



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P3

FEBRUARY/MARCH 2012

MEMORANDUM

MARKS: 100

This memorandum consists of 13 pages.

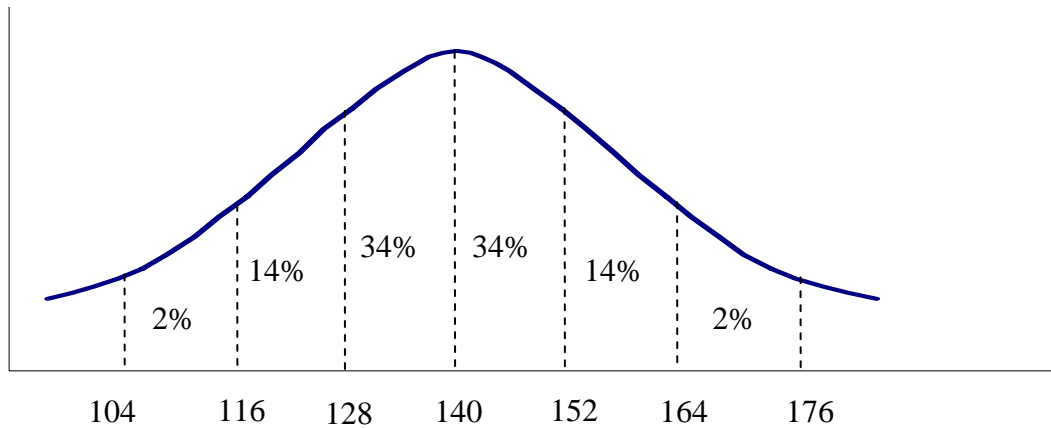
QUESTION 1

| | | |
|-----|--|--|
| 1.1 | 26; 37 | ✓ answer ✓ answer (2) |
| 1.2 | $T_1 = 2$ $T_2 = 2 + 3 = 2 + 2(1) + 1 = 5$ $T_3 = 5 + 5 = 5 + 2(2) + 1 = 10$ $T_5 = 10 + 7 = 10 + 2(3) + 1 = 17$ $T_{k+1} = T_k + 2k + 1; T_1 = 2$ and $k \geq 1$ OR $T_k = T_{k-1} + 2k - 1; T_1 = 2$ and $k \geq 2$ | ✓ $T_{k+1} = T_k + 2k + 1$ ✓ $T_1 = 2$ ✓ $k \geq 1$ (3) ✓ $T_k = T_{k-1} + 2k - 1$ ✓ $T_1 = 2$ ✓ $k \geq 2$ (3) [5] |

QUESTION 2

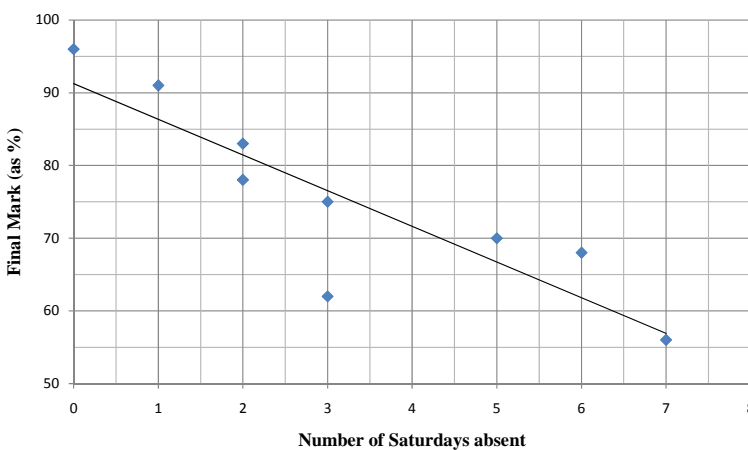
| | | |
|-----|---|--|
| 2.1 | Total number of employees $= 1 + 2 + 2 + 5 + 30 + 40 + 65 + 5$ $= 150$ | ✓ answer (1) |
| 2.2 | Total amount needed $= (1 \times 150\,000) + (2 \times 100\,000) + (2 \times 75\,000) + (5 \times 15\,000) + (30 \times 10\,000)$ $+ (40 \times 7\,500) + (65 \times 6\,000) + (5 \times 5\,000)$ $= R1\,590\,000$ | ✓ method ✓ answer (2) |
| 2.3 | Mean monthly salary $= \frac{1\,590\,000}{150}$ $= R10\,600$ | ✓ $\frac{1\,590\,000}{150}$ ✓ answer (2) |
| 2.4 | No. Only 10 employees in this company earn more than R10 600. The majority (140) of the employees earn below this amount. It is therefore not a good indicator of the average monthly amount earned by an employee. OR 110 of the 150 employees earn R7 500 or less. | ✓ No ✓ 140 earn below the mean (2) [7] |

