SEKOLAH MENENGAH JENIS KEBANGSAAN
PEREMPUAN CHINA PULAU PINANG

PEPERIKSAAN PERCUBAAN SPM 2013 **3472/2**

ADDITIONAL MATHEMATICS

Kertas 2

$2\frac{1}{2}$ **jam** **Dua jam tiga puluh minit**

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

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**, any **four** questions from **Section B** and any **two** questions from **Section C**.
3. Write your answer on the paper provided.
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 in page 2 and page 3.
8. Graphs paper and a four-figure mathematical sheet are provided.
9. You may use a scientific calculator

Kertas soalan ini mengandungi 11 halaman bercetak

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. $\log_a \frac{m}{n} = \log_a m - \log_a n$

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. $y = uv$, $\dfrac{dy}{dx} = u\dfrac{dv}{dx} + v\dfrac{du}{dx}$

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

3. $\dfrac{dy}{dx} = \dfrac{dy}{du} \times \dfrac{du}{dx}$

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

5. Volume of revolution $= \int_a^b \pi y^2\,dx$ or Volume of revolution $= \int_a^b \pi x^2\,dy$

Statistics

1. $\bar{x} = \dfrac{\Sigma x}{N}$

2. $\bar{x} = \dfrac{\Sigma fx}{\Sigma f}$

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

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

5. $m = L + \left[\dfrac{\frac{1}{2}N - F}{f_m}\right]C$

6. $I = \dfrac{Q_1}{Q_0} \times 100$

7. $\bar{I} = \dfrac{\Sigma W_i I_i}{\Sigma W_i}$

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

9. ${}^nC_r = \dfrac{n!}{(n-r)!\,r!}$

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. $z = \dfrac{X - \mu}{\sigma}$

Geometry

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

2. Midpoint

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

3. A point dividing a segment of a line

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

4. Area of triangle $= \dfrac{1}{2}\left|(x_1y_2 + x_2y_3 + x_3y_1) - (x_2y_1 + x_3y_2 + x_1y_3)\right|$

5. $|\underline{r}| = \sqrt{x^2 + y^2}$

6. $\hat{\underline{r}} = \dfrac{x\mathbf{i} + yj}{\sqrt{x^2 + y^2}}$

Trigonometry

1. Arc length, s = $r\theta$

2. Area of sector , $A = \dfrac{1}{2}r^2\theta$

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

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

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

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

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

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

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

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

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

SECTION A

[40 marks]

Answer **all** questions.

1. Solve the simultaneous equations

$$3h - 2k = 1$$
$$k^2 = 2(h + 1)$$

Give the answers correct to three decimal places. [5 marks]

2. Given a curve $y = \dfrac{4}{(1-2x)^3}$

(a) Find the gradient of the curve at the point where $x = 1$ [2 marks]

(b) Find the equation of the tangent to the curve at this point. [2 marks]

(c) If x changes at the rate of 2 unit per second, find the rate of change of y when $x = 1$ [2 marks]

3. The base and height of the first triangle are 240cm and 482cm respectively. The base and height of the subsequent triangles are half of the previous triangle. Find

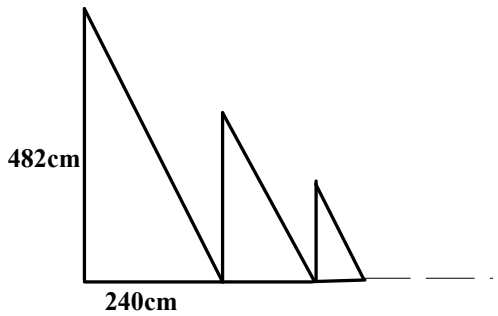

Diagram 1

(a) the least value of n such that the area of the nth triangle is less than 10 cm^2. [3 marks]

(b) the sum of the area of triangles to infinity. [2 marks]

4. (a) Prove $\dfrac{6\tan x}{\tan^2 x + 1} = 3\sin 2x$ [3 marks]

(b) By sketching the graph of y = 3sin 2x and a suitable straight line on the same axis of $0 \le x \le 2\pi$, state the number of solutions for the equation $\dfrac{6\tan x}{\tan^2 x + 1} + \dfrac{2x}{\pi} = 1$ [5 marks]

5. Table 1 shows the frequency distribution of the marks scored by a group of students in a quiz.

Marks	Number of pupils
10 - 14	7
15 - 19	14
20 - 24	8
25 - 29	12
30 - 34	10
35 - 39	9

