MAKTAB RENDAH SAINS MARA

PEPERIKSAAN AKHIR SIJIL PENDIDIKAN MRSM 2019

MATEMATIK TAMBAHAN

Kertas 1

Dua jam

JANGAN BUKA KERTAS PEPERIKSAAN INI SEHINGGA DIBERITAHU

1. *Tulis* **nama** *dan* **kelas** *anda pada ruang yang disediakan.*
2. *Kertas peperiksaan ini adalah dalam dwibahasa.*
3. *Soalan dalam bahasa Inggeris mendahului soalan yang sepadan dalam bahasa Melayu.*
4. *Calon dibenarkan menjawab keseluruhan atau sebahagian soalan sama ada dalam bahasa Inggeris atau bahasa Melayu.*
5. *Calon dikehendaki membaca maklumat di halaman belakang buku soalan ini.*

Soalan	Markah Penuh	Markah Diperoleh
1	3	
2	3	
3	4	
4	4	
5	3	
6	3	
7	3	
8	3	
9	2	
10	3	
11	3	
12	4	
13	3	
14	4	
15	2	
16	3	
17	3	
18	3	
19	3	
20	3	
21	3	
22	4	
23	4	
24	4	
25	3	
Jumlah	**80**	

Kertas peperiksaan ini mengandungi 28 halaman bercetak.

[*Lihat halaman sebelah*

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

Rumus-rumus berikut boleh membantu anda menjawab soalan. Simbol-simbol yang diberi adalah yang biasa digunakan.

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
KALKULUS

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

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

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

4 Area under a curve

Luas di bawah lengkung

$= \int_a^b y\,dx$ or (*atau*)

$= \int_a^b x\,dy$

5 Volume of revolution

Isi padu kisaran

$= \int_a^b \pi y^2\,dx$ or (*atau*)

$= \int_a^b \pi x^2\,dy$

STATISTICS
STATISTIK

1 $\bar{x} = \dfrac{\sum x}{N}$

2 $\bar{x} = \dfrac{\sum fx}{\sum f}$

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

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

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

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

7 $\bar{I} = \dfrac{\sum W_i I_i}{\sum W_i}$

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 / *Min* , $\mu = np$

13 $\sigma = \sqrt{npq}$

14 $Z = \dfrac{X - \mu}{\sigma}$

GEOMETRY
GEOMETRI

1 Distance / *Jarak*

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

2 Midpoint / *Titik tengah*

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

3 A point dividing a segment of a line
Titik yang membahagi suatu tembereng garis

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

4 Area of triangle / *Luas segi tiga*

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

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

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

TRIGONOMETRY
TRIGONOMETRI

1 Arc length, $s = r\theta$

Panjang lengkok, $s = j\theta$

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

Luas sektor, $L = \frac{1}{2}j^2\theta$

3 $\sin^2 A + \cos^2 A = 1$
$\sin^2 A + \text{kos}^2 A = 1$

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

$\text{sek}^2 A = 1 + \tan^2 A$

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

$\text{kosek}^2 A = 1 + \text{kot}^2 A$

6 $\sin 2A = 2 \sin A \cos A$
$\sin 2A = 2 \sin A \text{ kos } A$

7 $\cos 2A = \cos^2 A - \sin^2 A$
$= 2\cos^2 A - 1$
$= 1 - 2\sin^2 A$

$\text{kos } 2A = \text{kos}^2 A - \sin^2 A$
$= 2\,\text{kos}^2 A - 1$
$= 1 - 2\sin^2 A$

8 $\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$

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

$\sin(A \pm B) = \sin A \text{ kos } B \pm \text{kos } A \sin B$

10 $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$
$\text{kos}(A \pm B) = \text{kos } A \text{ kos } B \mp \sin A \sin B$

11 $\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

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

13 $a^2 = b^2 + c^2 - 2bc\cos A$
$a^2 = b^2 + c^2 - 2bc\,\text{kos } A$

14 Area of triangle / *Luas segi tiga*
$= \frac{1}{2}ab\sin C$

For Examiner's Use

Answer **all** questions.
Jawab **semua** *soalan.*

1 Table 1 shows the cumulative frequency distribution in Mathematics test for Class 5 Newton.

Jadual 1 *menunjukkan taburan kekerapan longgokan dalam ujian Matematik bagi Kelas* 5 *Newton.*

Marks ***Markah***	**Cumulative frequency** ***Kekerapan longgokan***
40 – 49	6
50 – 59	16
60 – 69	31
70 – 79	37
80 – 89	k

Table 1
Jadual 1

Given that the median mark is 63·5, find the value of k. [3 *marks*]
Diberi bahawa nilai median ialah 63·5, *cari nilai* k. [3 *markah*]

Answer / *Jawapan* :

1
3

[*Lihat halaman sebelah*

2 Class 5 Beta consists of n students and 21 of them are boys. It is given that 15 out of 28 students who wear glasses are boys. If a student from the class is randomly selected, the probability that the student is a girl who does not wear glasses is $\frac{3}{20}$.

[3 *marks*]

Find the value of n.

Kelas 5 Beta terdiri daripada n orang pelajar dan 21 daripadanya adalah lelaki. Diberi bahawa 15 daripada 28 orang pelajar yang memakai cermin mata adalah lelaki. Jika seorang pelajar dari kelas itu dipilih secara rawak, kebarangkalian bahawa pelajar itu adalah pelajar perempuan yang tidak memakai cermin mata ialah $\frac{3}{20}$.