QUESTION 3



| | | |
|-----|---|--|
| 3.1 | $140 - 12 = 128$ 128 is 1 standard deviation to the left of the mean \therefore percentage of teenagers who sent less than 128 messages $\approx 50\% - 34\%$ $\approx 16\%$ | ✓ 1 standard deviation ✓ 50%–34% ✓ 16% (3) |
| 3.2 | 116 minutes is 2 standard deviations from the mean \therefore 48% 152 minutes is 1 standard deviation from the mean \therefore 34% Percentage of the teenagers who sent between 116 and 152 messages $\approx 48\% + 34\%$ $\approx 82\%$ NOTE: Answer only: Full marks | ✓ 48% ✓ 34% ✓ 82% (3) [6] |

QUESTION 4

| 4.1 | $a = 91,27$ (91,26785714...) $b = -4,91$ (-4,910714286...) $\hat{y} = 91,27 - 4,91x$ | ✓✓ a ✓ b ✓ equation (4) | | | | | | | | | | | | | | | | | | | | |
|----------------------------|---|---|-------------------|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 4.2 | <p style="text-align: center;">SCATTER PLOT SHOWING THE NUMBER OF SATURDAYS ABSENT AND THE FINAL MARK ACHIEVED</p>  <p>The scatter plot shows a negative correlation between the number of Saturdays absent and the final mark. The data points are approximately as follows:</p> <table border="1" style="display: none;"> <thead> <tr> <th>Number of Saturdays absent</th> <th>Final Mark (as %)</th> </tr> </thead> <tbody> <tr><td>0</td><td>95</td></tr> <tr><td>1</td><td>91</td></tr> <tr><td>2</td><td>83</td></tr> <tr><td>2</td><td>78</td></tr> <tr><td>3</td><td>75</td></tr> <tr><td>3</td><td>62</td></tr> <tr><td>5</td><td>70</td></tr> <tr><td>6</td><td>68</td></tr> <tr><td>7</td><td>56</td></tr> </tbody> </table> | Number of Saturdays absent | Final Mark (as %) | 0 | 95 | 1 | 91 | 2 | 83 | 2 | 78 | 3 | 75 | 3 | 62 | 5 | 70 | 6 | 68 | 7 | 56 | ✓ y-intercept (91) ✓ Point (7 ; 57) (2) |
| Number of Saturdays absent | Final Mark (as %) | | | | | | | | | | | | | | | | | | | | | |
| 0 | 95 | | | | | | | | | | | | | | | | | | | | | |
| 1 | 91 | | | | | | | | | | | | | | | | | | | | | |
| 2 | 83 | | | | | | | | | | | | | | | | | | | | | |
| 2 | 78 | | | | | | | | | | | | | | | | | | | | | |
| 3 | 75 | | | | | | | | | | | | | | | | | | | | | |
| 3 | 62 | | | | | | | | | | | | | | | | | | | | | |
| 5 | 70 | | | | | | | | | | | | | | | | | | | | | |
| 6 | 68 | | | | | | | | | | | | | | | | | | | | | |
| 7 | 56 | | | | | | | | | | | | | | | | | | | | | |
| 4.3 | $r = -0,87$ (-0,8748915491...) | ✓✓ answer (2) | | | | | | | | | | | | | | | | | | | | |
| 4.4 | The greater the number of Saturdays absent, the lower the mark. | ✓ number of Saturdays absent ✓ final mark (2) | | | | | | | | | | | | | | | | | | | | |
| 4.5 | $\hat{y} = 91,27 - 4,91(4)$ $\approx 71,63\%$ $\approx 72\%$ NOTE: Allow for the range 70%–74% for a student who reads off the graph. | ✓ substitution ✓ answer (2) [12] | | | | | | | | | | | | | | | | | | | | |

