



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/*GRAAD* 12

MATHEMATICS P3/*WISKUNDE V3*

NOVEMBER 2013

MEMORANDUM

MARKS/*PUNTE*: 100

**This memorandum consists of 14 pages.
*Hierdie memorandum bestaan uit 14 bladsye.***

NOTE:

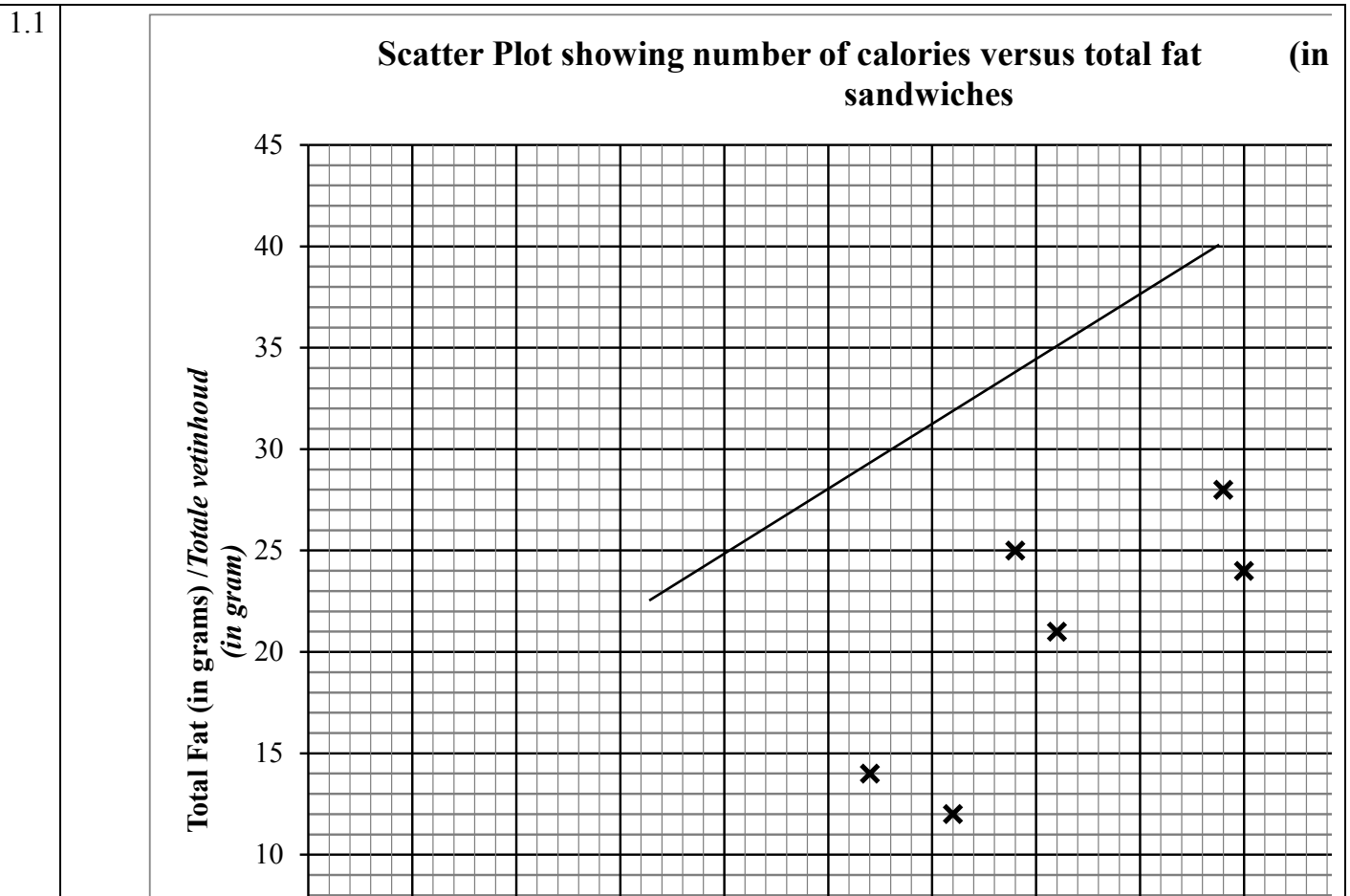
- If a candidate answered a question TWICE, mark only the first attempt.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed-out question.
- Consistent accuracy applies in ALL aspects of the marking memorandum.