[3 *markah*]

Cari nilai n.

Answer / *Jawapan* :

2

3

For Examiner's Use

3 Diagram 1 shows a normal distribution graph representing the mass of rice packed by Syarikat Muara with a standard deviation of 1·2 kg.

Rajah 1 *menunjukkan graf taburan normal yang mewakili jisim beras yang dibungkus oleh Syarikat Muara dengan sisihan piawai* 1·2 kg.

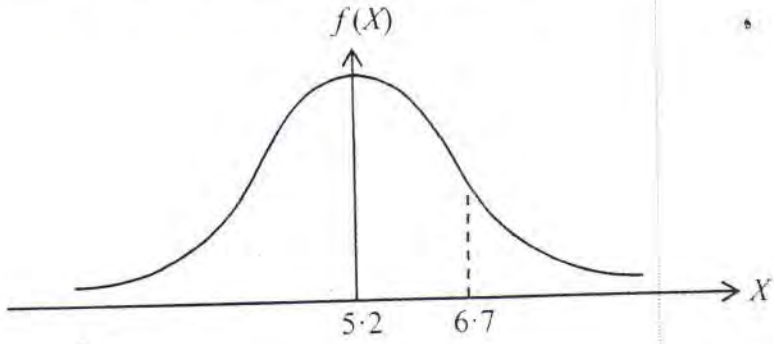


Diagram 1
Rajah 1

Find

Cari

(*a*) the *z*-score of a pack of rice with mass of 6·7 kg,

skor-z bagi sekampit beras yang berjisim 6·7 kg,

(*b*) $P(X < 6{\cdot}7)$.

[4 *marks*]

[4 *markah*]

Answer / *Jawapan* :

3

4

4 Diagram 2 shows the rewards Madam Nurin prepared for her students who excel in an Additional Mathematics test.

Rajah 2 menunjukkan ganjaran yang disediakan oleh Madam Nurin untuk pelajar-pelajarnya yang cemerlang dalam suatu ujian Matematik Tambahan.

Diagram 2
Rajah 2

Danial and Arfan are the two top scorer in the test.

Danial dan Arfan adalah dua pelajar yang mendapat markah tertinggi dalam ujian tersebut.

(*a*) Danial who scored the highest mark is allowed to choose first. He can choose 2 items from each boxes.
Find the number of different ways he can choose his rewards.

Danial yang telah mendapat markah tertinggi dibenarkan untuk memilih dahulu. Dia boleh memilih 2 barang daripada setiap kotak.
Cari bilangan cara yang berbeza dia boleh memilih ganjarannya.

(*b*) Arfan who scored the second highest mark is asked to choose next. He can choose from any two boxes and take only 1 item from those boxes.
Find the number of different ways he can choose his rewards.

Arfan yang telah mendapat markah kedua tertinggi dibenarkan untuk memilih berikutnya. Dia boleh memilih daripada mana-mana dua kotak dan mengambil hanya 1 barang daripada setiap kotak.
Cari bilangan cara yang berbeza dia boleh memilih ganjarannya.

[4 *marks*]
[4 *markah*]

Answer / *Jawapan* :

For Examiner's Use

4

4

5 It is given that 97% of the microwave ovens produced by a factory approved by Quality Control Unit. If 7 microwave ovens are chosen at random, find the probability that at most one microwave oven is rejected by Quality Control Unit.

[3 *marks*]

Diberi bahawa 97% daripada ketuhar gelombang mikro yang dihasilkan oleh sebuah kilang diluluskan oleh Unit Kawalan Kualiti. Jika 7 buah ketuhar gelombang mikro dipilih secara rawak, cari kebarangkalian bahawa selebih-lebihnya sebuah ketuhar gelombang mikro ditolak oleh Unit Kawalan Kualiti.

[3 *markah*]

Answer / *Jawapan* :

5

3

6 A cylindrical container with radius of p cm is being filled up with water at a rate of $\frac{\pi}{p}$ cm^3 s^{-1}, where p is a constant.

Find the rate of change, in terms of p, in cm s^{-1}, of the water level. [3 *marks*]

Sebuah bekas berbentuk silinder mempunyai jejari p cm *diisi dengan air pada kadar* $\frac{\pi}{p}$ cm^3 s^{-1}, *dengan keadaan p ialah pemalar.*

Cari kadar perubahan, dalam sebutan p, dalam cm s^{-1}, *bagi kedalaman air.* [3 *markah*]

Answer / *Jawapan* :

6
3

7 Given $y = -3x^3 + 3x - 5$, find the equation of the tangent to the curve at the point $(1, -5)$.

Diberi $y = -3x^3 + 3x - 5$, *cari persamaan tangen kepada lengkung pada titik* $(1, -5)$. [3 *marks*] [3 *markah*]

Answer / *Jawapan* :

7
3

For Examiner's Use

8 Given $\frac{d}{dx}\left(\frac{x^2-1}{3x+1}\right)=3g(x)$, find the value of $\int_0^3\left[\frac{x}{2}-\frac{3}{4}g(x)\right]dx$. [3 *marks*]

Diberi $\frac{d}{dx}\left(\frac{x^2-1}{3x+1}\right)=3g(x)$, *cari nilai* $\int_0^3\left[\frac{x}{2}-\frac{3}{4}g(x)\right]dx$. [3 *markah*]

Answer / *Jawapan* :

8

3

9 It is given that $\overrightarrow{OR}=\begin{pmatrix}2\\3\end{pmatrix}$ and $\overrightarrow{OS}=\begin{pmatrix}7\\9\end{pmatrix}$, find the unit vector in the direction of $\overrightarrow{RS}$. [2 *marks*]

Diberi bahawa $\overrightarrow{OR}=\begin{pmatrix}2\\3\end{pmatrix}$ *dan* $\overrightarrow{OS}=\begin{pmatrix}7\\9\end{pmatrix}$, *cari vektor unit pada arah* $\overrightarrow{RS}$. [2 *markah*]

Answer / *Jawapan* :

9

2

10 Diagram 3 shows a graph of a straight line $x = f(y)$ and a curve $x = g(y)$. The point $(-3, 2)$ lies on the straight line $x = f(y)$.

