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 diagram 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 and normal distribution table is provided on pages 2 to 4.

8. A booklet of four-figure mathematical tables is provided.

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. \[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]
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. \[ \log_b a = \frac{\log_c a}{\log_c b} \]
9. \[ T_n = a + (n-1)d \]
10. \[ S_n = \frac{n}{2} [2a + (n-1)d] \]
11. \[ T_n = a r^{n-1} \]
12. \[ S_n = \frac{a(r^n - 1)}{r - 1}, \quad (r \neq 1) \]
13. \[ S_\infty = \frac{a}{1-r}, \quad |r| < 1 \]

**CALCULUS**

1. \[ y = uv, \quad \frac{dy}{dx} = u \frac{dy}{dx} + v \frac{du}{dx} \]
2. \[ y = \frac{u}{v}, \quad \frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}, \]
3. \[ \frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx} \]
4. Area under a curve
   \[ = \int_b^a y \, dx \text{ or } \int_a^b x \, dy \]
5. Volume generated
   \[ = \int_a^b \pi y^2 \, dx \text{ or } \int_a^b \pi x^2 \, dy \]

**GEOMETRY**

1. Distance \[ = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \]
2. Midpoint \[ \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) \]
3. \[ |r| = \sqrt{x^2 + y^2} \]
4. \[ r = \frac{\sqrt{x_1^2 + y_1^2}}{\sqrt{x_2^2 + y_2^2}} \]
5. A point dividing a segment of a line \[ (x, y) = \left( \frac{nx_1 + mx_2}{m+n}, \frac{ny_1 + my_2}{m+n} \right) \]
6. Area of triangle \[ = \frac{1}{2} \left| x_1(y_2 + y_3 + y_3y_1) - (x_2y_1 + x_3y_2 + x_4y_3) \right| \]
STATISTIC

1. $x = \frac{\sum x}{N}$

2. $\bar{x} = \frac{\sum fx}{\sum f}$

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

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

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

6. $I = \frac{P_1}{P_0} \times 100$

TRIGONOMETRY

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

2. Area of 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. $\csc^2 A = 1 + \cot^2 A$

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

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

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

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

14. Area of triangle $= \frac{1}{2} ab \sin C$
THE UPPER TAIL PROBABILITY $Q(z)$ FOR THE NORMAL DISTRIBUTION $N(0,1)$

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

\[
Q(z) = \int_{k}^{\infty} f(z) \, dz
\]

Example / Contoh:
If \(X \sim N(0, 1)\), then \(P(X > k) = Q(k)\)
Jika \(X \sim N(0, 1)\), maka \(P(X > k) = Q(k)\)
Section A
Bahagian A

[40 marks]
[40 markah]

Answer all questions.
Jawab semua soalan.

1 Solve the following simultaneous equations:
Selesaikan persamaan serentak berikut:

\[ 4x + 3y = x^2 - xy = 8 \]

Give your answer correct to 3 significant figures.
Beri jawapan betul kepada 3 angka bererti.

[5 marks]
[5 markah]

2 (a) Prove that \( \sin(2\theta + 90^\circ) = \cos 2\theta \)

Buktikan \( \sin(2\theta + 90^\circ) = \cos 2\theta \)

[2 marks]
[2 markah]

(b) i. Sketch the graph of \( y = 2\cos 2\theta \) for \( 0 \leq \theta \leq 2\pi \).
Lakar graf bagi \( y = 2\cos 2\theta \) untuk \( 0 \leq \theta \leq 2\pi \).

[3 marks]
[3 markah]

ii. Hence, using the same axes, sketch a suitable straight line to find the
number of solution for the equation \( \sin(2\theta + 90^\circ) = 1 - \frac{\theta}{\pi} \).
State the number of solutions.

Seterusnya, dengan menggunakan paksi yang sama, lakar satu garis
lurus yang sesuai untuk mencari bilangan penyelesaian bagi
persamaan \( \sin(2\theta + 90^\circ) = 1 - \frac{\theta}{\pi} \).
Nyatakan bilangan penyelesaian itu.

[3 marks]
[3 markah]
Ravi and Hamid were given a piece of wire each, it is to be bend into several parts successively as shown in Diagram 3.

The first part must be measured $A$ cm and every part should be shortened by $D$ cm respectively.

Ravi’s wire which is 720 cm was bent exactly into 10 parts and Hamid’s which is 1040 cm was bent exactly 20 parts.