QUESTION 5

| | DO NOT PLAY SPORT | PLAY SPORT | TOTAL |
|---------------|--------------------------|-------------------|--------------|
| Male | 51 | 69 | 120 |
| Female | 49 | 67 | 116 |
| Total | 100 | 136 | 236 |

| | | |
|-------|---|--|
| 5.1.1 | $P(\text{male}) = \frac{120}{236}$ $= \frac{30}{59}$ $= 0,51 \text{ (0,508474...)}$ | ✓ 120 ✓ 236 (2) |
| 5.1.2 | $P(\text{female and plays sport})$ $= \frac{67}{236}$ $= 0,28 \text{ (0,2838983051...)}$ | ✓ 67 ✓ 236 (2) |
| 5.2 | <p>No. From the table, $P(\text{male and do not play sport}) = \frac{51}{236}$, which is greater than zero. Since the probability of the intersection of these two events is greater than zero, these events are not mutually exclusive.</p> | ✓ No ✓ probability of intersection greater than zero (2) |
| 5.3 | $P(\text{male}) = \frac{120}{236}$ $P(\text{NS}) = \frac{100}{236}$ $P(\text{male}) \times P(\text{NS}) = \frac{120}{236} \times \frac{100}{236}$ $= \frac{750}{3481}$ $= 0,22 \text{ (0,215455...)}$ $P(\text{male and NS}) = \frac{51}{236}$ $= 0,22 \text{ (0,2161016949...)}$ <p>So, $P(\text{male}) \times P(\text{NS}) = P(\text{male and NS})$</p> <p>Therefore the events 'male' and 'do not play sport' are independent (correct to TWO decimal places).</p> <p>OR</p> <p>The events are not independent as there is a discrepancy from the third decimal place.</p> | ✓ $\frac{100}{236}$ ✓ $\frac{750}{3481}$ ✓ $\frac{51}{236}$ ✓ are independent (4) [10] |