Rajah 3 *menunjukkan graf bagi suatu garis lurus* $x = f(y)$ *dan lengkung* $x = g(y)$. *Titik* $(-3, 2)$ *terletak pada garis lurus* $x = f(y)$.

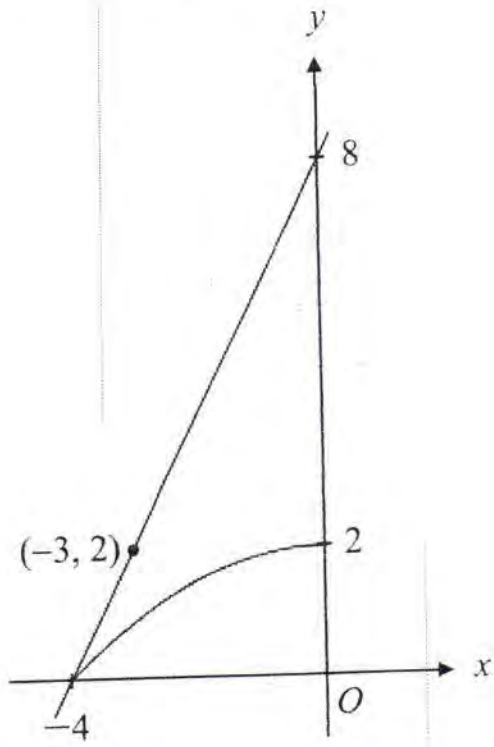


Diagram 3
Rajah 3

Given $\int_0^2 g(y)\,dy = -\frac{16}{3}$, find the area of the region represented by $\int_0^2 f(y)\,dy - \int_0^2 g(y)\,dy$.

Diberi $\int_0^2 g(y)\,dy = -\frac{16}{3}$, *cari luas rantau yang diwakili oleh* $\int_0^2 f(y)\,dy - \int_0^2 g(y)\,dy$.

[3 *marks*]
[3 *markah*]

Answer / *Jawapan* :

10

3

For Examiner's Use

11 Diagram 4 shows graphs of $y = \sin\theta$ and $y = -\frac{1}{2}\cos\theta$ for $0^\circ \le \theta \le 360^\circ$.

Rajah 4 *menunjukkan graf* $y = \sin\theta$ *dan* $y = -\frac{1}{2}\cos\theta$ *untuk* $0^\circ \le \theta \le 360^\circ$.

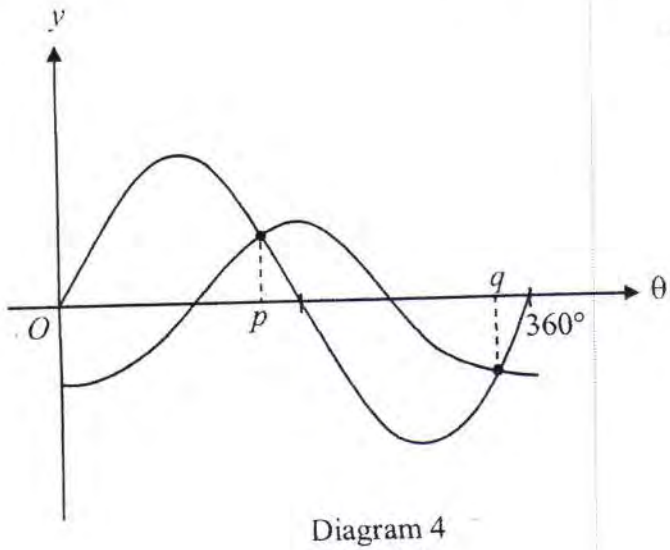


Diagram 4
Rajah 4

Find the value of p and of q.

Cari nilai p *dan* q.

[3 *marks*]
[3 *markah*]

Answer / *Jawapan* :

11

3

12 Diagram 5 shows a piece of land owned by Pak Zahid in the shape of a semicircle *PQR* with centre *O*. The sector *PTS* with centre *P* is fenced by barbed wire for his livestock cattle. The length of *PT* and the length of arc *TS* are 54 metre and 9π metre respectively. The remainder of the area is planted with Napier grass for cattle food. *OS* is the entrance to the barn and its length is 4 metre.

Rajah 5 menunjukkan sebidang tanah yang dimiliki oleh Pak Zahid yang berbentuk semibulatan PQR berpusat di O. Sektor PTS berpusat di P dipagari kawat duri untuk menempatkan lembu ternakannya. Panjang PT dan panjang lengkuk TS masing-masing ialah 54 meter dan 9π meter. Baki kawasan tersebut ditanam rumput Napier untuk dijadikan makanan lembu. OS adalah laluan masuk ke ladang tersebut dan panjangnya ialah 4 meter.