(b) the difference of the length of the last part of the both wire.

$$\text{beza di antara panjang bahagian terakhir bagi kedua-dua dawai tersebut.}$$
4. Diagram 4 shows the straight line \( y = x + 9 \) intersecting the curve \( y = (x - 3)^2 \) at points \( M \) and \( N(7,16) \).

\[ \text{Rajah 4 menunjukkan garis lurus } y = x + 9 \text{ bersilang dengan lengkung } y = (x - 3)^2 \text{ pada titik-titik } M \text{ dan } N(7,16). \]

**Diagram 4**

\[ \text{Rajah 4} \]

Find

Cari

(a) the area of the shaded region \( K \),

\[ \text{luas rantau berlorek } K, \] [4 marks]

(b) the volume generated when the shaded region \( A \) is rotated through 360° about \( x \)-axis.

\[ \text{isipadu janaan apabila rantau berlorek } A \text{ diputarkan } 360^\circ \text{ pada paksi-x.} \] [3 markah]
5. Solution by scale drawing will **not** be accepted.
*Penyelesaian secara lukisan berskala **tidak** akan diterima.*

Diagram 5 shows quadrilateral \( PQRS \).
*Rajah 5 menunjukkan sisi empat \( PQRS \).*

![Diagram 5](image.png)

Given that the coordinates of point \( P(-3, 3) \) and point \( S(2, 6) \).
*Diberi bahawa koordinat bagi titik \( P(-3, 3) \) dan titik \( S(2, 6) \).*

(a) Find the equation of \( PQ \),
*Cari persamaan garis lurus \( PQ \),*  
[3 marks]

(b) A point \( W \) moves such that its distance from point \( Q \) is always twice its distance from point \( S \). Find the equation of the locus of point \( W \).
*Titik \( W \) bergerak dengan keadaan jaraknya dari titik \( Q \) adalah sentiasa dua kali jaraknya dari titik \( S \). Cari persamaan lokus bagi \( W \).*  
[4 marks]
6. Table 6 shows the marks obtained by a group of students in a class.

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<td>85 – 99</td>
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Table 6
Jadual 6

(a) Given that the median mark of a student is \(60 - \frac{7}{26}\), find the value of \(k\)

Diberi markah median pelajar ialah \(60 - \frac{7}{26}\), cari nilai bagi \(k\)

[3 marks]

(b) Calculate the standard deviation of the distribution.

\[ \text{Kira sisihan piawai taburan tersebut.} \]

[3 marks]

(c) If each marks of the students in the class is multiplied by 2 and then subtracted by 3. For the new set of marks, find the standard deviation.

\[ \text{Jika setiap markah pelajar dalam kelas didarab dengan 2 dan kemudian ditolak dengan 3. Bagi set baru markah, cari sisihan piawai.} \]

[1 mark]
[1 markah]
Section B  
Bahagian B

[40 marks]  
[40 markah]

Answer any four questions from this section.  
Jawab mana-mana empat soalan daripada bahagian ini.

7 Use graph paper to answer this questions.  
Gunakan kertas graf untuk menjawab soalan ini.

Table 7 shows the values of two variables $x$ and $y$ obtained from an experiment. Variable $x$ and $y$ are related by equation $y = pk^x$, where $k$ and $p$ are constants.

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Table 7  
Jadual 7

(a) Plot $\log_{10} y$ against $x^2$, using a scale of 2 cm to 0.2 unit on both axes.  
Hence, draw the line of best fit.  

Plot $\log_{10} y$ melawan $x^2$, dengan menggunakan skala 2 cm mewakili 0.2 unit pada kedua-dua paksi.  
Seterusnya, lukis garis lurus penyuaian terbaik.  

[6 marks]  
[6 markah]

(b) Use your graph in 7(a) to find the value of  
Gunakan graf anda di 7(a) untuk mencari nilai

(i) $k$  
(ii) $p$  
(iii) $x$ when $y = 10$  
$x$ apabila $y = 10$

[4 marks]  
[4 markah]
8. (a) Given that the equation of the curve \( y = 3x^2 + 4x - 2 \) is passing through point \((-1,3)\).

Diberi bahawa persamaan lengkung \( y = 3x^2 + 4x - 2 \) melalui titik \((-1,3)\).

