These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.
SECTION A

QUESTION 1  [LO 1: AS 12.1.3]

(a) \( T_i = 2 \)

\[
T_{i+1} = -(2) \left( \frac{1+2}{1+1} \right) = -2 \left( \frac{3}{2} \right) = -3
\]

\[
T_{2+1} = -(3) \left( \frac{2+2}{2+1} \right) = 3 \left( \frac{4}{3} \right) = 4
\]

\[
T_{3+1} = -(4) \left( \frac{3+2}{3+1} \right) = -4 \left( \frac{5}{4} \right) = -5
\]

(b) \( 2 - 3 + 4 - 5 + 6 - 7 + 8 \ldots + 50 - 51 = (-1) + (-1) + (-1) + (-1) \ldots = -25 \)

OR

\[
2 + 4 + 6 + \ldots + 50 = \frac{25}{2} (52) = \frac{25}{2} (-54) = (25)(-27)
\]

\[
= 650 = -675
\]

add two together = -25

OR

\( s_1 = 2; s_2 = -1; s_3 = 3; s_4 = -2; s_5 = 4 \ldots s_{50} = -25 \)

QUESTION 2  [LO 4: AS 11.4.2; 12.4.2]

(a) (1) \( 3 \times 5 \times 3 \times 2 = 90 \)

(2) \( 8! = 40320 \)

(3) Total number of arrangements = \( 4! \times 5! = 2880 \)

\[
\begin{array}{cc}
\text{5 shirts} & \text{5!} \\
\hline
\text{4!} & \text{3!} \\
\end{array}
\]

Probability = \( \frac{4! \times 5!}{8!} = \frac{1}{14} = 0,0714 \) OR \( \frac{2880}{40320} \)

(b) \( \frac{7!}{3! \times 2!} = 420 \)

QUESTION 3  [LO 4: AS 11.4.2; 12.4.2]

(a) \( \frac{1}{3} \)

(b) \( \frac{4}{9} \)

(c) \( \frac{2}{9} \)

(d) \( \frac{5}{9} \)
QUESTION 4  [LO 4: AS 11.4.2; 12.4.2]

(a) 0,88  

(b) \[ P(\text{does}; \text{doesn't}; \text{doesn't}) = (0,12)(0,88)^2 = \frac{1452}{15625} = 0,092928 \]

\[ \text{OR} \]

\[ P(\text{doesn't}; \text{does}; \text{doesn't}) = (0,12)(0,88) = \frac{198}{15625} = 0,012672 \]

\[ P(\text{does}; \text{does}; \text{doesn't}) = (0,12)^2(0,88) = \frac{27}{15625} = 0,001728 \]

\[ = 3(0,092928) + 3(0,012672) + 0,001728 = 0,318528 \]

\[ \text{OR} \]

\[ 1 - \text{Prob (none)} = 1 - (0,88)^3 = \frac{4977}{15625} \approx 0,3185 \]

QUESTION 5  [LO 4: AS 11.4.2; 12.4.2]

(a) \[ 0,92 \times 700 = 644 \]

\[ \text{OR} \]

\[ 0,08 \times 700 = 56 \]

\[ 700 - 56 = 644 \]
(b) \[0,72 - x + x + 0,48 - x = 0,92\]
\[-x = -0,28\]
\[x = 0,28\]
So probability of using exactly one facility = 0,92 – 0,28 = 0,64
504 + 336 = 840
**OR**
840 – 644 = 196
so \[x = 196\]
\[
\frac{308 + 140}{700} = \frac{448}{700} = \frac{16}{25} = 0,64
\] (3)

(c) \[P(\text{tennis} \cap \text{golf}) = 0,28\]
\[\therefore P(\text{tennis}) \times P(\text{golf}) \neq P(\text{tennis} \cap \text{golf})\]
\[\therefore \text{events are not independent.}\] (2)

**QUESTION 6** [LO 4: AS 12.4.1]

(a) \[A = 14,0566\]
\[B = 0,9282 \text{ each } \therefore y = 0,9282x + 14,0566\] (5)

(b) \[\hat{y} = 0,9282(160) + 14,0566 = 162,5686 \text{ OR } 160\hat{y} = 162,5618\] (2)

(c) Candidate G (1)

(d) choice (iii) – the r value would be closer to 1 for case 2 than for case 1 (1)

[9]
QUESTION 7  [LO 4: AS 12.4.3]

(a) (1) \( \bar{x} = 39,5 \)  
(2) (i) \( \sigma = 11,192 \)  
(ii) \( \sigma^2 = 124,75 \)

(b) for drawing with endpoints plotted together with cumulative frequency. 
   for anchoring at (10 ; 0)

\[
\text{Estimated median} = 38 \text{ or } 39 \text{ (from their ogive)} \quad (1)
\]

(c) below 25 grams is about 8% and below 40 grams is 55% therefore between them is 
   47%  (mark according to their graph)  
   (2)

(d) Mean would go up/increase
   Median would stay same
   Standard deviation would go up/increase

[14]

QUESTION 8  [LO 1: AS 12.4.1 and 11.4.3]

(a) \( \bar{x} - \sigma n = 42 - 0,06 = 41,94 \)  
\( \bar{x} + \sigma n = 42 + 0,06 = 42,06 \)  
\( 42 - 0,06 = 41,94 \)  
\( 42 + 0,06 = 42,06 \)  
This is within 1 standard deviation either side of the mean.
Therefore unacceptable 100% – 68% = 32%  
(1)

