This memorandum consists of 11 pages.
Hierdie memorandum bestaan uit 11 bladsye.
NOTE:
• If a candidate answers a question TWICE, only mark the first attempt.
• If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out question.
• Consistent accuracy applies in ALL aspects of the marking memorandum.

LET WEL:
• As 'n kandidaat 'n vraag TWEE keer beantwoord, merk net die eerste poging.
• As 'n kandidaat 'n antwoord deurhaal en nie oordoen nie, merk die deurgehaalde antwoord.
• Volgehou akkuraatheid moet DEURGAANS in die memorandum toegepas word.

QUESTION/VRAAG 1

<table>
<thead>
<tr>
<th>Temperature (°C) (x)</th>
<th>17</th>
<th>15</th>
<th>13</th>
<th>16</th>
<th>11</th>
<th>13</th>
<th>10</th>
<th>8</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>4</th>
<th>5</th>
<th>9</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO (ppm) (y)</td>
<td>8</td>
<td>9</td>
<td>11</td>
<td>10</td>
<td>14</td>
<td>11</td>
<td>14</td>
<td>14</td>
<td>16</td>
<td>13</td>
<td>14</td>
<td>17</td>
<td>15</td>
<td>13</td>
<td>16</td>
</tr>
</tbody>
</table>

1.1 & 1.3

Scatter plot showing the relationship between concentration of dissolved oxygen at various temperatures

1.1
✓ 1 – 4 points correct
✓ 5 – 9 points correct
✓ all 12 points correct

(3)

1.3
✓ correct gradient
✓ passing close to (8 ; 14) and (13 ; 11)

(2)

1.2
\[ a = 19,01 \quad (19,00889878\ldots) \]
\[ b = -0,61 \quad (-0,6090100111\ldots) \]
\[ y = 19,01 - 0,61x \]

✓✓ a = 19,01
✓ b = -0,61
✓ y = 19,01 − 0,61x
1.4 \( \hat{y} = 19.01 - 0.61(14) \)
\( = 10.47 \)

**OR**

If calculator is used
\( \hat{y} = 10.48 \)  \((10.48275862\ldots)\)

**OR**

If least squares method is used or the graph is used,
\( \hat{y} = 10.5 \)

✓ substitute \( x = 14 \)
✓ answer
(2)

✓✓ answer
(2)

✓✓ answer
(2)

1.5 \( r = -0.94 \)  \((-0.9429488543\ldots)\)

✓✓ answer
(2)

1.6 There exists a very strong negative correlation between the variables. As the temperature in the lake water increases, so the concentration of dissolved oxygen decreases.

Daar bestaan 'n sterk negatiewe korrelasie tussen die veranderlikes. Soos wat die temperatuur van die water in die meer verhoog, so verlaag die konsentrasie van die opgeloste suurstof.

✓ strong
✓ negative
(2)

**QUESTION/VRAAG 2**

2.1
\( a = 73 \)
\( b = 42 \)
\( c = 107 \)
\( d = 68 \)

\[
\begin{array}{ccc}
&Aged < 40&Aged \geq 40&\text{Totals} \\
\text{Liked the movie} & 65 & 37 & 102 \\
\text{Did not like the movie} & b = 42 & 31 & a = 73 \\
\text{Totals} & c = 107 & d = 68 & 175 \\
\end{array}
\]

✓ \( a = 73 \)
✓ \( b = 42 \)
✓ \( c = 107 \)
✓ \( d = 68 \)

(4)

2.2 \( P(\text{less than 40 and did not like the movie}) = \frac{42}{175} \) \((0.24)\)

✓ 42
✓ 175

(2)

2.3 \( P(\text{less than 40 and liked the movie}) = \frac{65}{175} = 0.37 \) \((0.3714285714\ldots)\)

\( P(\text{Age less than 40}) = \frac{107}{175} \)

\( P(\text{Critic liked the movie}) = \frac{102}{175} \)

\( P(\text{Age less than 40 \times P(Critic liked the movie)}) = \frac{107}{175} \times \frac{102}{175} = 0.36 \) \((0.3563755102\ldots)\)

Since \( P(\text{less than 40 and liked the movie}) \neq P(\text{Age less than 40}) \times P(\text{Critic liked the movie}) \), we can conclude that the events are not independent/\( nie \ onafhanklik \ nie \).