LET WEL:

- *As 'n kandidaat 'n vraag TWEE keer beantwoord het, merk slegs die eerste poging.*
- *As 'n kandidaat 'n antwoord deurgehaal en nie oorgedoen het nie, merk die deurgehaalde antwoord.*
- *Volgehoue akkuraatheid is DEURGAANS in ALLE aspekte van die memorandum van toepassing.*

QUESTION/VRAAG 1

Calories	270	310	340	360	440	450	580	620
Total fat (in grams)	14	12	25	21	28	24	32	43



NOTE:

- The English and Afrikaans diagrams are different in size
- The point (300 ; 34) is from 1.4. Do not penalise for this point in question 1.1.
- The learner may have other points due to trying to draw the least squares regression line

✓✓✓ all 8 points plotted correctly

2 marks for 5 – 7 points plotted correctly

1 mark for 2 – 4 points plotted correctly

No marks for 1 point or less plotted correctly. (3)

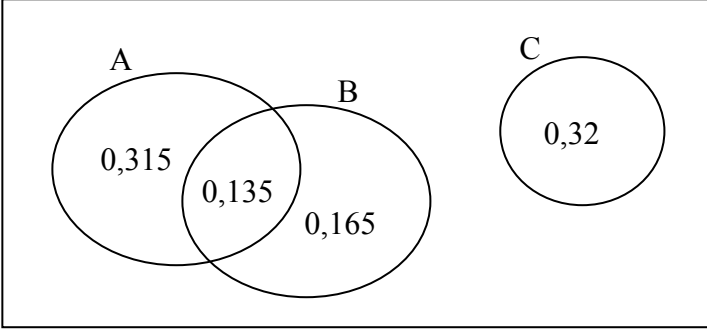
1.2	$a = -5,62$ ($-5,62181859\dots$) $b = 0,07$ ($0,072396008\dots$) $\hat{y} = -5,62 + 0,07x$	NOTE: Penalty 1 for rounding in question 1.2.	$\checkmark\checkmark$ a or b \checkmark b or a \checkmark equation (4)
1.3	Drawn on the scatter plot		\checkmark graph passing close to $(350 ; 19)$ / $(300 ; 16)$ / $(650 ; 40)$ \checkmark gradient (graph close to $(450 ; 26)$) (2)
1.4	<p>The sandwich from Pinky's restaurant has 30 grams of fat. In terms of the model, the sandwich with 16 grams of total fat should provide 300 calories. This suggests that the sandwich from Pinky's restaurant is far removed from expected model and is therefore an outlier.</p> <p><i>Die toebroodjie van Pinky se restaurant het 'n vetinhoud van 30 gram. In terme van die model, sal 'n toebroodjie van 16 gram, 300 kalorieë verskaf. Dit veronderstel dat die toebroodjie van Pinky se restaurant ver van die verwagte model verwyder is en is dus 'n uitskieter.</i></p>		\checkmark comparison with model (literal or graphical (i.e. plotting the point)) \checkmark outlier / explain this concept (2) \checkmark vergelyking met model \checkmark uitskieter (2)
1.5	$r = 0,92$ ($0,92099548\dots$)		$\checkmark\checkmark$ answer (2)
1.6	<p>There is a very strong, positive correlation between the number of calories and the total fat in the sandwiches. A sandwich with higher number of calories will have a higher total fat content.</p> <p><i>Daar is 'n baie sterk positiewe korrelasie tussen die aantal kalorieë en die totale vetinhoud in die toebroodjies. 'n Toebroodjie met 'n hoër aantal kalorieë sal 'n hoër totale vetinhoud hê.</i></p>		\checkmark strong / reference to correlation \checkmark positive / increasing / explain the concept of increasing (2)

[15]

QUESTION/VRAAG 2

2.1	<p>Random Sampling Method</p> <p><i>Ewekansige Steekproef Metode / Willekeurig / Onwillekeurig/ Lukraak</i></p>	<p>✓ answer (1)</p>
2.2	<p>Although the sample is selected randomly, there exists a chance that this could be a homogenous sample. For example the sample could contain many learners from one grade and few from other grades. The sample could contain many more learners of a particular gender and few from the other.</p> <p><i>Al is die steekproef ewekansig gedoen bestaan die kans wel dat die steekproef homogeen kan wees. Ter voorbeeld, die steekproef kan baie leerders van een graad insluit en min van ander grade.</i></p> <p><i>Die steekproef kan ook meer leerders van 'n bepaalde geslag insluit en min van die ander geslag.</i></p>	<p>✓ homogenous sample / the sample will be biased towards one characteristic (1)</p> <p>✓ homogene steekproef (1)</p>
2.3	<p>The sampling should have equal representation across various criteria. In this case the criteria will possibly be grade and gender. There should possibly be a selection of 8 boys and 8 girls randomly from each grade for the sample.</p> <p><i>Gelyke verteenwoordiging van verskillende kategorieë moet in die steekproef teenwoordig wees. In die geval sal die kategorieë graad en geslag wees. Daar behoort moontlik 8 seuns en 8 meisies van elke graad ewekansig gekies te word vir die steekproef.</i></p>	<p>✓ equal representation of grade</p> <p>✓ equal representation of gender</p> <p>any explanation that indicates representing the school for equally</p> <p>Ideas to consider: gender; race; grade</p> <p>(2)</p> <p>[4]</p>