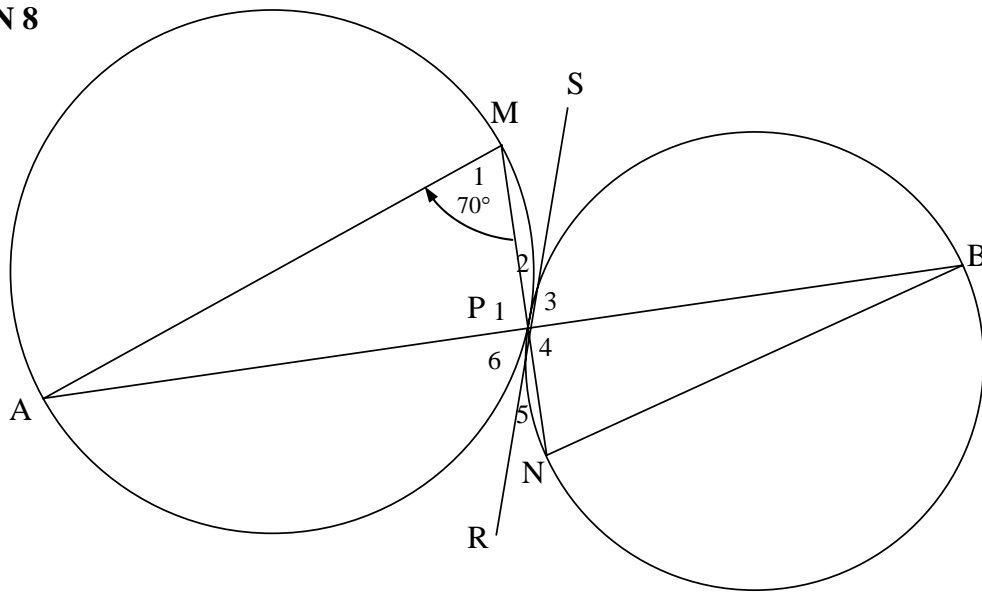
QUESTION 6

| | | |
|--------------|--|---|
| <p>6.1</p> | | <ul style="list-style-type: none"> ✓ first tier ✓ second tier ✓ probabilities ✓ outcomes <p style="text-align: right;">(4)</p> |
| <p>6.2.1</p> | <p>$P(B; ND)$ $= 0,3 \times 0,98$ $= 0,29$</p> <p>Accept: 0,294</p> | <ul style="list-style-type: none"> ✓ 0,3 ✓ 0,98 ✓ 0,29 <p style="text-align: right;">(3)</p> |
| <p>6.2.2</p> | <p>$P(\text{defective})$ $= P(A; D) + P(B; D) + P(C; D)$ $= (0,2 \times 0,01) + (0,3 \times 0,02) + (0,5 \times 0,06)$ $= 0,04$</p> <p>Accept: 0,038</p> | <ul style="list-style-type: none"> ✓ multiplying probabilities ✓ adding probabilities ✓ answer <p style="text-align: right;">(3) [10]</p> |

QUESTION 7

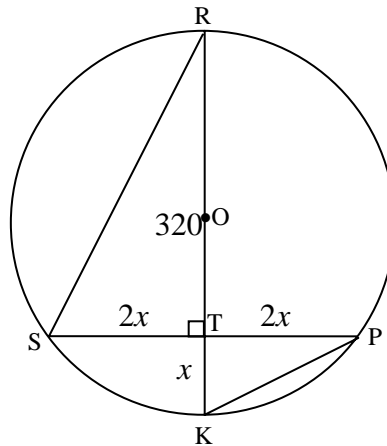
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|------------|---|--|
| <p>7.1</p> | <p>$12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$ $= 12!$ $= 479\ 001\ 600$ different ways</p> | <ul style="list-style-type: none"> ✓ 12 ✓ answer <p style="text-align: right;">(2)</p> |
| <p>7.2</p> | <p>$9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$ $= 9!$ $= 362\ 880$ different ways</p> | <ul style="list-style-type: none"> ✓ $9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$ ✓ 9! <p style="text-align: right;">(2)</p> |
| <p>7.3</p> | <p>The items from each department can be arranged in 3! ways. The departments can be arranged in 4! ways. Advertisements can be arranged in 3!.4! $= 6 \times 24$ $= 144$ different ways.</p> | <ul style="list-style-type: none"> ✓ 3! ✓ 4! ✓ 144 <p style="text-align: right;">(3) [7]</p> |