Find

Cari

(i) the equation of normal to the curve at point \((-1,3)\).  

\[ \text{persamaan normal kepada lengkung pada titik } (-1,3). \]  

[3 marks]

(ii) the approximate value in \( y \), when \( x \) decrease from 2 to 1.99.

\[ \text{nilai hampir bagi } y, \text{ apabila } x \text{ menyusut dari 2 kepada 1.99.} \]  

[3 markah]

(b) Given that the gradient function of a curve \( \frac{8 - x^3}{2x^5} \) which has a turning point at \((p,3)\).

Diberi bahawa fungsi kecerunan kepada lengkung \( \frac{8 - x^3}{2x^5} \) yang mempunyai titik pusingan pada titik \((p,3)\).

Find

Cari

(i) the value of \( p \)

\[ \text{nilai } p. \]  

[3 marks]

(ii) the equation of the curve.

\[ \text{persamaan lengkung itu.} \]  

[4 markah]
9. Diagram 10 shows triangles $OAB$ and $APR$.
Rajah 10 menunjukkan segi tiga $OAB$ dan $APR$.

![Diagram 10](https://example.com/diagram10.png)

OPA, OQB, PQR and ABR are straight lines.
OPA, OQB, PQR dan ABR ialah garislurus.

Given $\overrightarrow{OA} = a$, $\overrightarrow{OB} = 2b$, $3\overrightarrow{OP} = \overrightarrow{OA}$ and $2\overrightarrow{OQ} = \overrightarrow{OB}$.

(a) Express each of the following vectors in terms of $a$ and/or $b$.
Ungkapkan dalam sebutan $a$ dan/ atau $b$.

(i) $\overrightarrow{AB}$
(ii) $\overrightarrow{PQ}$

[3 marks]
[3 markah]

(b) Given $\overrightarrow{AR} = m\overrightarrow{AB}$ and $\overrightarrow{QR} = n\overrightarrow{PQ}$, where $m$ and $n$ are constants.
Diberi $\overrightarrow{AR} = m\overrightarrow{AB}$ dan $\overrightarrow{QR} = n\overrightarrow{PQ}$, dengan keadaan $m$ dan $n$ ialah pemalar.
Express $\overrightarrow{OR}$ in terms of
Ungkapkan $\overrightarrow{OR}$ dalam sebutan

(i) $m$, $a$ and $b$,
$m$, $a$ dan $b$,

(ii) $n$, $a$ and $b$.
$n$, $a$ dan $b$.

[4 marks]
[4 markah]

(c) Hence, find the value of $m$ and of $n$.
Seterusnya, cari nilai $m$ dan nilai $n$.

[3 marks]
[3 markah]
10 (a) At SMK Bandar Baru, 30 out of 120 form 4 students cycle to school. If 10 students are chosen at random, calculate the probability that

\begin{align*}
\text{Di SMK Bandar Baru, 30 daripada 120 orang pelajar tingkatan 4 mengayuh basikal ke sekolah. Jika 10 orang pelajar dipilih secara rawak, hitung kebarangkalian bahawa} \\
\text{(i) exactly 2 of them cycle to school} \\
\text{tepat 2 orang pelajar mengayuh basikal ke sekolah.} \\
\text{(ii) more than 2 students cycle to school} \\
\text{lebih daripada 2 orang pelajar mengayuh basikal ke sekolah.} \\
\end{align*}

[4 marks]

(b) In a fresh water fish pond, the weight of one type of fish is normally distributed with a mean of 1.0 kg and a standard deviation of 0.3 kg.

\begin{align*}
\text{Dalam sebuah kolam ikan air tawar, berat sejenis ikan adalah tertabur secara normal dengan min 1.0 kg dan sisihan piawai 0.3 kg.} \\
\text{(i) Find the probability of a fish chosen randomly which is less than 0.8 kg.} \\
\text{Cari kebarangkalian bahawa seekor ikan yang dipilih secara rawak mempunyai berat kurang daripada 0.8 kg.} \\
\text{(ii) If there are 100 fish which has weight less than 0.8 kg, find the total number of fish in the pond.} \\
\text{Jika terdapat 100 ekor ikan yang mempunyai berat kurang daripada 0.8 kg, cari jumlah ikan di dalam kolam itu.} \\
\text{(iii) Given that 20\% of the fish has the weight more than m kg. Find the value of m.} \\
\text{Diberi bahawa 20\% daripada ikan tersebut mempunyai berat lebih daripada m kg. Cari nilai bagi m.} \\
\end{align*}

[6 marks]
Diagram 11 shows a semicircle $ABE$ and a sector $OCD$, with centre $O$.

