JANGAN BUKA KERTAS PEPERIKSAAN SEHINGGA DIBERITAHU

1. Tulis nama dan kelas anda pada petak yang disediakan.

2. Kertas peperiksaan ini adalah dalam Bahasa Inggeris.

3. Calon dibenarkan menjawab keseluruhan atau sebahagian soalan sama ada dalam bahasa Inggeris atau bahasa Melayu.


<table>
<thead>
<tr>
<th>Bahagian</th>
<th>Soalan</th>
<th>Markah Penuh</th>
<th>Markah Diperoleh</th>
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</table>

Disahkan oleh:

(MOHAMAD SYAMIM)
Guru Akademik
St. John’s Institution

Disemak oleh:

(LEE CHEE SENG)
Ketua Panitia Matematik
St. John’s Institution

Kertas peperiksaan ini mengandungi 26 halaman bercetak dan 0 halaman tidak bercetak.
Section A

[52 marks]

Answer all questions in this section.

1. The Venn diagram in the answer space shows sets \( P, Q \) and \( R \) such that the universal set \( \xi = P \cup Q \cup R \).

On the diagram in the answer space, shade the set

a) \( P \cap R \)

b) \( Q \cup (P' \cap R) \)

[3 marks]

Answer :

a) 

b) 

[Diagram of Venn diagrams showing intersections and unions.]

A paper plane is thrown at the height of 1m from the ground. The paper plane creates a curve path, \( h = -2t^2 + 7t - 2 \). When will the paper plane been caught 1m from the ground?

Answer:
3 Diagram 3 shows the base of a swimming pool.

The difference between the length and its width is 10m.
The perimeter of the base is 36m.
What is the length and the width of the swimming pool?

Answer: [4 marks]
Diagram 4 shows a right prism with a uniform cross section in the shape of right-angled triangle \( RST \). \( M \) is a midpoint of \( ST \).

Diagram 4

a) Name the angle between line \( HM \) and the plane \( RST \).

b) Hence, calculate the angle between the line \( HM \) and the plane \( RST \).

[4 marks]

Answer:
5 A gold cone is melted to produce 3 identical gold spheres.
Given that the radius of the gold cone is 7cm and its height is 14cm.

Find the radius, in cm for each of the sphere.

Answer:
6. Diagram 6 shows two parallel lines, \( OP \) and \( QR \).

Straight line \( PR \) is parallel to \( x \)-axis and \( O \) is origin.

Given the gradient of \( OP \) is \( \frac{3}{4} \).

![Diagram 6](image)

(a) Find the equation of straight line \( PR \).

(b) Find the equation of straight line \( QR \).

Find the \( y \)-intercept of straight line \( QR \).

Answer:

(a)

(b)
7  a) State whether the following statement is true or false.
   Some multiples of 3 is divisible by 2

   b) Write down the converse of the following implication.
      Hence, state whether the converse is true or false.
      \[\text{If } x^2 = 125, \text{ then } x = 5\]

   c) Area of a trapezium with the sum of its parallel line is 24cm and its height, \(h\) is
      \[\frac{1}{2}(24)(h)\].
      Make one conclusion by deduction for the area of trapezium with the same sum
      of parallel lines and the height is 7cm.

      Answer:
      a)
      b)
      c)
It is given matrix \( A = \begin{pmatrix} 5 & -3 \\ -2 & 4 \end{pmatrix} \).

Find the inverse matrix of \( A \).

b) Write the following simultaneous linear equation as matrix equation:

\[
5x - 3y = 11 \\
-2x + 4y = -10
\]

Hence, by using matrix method, calculate the value of \( x \) and \( y \). [6 marks]

Answer:

a) 

b)
Tony Stark wanted to build an arc reactor. The plan of the arc reactor is as shown in Diagram 9.

It is noted that an equilateral triangle can exactly fit into the circle. The length of the triangle is 12.12 cm and the diameter of the circle is 14 cm.

Diagram 9

Using $\pi = \frac{22}{7}$, calculate:

a) the perimeter, in cm, of the shaded region.

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

Answer:

a) 

b) 

[6 marks]
10 Diagram 10 shows nine labelled cards in two boxes.

A card is picked at random from each of the boxes.
By listing the outcomes, find the probability that
a) both cards are labelled with a number,
b) one card is labelled with a number and the other card is labelled with a letter.

