3472/2
Form Five
Additional Mathematics
Paper 2
September 2007
2 ½ hours

PEPERIKSAAN PERCUBAAN SPM
TAHUN 2007

ADDITIONAL MATHEMATICS
Form Five

Paper 2
Two hours and thirty minutes

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE INSTRUCTED TO DO SO

1. *Please read the information given on page 2 carefully.*

This question paper consists of ***13*** printed pages

INFORMATION FOR CANDIDATES

1 *This question paper consists of three sections :* ***Section A, Section B*** *and* ***Section C.***

2 *Answer* **all** *questions in* ***Section A***, ***four*** *questions from* ***Section B*** *and* ***two*** *questions from* ***Section C***.

3 *Give only* ***one*** *answer/solution to each question.*

4 *Show your working. It may help you to get marks.*

5 *The diagrams in the questions provided are not drawn to scale unless stated.*

6 *The marks allocated for each question and sub-part of a question are shown in brackets.*

7 *A list of formulae is provided on pages 2 and 3.*

8 *You may use a four-figure mathematical table.*

9 *You may use a non-programmable scientific calculator.*

The following formulae may be helpful in answering the questions. The symbols given are the ones commonly used.

ALGEBRA

1 $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

2 $a^m \times a^n = a^{m+n}$

3 $a^m \div a^n = a^{m-n}$

4 $(a^m)^n = a^{mn}$

5 $\log_a mn = \log_a m + \log_a n$

6 $\log_a \dfrac{m}{n} = \log_a m - \log_a n$

7 $\log_a m^n = n \log_a m$

8 $\log_a b = \dfrac{\log_c b}{\log_c a}$

9 $T_n = a + (n-1)d$

10. $S_n = \dfrac{n}{2}[2a + (n-1)d]$

11 $T_n = ar^{n-1}$

12 $S_n = \dfrac{a(r^n - 1)}{r - 1} = \dfrac{a(1 - r^n)}{1 - r}, \; r \neq 1$

13 $S_\infty = \dfrac{a}{1 - r}, \; |r| < 1$

CALCULUS

1 $y = uv$, $\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$

2 $y = \frac{u}{v}$, $\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

3 $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

4 Area under a curve = $\int_a^b y\ dx$ or $\int_a^b x\ dy$

5 Volume generated = $\int_a^b \pi y^2\ dx$ or $\int_a^b \pi x^2\ dy$

STATISTICS

1 $\bar{x} = \frac{\Sigma x}{N}$

2 $\bar{x} = \frac{\Sigma fx}{\Sigma f}$

3 $\sigma = \sqrt{\frac{\Sigma(x-\bar{x})^2}{N}} = \sqrt{\frac{\Sigma x^2}{N} - \bar{x}^2}$

4 $\sigma = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{\Sigma f}} = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \bar{x}^2}$

5 $m = L + \left(\frac{\frac{1}{2}N - F}{f_m}\right)C$

6 $I = \frac{Q_1}{Q_0} \times 100$

7 $\bar{I} = \frac{\Sigma W_i I_i}{\Sigma W_i}$

8 ${}^nP_r = \frac{n!}{(n-r)!}$

9 ${}^nC_r = \frac{n!}{(n-r)!r!}$

10 $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

11 $P(X = r) = {}^nC_r p^r\ q^{n-r}$, $p + q = 1$

12 *Mean*, $\mu = np$

13 $\sigma = \sqrt{npq}$

14 $Z = \frac{x - \mu}{\sigma}$

GEOMETRY

1 Distance = $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

2 Mid point

$(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

3 A point dividing a segment of a line

$(x, y) = \left(\frac{nx_1 + mx_2}{m+n}, \frac{ny_1 + my_2}{m+n} \right)$

4 Area of a triangle =

$\frac{1}{2} \left| (x_1 y_2 + x_2 y_3 + x_3 y_1) - (x_2 y_1 + x_3 y_2 + x_1 y_3) \right|$

5 $\left| \underset{\sim}{r} \right| = \sqrt{x^2 + y^2}$

6 $\hat{\underset{\sim}{r}} = \frac{x\underset{\sim}{i} + y\underset{\sim}{j}}{\sqrt{x^2 + y^2}}$

TRIGONOMETRY

1 Arc length, $s = r\theta$

2 Area of a sector, $A = \frac{1}{2} r^2 \theta$

3 $\sin^2 A + \cos^2 A = 1$

4 $\sec^2 A = 1 + \tan^2 A$

5 $\operatorname{cosec}^2 A = 1 + \cot^2 A$

6 $\sin 2A = 2 \sin A \cos A$

7 $\cos 2A = \cos^2 A - \sin^2 A$

$= 2\cos^2 A - 1$

$= 1 - 2\sin^2 A$

8 $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$

9 $\cos(A \pm B) = \sin A \cos B \mp \cos A \sin B$

10 $\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

11 $\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$

12 $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

13 $a^2 = b^2 + c^2 - 2bc \cos A$

14 Area of triangle = $\frac{1}{2} ab \sin C$

Section A

[40 *marks*]

Answer **all** *questions*.

