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.

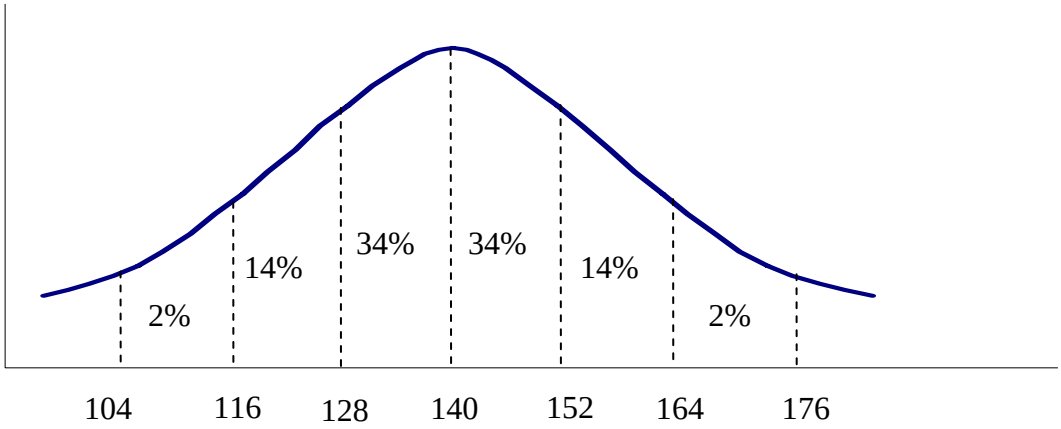
QUESTION 1

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

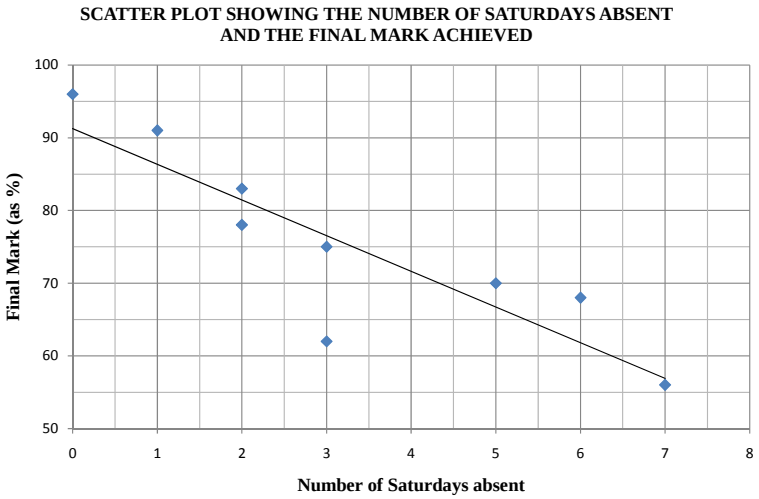
2.1	Total number of employees $=1+2+2+5+30+40+65+5$ $=150$	✓ answer (1)
2.2	Total amount needed $=(1\times150\,000)+(2\times100\,000)+(2\times75\,000)+(5\times15\,000)+(30\times10\,000)$ $+(40\times7\,500)+(65\times6\,000)+(5\times5\,000)$ = R1 590 000	✓ method ✓ answer (2)
2.3	Mean monthly salary $= \frac{1\,590\,000}{150}$ = 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 ∴ percentage of teenagers who sent less than 128 messages ≈ 50% – 34% ≈16%	✓ 1 standard deviation ✓ 50%–34% ✓ 16% (3)
3.2	116 minutes is 2 standard deviations from the mean ∴ 48% 152 minutes is 1 standard deviation from the mean ∴ 34% Percentage of the teenagers who sent between 116 and 152 messages ≈ 48% + 34% ≈ 82% **NOTE:** Answer only: Full marks	✓ 48% ✓ 34% ✓ 82% (3) **[6]**