Table 1

Find

(a) The mean score [2 marks]

(b) The standard deviation [2 marks]

(c) Without drawing an ogive, find the interquartile range. [4 marks]

6. In Diagram 2, OAR is a triangle . OQP and AQB are straight lines.

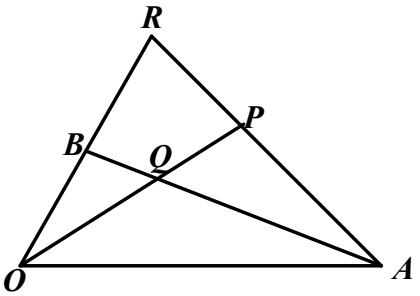

Diagram 2

Given that $AQ : AB = 3 : 5$, $OP = 2\,OQ$, $\overrightarrow{OA} = 3\underline{a}$ and $\overrightarrow{OB} = 2\underline{b}$.

Express in terms of $\underline{a}$ and $\underline{b}$:

(i) $\overrightarrow{AQ}$ (ii) $\overrightarrow{OQ}$ [3 marks]

(b) Given that $\overrightarrow{OR} = h\,\underline{b}$ *and* $\overrightarrow{AR} = k\,\overrightarrow{AP}$, where h and k are constants, express $\overrightarrow{AR}$ in terms of i) h, a and b

ii) k, a and b

Hence, find the value of h and of k. [5 marks]

SECTION B

[40 marks]

Answer any **four** questions from this section.

7. Use graph paper to answer this question.

Table 2 shows the values of two variables, x and y, obtained from an experiment. The variables x and y are related by the equation $y = \frac{a}{x} + b\sqrt{x}$ where a and b are constants.

x	1	2	3	4	5	6
y	2.2	1.8	1.8	1.9	2.0	2.16

Table 2

(a) Plot xy against $x\sqrt{x}$, using a scale of 1 cm to 1 unit on both the $x\sqrt{x}$-axis and the xy-axis. Hence, draw the line of best fit. [4 marks]

(b) Use the graph in (a) to find the value of

(i) a

(ii) b

(iii) y when $x = 2.5$ [6 marks]

8. Diagram 3 shows sector OAC of a circle with centre O and radius 6 cm and sector ODE with radius OD. Given that $OA : OD$ is 3 : 4 , arc DE is 10.16cm and OB bisects $\angle AOC$.

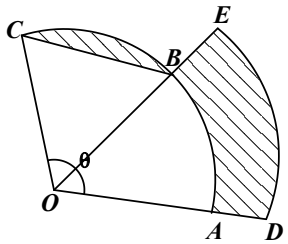

Diagram 3

Find

(a) θ in radian [2 marks]

(b) the perimeter of the shaded region [4 marks]

(c) the area of the shaded region [4 marks]

9 Solution by scale drawing is **not** accepted.

Diagram 4 shows straight line *RS* is perpendicular to line *PQ*.

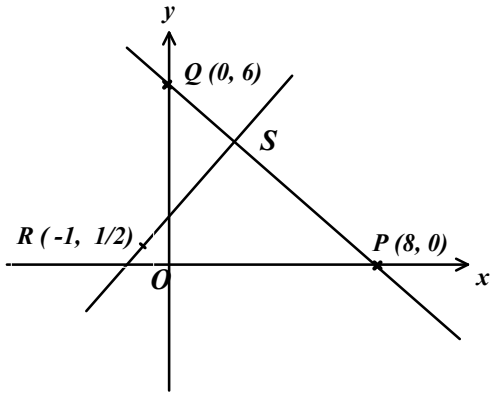

Diagram 4

Find

(a) the equation of the line RS. [2 marks]

(b) the coordinates of point S. [4 marks]

(c) the ratio of PS : SQ [2 marks]

(d) the area of triangle SPR. [2 marks]

10 (a) In a survey carried out among students in an urban school, it is found that 3 out of 5 students attend tuition classes. If 8 of the students are chosen at random, calculate the probability that

(i) exactly 5 students attend tuition classes. [2 marks]

(ii) more than 6 students do not attend tuition classes. [3 marks]

(b) In the survey, it is also found that the expenses on tuition fees follows a normal distribution with a mean of RM160 and a standard deviation of RM 20.