QUESTION 8



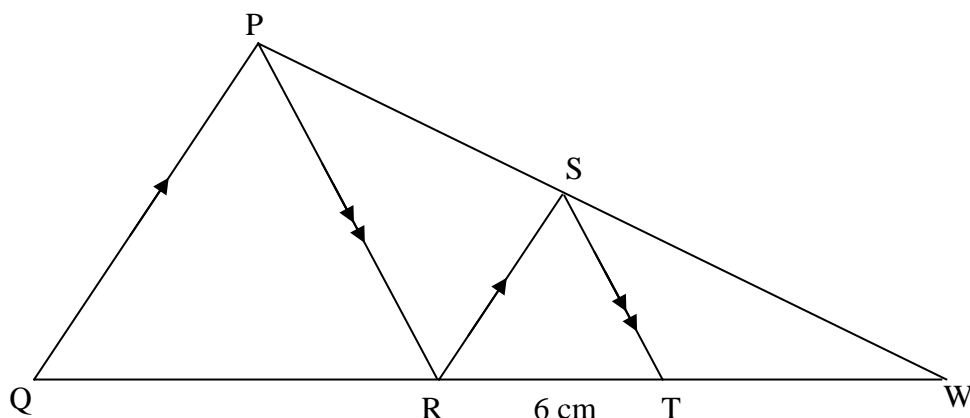
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|-------|--|--|
| 8.1 | $\hat{P}_1 = 90^\circ$ (\angle in semicircle) | $\checkmark \hat{P}_1 = 90^\circ$ (1) |
| 8.2 | $\hat{P}_4 = 90^\circ$ (vert opp \angle s) BN is a diameter (chord subtends 90°) | $\checkmark \hat{P}_4 = 90^\circ$ \checkmark chord subtends 90° (2) |
| 8.3.1 | $\hat{A} = 20^\circ$ (\angle sum Δ) | \checkmark answer (1) |
| 8.3.2 | $\hat{P}_6 = 70^\circ$ (tan ch th) | \checkmark answer (1) |
| 8.3.3 | $\hat{P}_3 = 70^\circ$ (vert opp \angle s) $\hat{N} = 70^\circ$ (tan ch th) $\hat{P}_4 = 90^\circ$ (proven) $\hat{B} = 20^\circ$ (\angle sum Δ) OR $\hat{P}_5 = 20^\circ$ (\angle s on str line) $\hat{B} = 20^\circ$ (tan ch th) | $\checkmark \hat{N} = 70^\circ$ $\checkmark \hat{B} = 20^\circ$ (2) $\checkmark \hat{P}_5 = 20^\circ$ $\checkmark \hat{B} = 20^\circ$ (2) [7] |

QUESTION 9



| | | |
|-----|---|--|
| 9.1 | ST = PT = 2x (line from circ centre \perp ch bis ch) | ✓ S/R (1) |
| 9.2 | In ΔRST and ΔPKT 1. $\hat{R} = \hat{P}$ (\angle in same seg) 2. $\hat{S} = \hat{K}$ (\angle in same seg) 3. $R\hat{T}K = P\hat{T}K = 90^\circ$ (given) $\Delta RST \parallel \Delta PKT$ ($\angle\angle\angle$) | ✓ S/R ✓ S/R ✓ R (3) |
| 9.3 | $\frac{ST}{KT} = \frac{RT}{PT} \quad (\parallel \Delta s)$ $\frac{2x}{x} = \frac{320}{2x}$ $4x = 320$ $x = 80 \text{ mm}$ <p>OR</p> $\frac{ST}{RT} = \frac{KT}{PT}$ $\frac{2x}{320} = \frac{x}{2x}$ $2x = 160$ $x = 80 \text{ mm}$ | ✓ $\frac{ST}{KT} = \frac{RT}{PT}$ ✓ substitution ✓ answer (3) [7] |