1 Solve the simultaneous equations $3m+2n = 3m^2+mn+6=7$. Give your answer correct to three decimal places. [6 *marks*]

2 (a) Express quadratic function $f(x)=-2x^2+4x-3$ in the form of $a(x+p)^2+q$.
Hence, state the maximum or minimum value of the function. [3 *marks*]

(b) Find the range values of x for which $x(x+4)\le 21$. [3 *marks*]

3 (a) Prove that $\dfrac{\sin 2x}{1-\cos 2x}=\cot x$. [3 *marks*]

(b) Given $\cos\dfrac{\theta}{2}=\dfrac{1}{\sqrt{1+p^2}}$,

i. prove that $\tan\theta=\dfrac{2p}{1-p^2}$.

ii. hence, find $\sin 2\theta$, when $p=2$.

[5 *marks*]

4 (a) Find the equation of the normal to the curve $y=x^3-2x^2$ at the point (1, -1).
[3 *marks*]

(b) Given $y=\dfrac{2}{x^2}$, find the approximate change in y when x decreases from 4 to 3.9.
[3 *marks*]

5 (a) A curve has a gradient function of $3x^2 + 2x - 2$. Given that the curve passes through the point (1,-3), find the equation of the curve. [3 *marks*]

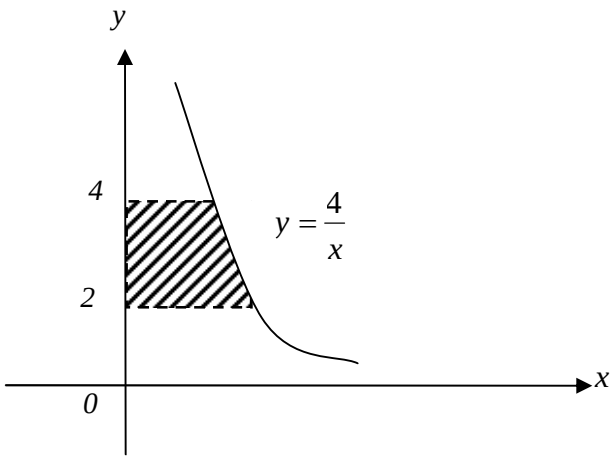

DIAGRAM 1

(b) Diagram 1 shows part of the curve of $y = \frac{4}{x}$. Calculate the volume generated when the shaded region is revolved through 360° about the *y*-axis. [4 *marks*]

6 Diagram 2 shows an arrangement of these right-angled triangles for the infinite series of similar triangles.

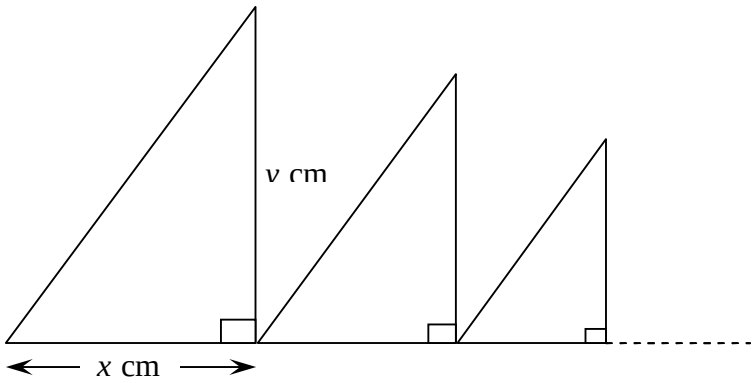

DIAGRAM 2

The base and the height of the first right-angled triangle is x cm and y cm respectively. The base and the height of the subsequent triangle are a quarter of the base and half of the height of the previous triangle.

(a) Show that the areas of the triangles form a geometric progression. State the common ratio of the progression. [3 *marks*]

(b) Given $x = 160$ cm and $y = 320$.

(i) Determine which triangle has an area of $6\frac{1}{4}$ cm².

(ii) Find the sum to infinity for the area, in cm², of all the triangles.

[4 *marks*]

Section B

[40 marks]

Answer **four** *questions.*

7 *Use the graph paper provided to answer this question.*

Table 1 shows experiment values of two variables x and y. Variables x and y are related by the equation $y = \frac{a}{x+b}$, where a and b are constants.

x	0.5	1.5	2.5	3.5	4.5	5.5
y	3.3	2.4	1.8	1.5	1.3	1.1

TABLE 1

(a) **Plot *xy* against *y*** by using a scale of 2 cm to 0.5 unit on the y-axis and 2 cm to 1 unit to the xy-axis.