Given that the length of $AE = 16$ cm and $OB : BC = 2 : 1$.

Given bahawa panjang $AE = 16$ cm dan $OB : BC = 2 : 1$.

[Use $\pi = 3.142$]

[Guna $\pi = 3.142$]

Calculate

Hitung

(a) $\theta$, in radian.

$\theta$, dalam radian.

[3 marks]

(b) the area, in cm$^2$, of the shaded region,

luas, dalam cm$^2$, bagi kawasan berlorek.

[3 marks]

(c) perimeter, in cm, for the whole diagram.

perimeter, dalam cm, untuk seluruh rajah.

[4 marks]
Section C  
Bahagian C

[20 marks]  
[20 markah]

Answer any two questions from this section.  
Jawab mana-mana dua soalan daripada bahagian ini.

12. A particle moves along a straight line from a fixed point O, which situated 3 meter on the right of point O. Its velocity, \( V \) \( ms^{-1} \) is given by \( v = t^2 - 8t + 12 \), where \( t \) is the time in seconds, after leaving O.

Suatu zarah bergerak disepanjang suatu garis lurus daripada satu titik tetap O yang berada 3 meter di kanan O. Halajunya. \( V \) \( ms^{-1} \) diberi oleh \( v = t^2 - 8t + 12 \), dengan keadaan t ialah masa dalam saat selepas melalui O.

[Assume motion to the right is positive]  
[Anggapkan gerakan ke arah kanan sebagai positif]

Find  
Cari

(a) (i) the minimum velocity,  
halaju minimum,  
[2 marks]  
[2 markah]

(ii) the range of values of \( t \) when the particle moving to the left,  
julat nilai \( t \) apabila zarah bergerak ke kiri,  
[3 marks]  
[3 markah]

(b) Sketch the velocity-time graph for \( 0 \leq t \leq 5 \).  
Hence or otherwise calculate the total distance travelled during the first 5 seconds after leaving O.

Lakarkan graf halaju-masa untuk \( 0 \leq t \leq 5 \).  
Seterusnya atau dengan cara lain hitung jumlah jarak yang dilalui dalam 5 saat yang pertama selepas melalui O.  
[5 marks]  
[5 markah]
Diagram 13 shows two triangles $ACD$ and $DBC$, where $AEC$ and $BED$ are straight lines.

$\text{Rajah 13 menunjukkan segitiga } ACD \text{ dan } DBC \text{ di mana } AEC \text{ dan } BED \text{ adalah garis lurus.}$

Given that $AE = 5 \text{ cm}$, $AD = 4 \text{ cm}$, $EC = 8 \text{ cm}$, $\angle ADE = 38^0$, and $\angle DEC$ is an obtuse angle.

$\text{Diberi bahawa } AE = 5 \text{ cm}, \ AD = 4 \text{ cm}, \ EC = 8 \text{ cm}, \ \angle ADE = 38^0, \ \text{dan } \angle DEC \text{ ialah sudut cakah.}$

Calculate

$\text{Kira}$

(a) $\quad (i) \ \angle DEC \quad \text{[3 marks]}$  

$\quad (ii) \ \text{the length of } DC \quad \text{[3 marks]}$  

$\quad (iii) \ \text{the area of the triangle } ADC. \quad \text{[2 marks]}$

(b) Sketch triangle $C'B'D'$ which has a different shape from triangle $CBD$ such that $D'C' = DC$, $B'C' = BC$ and $\angle C'D'B' = \angle CDB$.  

$\text{Lakar segitiga } C'B'D' \text{ yang mempunyai bentuk yang berlainan dengan segitiga } CBD \text{ dengan keadaan } D'C' = DC, \ B'C' = BC \text{ dan } \angle C'D'B' = \angle CDB. \quad \text{[2 markah]}$
14. Use the graph paper provided to answer this question.
*Gunakan kertas graf yang disediakan untuk menjawab soalan ini.*

Mr. Ridhuan intends to plant banana trees and papaya trees on a piece of 80 hectares land. He employed 360 labours and allocated a capital of at least RM 24 000. Mr. Ridhuan used \( x \) hectares of land to plant banana trees and \( y \) hectares to plant papaya trees. Each hectare of banana trees farm is supervised by 3 labours while each hectare of papaya trees farm is supervised by 6 labours. The cost of consumption for a hectare of banana trees farm are RM 800 and a hectare of papaya trees farm are RM 300.