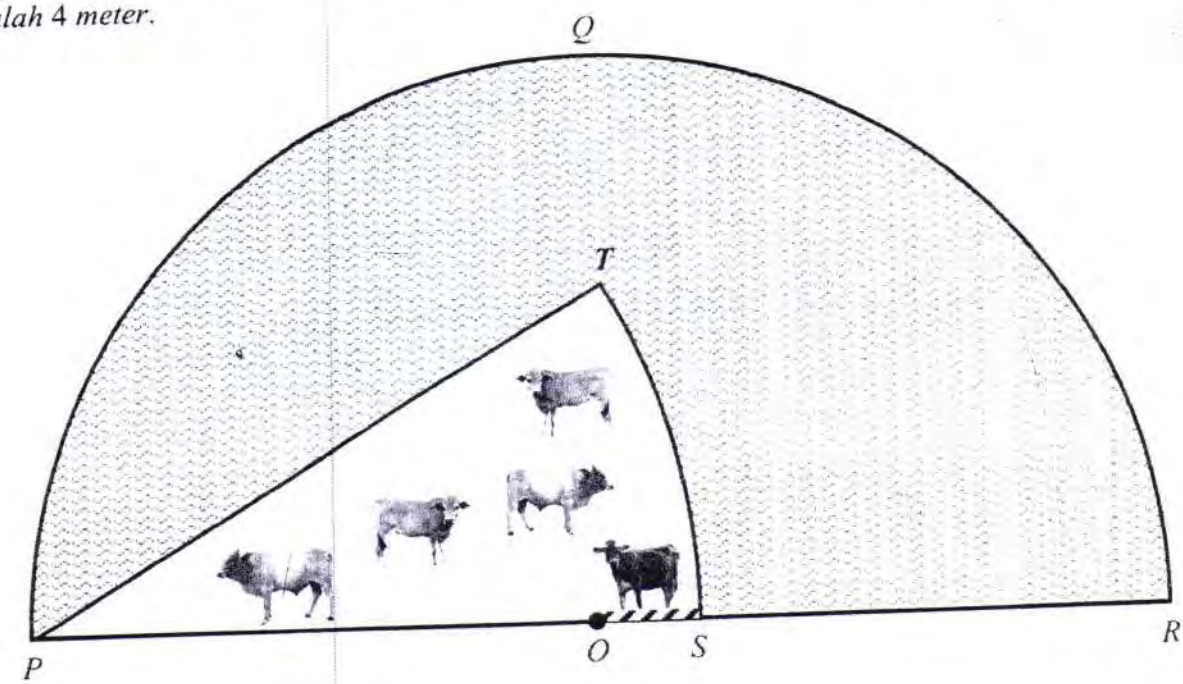


Diagram 5
Rajah 5

If the cost of hiring workers to cut off the Napier grass is RM 0.20 per m^2, find the cost Pak Zahid has to bear.

Jika kos mengupah orang untuk memotong rumput Napier ialah RM 0.20 *per* m^2, *cari kos yang perlu ditanggung oleh Pak Zahid.*

[4 *marks*]
[4 *markah*]

[Use / *Guna* $\pi = 3{\cdot}142$]

Answer / *Jawapan* :

For Examiner's Use

12
4

13 Point $V(-2, 10)$ and point $W(4, 2)$ are two end points of the diameter of a circle. Given point $Q(x, y)$ is a moving point on the circumference of the circle.

Find the equation of the locus of Q.

Titik $V(-2, 10)$ *dan titik* $W(4, 2)$ *adalah dua titik hujung pada diameter suatu bulatan. Diberi titik* $Q(x, y)$ *adalah suatu titik yang bergerak di sepanjang lilitan bulatan tersebut.*

Cari persamaan lokus Q.

[3 *marks*]
[3 *markah*]

Answer / *Jawapan* :

13
3

14 It is given that $\overrightarrow{OP} = 3\underline{a} + \underline{b}$, $\overrightarrow{OQ} = 2(\underline{a} - \underline{b})$ and $\overrightarrow{OR} = 4\underline{a} + 4\underline{b}$.

Diberi bahawa $\overrightarrow{OP} = 3\underline{a} + \underline{b}$, $\overrightarrow{OQ} = 2(\underline{a} - \underline{b})$ *dan* $\overrightarrow{OR} = 4\underline{a} + 4\underline{b}$.

(*a*) Find the relation between $\overrightarrow{QR}$ and $\overrightarrow{PQ}$.

Cari hubungan antara $\overrightarrow{QR}$ *dan* $\overrightarrow{PQ}$.

(*b*) Does vector $\overrightarrow{QR}$ and vector $\overrightarrow{PQ}$ are in the same direction? Give your reason.

Adakah vektor $\overrightarrow{QR}$ *dan vektor* $\overrightarrow{PQ}$ *dalam arah yang sama? Beri alasan anda.*

[4 *marks*]
[4 *markah*]

Answer / *Jawapan* :

For Examiner's Use

15 Diagram 6 shows x maps onto $f(x)$.

Rajah 6 menunjukkan x dipetakan kepada f(x).

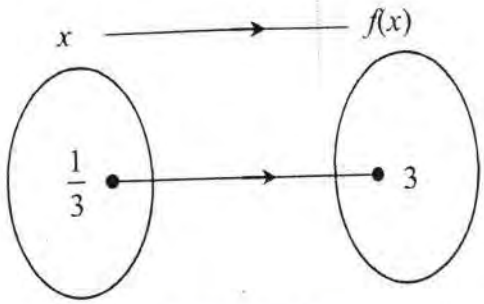


Diagram 6
Rajah 6

State two possible linear functions to represent the above relation.