Hence, draw the line of best fit.

(b) Use your graph from *(a)* to find the values of a and b.

(c) Find the value of the gradient of the straight line obtained when $\frac{1}{y}$ is plotted against x.

[10 *marks*]

8 The coordinates of point A, B and C are (1, 2), (7, 8) and (-3, k) respectively. Given that the area of ΔABC is 24 unit².

(a) Find

i. the possible values of k.

ii. the equation of perpendicular bisector of AB.

[6 *marks*]

(b) A point P moves such that its distance from point A is always $\sqrt{10}$ units.

i. Find the equation of the locus of P.

ii. Determine whether or not this locus passes through the point (4, 1).

[4 *marks*]

9 Table 2 shows the marks scored by 100 students in the Additional Mathematics March Monthly test.

Marks scored	Number of students
10 - 19	6
20 - 29	8
30 - 39	11
40 - 49	17
50 - 59	25
60 - 69	14
70 - 79	12
80 - 89	7

TABLE 2

(a) Based on the data in Table 2 and without using the graphical method, calculate

(i) the median,

(ii) the mean, and

(iii) the standard deviation.

[6 *marks*]

(b) *Use the graph paper provided for this part of the question.*

Based on Table 2, draw a histogram.

Use your histogram to estimate the mode for the marks. [4 *marks*]

10 (a) In an examination, 65% of its candidates passed with full certification. For a sample of 10 candidates taken randomly, find the probability of at least 3 candidates will pass with full certification. [4 *marks*]

(b) Given that the weight, in kg, of the students in a school have a normal distribution with a mean of 55 kg and a variance of 100 kg^2, find

(i) the z-score for the weight 66 kg,

(ii) the weight of the student that correspond with the z-score of -1.03,

(iii) the probability that the weight of a student picked randomly will be between 42 kg and 66 kg.

[6 *marks*]

11 Diagram 3 shows a square *ABCD* with sides 5 cm in length.
BAPC is a sector with its centre at *B* and *ABC* is a semicircle.

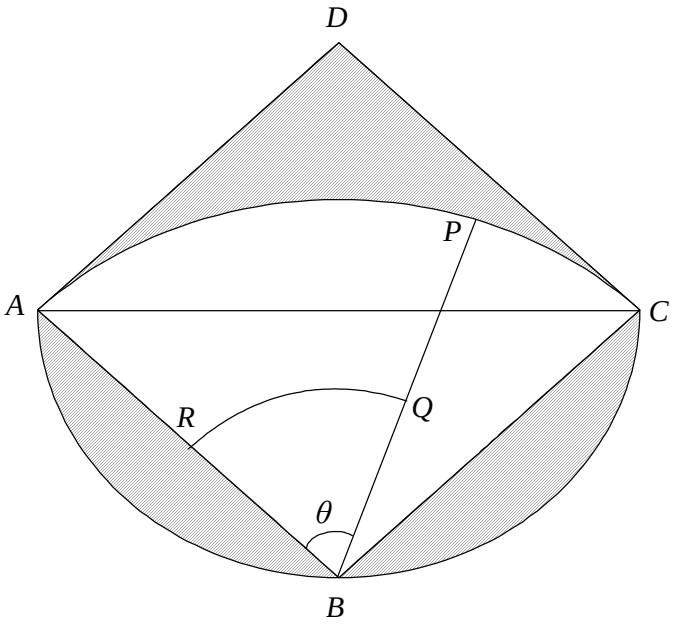

DIAGRAM 3

[Use π = 3.142]

(a) Calculate

(i) the area of the segment *APC*, [2 *marks*]

(ii) the perimeter of the shaded regions, [2 *marks*]

(iii) the area of the shaded regions, [2 *marks*]

(b) Given that *BQR* is a sector with an angle θ at its centre, *B* and the length of the arc *AP* is 6 cm, find

(i) the angle θ in radians, [1 *mark*]

(ii) the length of the arc *QR* if the area of *APQR* is 12.6 cm^2. [3 *marks*]

Section C

[20 marks]

Answer **two** *questions*.

12 Diagram 4 shows the bar chart for the monthly sales of five essential items sold at a sundry shop. Table 3 shows their price in the year 2000 and 2006, and the corresponding price index for the year 2006 taking 2000 as the base year.