*En. Ridhuan ingin menanam pokok pisang dan pokok betik di atas sebidang tanah seluas 80 hektar. Dia mempunyai 360 orang tenaga pekerja dan modal sekurang-kurangnya RM 24 000. En. Ridhuan menggunakan \( x \) hektar tanah untuk menanam pokok pisang dan \( y \) hektar tanah untuk menanam pokok betik. Setiap hektar ladang pokok pisang diselia oleh tiga orang pekerja sementara enam orang pekerja untuk setiap hektar ladang pokok betik. Kos perbelanjaan untuk sehektar ladang pokok pisang ialah RM 800 dan sehektar ladang pokok betik ialah RM 300.*

(a) State three inequalities, other than \( x \geq 0 \) and \( y \geq 0 \) which satisfy the above conditions.

*Nyatakan tiga ketaksamaan selain \( x \geq 0 \) dan \( y \geq 0 \) yang memuaskan syarat-syarat di atas.*

[3 marks]

(b) Using the scale of 2 cm to 10 hectares on both axes, draw and shade a region \( R \) which satisfies all of the above conditions.

*Dengan menggunakan skala 2 cm kepada 10 hektar pada kedua-dua paksi, lukis dan lorekkan rantau \( R \) yang memuaskan semua syarat-syarat di atas.*

[3 marks]

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

*Berdasarkan graf anda, jawab soalan-soalan berikut :*

(i) If the area of land allocated for planting banana trees is twice the land for papaya trees, find the maximum area of land for each type of fruit. If the area of land allocated for planting banana trees is twice the land for papaya trees, find the maximum area of land for each type of fruit.

*Jika luas kawasan tanah untuk menanam pokok pisang adalah 2 kali luas kawasan tanah untuk menanam pokok betik, cari keluasan maksimum tanah yang digunakan untuk menanam setiap tanaman.*

(ii) The profit gained by selling bananas are RM 700 and by selling papayas are RM 250 for each hectare. Find the minimum profit gained.

*Keuntungan hasil jualan pisang ialah RM 700 dan hasil jualan betik ialah RM 250 bagi setiap hektar. Cari keuntungan minimum yang diperolehi.*

[4 marks]
15. Table 15 shows the price indices of the monthly expenditures for Muhammad's family in the year 2000 based on the year 1996, the change in price index from the year 2000 to the year 2004 and the percentage of expenditure respectively.


<table>
<thead>
<tr>
<th>Expenditure</th>
<th>Price index in the year 2000</th>
<th>Change of price index from the year 2000 to the year 2004</th>
<th>Percentage of expenditure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>110</td>
<td>Increased 15 %</td>
<td>x</td>
</tr>
<tr>
<td>Q</td>
<td>120</td>
<td>Decreased 10 %</td>
<td>30</td>
</tr>
<tr>
<td>R</td>
<td>125</td>
<td>Unchanged</td>
<td>y</td>
</tr>
<tr>
<td>S</td>
<td>150</td>
<td>Unchanged</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 15

(a) Calculate the expenditure of item P in the year 1996 if its expenditure in the year 2000 is RM 150.65.


[2 marks]

(b) The composite index number in the year 2000 based on the year 1996 is 121.25.

Nombor indeks gubahan pada tahun 2000 berasaskan tahun 1996 ialah 121.25.

Calculate

Hitungkan

(i) the value of x and of y,

nilai x dan nilai y,

(ii) the total monthly expenditure in the year 2000 if the total monthly expenditure for Muhammad's family in the year 1996 is RM 260.


[5 marks]

(c) Find the composite index number in the year 2004 based on the year 1996.

Cari nombor indeks gubahan pada tahun 2004 berasaskan tahun 1996.