Find

(i) the probability that a student who is chosen at random spends less than RM120 for tuition. [2 marks]

(ii) the value of *P* if 30% of the students spend more than RM *P* for tuition. [3 marks]

11. Diagram 5 shows the line AB is the tangent to the curve $y = -x^2 + 12$ at point B.

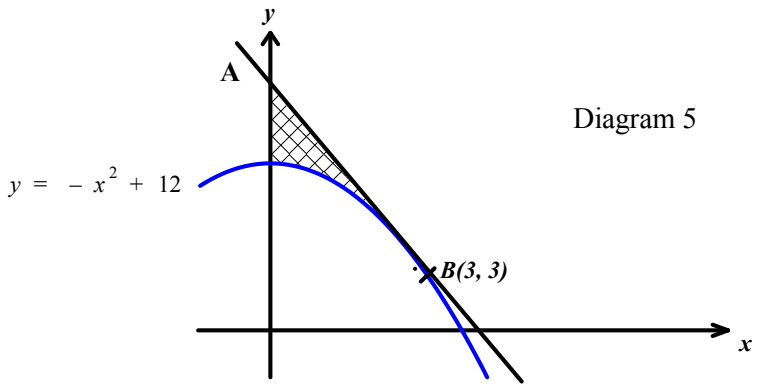

Diagram 5

Find

(a) the equation of the normal at point B [3 marks]

(b) the area of the shaded region [3 marks]

(c) the volume generated, in terms of π, when the region which is bounded by the curve, the y-axis and the normal at B is rotated through 360° about the y-axis. [4 marks]

SECTION C

[20 marks]

Answer any **two** questions from this section.

12 Diagram 6 shows quadrilateral ABCD.

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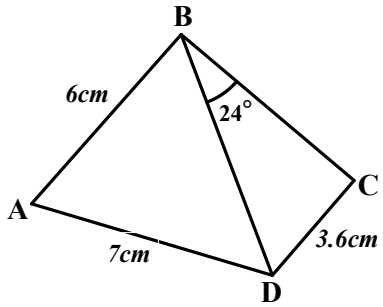

Diagram 6

The area of ΔABD is 20.5cm^2 and $\angle BAD$ is acute. Calculate

(a) $\angle BAD$ [2 marks]

(b) the length of BD [2 marks]

(c) $\angle BCD$ given that it is an obtuse angle. [2 marks]

(d) Given $CD = CE$ and E is on BD, find the length of BE [4 marks]

13.

Item	Price per kg (RM)		**Price index in the year 2012 based on the year 2010**	Weightage
	2010	2012		
P	1.60	2.00	125	k
Q	4.00	5.60	x	k+1
R	0.80	y	150	3
S	z	0.80	80	$2k$

Table 3

Table 3 above shows the prices and the price indices for four ingredients, P, Q, R and S used in baking a particular kind of cake.

(a) Find the values of x, y and z. [3 marks]

(b) The composite index for the cost of baking the cake in the year 2012 based on the year 2010 is 114.5. Calculate the value of k. [3 marks]

(c) The total cost for baking the cake in the year 2012 is RM137.40. Calculate the corresponding total cost in the year 2010. [2 marks]

(d) The cost of baking these cakes is expected to increase by 28% from the year 2012 to the year 2013. Find the expected composite index for the year 2013 based on the year 2010. [2 marks]

14. A particle moves in a straight line and passes through a fixed point O. The velocity of the particle v cms^{-1}, is given by $v = 6 + 7t - 3t^2$. Find

(a) the acceleration of the particle when t = 2. [2 marks]

(b) the maximum velocity of the particle. [2 marks]

(c) the distance from O when the particle stops instantaneously. [3 marks]

(d) the total distance traveled by the particle in the first 4 second. [3 marks]

15 Use the graph paper provided to answer this question.

A school band wants to recruit members for a competition. There are x girls and y boys joining the band. However the number of band members is restricted to the following constraints :-

I. The total number of the band members is at least 40.

II. The total number of the band members is at most 80.

III. The number of boys in the band is not more than twice the number of girls.

IV. The number of girls is less than 50

(a) Write down four inequalities, other than $x \geq 0$ and $y \geq 0$, which satisfy all the above constraints. [3 marks]

(b) Using a scale of 2 cm to 10 girls for the x-axis and 2 cm to 10 boys for the y-axis, construct and shade the region ***R*** which satisfies all the above constraints. [3 marks]

(c) Based on the graph constructed in 15(b), find

(i) the range for the number of girls in the band if there are 36 boys joining the band.