Nyatakan dua fungsi linear yang mungkin bagi mewakili hubungan di atas.

[2 *marks*]
[2 *markah*]

Answer / *Jawapan* :

15

2

16 Given that $f(x)=\frac{hx+3}{2}$ and $f^{-1}(k)=6$, express h in terms of k. [3 *marks*]

Diberi bahawa $f(x)=\frac{hx+3}{2}$ *dan* $f^{-1}(k)=6$, *ungkapkan h dalam sebutan k.*

[3 *markah*]

Answer / *Jawapan* :

16 3

17 Find the range of values of x for $(2x+5)(x+1)\geq 7+2x-x^2$. [3 *marks*]

Cari julat nilai x *bagi* $(2x+5)(x+1)\geq 7+2x-x^2$. [3 *markah*]

Answer / *Jawapan* :

17 3

For Examiner's Use

18 Diagram 7 shows the graph of the quadratic functions $f(x)=x^2-4x$ and $g(x)=-(x-h)^2+k$, where h and k are constants. Both functions have the same axis of symmetry.

Rajah 7 menunjukkan graf bagi fungsi-fungsi kuadratik $f(x)=x^2-4x$ *dan* $g(x)=-(x-h)^2+k$, *dengan keadaan* h *dan* k *adalah pemalar. Kedua-dua fungsi mempunyai paksi simetri yang sama.*

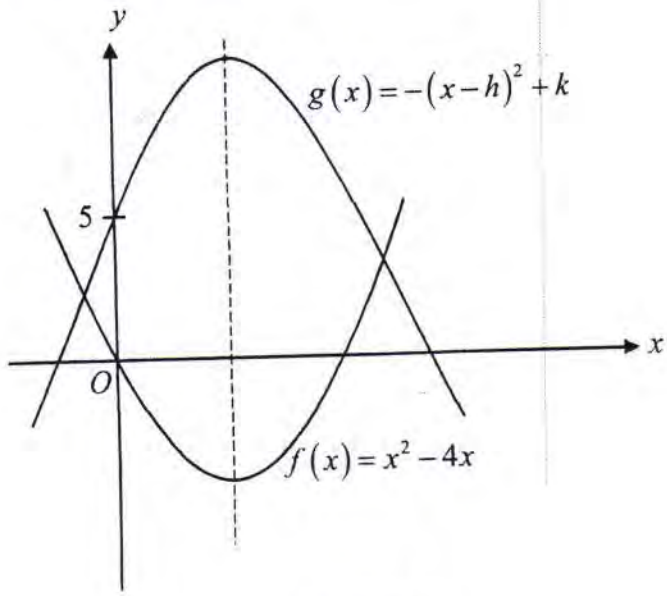


Diagram 7
Rajah 7

Find the value of

Cari nilai bagi

(*a*) h,

(*b*) k.

[3 *marks*]
[3 *markah*]

Answer / *Jawapan* :

18

3

19 It is given that p and q are the roots of the quadratic equation $3x^2 = 5x - 1$.
Form a quadratic equation with roots $2p$ and $2q$. [3 *marks*]

Diberi bahawa p dan q ialah punca-punca bagi persamaan kuadratik $3x^2 = 5x - 1$.
Bentukkan persamaan kuadratik dengan punca-punca $2p$ *dan* $2q$. [3 *markah*]

Answer / *Jawapan* :

19
3

20 It is given that the curve $y - x^2 = 2$ does not intersect with the straight line $y = k(1 - 2x)$, where k is a constant.
Find the range of values of k. [3 *marks*]

Diberi bahawa lengkung $y - x^2 = 2$ *tidak bersilang dengan garis lurus* $y = k(1 - 2x)$, *dengan keadaan* k *ialah pemalar.*
Cari julat nilai-nilai k. [3 *markah*]

Answer / *Jawapan* :

20
3

For Examiner's Use

21 Solve $4^m + 4^{m+1} + 4^{m+2} = 5 \cdot 25$. [3 *marks*]

Selesaikan $4^m + 4^{m+1} + 4^{m+2} = 5 \cdot 25$. [3 *markah*]

Answer / *Jawapan* :

21
3

22 Given $\log_r 3 = p$ and $\log_r 5 = q$, express $\log_9 75$ in terms of p and q. [4 *marks*]

Diberi $\log_r 3 = p$ *dan* $\log_r 5 = q$, *ungkapkan* $\log_9 75$ *dalam sebutan p dan q*. [4 *markah*]

Answer / *Jawapan* :

22
4

23 During Merdeka Day Celebration, some of form four students from MRSM Putrajaya are invited to perform a choir. The students will be arranged in the performance such that there will be 21 participant in the fifth row and the number of participant of each subsequent row is 3 more than the preceding row.

If there are 140 form four students, find the maximum number of students that can perform in the choir. [4 *marks*]

Semasa Sambutan Hari Kemerdekaan, sebilangan pelajar tingkatan empat dari MRSM Putrajaya dijemput untuk membuat persembahan koir. Pelajar-pelajar akan disusun dalam persembahan tersebut dengan keadaan 21 *orang peserta akan berada di baris yang kelima dan bilangan peserta pada baris yang seterusnya adalah lebih* 3 *orang daripada baris sebelumnya.*

Jika terdapat 140 *orang pelajar tingkatan empat, cari bilangan maksimum pelajar yang dapat membuat persembahan koir itu.* [4 *markah*]

Answer / *Jawapan* :

23

4

For Examiner's Use

24 The first term of a geometric progression is 16 and all the terms are positive. The product of the first term and the eight term is equal to the fourth term.