[3 marks]
BAHAGIAN PENGURUSAN
SEKOLAH BERASRAMA PENUH DAN SEKOLAH KECEMERLANGAN
KEMENTERIAN PELAJARAN MALAYSIA

PEPERIKSAAN PERCUBAAN
SIJIL PELAJARAN MALAYSIA 2011
TINGKATAN 5

ADDITIONAL MATHEMATICS

Paper 2

MARKING SCHEME

Skema Pemarkahan ini mengandungi 9 halaman bercetak

1

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### Solution and Mark Scheme

<table>
<thead>
<tr>
<th>No</th>
<th>Solution</th>
<th>Sub Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( y = \frac{8 - 4x}{3} ) or ( x = \frac{8 - 3y}{4} )</td>
<td>P1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>( x^2 - x\left(\frac{8 - 4x}{3}\right) = 8 ) or ( \left(\frac{8 - 3y}{4}\right)^2 - \left(\frac{8 - 3y}{4}\right) y = 8 )</td>
<td>K1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>( 7x^2 - 8x - 24 = 0 ) or ( 21y^2 - 80y - 64 = 0 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>( x = \frac{(-8) \pm \sqrt{(-8)^2 - 4(7)(-24)}}{2(7)} ) or ( y = \frac{(-80) \pm \sqrt{(-80)^2 - 4(21)(-64)}}{2(21)} )</td>
<td>K1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( x = 2.51, -1.37 ) OR ( y = 4.49, -0.679 )</td>
<td>N1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>( y = -0.680, 4.49 ) ( x = -1.37, 2.51 )</td>
<td>N1</td>
<td></td>
</tr>
</tbody>
</table>

| 2  | (a) \((\sin 2\theta \cos 90^\circ + \cos 2\theta \sin 90^\circ)\) | K1        | 2           |
|    | \( \cos 2\theta \) | N1        |             |
|    | (b) i) \( y = 2\cos 2\theta \) N1-cosine curve | N1        |             |
|    | N1-amplitude | N1-2 cycle |             |
|    | ii) \( y = 2 - \frac{2\theta}{\pi} \) K1-straight line | K1        |             |
|    | Number of solutions = 4 | N1        |             |

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### 3

(a) \( a = A, d = -D \)

\[
S_{10} = \frac{10}{2} [2A + 99(-D)] = 720 \quad \text{or} \quad S_{20} = \frac{20}{2} [2A + 19(-D)] = 1040
\]

Solving the simultaneous in linear equation

\[
\begin{align*}
A &= 90 & \text{or} & D &= 4 \\
A &= 90 & \text{and} & D &= 4
\end{align*}
\]

(b) \( T_{10} = 90 + 9(-4) \quad \text{or} \quad T_{20} = 90 + 19(-4) \)

Difference = 40

### 4

(a) Area of trapezium – area under curve

\[
\begin{align*}
\int_{0}^{7} (x + 9) \, dx & \quad \text{or} \quad \frac{1}{2} (16 + 9)(7) \quad \text{OR} \quad \int_{0}^{7} (x - 3)^2 \, dx \quad \text{K1} \\
\left[ \frac{x^2}{2} + 9x \right]_{0}^{7} & \quad \text{OR} \quad \left[ \frac{(x - 3)^3}{3} \right]_{0}^{7} \quad \text{K1}
\end{align*}
\]

\[
\begin{align*}
\frac{175}{2} &= \frac{91}{3} \quad \text{K1} \\
\frac{343}{6} \text{unit}^2 &= \frac{57\frac{1}{6}}{6} \text{unit}^2 \quad \text{N1}
\end{align*}
\]

(b) \( y = 0, \ x = 3 \quad \text{OR} \quad \pi \int_{0}^{3} [(x - 3)^2]^2 \, dx \quad \text{K1} \)

\[
\begin{align*}
\pi \left[ \frac{(x - 3)^5}{5} \right]_{0}^{3} \quad \text{K1} \\
\frac{243}{5} \pi \text{ unit}^3 &= \pi \text{ unit}^3 \quad \text{N1}
\end{align*}
\]
<table>
<thead>
<tr>
<th>5(a)</th>
<th>( m_{PQ} = -\frac{5}{3} )</th>
<th>K1</th>
<th>3</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( y - 3 = -\frac{5}{3}(x + 3) )</td>
<td>K1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>( 3y = -5x - 6 )</td>
<td>N1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b)</td>
<td>( Q(0, -2) )</td>
<td>P1</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>( \sqrt{(x-0)^2 + (y+2)^2} \ or \ \sqrt{(x-2)^2 + (y-6)^2} )</td>
<td>K1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>( \sqrt{(x-0)^2 + (y+2)^2} = 2\sqrt{(x-2)^2 + (y-6)^2} )</td>
<td>K1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>( 3x^2 + 3y^2 - 16x - 52y + 156 = 0 )</td>
<td>N1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6(a)</td>
<td>( L = 54.5 \ OR \ 25 \ and \ k )</td>
<td>P1</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>( 60 \frac{7}{26} = 54.5 + \left(\frac{47+k}{2} - \frac{25}{k}\right) \frac{15}{15} )</td>
<td>K1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>( k = 13 )</td>
<td>N1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b)</td>
<td>Mean, ( x = \frac{3563}{60} )</td>
<td>P1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( \sigma = \sqrt{\frac{232 755}{60} - \left(\frac{3563}{60}\right)^2} )</td>
<td>K1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>= 18.79</td>
<td>N1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c)</td>
<td>( 37.58 )</td>
<td>N1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