QUESTION 4

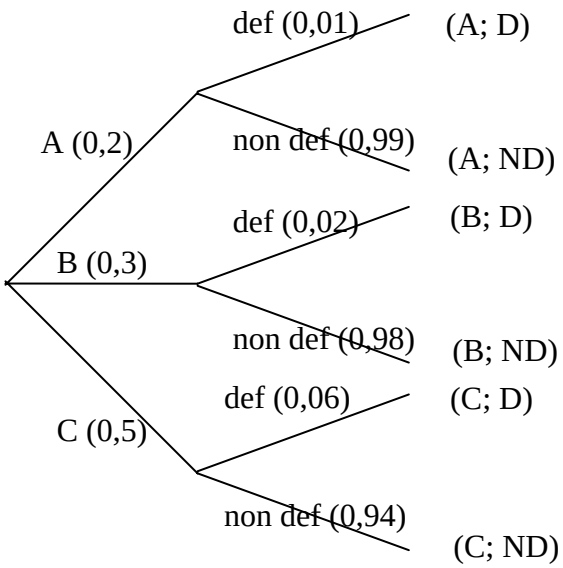
4.1	$a = 91{,}27$ (91,26785714...) $b = -4{,}91$ (– 4,910714286...) $\hat{y} = 91{,}27 - 4{,}91x$	✓✓ a ✓ b ✓ equation (4)
4.2		✓ y-intercept (91) ✓ Point (7 ; 57) (2)
4.3	$r = -0{,}87$ (– 0,8748915491...)	✓✓ answer (2)
4.4	The greater the number of Saturdays absent, the lower the mark.	✓number of Saturdays 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	$P(\text{male}) = \frac{120}{236}$ $= \frac{30}{59}$ $= 0,51\ (0,508474...)$	✓ 120 ✓ 236 (2)
5.1.2	$P(\text{female and plays sport})$ $= \frac{67}{236}$ $= 0,28\ (0,2838983051...)$	✓ 67 ✓ 236 (2)
5.2	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.	✓ No ✓ probability of intersection greater than zero (2)
5.3	$P(\text{male}) = \frac{120}{236}$ $P(NS) = \frac{100}{236}$ $P(\text{male}) \times P(NS) = \frac{120}{236} \times \frac{100}{236}$ $= \frac{750}{3\,481}$ $= 0,22 \quad (0,215455...)$ $P(\text{male and NS}) = \frac{51}{236}$ $= 0,22 \quad (0,2161016949...)$ So, $P(\text{male}) \times P(NS) = P(\text{male and NS})$ Therefore the events 'male' and 'do not play sport' are independent (correct to TWO decimal places). **OR** The events are not independent as there is a discrepancy from the third decimal place.	✓ $\frac{100}{236}$ ✓ $\frac{750}{3\,481}$ ✓ $\frac{51}{236}$ ✓ are independent (4) **[10]**