[5 mark]

Answer:

a) 

b) 

Diagram 11 shows a speed-time graph for the movement of a photon for a period of 40 seconds.

Speed (ms\(^{-1}\))

Diagram 11

The total distance travelled by the photon is 380m.

a) Find the average speed in ms\(^{-1}\) of the photon for the period of 40 seconds.

b) Calculate the rate of change of speed, in ms\(^{-2}\), of the photon in the last 10 seconds.

c) Calculate the value of t.

Answer:

a)

b)

c)
Section B

[48 marks]

Answer any four questions from this section.

12

a) Complete Table 12 in the answer space on page 16 for the equation \( y = -\frac{10}{x} \) by writing down the values of \( y \) when \( x = -2.5 \) and \( x = 1.6 \).

[2 marks]

b) For this part of the question, use the graph paper provided. You may use a flexible curve ruler.

By using a scale of 2 cm to 1 unit on the \( x \)-axis and 2 cm to 2 units on the \( y \)-axis, draw the graph of \( y = -\frac{10}{x} \) for \(-4 \leq x \leq 4\).

[4 marks]

c) From the graph in 12(b), find

i) the value of \( y \) when \( x = -2.9 \)

ii) the value of \( x \) when \( y = -7.8 \)

[2 marks]

d) Draw a suitable straight line on the graph in 12(b) to find the values of \( x \) which satisfy the equation \( -\frac{10}{x} + 2x - 4 = 0 \) for \(-4 \leq x \leq 4\).

[4 marks]

Answer:

a) \( y = -\frac{10}{x} \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-4</th>
<th>-2.5</th>
<th>-2</th>
<th>-1</th>
<th>1</th>
<th>1.6</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>2.5</td>
<td>5</td>
<td>10</td>
<td>-10</td>
<td></td>
<td>-5</td>
<td>-2.5</td>
<td></td>
</tr>
</tbody>
</table>

b) Refer graph

c) i) \( y = \ldots \)

ii) \( x = \ldots \)

d) \( x = \ldots \)
13 (a) Diagram 13(i) shows the point (2,4) and the straight line $y = x$ drawn on a Cartesian plane.

![Diagram 13(i)](image1)

Transformation $T$ is a translation $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$. Transformation $U$ is a reflection in the line $y = x$. State the coordinates of the image of point (2,4) under each of the following transformations:

(i) $T^2$

(ii) $TU$

[3 marks]

(b) Diagram 13(ii) shows pentagons $ABCDE$, $OKRSU$ and $JKLMN$ drawn on a Cartesian plane.

![Diagram 13(ii)](image2)
(i) JKLMP is the image of ABCDE under the combined transformation WV. Describe in full, the transformation:
   a) V
   b) W

(ii) Given the pentagon ABCDE represents a region of 60cm². Calculate the area, in cm², of the shaded region.

Answer:
   a) i)
   ii)
   b) i) a) 
   b) 
   ii)
Diagram 14 shows an ogive which represent the time taken by 100 students from their house to St. John’s Institution.

Diagram 14

a) Based on diagram 14, complete the Table 14 in the answer space on page 20.

b) Calculate the estimated mean.

[4 marks]

[3 marks]

c) For this part of the question, use the graph paper provided.

By using a scale of 2 cm to 5 minutes on the horizontal axis and 2 cm to 2 students on the vertical axis, draw a frequency polygon for the data.

[4 marks]

d) Based on the frequency polygon drawn in 14(c), state one information.

[1 marks]
Answer:

a)

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Upper boundary</th>
<th>Cumulative frequency</th>
<th>Frequency</th>
<th>Midpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>4.5</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>5 - 9</td>
<td>9.5</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 14

c) Refer graph

d)
15 You are not allowed to use graph paper to answer this question.

a) Diagram 15 shows a solid right prism with a rectangular base $ABCD$ on a horizontal plane. The surface $ABJFE$ is the uniform cross section of the prism. $AE$, $DH$, $FJ$ and $GK$ are vertical edges. It is given that $KG$ is 2cm and $HG$ is 6cm. Rectangle $EFGH$ is a horizontal plane and rectangle $BCKJ$ is an inclined plane.

![Diagram 15(i)]

Draw a full scale, the plan of the solid.