Find the sum to infinity of this progression. [4 *marks*]

Sebutan pertama bagi suatu janjang geometri ialah 16 *dan semua sebutannya adalah positif. Hasil darab sebutan pertama dengan sebutan kelapan adalah sama dengan sebutan keempat.*

Cari hasil tambah ketakterhinggaan bagi janjang ini. [4 *markah*]

Answer / *Jawapan* :

24

4

25 Diagram 8 shows the straight line graph obtained by plotting $\log_{10} y$ against x^2. The variables x and y are related by the equation $y = b^{x^2+2k}$, where b and k are constants.

Rajah 8 menunjukkan graf garis lurus yang diperoleh dengan memplotkan $\log_{10} y$ *melawan* x^2. *Pembolehubah x dan y dihubungkan oleh persamaan* $y = b^{x^2+2k}$, *dengan keadaan b dan k ialah pemalar.*

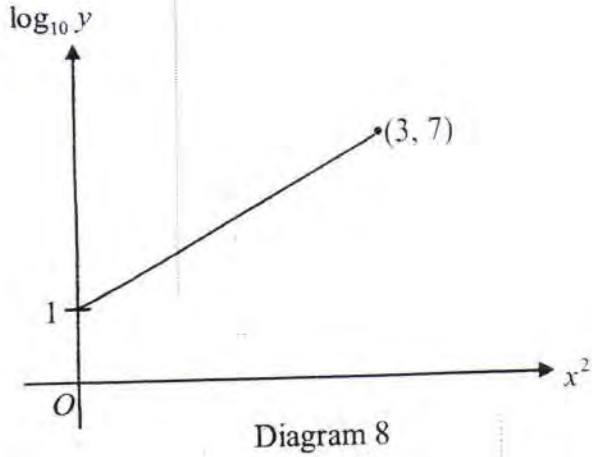


Diagram 8
Rajah 8

Find the value of b and of k. [3 *marks*]

Cari nilai b dan nilai k. [3 *markah*]

Answer / *Jawapan* :

25

3

END OF QUESTION PAPER
KERTAS SOALAN TAMAT
@stepsofficial

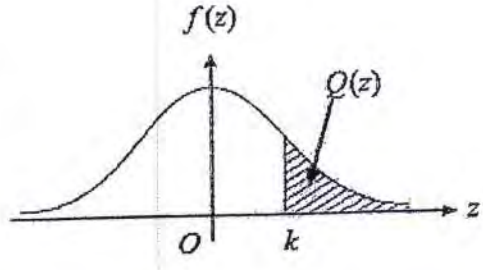
THE UPPER TAIL PROBABILITY Q(z) FOR THE NORMAL DISTRIBUTION N(0,1)
KEBARANGKALIAN HUJUNG ATAS Q(z) BAGI TABURAN NORMAL N(0,1)

z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
											TOLAK								
0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641	4	8	12	16	20	24	28	32	36
0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247	4	8	12	16	20	24	28	32	36
0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859	4	8	12	15	19	23	27	31	35
0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483	4	7	11	15	19	22	26	30	34
0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121	4	7	11	14	18	22	25	29	32
0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776	3	7	10	14	17	20	24	27	31
0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451	3	7	10	13	16	19	23	26	29
0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148	3	6	9	12	15	18	21	24	27
0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867	3	5	8	11	14	16	19	22	25
0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611	3	5	8	10	13	15	18	20	23
1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379	2	5	7	9	12	14	16	19	21
1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170	2	4	6	8	10	12	14	16	18
1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985	2	4	6	7	9	11	13	15	17
1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823	2	3	5	6	8	10	11	13	14
1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681	1	3	4	6	7	8	10	11	13
1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559	1	2	4	5	6	7	8	10	11
1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455	1	2	3	4	5	6	7	8	9
1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367	1	2	3	4	4	5	6	7	8
1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294	1	1	2	3	4	4	5	6	6
1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233	1	1	2	2	3	4	4	5	5
2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183	0	1	1	2	2	3	3	4	4
2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143	0	1	1	2	2	2	3	3	4
2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110	0	1	1	1	2	2	2	3	3
2.3	.0107	.0104	.0102								0	1	1	1	1	2	2	2	2
				.$0^2$990	.$0^2$964	.$0^2$939	.$0^2$914				3	5	8	10	13	15	18	20	23
								.$0^1$889	.$0^2$866	.$0^2$842	2	5	7	9	12	14	16	18	21
2.4	.$0^2$820	.$0^2$798	.$0^2$776	.$0^2$755	.$0^2$734						2	4	6	8	11	13	15	17	19
						.$0^2$714	.$0^2$695	.$0^2$676	0^{2}657	.$0^2$639	2	4	6	7	9	11	13	15	17
2.5	.$0^2$621	.$0^2$604	.$0^2$587	.$0^2$570	.$0^2$554	.$0^2$539	.$0^2$523	.$0^2$508	.$0^2$494	.$0^2$480	2	3	5	6	8	9	11	12	14
2.6	.$0^2$466	.$0^2$453	.$0^2$440	.$0^2$427	.$0^2$415	.$0^2$402	.$0^2$391	.$0^2$379	0^{2}368	.$0^2$357	1	2	3	5	6	7	8	9	10
2.7	.$0^2$347	.$0^2$336	.$0^2$326	.$0^2$317	.$0^2$307	.$0^2$298	.$0^2$289	.$0^2$280	.$0^2$272	.$0^2$264	1	2	3	4	5	6	7	8	9
2.8	.$0^2$256	.$0^2$248	.$0^2$240	.$0^2$233	.$0^2$226	.$0^2$219	.$0^2$212	.$0^2$205	.$0^2$199	.$0^2$193	1	1	2	3	4	4	5	6	6
2.9	.$0^2$187	.$0^2$181	.$0^2$175	.$0^2$169	.$0^2$164	.$0^2$159	.$0^2$154	.$0^2$149	.$0^2$144	.$0^2$139	0	1	1	2	2	3	3	4	4
3.0	.$0^2$135	.$0^2$131	.$0^2$126	.$0^2$122	.$0^2$118	.$0^2$114	.$0^2$111	.$0^2$107	.$0^2$104	.$0^2$100	0	1	1	2	2	2	3	3	4