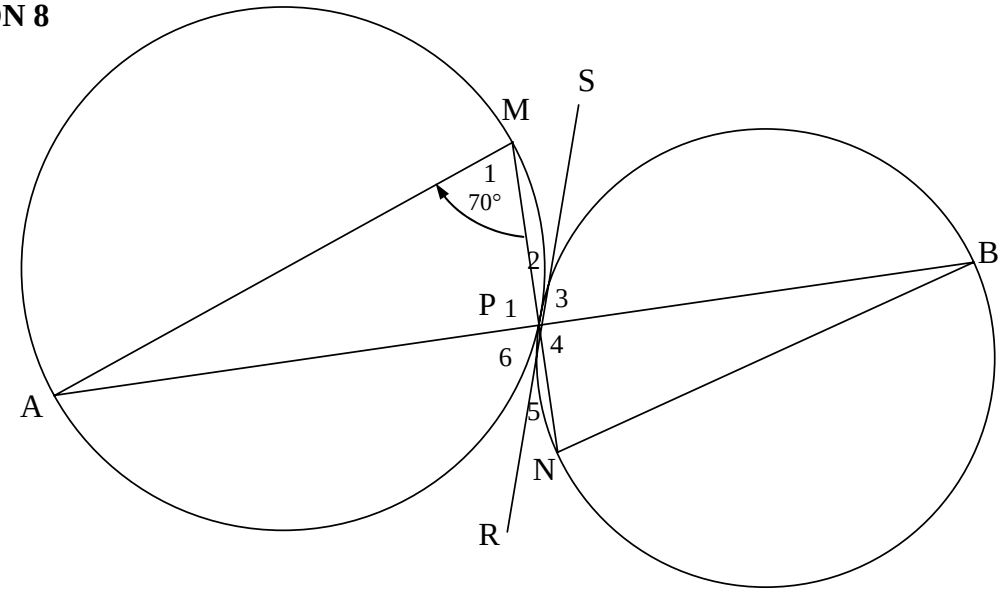
QUESTION 6

6.1		✓ first tier ✓ second tier ✓ probabilities ✓ outcomes (4)
6.2.1	P(B; ND) = 0,3 × 0,98 = 0,29 Accept: 0,294	✓ 0,3 ✓ 0,98 ✓ 0,29 (3)
6.2.2	P(defective) = P(A; D) + P(B; D) + P(C; D) = (0,2 × 0,01) + (0,3 × 0,02) + (0,5 × 0,06) = 0,04 Accept: 0,038	✓ multiplying probabilities ✓ adding probabilities ✓ answer (3) **[10]**

QUESTION 7

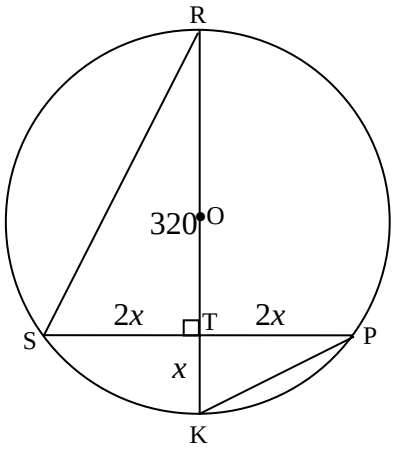
7.1	12 × 11 × 10 × 9 × 8 × 7 × 6 × 5 × 4 × 3 × 2 × 1 = 12! = 479 001 600 different ways	✓ 12 ✓ answer (2)
7.2	9 × 8 × 7 × 6 × 5 × 4 × 3 × 2 × 1 = 9! = 362 880 different ways	✓ 9 × 8 × 7 × 6 × 5 × 4 × 3 × 2 × 1 ✓ 9! (2)
7.3	The items from each department can be arranged in 3! ways. The departments can be arranged in 4! ways. Advertisements can be arranged in 3!.4! = 6 × 24 = 144 different ways.	✓ 3! ✓ 4! ✓ 144 (3) **[7]**

QUESTION 8



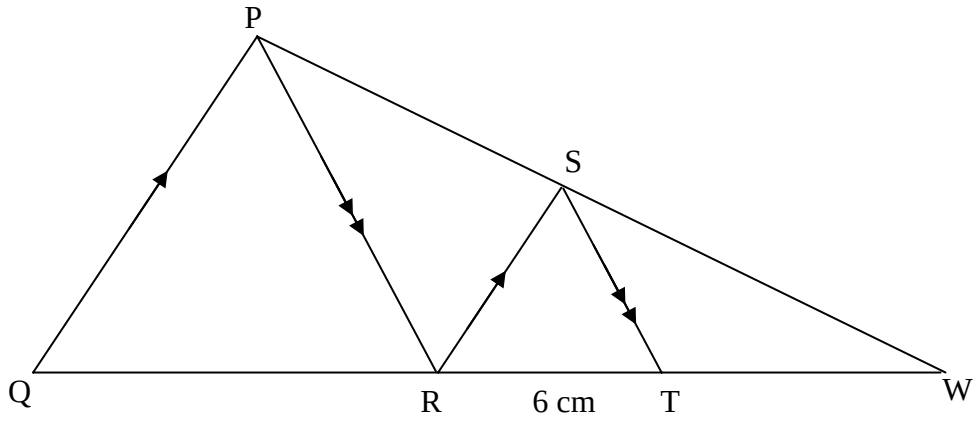
8.1	$\hat{P}_1 = 90°$ (∠ in semicircle)	✓ $\hat{P}_1 = 90°$ (1)
8.2	$\hat{P}_4 = 90°$ (vert opp ∠s) BN is a diameter (chord subtends 90°)	✓ $\hat{P}_4 = 90°$ ✓ chord subtends 90° (2)
8.3.1	$\hat{A} = 20°$ (∠ sum Δ)	✓ answer (1)
8.3.2	$\hat{P}_6 = 70°$ (tan ch th)	✓ answer (1)
8.3.3	$\hat{P}_3 = 70°$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