[3 marks]

Answer:

a)
b) A part of the prism is removed and a cone with the height of 5cm and diameter of 5cm is joined to the prism in diagram 15(i). The combined solid is shown in Diagram 15(ii).

Diagram 15(ii)

Draw full scale,

(i) the combination of combined solid on a vertical plane parallel to $AB$ as viewed from $X$.

[4 marks]

(ii) the elevation of the combined solid on a vertical plane parallel to $BC$ as viewed from $Y$.

[5 marks]
Answer:

b) i)

ii)
16 Diagram 16 shows the locations of points $K, L, M, P, Q$ and $R$ on the surface of the earth. $O$ is the centre of the earth.

Diagram 16

- a) Find the location of $P$. [3 marks]

- b) Given the distance of $LM$ is 3660 nautical miles, find the longitude of $L$. [3 marks]

- c) Calculate the distance in nautical miles of $QP$ measured along the common parallel of latitude. [3 marks]

- d) An aeroplane took off from $P$ and flew due west to $Q$ along the common parallel of latitude. Then it flew due south to $L$. The average speed of the aeroplane was 550 knots. Calculate the total time, in hours, taken from the whole flight. [3 marks]
Answer:

a) 

b) 

c) 

d) 

END OF QUESTION PAPER
2.

\[ h = -\alpha^2 + \alpha - 2 \]

\[ l = -\alpha^2 + \alpha - 2 \]

\[ -\alpha^2 + \alpha - 2 - 1 = 0 \]

\[ -\alpha^2 + \alpha - 3 = 0 \]

\[ (t-3)(\alpha-1) = 0 \]

\[ t = 3, \quad \alpha = \frac{1}{2} \]
3. \[4x - y = 10\]
\[8x + 2y = 36\]
\[y = 4x - 10\]
\[8x + 2(4x - 10) = 36\]
\[8x + 8x - 20 = 36\]
\[16x = 36 + 20\]
\[16x = 56\]
\[x = \frac{56}{16}\]
\[u \left(\frac{2}{3}\right) - y = 10\]
\[\text{length} = 14 \text{ cm}\]
\[\text{width} = \text{u cm}\]
\[14 - 10 = y\]
\[x = \frac{7}{2}\]

4. \[X HMR\]
\[\sqrt{12^2 + 5^2} = 13 \text{ cm}\]
\[\tan \theta = \frac{7}{13}\]
\[\theta = \tan^{-1} \frac{7}{13}\]
\[\theta = 28.30^\circ\]
5. \[
\frac{1}{3} \times \frac{22}{7} \times 7^2 \times 10
\]
\[
= 718.67 \text{ cm}^3
\]
\[
718.67 \div 3
\]
\[
= 239.56 \text{ cm}^3
\]
\[
\frac{4}{3} \times \frac{22}{7} \times r^3 = 239.56 \text{ cm}^3
\]
\[
r = 3.88 \text{ cm}
\]
\[
\frac{r^3}{u} = 239.56
\]
\[
r = 3.88 \text{ cm}
\]

6. (a) \[y = 1\]

(b) \[y = mx + c\]
\[
y = \frac{3}{4}x - 5
\]
\[
1 = \frac{3}{4}(9) + c
\]
\[
1 = 6 + c
\]
\[
1 - 6 = c
\]
\[
c = -5
\]
\[
y = \frac{3}{4}(0) - 5
\]
\[
y = -5
\]
7. a) True
b) If \( x = 5 \), then \( x^3 = 125 \)
The converse is true

8. a) \[
\begin{pmatrix}
5 & 3 \\
-2 & u
\end{pmatrix}
\]
\[
\begin{pmatrix}
2 & 3 \\
10 & 6
\end{pmatrix}
\]
\[
\begin{pmatrix}
4 & 3 \\
2 & 5
\end{pmatrix}
\]
b) \[
\begin{pmatrix}
5 & 3 \\
-2 & u
\end{pmatrix}
\begin{pmatrix}
x \\
y
\end{pmatrix} =
\begin{pmatrix}
11 \\
-10
\end{pmatrix}
\]
\[
\begin{pmatrix}
\frac{1}{20 - 6} \\
\frac{1}{iu}
\end{pmatrix}
\begin{pmatrix}
2 & 3 \\
4 & 5
\end{pmatrix}
\begin{pmatrix}
11 \\
-10
\end{pmatrix}
\]
\[
\begin{pmatrix}
x \\
y
\end{pmatrix} =
\begin{pmatrix}
1 \\
3
\end{pmatrix}
\]
\[
x = 1, \quad y = 3
\]
9.