For negative z use relation:
Bagi z negatif guna hubungan:
$Q(z) = 1 - Q(-z) = P(-z)$

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

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



Example / *Contoh*:
If $X \sim N(0, 1)$, then
Jika $X \sim N(0, 1)$, *maka*
$P(X > k) = Q(k)$
$P(X > 2.1) = Q(2.1) = 0.0179$

MAKTAB RENDAH SAINS MARA

PEPERIKSAAN AKHIR SIJIL PENDIDIKAN MRSM 2019

3472 / 1

PERATURAN PEMARKAHAN

MATEMATIK TAMBAHAN

Kertas 1

Dua jam

UNTUK KEGUNAAN PEMERIKSA SAHAJA

AMARAN

Peraturan pemarkahan ini SULIT dan Hak Cipta Bahagian Pendidikan Menengah MARA. Kegunaannya khusus untuk pemeriksa yang berkenaan sahaja. Sebarang maklumat dalam peraturan pemarkahan ini tidak boleh dimaklumkan kepada sesiapa.

Kertas soalan ini mengandungi 6 halaman bercetak.

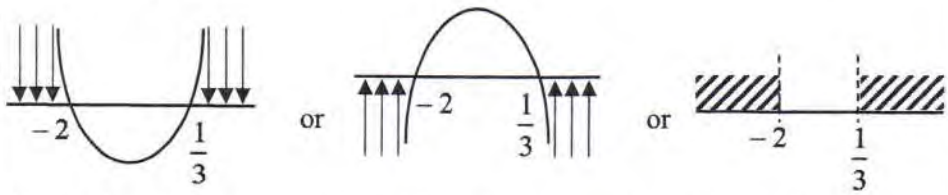
Additional Mathematics Paper 1
SPMRSM 2019

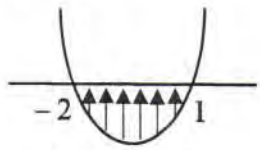
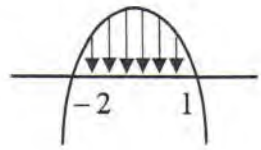
Answer Scheme

No	Answer	Marks
1	44	3
	$63.5 = 59.5 + \left[\dfrac{\frac{k}{2}-16}{15}\right](10)$	B2
	At least 2 corrects from $L = 59.5,\ f_m = 15,\ F = 16,\ c = 10$	B1
2	40	3
	$\dfrac{n-6-15-13}{n} = \dfrac{3}{20}$ OR $\dfrac{7}{20} = \dfrac{15+13+6}{n}$	B2
	$n-6-15-13$ OR $15+13+6$	B1
3	(a) 1.25	2
	$\dfrac{6.7-5.2}{1.2}$	B1
	(b) 0.8944 // 0.89435	2
	0.1056 // 0.10565	B1
4	(a) 2100	2
	${}^5C_2 \times {}^5C_2 \times {}^7C_2$	B1
	(b) 39	2
	${}^3C_1 \times {}^5C_1$ or ${}^3C_1 \times {}^3C_1$	B1
5	0.9829	3
	${}^7C_0(0.03)^0(0.97)^7 + {}^7C_1(0.03)^1(0.97)^6$ OR ${}^7C_6(0.97)^6(0.03)^1 + {}^7C_7(0.97)^7(0.03)^0$	B2
	${}^7C_0(0.03)^0(0.97)^7$ or ${}^7C_1(0.03)^1(0.97)^6$ OR ${}^7C_6(0.97)^6(0.03)^1$ or ${}^7C_7(0.97)^7(0.03)^0$	B1

6	$\frac{1}{p^3}$ $\frac{\pi}{p} = p^2\pi\left(\frac{\mathrm{d}h}{\mathrm{d}t}\right)$ $\frac{\mathrm{d}V}{\mathrm{d}h} = p^2\pi$ or $\frac{\mathrm{d}V}{\mathrm{d}t} = \frac{\pi}{p}$ Note: for V accept any symbol except h and t.	3 B2 B1
7	$y = -6x + 1$ gradient = -6 or $-5 = -6(1) + c$ OR $y - (-5) = -6(x - 1)$ $-9x^2 + 3$	3 B2 B1
8	$\frac{9}{5}$ // $1\frac{4}{5}$ // 1.8 $\left[\frac{3^2}{4} - \frac{0^2}{4}\right] - \frac{1}{4}\left[\frac{3^2 - 1}{3(3)+1} - \frac{0^2 - 1}{3(0)+1}\right]$ $\frac{x^2}{4}$ or $\frac{1}{4}\left(\frac{x^2 - 1}{3x + 1}\right)$	3 B2 B1
9	$\frac{1}{\sqrt{61}}\begin{pmatrix}5\\6\end{pmatrix}$ or $\frac{5i + 6j}{\sqrt{61}}$ $\begin{pmatrix}5\\6\end{pmatrix}$ or $\sqrt{61}$	2 B1
10	$\frac{5}{3}$ $\frac{1}{2} \times (3+4) \times 2 - \frac{16}{3}$ $\frac{1}{2} \times (3+4) \times 2$	3 B2 B1