QUESTION 9



9.1	ST = PT = 2x (line from circ centre ⊥ ch bis ch)	✓ S/R (1)
9.2	In ΔRST and ΔPKT 1. $\hat{R} = \hat{P}$ (∠ in same seg) 2. $\hat{S} = \hat{K}$ (∠ in same seg) 3. $R\hat{T}K = P\hat{T}K = 90°$ (given) ΔRST ||| ΔPKT (∠∠∠)	✓ S/R ✓ S/R ✓ R (3)
9.3	$\frac{ST}{KT} = \frac{RT}{PT}$ (||| Δs) $\frac{2x}{x} = \frac{320}{2x}$ $4x = 320$ $x = 80$ mm **OR** $\frac{ST}{RT} = \frac{KT}{PT}$ $\frac{2x}{320} = \frac{x}{2x}$ $2x = 160$ $x = 80$ mm	✓ $\frac{ST}{KT} = \frac{RT}{PT}$ ✓ substitution ✓ answer (3) **[7]**

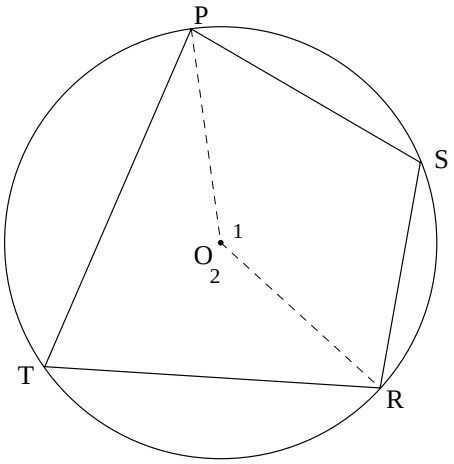
QUESTION 10



10.1	$\frac{WS}{SP}=\frac{3}{2}$ $\frac{WS}{SP}=\frac{WT}{RT}=\frac{3}{2}$ (ST || PR; Prop th) $WT=\frac{3\times 6}{2}$ WT = 9 cm	✓ $\frac{WS}{SP}=\frac{WT}{RT}$ ✓ ST || PR; Prop th ✓ answer (3)
10.2	$\frac{WS}{SP}=\frac{WR}{RQ}=\frac{3}{2}$ (SR || PQ; Prop th) $\frac{9+6}{RQ}=\frac{3}{2}$ RQ = 10 cm WQ = 10 + 9 + 6 = 25 cm	✓ $\frac{WS}{SP}=\frac{WR}{RQ}=\frac{3}{2}$ ✓ $\frac{9+6}{RQ}=\frac{3}{2}$ ✓ RQ = 10 ✓ WQ = 25 (4) **[7]**

QUESTION 11

11.1



Join RO and OP

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

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

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

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

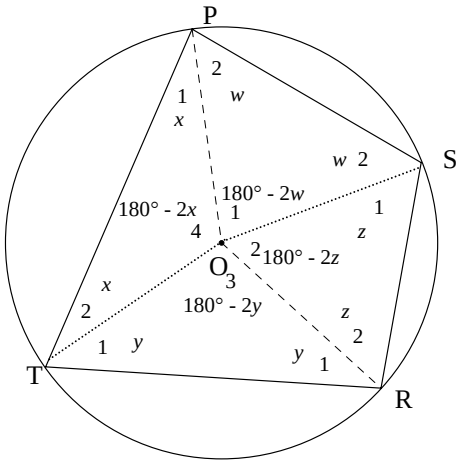
$\hat{S} + \hat{T} = x + 180° - x$

$= 180°$

✓ construction
✓ $\hat{O}_1 = 2x$
✓ $\hat{O}_2 = 360° - 2x$
✓ $\hat{T} = x$
✓ $\hat{S} = 180° - x$
✓ reason