✓ \( P(\text{less than 40 and liked the movie}) = \frac{65}{175} \)
✓ \( P(\text{Age less than 40}) = \frac{107}{175} \)

OR

\( P(\text{Critic liked the movie}) = \frac{102}{175} \)

✓ \( P(\text{Age less than 40 \times P(Critic liked the movie)}) = 0.36 \)

✓ conclusion

(4)
OR

\[ P(\text{less than 40 and did not like the movie}) = \frac{42}{175} = 0.24 \]
\[ P(\text{Age less than 40}) = \frac{107}{175} \]
\[ P(\text{Critic did not like the movie}) = \frac{73}{175} \]
\[ P(\text{Age less than 40}) \times P(\text{Critic did not like the movie}) = \frac{107}{175} \times \frac{73}{175} = 0.255 \ (0.2550530612...) \]

Since \( P(\text{less than 40 and did not like the movie}) \neq P(\text{Age less than 40}) \times P(\text{Critic did not like the movie}) \), we can conclude that the events are not independent.

\[ \therefore \]

\[
\text{QUESTION/VRAAG 3}
\]

\[ [10] \]

3.1 The interval 500 to 542 hours represents 48% of the data.
\[ \Rightarrow 542 \text{ is at 2 standard deviations to the right of the mean}. \]
\[ 542 = 500 + 2\sigma \]
\[ 2\sigma = 42 \]
\[ \sigma = 21 \]
\[ \checkmark \text{2 standard deviations} \]

\[ \checkmark 21 \]

(2)

3.2 458 is at 2 standard deviations to the left of the mean.
area between mean and 2 standard deviations = 48% 
521 is at 1 standard deviation to the right of the mean.
area between mean and 1 standard deviation = 34%

\[ \therefore \text{Total area between 458 and 521 hours} = 48\% + 34\% = 82\% \]
\[ \checkmark 48\% \]
\[ \checkmark 34\% \]
\[ \checkmark 82\% \]

(3)

3.3 The expected minimum lifetime will occur at 3 standard deviations to the left of the mean.
\[ \therefore \text{Expected minimum lifetime} = 500 - 3(21)\sigma = 437 \text{ hours} \]
\[ \checkmark \text{3 standard deviations} \]

\[ \checkmark 437 \]

(2) [7]
### QUESTION/VRAAG 4

<table>
<thead>
<tr>
<th>4.1</th>
<th>Different ways for 8 learners to be seated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>= 8!</td>
</tr>
<tr>
<td></td>
<td>= 40 320</td>
</tr>
</tbody>
</table>

\[ \begin{array}{c}
8 \\
40 320
\end{array} \] \hspace{1cm} (2)

<table>
<thead>
<tr>
<th>4.2</th>
<th>Consider the 3 learners as a single entity.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>These 3 learners can be seated in 3! = 6 different ways.</td>
</tr>
<tr>
<td></td>
<td>Now this group of 3 and the remaining 5 learners can be seated in 6! = 720 different ways.</td>
</tr>
<tr>
<td></td>
<td>In total there are 6 \times 720 = 4320 different ways for the 3 learners to be seated together.</td>
</tr>
</tbody>
</table>

\[ \begin{array}{c}
3!6! \\
4320
\end{array} \] \hspace{1cm} (3)

<table>
<thead>
<tr>
<th>4.3</th>
<th>First let us consider the different number of ways that these 2 learners can be seated next to one another.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This can be done in 2! \times 7! = 10 080 different ways.</td>
</tr>
<tr>
<td></td>
<td>Now these two learners may not be seated next to one another in 40 320 – 10 080 = 30 240 different ways.</td>
</tr>
</tbody>
</table>

\[ \begin{array}{c}
2! \times 7! \\
40 320 – 10 080
\end{array} \] \hspace{1cm} (3)

**OR/OF**

Let person A sit at the end of the row and person B not sit next to person A.
This can be done in \( 1 \times 6 \times 6! \times 2 \) different ways

\[ 1 \times 6 \times 6! \times 2 = 8 640 \] \hspace{1cm} (3)

Let person A not sit at the end of the row.
this can be done in \( 1 \times 6 \times 5 \times 5! \times 6 \) different ways

\[ 1 \times 6 \times 5 \times 5! \times 6 = 21 600 \] \hspace{1cm} (3)