a) \[ \frac{22}{7} \times 14 \]
\[ = 88 \text{ cm} \]
\[ = 14 \times 6 \text{ cm} + 12 \times 12 \text{ cm} + 12 \times 12 \text{ cm} \]
\[ = 88 \text{ cm} \]

b) Area of triangle
\[ \sqrt{12.12^2 - 6.66^2} \]
\[ = 10.50 \text{ cm} \]
\[ \frac{1}{2} \times 12.12 \times 10.50 \]
\[ = 63.63 \text{ cm}^2 \]

Area of circle
\[ \frac{22}{7} \times 7^2 \]
\[ = 154 \text{ cm}^2 \]
\[ = 90.37 \text{ cm}^2 \]

10.

a) \( p = \{(A, C), (A, E), (A, U), (A, D), (A, F), (B, C), (B, E), (B, U), (B, D), (B, F), (C, E), (2, E), (3, D), (2, F), (3, C), (3, E), (3, U), (3, D), (3, F)\} \)
\[ n(p) = 30 \]
\[ p = \{(3, U), (3, U)\} \]
\[ p = \frac{2}{30} = \frac{1}{15} \]

b) \[ p = \{(A, U), (B, U), (C, C), (2, E), (3, D), (3, F), (3, C), (3, E), (3, D), (3, F)\} \]
\[ p = \frac{10}{30} = \frac{1}{3} \]
11. a) \[
\text{a-smooth}
\]

b) \[
\begin{align*}
0 - 8 &= -0.8 \text{ m/s} - 1 \\
\end{align*}
\]

c) \[
\frac{1}{2} \times (16 + 8) t + (30 - t)8 + \frac{1}{2} \times 8 \times 10 = 380 \\
12t + 240 - 8t + 40 = 380 \\
4t = 380 - 280 \\
4t = 100 \\
t = 25 \text{s}
\]

12. (a) 4, -6.25
(c) i) 3.5
ii) 1.25

13. a) i) \[
(3,1) \xrightarrow{T} (5,3) \xrightarrow{T} (8,2)
\]

ii) \[
(2,1) \xrightarrow{T} (4,2) \xrightarrow{T} (7,1)
\]

b) i) \(V \rightarrow\) Rotation 90° anticlockwise at centre (3,3)

b) \(W \rightarrow\) Enlargement, \(K = 3\), at centre \(K\)

ii) \(K^2 = \frac{\text{Area Image}}{\text{Area object}}\), If \(x\) is the area of the shaded region

\[
3^2 = \frac{60 + x}{60}
\]

\[
540 - 60 = x \Rightarrow x = 480 \text{cm}^2
\]
a)

<table>
<thead>
<tr>
<th>Time (minutes)</th>
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<td>10 - 14</td>
<td>14.5</td>
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<td>12</td>
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<td>25 - 29</td>
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<td>17</td>
<td>27</td>
</tr>
<tr>
<td>30 - 34</td>
<td>34.5</td>
<td>100</td>
<td>6</td>
<td>34</td>
</tr>
</tbody>
</table>

Table 14

b)

\[
(0 \times 9) + (7 \times 7) + (12 \times 18) + (19 \times 17) + (21 \times 22) + (27 \times 27) + (12 \times 30) + (6 \times 31) \\
0 + 7 + 216 + 323 + 222 + 729 + 360 + 186 \\
3115 \\
100
\]

\[
\text{Mean} = 31.15
\]
16. a) \((60^\circ \text{N}, 135^\circ \text{E})\)

b) \(\frac{3660}{60} = 61\)

\[135 - 61 = 74^\circ \text{E}\]

c) \(61 \times 60 \times \cos 60 = 1830 \text{ n.m}\)

d)

\[
\begin{align*}
1830 & \\
\frac{60 \times 60}{3600} & = 3600 \\
& \downarrow \\
& \text{L}
\end{align*}
\]

\[S = 550 \text{ knots, } T = \frac{3600 + 1830}{550} = 9.87 \text{ hours}\]