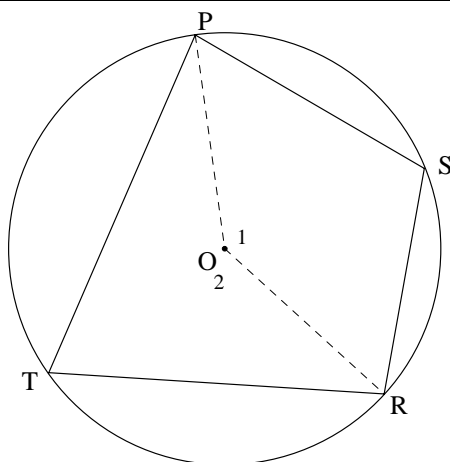
QUESTION 10



| | | |
|------|---|--|
| 10.1 | $\frac{WS}{SP} = \frac{3}{2}$ $\frac{WS}{SP} = \frac{WT}{RT} = \frac{3}{2} \quad (ST \parallel PR; \text{Prop th})$ $WT = \frac{3 \times 6}{2}$ $WT = 9\text{ cm}$ | $\checkmark \frac{WS}{SP} = \frac{WT}{RT}$ $\checkmark ST \parallel PR; \text{Prop th}$ $\checkmark \text{answer}$ <p style="text-align: right;">(3)</p> |
| 10.2 | $\frac{WS}{SP} = \frac{WR}{RQ} = \frac{3}{2} \quad (SR \parallel PQ; \text{Prop th})$ $\frac{9+6}{RQ} = \frac{3}{2}$ $RQ = 10\text{ cm}$ $WQ = 10 + 9 + 6 = 25\text{ cm}$ | $\checkmark \frac{WS}{SP} = \frac{WR}{RQ} = \frac{3}{2}$ $\checkmark \frac{9+6}{RQ} = \frac{3}{2}$ $\checkmark RQ = 10$ $\checkmark WQ = 25$ <p style="text-align: right;">(4) [7]</p> |

QUESTION 11

11.1



Join RO and OP

Let $\hat{O}_1 = 2x$

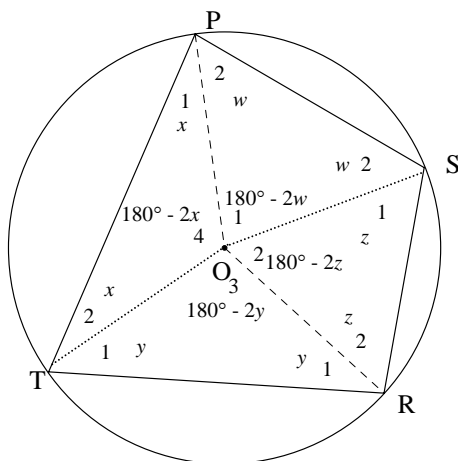
$\hat{O}_2 = 360^\circ - 2x$ (\angle s in a rev)

$\hat{T} = x$ (\angle circ centre = 2 \angle circumference)

$\hat{S} = 180^\circ - x$ (\angle circ centre = 2 \angle circumference)

$\hat{S} + \hat{T} = x + 180^\circ - x$
 $= 180^\circ$

OR



Draw radii OP, OS, OR and OT

Let $\hat{P}_1 = x$, $\hat{S}_2 = w$, $\hat{S}_1 = z$ and $\hat{R}_1 = y$

$\therefore \hat{T}_2 = x$, $\hat{P}_2 = w$, $\hat{R}_2 = z$ and $\hat{T}_1 = y$ (\angle s opp = radii)

$\hat{O}_1 = 180^\circ - 2w$ (\angle sum Δ)

Similarly

$\hat{O}_2 = 180^\circ - 2z$, $\hat{O}_3 = 180^\circ - 2y$, $\hat{O}_4 = 180^\circ - 2x$

By angles in a revolution

$\hat{O}_1 + \hat{O}_2 + \hat{O}_3 + \hat{O}_4 = 180^\circ - 2w + 180^\circ - 2z + 180^\circ - 2y + 180^\circ - 2x$
 $360^\circ = 720^\circ - 2(w + z + y + x)$

$2(w + z + y + x) = 360^\circ$

$w + z + y + x = 180^\circ$

OR

✓ construction

✓ $\hat{O}_1 = 2x$

✓ $\hat{O}_2 = 360^\circ - 2x$

✓ $\hat{T} = x$

✓ $\hat{S} = 180^\circ - x$

✓ reason

(6)

✓ construction

✓ Let $\hat{P}_1 = x$,

$\hat{S}_2 = w$, $\hat{S}_1 = z$ and

$\hat{R}_1 = y$

✓ $\hat{O}_1 = 180^\circ - 2w$

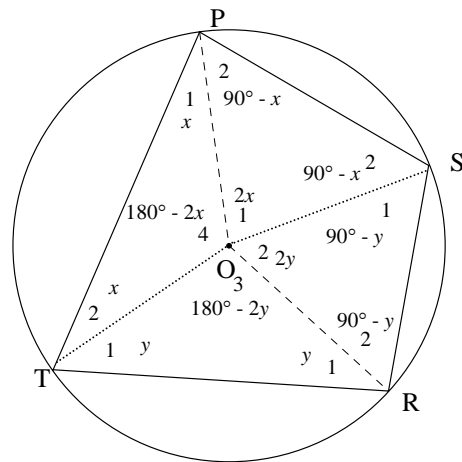
(\angle sum Δ)