(6)

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)

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

Similarly

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

By angles in a revolution

$\hat{O}_1 + \hat{O}_2 + \hat{O}_3 + \hat{O}_4 = 180° - 2w + 180° - 2z + 180° - 2y + 180° - 2x$

$360° = 720° - 2(w + z + y + x)$

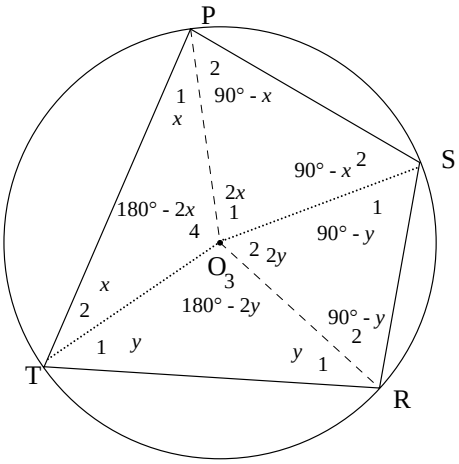
$2(w + z + y + x) = 360°$

$w + z + y + x = 180°$

✓ construction
✓ Let $\hat{P}_1 = x$, $\hat{S}_2 = w$, $\hat{S}_1 = z$ and $\hat{R}_1 = y$
✓ $\hat{O}_1 = 180° - 2w$ ($\angle$ sum Δ)
✓ setting up equation
✓ simplification
✓ conclusion

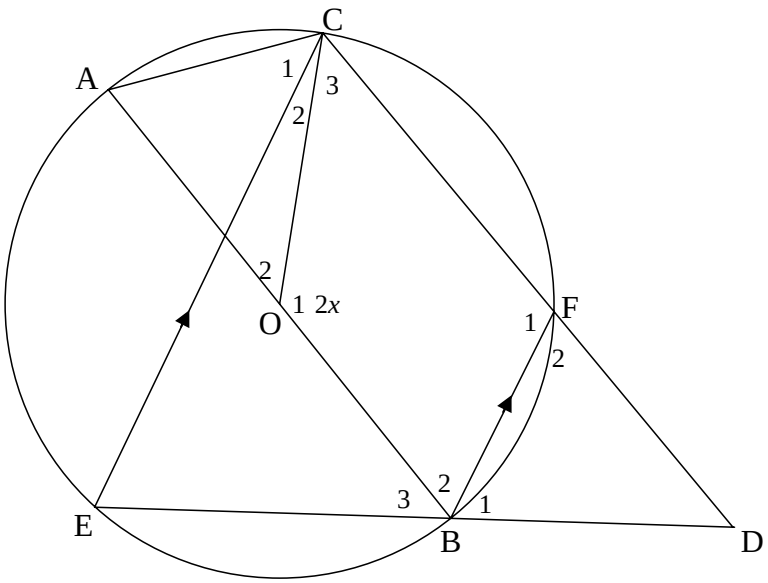
(6)

OR



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)
$\hat{O}_3 = 180° - 2y$ ($\angle$ sum Δ)
Similarly
$\hat{O}_4 = 180° - 2x$
$\hat{S}_2 = \hat{P}_2$ and $\hat{S}_1 = \hat{R}_1$ ($\angle$s opp = radii)
$\hat{T}_1 + \hat{T}_2 + \hat{S}_1 + \hat{S}_2 = x + y + 90° - x + 90° - y$
$= 180°$

✓ construction
✓ Let $\hat{P}_1 = x$ and $\hat{R}_1 = y$
✓ $\hat{O}_3 = 180° - 2y$ ($\angle$ 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)



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

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

TOTAL: 100