In total we have

\[ 1 \times 6 \times 6! \times 2 + 1 \times 6 \times 5 \times 5! \times 6 \]

\[ = 30 240 \] \hspace{1cm} answer
**QUESTION/VRAAG 5**

### 5.1 Let A represent Alfred winning a point and B represent Barry winning a point.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>First branch correct</th>
<th>Second branch correct</th>
<th>Third branch correct</th>
<th>All outcomes listed</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A; A; A)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>(A; A; B)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>(A; B; A)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>(A; B; B)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>(B; A; A)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>(B; A; B)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>(B; B; A)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>(B; B; B)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

### 5.2 P(Barry wins three points) = \( \left( \frac{1}{2} \right)^3 = \frac{1}{8} \)

<table>
<thead>
<tr>
<th>Additions</th>
<th>✓ ( \left( \frac{1}{2} \right)^3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additions</td>
<td>( \frac{1}{8} )</td>
</tr>
</tbody>
</table>

### 5.3 P(Alfred wins two points and Barry wins one point)

\[
P(\text{A; A; B}) + P(\text{A; B; A}) + P(\text{B; A; A})
\]

\[
= \left( \frac{1}{2} \right)^3 + \left( \frac{1}{2} \right)^3 + \left( \frac{1}{2} \right)^3
\]

\[
= 3 \times \left( \frac{1}{2} \right)^3 = \frac{3}{8}
\]

### 5.4 P(Alfred wins 3 of the four points)

\[
P(\text{A; A; A; B}) + P(\text{A; A; B; A}) + P(\text{B; A; A; A}) + P(\text{B; A; A; B})
\]

\[
= \left( \frac{1}{2} \right)^4 + \left( \frac{1}{2} \right)^4 + \left( \frac{1}{2} \right)^4 + \left( \frac{1}{2} \right)^4
\]

\[
= 4 \left( \frac{1}{2} \right)^4 = \frac{256}{2^4} = \frac{1}{16}
\]

| ✓ P(\text{AAAB}) + P(\text{AABA}) + P(\text{BAAA}) + P(\text{BAAA}) | ✓\( \left( \frac{1}{2} \right)^4 \) | ✓ answer |

(2)
QUESTION/VRAAG 6

<table>
<thead>
<tr>
<th>6.1</th>
<th>By inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{n+1} = T_n + T_{n-1} - 2$; $T_1 = 4$, $T_2 = 7$; $n \geq 1$, $n \in N$</td>
<td>✓✓✓  Answer only: full marks</td>
</tr>
<tr>
<td>$a = 1$</td>
<td></td>
</tr>
<tr>
<td>$b = -2$</td>
<td></td>
</tr>
<tr>
<td><strong>OR/OF</strong></td>
<td></td>
</tr>
<tr>
<td>$T_{n+1} = T_n + aT_{n-1} + b$</td>
<td></td>
</tr>
<tr>
<td>$9 = 7 + 4a + b$</td>
<td>✓ $2 = 4a + b$</td>
</tr>
<tr>
<td>$2 = 4a + b$ ... (1)</td>
<td></td>
</tr>
<tr>
<td>$14 = 9 + 7a + b$</td>
<td>✓ $5 = 7a + b$</td>
</tr>
<tr>
<td>$5 = 7a + b$ ... (2)</td>
<td></td>
</tr>
<tr>
<td>(2) – (1): $3a = 3$</td>
<td>✓ $a = 1$</td>
</tr>
<tr>
<td>$a = 1$</td>
<td>✓ $b = -2$</td>
</tr>
<tr>
<td>$b = -2$</td>
<td></td>
</tr>
</tbody>
</table>

| 6.2 | $T_7 = 52$ | ✓ answer |

(1)

[5]
**QUESTION/VRAAG 7**

7.1  \( S \hat{O} W = 72^\circ \)  
\( (\angle \text{circ cent} = 2 \angle \text{circumference}) \)  
\( (\text{middelpunts} \angle = 2 \text{omtreks} \angle) \)  
\( \checkmark \ S \hat{O} W = 72^\circ \)  
\( \checkmark \ \angle \text{circ cent} = 2 \angle \text{circumference} \)  
(2)

7.2  \( \hat{W}_2 = 72^\circ \)  
\( (\text{alt} \angle \text{s; } PW || SA) \)  
\( (\text{verw} \ \angle \text{e; } PW || SA) \)  
\( \checkmark \ \hat{W}_2 = 72^\circ \)  
\( \checkmark \ PW || SO \)  
(2)