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### 8(a)

- **(i)** \( \frac{dy}{dx} = 6x + 4 \)
  - \( m_{normal} = \frac{1}{2} \)
  - \( 2y = x + 7 \) or equivalent
  - \( (ii) \delta y = (16)(-0.01) \)
  - \( y_{new} = \left(3(2)^2 + 4(2) - 2\right) + (\delta y) \)
  - \( 17.84 \)

### 8(b)

- **(i)** \( \frac{8-x^3}{2x^5} = 0 \)
  - \( p = 2 \)
  - \( (ii) y = -\frac{1}{x^4} + \frac{1}{2x} + c \)
  - \( y = -\frac{1}{x^4} + \frac{1}{2x} + \frac{45}{16} \)

### 9(a)

- **(i)** \(-a + 2b\)
  - \( (ii) -\frac{1}{3} \vec{OA} + \frac{1}{2} \vec{OB} \)
  - \(-\frac{1}{3}a + b\)

### 9(b)

- **(i)** \( a + m(-a + 2b) \)
  - \( (1-m)a + 2mb \)
  - **(ii)** \( b + n(-\frac{1}{3}a + b) \)
  - \(-\frac{1}{3}na + (1+n)b \)
(c) \[ 2m = 1 + m \quad \text{or} \quad 1 - m = -\frac{1}{3}n \]
Solve the simultaneous linear equation
\[ m = 2, \quad n = 3 \quad \text{(Both correct)} \]

10(a)

(i) \[ P(x = 2) = \binom{10}{2}(0.25)^2(0.75)^8 \]
\[ = 0.2186 \]

(ii) \[ P(x > 2) = 1 - P(x = 0) - P(x = 1) - P(x = 2) \]
\[ = 1 - \binom{10}{0}(0.25)^0(0.75)^{10} - \binom{10}{1}(0.25)^1(0.75)^9 - 0.2186 \]
\[ = 0.4744 \]

(b)

(i) \[ P(x < 0.8) = P(z < \frac{0.8 - 1}{0.3}) \]
\[ = P(z < -0.667) \]
\[ = 0.2524 \]

(ii) Total \[ = \frac{100}{0.2524} \]
\[ = 396 \]

(iii) \[ P(x > m) = 0.2 \]
\[ Z = 0.842 \]
\[ 0.842 = \frac{m-1.0}{0.3} \]
\[ m = 1.253 \text{ kg} \]

11(a)

BC = 4, OC = 12
\[ \cos \theta = \frac{8}{12} \]
\[ \theta = 0.8411 \text{ rad} \]

(b)
Area shaded = Area triangle OCE – Area sector OBE
\[ = \frac{1}{2}(8)(12)\sin 0.8411 - \frac{1}{2}(8)^2(0.8411) \]
\[ = 8.863 \text{ cm}^2 \]
| (c) | \[ \text{OR Area shaded} = \frac{1}{2} (8)(\sqrt{80}) - \frac{1}{2} (8)^2 (0.8411) \]  
\[ = 8.863 \]  
\[ \angle AOB = 2.3009 \text{ rad} \]  
\[ \text{Perimeter} = \text{arc AB} + \text{BC} + \text{arc CD} + \text{AE} + \text{ED} \]  
\[ = 8(2.3009) + 4 + 12(0.8411) + 16 + 4 \]  
\[ = 52.50 \text{ cm} \] |
|---|---|
| 12(a) | \( (i) \)  
\[ 2t - 8 = 0 \]  
\[ t = 4 \]  
\[ V = -4 \]  
\( \text{K1} \)  
\( \text{N1} \) |
| 12(a) | \( (ii) \)  
\[ t^2 - 8t + 12 < 0 \]  
\[ (t - 2)(t - 6) < 0 \]  
\[ 2 < t < 6 \]  
\( \text{K1} \)  
\( \text{N1} \) |
| (b) |  
\[ \text{P1-shape} \]  
\[ \text{P1-passing through point} \]  
\[ (0,12), (2,0) \text{ and } (5,-3) \]  
| Total distance =  
\[ = \int_0^2 v \, dt + \left| \int_2^5 v \, dt \right| \]  
\[ = \frac{32}{3} + \left| \left( \frac{5}{3} - \frac{32}{2} \right) \right| \]  
\[ = \frac{59}{3} \text{ meter} \]  
\( \text{K1} \)  
\( \text{OR} \)  
\[ t = 0 \text{,} s = 3 \]  
\( \text{K1} \)  
\[ t = 2 \text{,} s = 13 \frac{2}{3} \]  
\( \text{K1} \)  
\[ t = 5 \text{,} s = 4 \frac{2}{3} \]  
\( \text{K1} \)  
\[ = \frac{59}{3} \text{ meter} \]  
\( \text{N1} \)  
\[ = \frac{59}{3} \text{ meter} \]  
\( \text{N1} \) |
### Question 13(a)