✓ setting up equation

✓ simplification

✓ conclusion

(6)



Draw radii OP, OS, OR and OT

Let $\hat{P}_1 = x$ and $\hat{R}_1 = y$

$\therefore \hat{T}_2 = x$ and $\hat{T}_1 = y$ (\angle s opp = radii)

$\hat{O}_3 = 180^\circ - 2y$ (\angle sum Δ)

Similarly

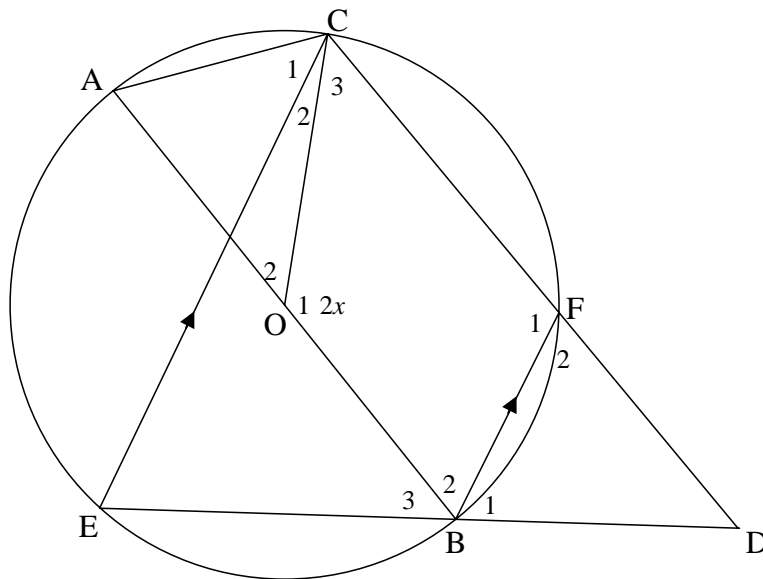
$\hat{O}_4 = 180^\circ - 2x$

$\hat{S}_2 = \hat{P}_2$ and $\hat{S}_1 = \hat{R}_1$ (\angle s opp = radii)

$\hat{T}_1 + \hat{T}_2 + \hat{S}_1 + \hat{S}_2 = x + y + 90^\circ - x + 90^\circ - y$
 $= 180^\circ$

- ✓ construction
- ✓ Let $\hat{P}_1 = x$ and $\hat{R}_1 = y$
- ✓ $\hat{O}_3 = 180^\circ - 2y$ (\angle sum Δ)
- ✓ $\hat{S}_2 = \hat{P}_2$ and $\hat{S}_1 = \hat{R}_1$
- ✓ $\hat{T}_1 + \hat{T}_2 + \hat{S}_1 + \hat{S}_2$
- ✓ conclusion

(6)