7.3  \( O\hat{S}W = \hat{W}_1 \)  
\( (\angle \text{opp} = \text{radii}) \)  
\( (\angle \text{e teenoor} = \text{radiusse}) \)  
\( 2O\hat{S}W + 72^\circ = 180^\circ \)  
\( (\text{sum} \ \Delta) \)  
\( 2O\hat{S}W = 108^\circ \)  
\( O\hat{S}W = 54^\circ \)  
\( \checkmark \ O\hat{S}W = \hat{W}_1 \)  
\( \checkmark \ \angle \text{opp} = \text{radii} \)  
\( \checkmark \ \text{answer} \)  
(3)

7.4  \( \hat{R} + \hat{W}_1 + \hat{W}_2 = 180^\circ \)  
\( (\text{opp} \angle \text{s cyclic quad}) \)  
\( (\text{oorst} \angle \text{e koordevierhoek}) \)  
\( \hat{R} + 54^\circ + 72^\circ = 180^\circ \)  
\( \hat{R} = 54^\circ \)  
\( \checkmark \ \hat{R} + \hat{W}_1 + \hat{W}_2 = 180^\circ \)  
\( \checkmark \ \text{opp} \angle \text{s cyclic quad} \)  
\( \checkmark \ \text{answer} \)  
(3)

**QUESTION/VRAAG 8**

8.  \( \hat{T}_1 = 90^\circ \)  
\( (\angle \text{s in a semi-circle}) \)  
\( (\angle \text{e in 'n halwe sirkel}) \)  
\( PT = TW = 24 \text{ cm} \)  
\( (\text{line from circ cent } \perp \ \text{ch}) \)  
\( (\text{lyn van middelpunt } \perp \ \text{koord}) \)  
\( \checkmark \ \hat{T}_1 = 90^\circ \)  
\( \checkmark \ \angle \text{s in a semi-circle} \)  
\( \checkmark \ \text{line from circ cent } \perp \ \text{ch} \)  
(5)

\[ \text{OP}^2 = OT^2 + PT^2 \]  
\[ \text{OP}^2 = (10)^2 + (24)^2 \]  
\[ \text{OP}^2 = 676 \]  
\[ \text{OP} = 26 \text{ cm} \]  
\( \text{Radius of smaller circle} = 13 \text{ cm} \)  
\( \checkmark \ \text{OP} = 26 \text{ cm} \)  
\( \checkmark \ \text{answer} \)  
[5]
### QUESTION/VRAAG 9

9.1

<table>
<thead>
<tr>
<th>( \hat{R}_2 = y )</th>
<th>(tan ch th)</th>
<th>(hoek tussen raaklyn en koord)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \hat{R}_2 = y )</td>
<td>tan ch th</td>
<td>( \hat{S}_2 = y )</td>
</tr>
<tr>
<td>( RT = ST )</td>
<td>(given)</td>
<td>( \triangle s ) opp = sides</td>
</tr>
<tr>
<td>( \hat{S}_2 = y )</td>
<td>( \angle e ) teenoor = sye</td>
<td></td>
</tr>
<tr>
<td>( SW = WT )</td>
<td>(tan from common point)</td>
<td>(raaklyn vanaf selfde punt)</td>
</tr>
<tr>
<td>( \hat{S}_3 = y )</td>
<td>( \triangle s ) opp = sides</td>
<td></td>
</tr>
<tr>
<td>( \hat{S}_3 = y )</td>
<td>( \angle e ) teenoor = sye</td>
<td></td>
</tr>
</tbody>
</table>

**OR**

<table>
<thead>
<tr>
<th>( SW = WT )</th>
<th>(tan from common point)</th>
<th>(raaklyn vanaf selfde punt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \hat{S}_3 = y )</td>
<td>( \triangle s ) opp = sides</td>
<td></td>
</tr>
<tr>
<td>( \hat{S}_3 = y )</td>
<td>( \angle e ) teenoor = sye</td>
<td></td>
</tr>
</tbody>
</table>

\[ \hat{R}_2 = \hat{S}_3 = y \] (tan ch th) (hoek tussen raaklyn en koord)

9.2

In \( \triangle PRS \) and \( \triangle PST \)

- i. \( \hat{P} \) is common
- ii. \( \hat{T}_1 = \hat{S}_1 = x \) (tan ch th) (hoek tussen raaklyn en koord)
- iii. \( \hat{R}_1 = \hat{PST} = x + y \) (3rd \( \angle \) of the \( \Delta \))