(b) standard deviation = 0,03
So 41,94 would be within 2 standard deviations and so would 42,06. Now 4,8% would be unacceptable.  
(2)  
[3]

60 marks
SECTION B

QUESTION 9  [LO 3: AS 12.3.2]

(a) \( \hat{O}_1 = 100^\circ \) ext angle of a triangle  
(b) \( \hat{H}_1 = 50^\circ \) angle at centre  
(c) \( \hat{T} = 130^\circ \) opp. angles cyclicquad  
(d) \( \hat{A}_2 = 28^\circ \) angles of a triangle  
\( \hat{H}_2 = 28^\circ \) alt angles EH//AF

QUESTION 10  [LO 3: AS 11.3.2]

(a) \( \frac{x}{9} = \frac{2x}{x+3} \) prop int theorem  
\( x^2 - 3x = 0 \)  
\( x(x - 3) = 0 \)  
\( x = 3 \)  
\( \therefore DL = x + 3 = 6 \)  
and DL = LN  
and so L is now the midpoint of DN 
(b) DE = 2.8 units  
(c) \( \frac{\text{AreaRED}}{\text{AreaREN}} = \frac{\text{RD}}{\text{RN}} = \frac{2}{14} = \frac{1}{7} \) same height  
Area\text{REN} = 7 \times \text{Area\text{RED}} = 18.9 \text{ units}^2  
OR  
\( \text{Area\text{RED}} = \frac{1}{2} \times 3.2 \times \sin R \) and \( \text{Area\text{REN}} = \frac{1}{2} \times 3.14 \times \sin 64.15^\circ \)  
\( 2.7 = 3 \sin R \)  
\( = 18.9 \text{ units}^2 \)  
\( R = 64.15^\circ \)
**QUESTION 11  [LO 3: AS 12.3.2]**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) $\hat{E}_3 = 90^\circ$</td>
<td>Angle in a semi-circle</td>
</tr>
<tr>
<td>$\therefore \hat{T}_2 = 90^\circ$</td>
<td>Co-interior angles; KO//EL</td>
</tr>
</tbody>
</table>
| $\therefore CT = TE$ | Line from centre perpendicular to chord  
Or Midpoint theorem  
Or Similar triangles COT and CEL |

(b) $\hat{E}_1 + \hat{E}_2 = \hat{L}$  
| tan chord theorem  
alt seg theorem |
| But $\hat{L} = \hat{O}_3$ | Corres. angles KO//EL |
| $\therefore \hat{O}_3 = \hat{E}_1 + \hat{E}_2$ | |
| $\therefore COEK$ is a cyclic quadrilateral | Converse angles same segment  
Line subtends equal angles |

(c) In $\triangle COT$ and $\triangle KET$  
$\hat{C} = \hat{K}$ (angles same segment)  
$\hat{O}_3 = \hat{E}_1 + \hat{E}_2$ (proved)  
$\hat{T}_1 = \hat{T}_3$ (3rd angle of triangles/vert. opp.)  
$\therefore \triangle COT \parallel \triangle KET$ (AAA)  
**OR**  
$\hat{T}_2 = 90^\circ$ (proved)  
$\therefore \hat{T}_1 = \hat{T}_3 = 90^\circ$ (\angle s on stline)  
In $\triangle COT$ and $\triangle KET$  
$\hat{T}_1 = \hat{T}_3$ (proved)  
$\hat{O}_3 = \hat{E}_1 + \hat{E}_2$ (proved)  
$\hat{C} = \hat{K}$ (sum\angle s of triangle)  
$\therefore \triangle COT \parallel \triangle KET$ (AAA)  

(d) $\triangle COT \parallel \triangle KET$  
$\frac{OT}{CT} = \frac{ET}{KT}$  
$\frac{1}{9} = \frac{CT}{ET}$  
But $ET = CT$ and so $CT^2 = 9$ and $CT = 3$  
$\therefore OC = \sqrt{10}$ (by Pythag)  
**OR**  
$\triangle COK : \cos \hat{O}_3 = \frac{CO}{10}$ and $\triangle COT : \cos \hat{O}_3 = \frac{1}{CO}$  
$\therefore CO^2 = 10$ and $CO = \sqrt{10}$
(e) \( \hat{K} = \hat{C} \) (similar \( \Delta s \))
\[
\tan \hat{C} = \frac{1}{3} \quad \text{or} \quad \sin \hat{C} / \cos \hat{C}
\]
\[
\therefore \hat{C} = \hat{K} = 18,43^\circ
\]

OR

\[
Area_{\Delta COT} = \frac{1}{2} (3)(1) = 1,5
\]
\[
\frac{1}{2} (3)(\sqrt{10}) \sin \hat{C} = 1,5
\]
\[
\hat{C} = 18,43^\circ
\]
QUESTION 12

(a) This circle has 16 arcs each subtending $x^\circ$ at the centre.

\[
16x = 360^\circ \quad \text{(angles about a point)} \quad 16x = 360
\]

\[
x = 22.5^\circ \quad x = 22.5
\]

\[
\therefore \hat{POJ} = 6 \times (22.5^\circ) = 135^\circ
\]

\[
\therefore \hat{PCJ} = 67.5^\circ \quad \text{(angle at centre twice angle at circum)}
\]

(b) $\hat{PQJ} = 112.5^\circ \quad \text{(opp angles cyclic quad suppl)}$

Total: 100 marks

[7]

40 marks