| | | |
|---------------|--|--|
| <p>11.2.1</p> | <p>$\hat{A} = x$ (\angle circ centre = 2 \angle circumference) $\hat{F}_1 = 180^\circ - x$ (opp \angles of cyclic quad = 180°)</p> <p>OR</p> <p>reflex $\hat{B}\hat{O}C = 360^\circ - 2x$ (\angle in revolution) $\hat{F}_1 = 180^\circ - x$ (\angle circ centre = 2 \angle circumference)</p> | <p>✓ $\hat{A} = x$ ✓ \angle circ centre = 2 \angle circumference ✓ $\hat{F}_1 = 180^\circ - x$ ✓ opp \angles of cyclic quad = 180°</p> <p>(4)</p> <p>✓ reflex $\hat{B}\hat{O}C = 360^\circ - 2x$ ✓ \angle in revolution ✓ $\hat{F}_1 = 180^\circ - x$ ✓ \angle circ centre = 2 \angle circumference</p> <p>(4)</p> |
| <p>11.2.2</p> | <p>$\hat{F}_2 = x$ (ext $\angle =$ int opp \angle) $\hat{B}_1 = x = \hat{E}$ (corres \angles; $EC \parallel BF$) $\hat{F}_2 = \hat{B}_1$ $DF = BD$ (sides opp = \angles)</p> <p>OR</p> <p>$\hat{E} = x$ (\angle circ centre = 2 \angle circumference) $\hat{B}_1 = \hat{E} = x$ (corres \angles; $EC \parallel BF$) $\hat{F}_2 = x$ (ext \angle cyclic quad) $\hat{F}_2 = \hat{B}_1$ $DF = BD$ (sides opp = \angles)</p> | <p>✓ $\hat{F}_2 = x$ ✓ ext $\angle =$ int opp \angle ✓ $\hat{B}_1 = x$ ✓ sides opp = \angles</p> <p>(4)</p> <p>✓ $\hat{B}_1 = x$ ✓ $\hat{F}_2 = x$ ✓ ext $\angle =$ int opp \angle ✓ sides opp = \angles</p> <p>(4)</p> |

| | | |
|---------------|--|--|
| <p>11.2.3</p> | <p>$\hat{C}_1 + \hat{C}_2 = x$ (\angles opp equal sides in Δ) $\hat{C}_3 + \hat{C}_2 = x$ (corresp \angles CE \parallel BF) $\hat{C}_1 = \hat{C}_3$</p> <p>OR</p> <p>$\hat{D} = 180^\circ - 2x$ (\angle sum Δ) $\hat{O}_1 + \hat{D} = 180^\circ$ OCDB is a cyclic quad (opp \angles suppl) $\hat{B}_3 = \hat{C}_3$ (ext \angle cyclic quad) $\hat{B}_3 = \hat{C}_1$ (\angle same seg) $\hat{C}_1 = \hat{C}_3$</p> | <p>✓ $\hat{C}_1 + \hat{C}_2 = x$ ✓ \angles opp equal sides in Δ ✓ $\hat{C}_2 + \hat{C}_3 = x$ ✓ corresp \angles CE \parallel BF</p> <p>(4)</p> <p>✓ opp \angles suppl ✓ $\hat{B}_3 = \hat{C}_3$ ✓ ext \angle cyclic quad ✓ $\hat{B}_3 = \hat{C}_1$</p> <p>(4)</p> |
| <p>11.2.4</p> | <p>$\hat{D} = 180^\circ - 2x$ (\angle sum Δ) $\hat{O}_2 = 180^\circ - 2x$ (\angle on straight line) $\therefore \hat{D} = \hat{O}_2$ $\therefore \sin \hat{D} = \sin \hat{O}_2$ $\frac{\text{area } \Delta\text{BFD}}{\text{area } \Delta\text{AOC}}$ $= \frac{\frac{1}{2} \text{DF} \cdot \text{BD} \cdot \sin \hat{D}}{\frac{1}{2} \text{AO} \cdot \text{OC} \cdot \sin \hat{O}_2}$ $= \frac{\frac{1}{2} 5.5 \cdot \sin \hat{D}}{\frac{1}{2} 6.6 \cdot \sin \hat{O}_2}$ $= \frac{5.5}{6.6}$ $= \frac{25}{36}$</p> | <p>✓ $\hat{D} = 180^\circ - 2x$ ✓ $\hat{O}_2 = 180^\circ - 2x$</p> <p>✓ $\frac{\frac{1}{2} \text{DF} \cdot \text{BD} \cdot \sin \hat{D}}{\frac{1}{2} \text{AO} \cdot \text{OC} \cdot \sin \hat{O}_2}$</p> <p>✓ $\frac{25}{36}$</p> <p>(4) [22]</p> |

TOTAL: 100