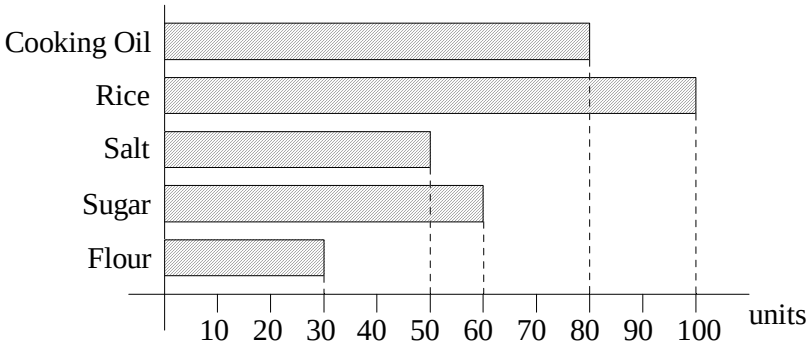

DIAGRAM 4

Items	Price in the year 2000	Price in the year 2006	Price Index for the year 2006 based on the year 2000
Cooking Oil	*x*	RM2.50	125
Rice	RM1.60	RM2.00	125
Salt	RM0.40	RM0.55	*y*
Sugar	RM0.80	RM1.20	150
Flour	RM2.00	*z*	120

TABLE 3

(a) Find the values of

(i) *x*,

(ii) *y*,

(iii) *z*.

[3 *marks*]

(b) Find the composite price index for cooking oil, rice, salt, sugar and flour in the year 2006 based on the year 2000. [2 *marks*]

(c) The total monthly sale for cooking oil, rice, salt, sugar and flour in the year 2000 is RM 2 500. Calculate the corresponding monthly sale for the same items in the year 2006. [2 *marks*]

(d) From the year 2006 to the year 2007, the price of the cooking oil, rice and sugar increased by 2%, while the price of both salt and flour increased by 5 sen. Find the composite price index for all the five items in the year 2007 taking 2006 as the base year. [3 *marks*]

13 Diagram 5 shows two triangles *ABE* and *CDE*. Given that *AB* = 20 cm, *DE* = 10 cm, $\angle BAE = 30^o$, *AE* = *BE* and *AED* is a straight line.

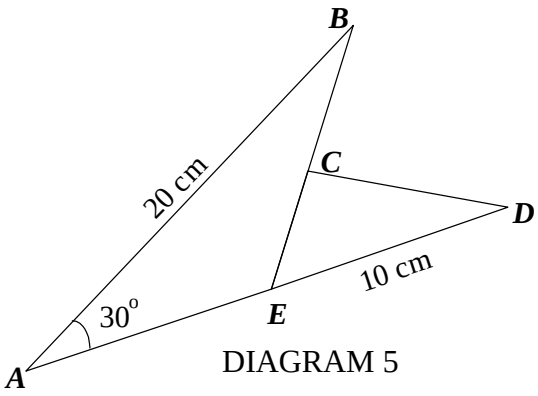

DIAGRAM 5

(a) Find the length, in cm, of *AE*. [2 *marks*]

(b) If the area of triangle *ABE* is twice the area of triangle *CDE*, find the length of *CE*. [3 *marks*]

(c) Find the length of *CD*. [2 *marks*]

(d) (i) Calculate the angle *CDE*.

(ii) Sketch and label the triangle *CDF* inside the triangle *CDE*, such that *CF* = *CE* and angle *CDF* = angle *CDE*. [3 *marks*]

14 Two particles A and B are travelling in the same direction along a straight line. The velocity of particle A, V_A ms^{-1}, is given by $V_A = 10 - 10t$ and the velocity of particle B, V_B ms^{-1}, is given by $V_B = 3t^2 - 8t + 4$ where t is the time, in seconds, after passing point O.

Find

(a) the acceleration of particle B at the moment of passing point O, [2 *marks*]

(b) the time interval when particles A and B move in the same direction again, [2 *marks*]

(c) the distance travelled by particle A during the interval of two seconds after it has momentarily stop, [3 *marks*]

(d) the time when particle A will meet with particle B again. [3 *marks*]

15 *For this question, use the graph paper provided.*

x and y are two positive integers that conform with the following constraints:

I: The minimum value of $2x + 3y$ is 90.

II: The maximum value of $3x + 2y$ is twice the minimum value of $2x + 3y$.

III: The value of $2x$ exceeds that of y by at least 40.

(a) Write down an inequality for each of the constraint stated above. [3 *marks*]

(b) Using a scale of 2 cm to 10 unit on both axes, construct, shade and label the region R which satisfies all the above constraints. [3 *marks*]

(c) Given that x is the number of slippers and y is the number of shoes sold by Syarikat Best Footwear. By using your graph, find

(i) the maximum value for k when $x = 40$ if y is k times the value of x.

(ii) the maximum total profit gained by the company if it earns RM 3 for a pair of slippers and RM 12 for a pair of shoes.

[4 *marks*]

END OF THE QUESTION PAPER