(ii) the maximum total subsidy on the uniforms if the school subsidies RM 65 for a girl's uniform and RM 40 for a boy's uniform. [4 marks]

Prepared by : ……. Checked by : ……Verified by : ……

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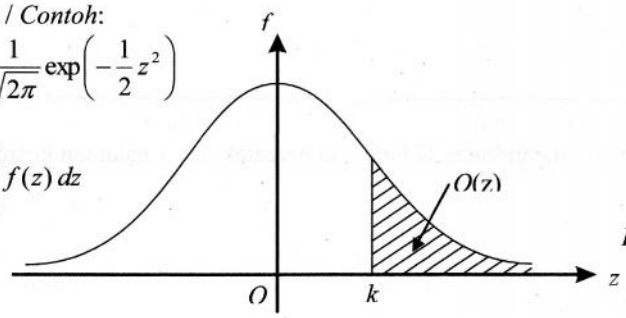
THE UPPER TAIL PROBABILITY Q(z) FOR THE NORMAL DISTRIBUTION N(0, 1)
KEBARANGKALIAN HUJUNG ATAS Q(z) *BAGI TABURAN NORMAL* N(0, 1)

z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
											Minus / *Tolak*								
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641	4	8	12	16	20	24	28	32	36
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247	4	8	12	16	20	24	28	32	36
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859	4	8	12	15	19	23	27	31	35
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483	4	7	11	15	19	22	26	30	34
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121	4	7	11	15	18	22	25	29	32
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776	3	7	10	14	17	20	24	27	31
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451	3	7	10	13	16	19	23	26	29
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148	3	6	9	12	15	18	21	24	27
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867	3	5	8	11	14	16	19	22	25
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611	3	5	8	10	13	15	18	20	23
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379	2	5	7	9	12	14	16	19	21
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170	2	4	6	8	10	12	14	16	18
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985	2	4	6	7	9	11	13	15	17
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823	2	3	5	6	8	10	11	13	14
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681	1	3	4	6	7	8	10	11	13
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559	1	2	4	5	6	7	8	10	11
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0..0475	0.0465	0.0455	1	2	3	4	5	6	7	8	9
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367	1	2	3	4	4	5	6	7	8
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294	1	1	2	3	4	4	5	6	6
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233	1	1	2	2	3	4	4	5	5
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183	0	1	1	2	2	3	3	4	4
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143	0	1	1	2	2	2	3	3	4
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110	0	1	1	1	2	2	2	3	3
2.3	0.0107	0.0104	0.0102								0	1	1	1	1	2	2	2	2
				0.00990	0.00964	0.00939	0.00914				3	5	8	10	13	15	18	20	23
								0.00889	0.00866	0.00842	2	5	7	9	12	14	16	16	21
2.4	0.00820	0.00798	0.00776	0.00755	0.00734						2	4	6	8	11	13	15	17	19
						0.00714	0.00695	0.00676	0.00657	0.00639	2	4	6	7	9	11	13	15	17
2.5	0.00621	0.00604	0.00587	0.00570	0.00554	0.00539	0.00523	0.00508	0.00494	0.00480	2	3	5	6	8	9	11	12	14
2.6	0.00466	0.00453	0.00440	0.00427	0.00415	0.00402	0.00391	0.00379	0.00368	0.00357	1	2	3	5	6	7	9	9	10
2.7	0.00347	0.00336	0.00326	0.00317	0.00307	0.00298	0.00289	0.00280	0.00272	0.00264	1	2	3	4	5	6	7	8	9
2.8	0.00256	0.00248	0.00240	0.00233	0.00226	0.00219	0.00212	0.00205	0.00199	0.00193	1	1	2	3	4	4	5	6	6
2.9	0.00187	0.00181	0.00175	0.00169	0.00164	0.00159	0.00154	0.00149	0.00144	0.00139	0	1	1	2	2	3	3	4	4
3.0	0.00135	0.00131	0.00126	0.00122	0.00118	0.00114	0.00111	0.00107	0.00104	0.00100	0	1	1	2	2	2	3	3	4

Example / *Contoh*:

$$f(z) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{1}{2}z^2\right)$$

$$Q(z) = \int_k^\infty f(z)\,dz$$



If $X \sim$ N(0, 1), then

Jika $X \sim$ N(0, 1), *maka*

$P(X > k) = Q(k)$

$P(X > 2.1) = Q(2.1) = 0.0179$