\( \triangle PRS \parallel \triangle PST \) (\( \angle \angle \angle \))

9.3

| \( PS = RS \) | (|| | \( \Delta s \) |
|-----------------|-------------------------|
| \( PT = ST \)   | (given)                 |
| \( ST = RT \)   |                         |

\( \hat{P} \) is common

\( \hat{T}_1 = \hat{S}_1 = x \)

\( \hat{R}_1 = \hat{PST} = x + y \) **OR** (\( \angle \angle \angle \))

<table>
<thead>
<tr>
<th>( PS = RS )</th>
<th>( PT )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(</td>
<td></td>
</tr>
</tbody>
</table>

\( PS \times RT = RS \times PT \)
QUESTION 10

10.1 Join E to B and D to C.

\[
\frac{\text{area } \triangle AED}{\text{area } \triangle DEB} = \frac{AD}{DB} \quad \text{(common altitudes)}/
\]

\[
(\text{gemeenskaplike hoogtelyne})
\]

\[
\frac{\text{area } \triangle AED}{\text{area } \triangle DEC} = \frac{AD}{EC} \quad \text{(common altitudes)}
\]

\[\text{area } \triangle AED \text{ is common} \]

\[\text{area } \triangle DEB = \text{area } \triangle DEC \text{ (DE } \parallel \text{ BC; same base BC)}\]

\[
\frac{\text{area } \triangle AED}{\text{area } \triangle DEB} = \frac{\text{area } \triangle AED}{\text{area } \triangle DEC}
\]

\[
\frac{AD}{DB} = \frac{AD}{EC}
\]

✓ construction

✓ \[\frac{\text{area } \triangle AED}{\text{area } \triangle DEB} = \frac{AD}{DB}\]

✓ = alts \; \div \; \text{ratio areas} = \text{ratio bases}

✓ \[\frac{\text{area } \triangle AED}{\text{area } \triangle DEC} = \frac{AD}{EC}\]

✓ \text{area } \triangle DEB = \text{area } \triangle DEC \text{ and} \]

✓ DE \; \parallel \; \text{BC; same base BC}

✓ \[\frac{\text{area } \triangle AED}{\text{area } \triangle DEB} = \frac{\text{area } \triangle AED}{\text{area } \triangle DEC}\]

(7)
10.2.1 \[
\frac{HF}{AH} = \frac{5}{8} \quad (\text{FD} \parallel AC; \text{Prop Th/Verhouding St})
\]

\[
\begin{align*}
HF &= \frac{5}{8}AH \\
HF &= \frac{5}{8}(48) \\
HF &= 30 \text{ cm}
\end{align*}
\]

\checkmark \frac{HF}{AH} = \frac{5}{8} \\
\checkmark \text{FD} \parallel AC

\checkmark \text{answer} (3)

10.2.2 \[
\frac{AF}{FG} = \frac{18}{14} \quad (BG \parallel CH; \text{Prop Th/Verhouding St})
\]

\[
\begin{align*}
18 + FG &= 2(30 - FG) \\
18 + FG &= 60 - 2FG \\
3FG &= 42 \\
FG &= 14 \text{ cm}
\end{align*}
\]

\checkmark \frac{AF}{FG} = \frac{2}{1} \\
\checkmark \frac{AF + FG}{HF - FG} = \frac{2}{1}

\checkmark \text{answer} (3)

\[
\begin{align*}
\frac{GH}{AH} &= \frac{BC}{AC} \\
\frac{GH}{AH} &= \frac{1}{3} \\
GH &= 16 \text{ cm} \\
FG &= HF - FG \\
&= 30 - 16 \\
&= 14 \text{ cm}
\end{align*}
\]

\checkmark \frac{GH}{AH} = \frac{BC}{AC} \\
\checkmark GH = 16 \text{ cm} \\
\checkmark \text{answer} (3)

10.2.3 \[
\frac{EF}{ED} = \frac{GF}{GH} \quad (BG \parallel CH; \text{Prop Th/Verhouding St})
\]

\[
\begin{align*}
EF : ED &= 14 : 16 \\
&= 7 : 8
\end{align*}
\]

\checkmark \frac{EF}{ED} = \frac{GF}{GH} \\
\checkmark \text{answer}

\checkmark \text{answer} (2)

\[15\]

**TOTAL**/**TOTAAL**: 100