diagram 5,  $ABC$  is a straight line. Calculate the length of  $BD$  and the area of  $\triangle BCD$ .

[4 marks]

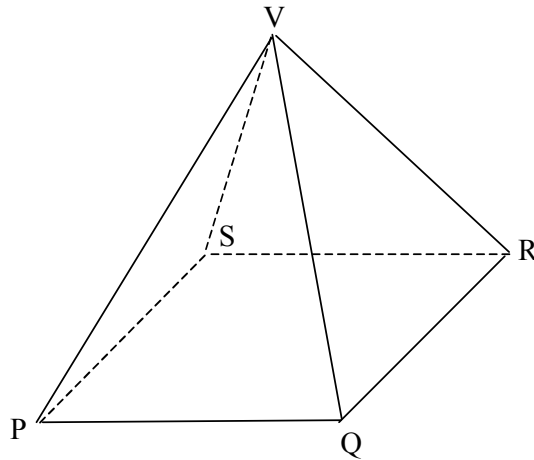


DIAGRAM 6

- (b) Diagram 6 shows a right pyramid with a square base. It is given that  $VQ = 10$  cm and  $PQ = 12$  cm.

- (i) Calculate angle  $PRV$ ,
- (ii) If  $T$  is a point on  $VR$  such that  $VT:TR = 3:2$ , calculate the length of  $PT$ .

[6 marks]

**END OF QUESTION PAPER**