#### (i)
\[
\sin \angle DEA = \frac{4 \sin 38}{5}
\]
\[
\angle DEA = 29.507^\circ
\]
\[
\angle DEC = 150.493^\circ
\]

#### (ii)
\[
\angle DAE = 180 - 38 - 29.507 = 112.493^\circ
\]
\[
DC^2 = 4^2 + 13^2 - 2(4)(13)\cos 112.49^\circ
\]
\[
DC = 14.99
\]

#### (iii)
Area of ADC = \[\text{Area} = \frac{1}{2} \times 4 \times 13 \times \sin 112.49^\circ = 24.02\]

### Question 14

#### (a)
\[
x + y \leq 80
\]
\[
3x + 6y \leq 360 \text{ or equivalent}
\]
\[
800x + 300y \geq 24000 \text{ or equivalent}
\]

#### (b)
Refer graph

#### (c) 

##### (i)
Draw \(x = 2y\)

\[
x = 52, \ y = 26
\]

##### (ii)
\[
K_{\text{min}} = 700(10) + 250(54)
\]
\[
\text{(substituted the point in } R) = RM \ 20500
\]
(a) \[ p_{96} = \frac{150.65}{110} \times 100 = RM136.95 \]

(b) (i) \( x + y = 55 \)

\[
\frac{110x + 120(30) + 125y + 150(15)}{100} = 121.25
\]

\[
15y = 225 \quad \text{(Solve simultaneous equation)}
\]

\[ y = 15 \), \( x = 40 \) (both) \]

(ii) \[ p_{2000} = \frac{260}{100} \times 121.25 = RM315.25 \]

(c) \[ I_{2004}^{1996} = \frac{126.50(40) + 108(30) + 125(15) + 150(15)}{100} \]

\[ 126.50, 108, 125, 150 \quad (I_{2004}^{1996} \text{ for every item}) \]

\[ = 124.25 \]
(b) one straight line drawn correctly \( K1 \)
all straight line drawn correctly \( K1 \)
Region \( R \) shaded \( N1 \)
No. 7(a)

<table>
<thead>
<tr>
<th>$x^2$</th>
<th>0.25</th>
<th>0.49</th>
<th>0.81</th>
<th>1.0</th>
<th>1.44</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\log_{10} y$</td>
<td>0.602</td>
<td>0.845</td>
<td>1.114</td>
<td>1.301</td>
<td>1.699</td>
</tr>
</tbody>
</table>

$\log_{10} y = \log_{10} p + x^2 \log_{10} k$  \hspace{1cm} \text{P1}

Plot $\log_{10} y$ against $x^2$  \hspace{1cm} \text{K1}

5 points plotted correctly  \hspace{1cm} \text{K1}

Line of best fit  \hspace{1cm} \text{N1}

\[ \log_{10} k = 0.901 \]  \hspace{1cm} \text{i.} \hspace{1cm} \text{K1}

\[ \log_{10} p = 0.4 \]  \hspace{1cm} \text{ii.} \hspace{1cm} \text{K1}

\[ k = 7.962 \]  \hspace{1cm} \text{N1}

\[ p = 2.51 \]  \hspace{1cm} \text{N1}

\[ x = 0.8124 \]  \hspace{1cm} \text{iii.} \hspace{1cm} \text{N1}

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