11	$153.43°, 333.43°$ // $153°34', 333°34'$ $26.57°$ // $26°34'$ $\tan\theta = -\frac{1}{2}$	3 B2 B1
12	632.80 $\frac{1}{2}\pi(50)^2 - \frac{1}{2}(54)^2\left(\frac{\pi}{6}\right)$ $\frac{1}{2}\pi(50)^2$ or $\frac{1}{2}(54)^2\left(\frac{\pi}{6}\right)$ $30°$ or $\frac{\pi}{6}$	4 B3 B2 B1
13	$x^2 + y^2 - 2x - 12y + 12 = 0$ $\sqrt{(x-1)^2 + (y-6)^2} = 5$ OR $\left(\frac{y-10}{x+2}\right)\left(\frac{y-2}{x-4}\right) = -1$ $(1,6)$ or 5 seen OR $\frac{y-10}{x+2}$ or $\frac{y-2}{x-4}$	3 B2 B1
14	(a) $\overrightarrow{QR} = -2\overrightarrow{PQ}$ or equivalent $\overrightarrow{PQ} = -(3a+b)+2(a-b)$ and $\overrightarrow{QR} = -2(a-b)+4a+4b$ $\overrightarrow{PQ} = -(3a+b)+2(a-b)$ or $\overrightarrow{QR} = -2(a-b)+4a+4b$	3 B2 B1
	(b) No, the value of constant is -2 or $-\frac{1}{2}$	1
15	Two correct linear function One correct linear function e.g : $f(x) = 9x$, $f(x) = x + \frac{8}{3}$, $f(x) = 2x + \frac{7}{3}$, $f(x) = \frac{10}{3} - x$ or equivalent Note: Accept any correct linear function.	2 B1

16	$h=\dfrac{2k-3}{6}$ $k=\dfrac{6h+3}{2}$ OR $6=\dfrac{2k-3}{h}$ $f(6)=k$ OR $\dfrac{2x-3}{h}$	3 B2 B1
17	$x\le -2,\ x\ge \dfrac{1}{3}$  $(3x-1)(x+2)\ge 0$ or $(-3x+1)(x+2)\le 0$ or $(3x-1)(-x-2)\ge 0$ or $3x^2+5x-2\ge 0$ or $-3x^2-5x+2\le 0$ Note: Accept any symbol : $>,<,\ge,\le$ for B1 only.	3 B2 B1
18	$k=9$ $5=-(0-2)^2+k$ $h=2$ seen	3 B2 B1
19	$x^2-\dfrac{10}{3}x+\dfrac{4}{3}=0$ or equivalent $2\left(\dfrac{5}{3}\right)$ and $4\left(\dfrac{1}{3}\right)$ $p+q=\dfrac{-(-5)}{3}$ or $pq=\dfrac{1}{3}$	3 B2 B1

20	$-2<k<1$  or  or  $(2k)^2-4(1)(2-k)<0$	3 B2 B1
21	-1 $4^m=\frac{1}{4}$ $4^m\times 4$ or $4^m\times 4^2$	3 B2 B1
22	$\frac{p+2q}{2p}$ $\frac{\log_r 3+2\log_r 5}{2\log_r 3}$ OR $r^{p+2q}=r^{p(2y)}$ OR $\frac{(p+2q)\log_r r}{2\log_r 3}$ $\log_r 3+2\log_r 5$ OR $r^p\times r^{2q}=q^y$ OR $\frac{\log_r r^{p+2q}}{\log_r 9}$ $\log_r 5^2$ or $\log_r 3$ or $\log_r 3$ or $\log_a 8$ OR $75=q^y$ OR $3=r^p$ OR $5=r^q$ Note: (i) Award B1 for using any one law correctly (ii) Award B2 for using any two laws correctly (iii) y can any unknown except p, q, and r.	4 B3 B2 B1
23	126 $n=7$ OR $\frac{7}{2}\left[2(9)+(7-1)3\right]$ $140=\frac{n}{2}\left[2(9)+(n-1)3\right]$ $a+(5-1)(3)=21$	4 B3 B2 B1

	Alternative method	4
	126	B3
	$9 + 12 + 15 + 18 + 21 + 24 + 27$	B2
	$n = 7$	B1
	9, 12, 15, 18, 21, 24, 27	
	Note: Must list completely	
24	32	4
	$\frac{16}{1-\frac{1}{2}}$	B3
	$r = \frac{1}{2}$	B2
	$a\left(ar^7\right) = ar^3$	B1
25	$b = 100$ and $k = \frac{1}{4}$	3
	$\log_{10} b = 2$ or $2k(2) = 1$	B2
	$m = 2$ seen OR $\log_{10} y = x^2 \log_{10} b + 2k \log_{10} b$	B1