QUESTION/VRAAG 3

<p>3.1</p>	<p>Disagree. The events A and B have an intersection and are therefore not mutually exclusive. $P(A \text{ and } B) \neq 0$</p> <p><i>Verskil. Die gebeurtenisse A en B sny mekaar en is daarom nie onderling uitsluitend nie.</i> $P(A \text{ en } B) \neq 0$</p> <p>OR Disagree $P(A) + P(B) + P(C) = 1,07$ Since the sum of the probabilities of the events is greater than 1, these events must have an intersection. Hence A and B are not mutually exclusive events.</p> <p><i>Verskil</i> $P(A) + P(B) + P(C) = 1,07$ Siende dat die som van die waarskynlikhede van al die gebeurtenisse groter as 1 is, moet daar 'n snyding wees. Vervolgens sal A en B nie onderling uitsluitend wees nie.</p>	<p>✓ disagree ✓ intersection between events exist (2)</p> <p>✓ disagree ✓ intersection between events exist (2)</p>
<p>3.2.1</p>	<p>$P(B \text{ or } C) = P(B) + P(C)$ $= 0,3 + 0,32$ $= 0,62$</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>NOTE: Answer only: full marks</p> </div> <p>OR</p> <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: 60%;">  </div> <p>$P(A \text{ and } B) = P(A) \cdot P(B)$ $= 0,45 \times 0,3$ $= 0,135$</p> <p>$P(B \text{ or } C) = 0,135 + 0,165 + 0,32$ $= 0,62$</p>	<p>✓ substitution into correct formula ✓ answer (2)</p> <p>✓ substitution into correct formula ✓ answer (2)</p>
<p>3.2.2</p>	<p>$P(A \text{ and } B) = P(A) \cdot P(B)$ $= 0,45 \times 0,3$ $= 0,135$</p> <p>$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $= 0,45 + 0,3 - 0,135$ $= 0,615$ $= 0,62$</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>NOTE: Answer only: 1/2 marks</p> </div>	<p>✓ 0,135 ✓ answer (2)</p> <p style="text-align: right;">[6]</p>

QUESTION/VRAAG 4

4.1	<p>The word "EQUATIONS" has 9 letters</p> <p>Number of different 5 letter codes $= 9 \times 8 \times 7 \times 6 \times 5$ $= 15120$</p> <p>OR</p> <p>Number of different 5 letter codes $= \frac{9!}{4!}$ $= 15120$</p> <p>ACCEPT:</p> <p>Number of different 5 letter codes (this is with repetition) $= 9^5$ $= 59049$</p>	<p>✓ multiplication rule in five "slots" ✓ answer (2)</p> <p>✓ multiplication rule in five "slots" ✓ answer (2)</p>
4.2	<p>4 consonants 5 vowels</p> <p>Number of different codes OR Number of different codes $= 5 \times 5 \times 4 \times 3 \times 2 \times 1$ $= 5 \times 5!$ $= 600$ $= 600$</p>	<p>✓ 5 ✓ 5! ✓ answer (3)</p> <p>[5]</p>

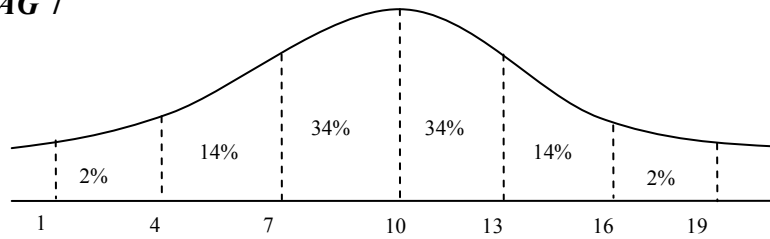
QUESTION/VRAAG 5

5.1	<p>The heights / frequency of the histogram for the interval $500 \leq x < 700$ are incorrect. <i>Die hoogtes / frekwensies van die histogram vir die wydte $500 \leq x < 700$ is nie korrek nie.</i></p> <p>OR</p> <p>The histogram has not taken into account the width of the classes. The first class is double the width of the other classes. The area of the rectangles for the class $500 \leq x < 700$ is double what it should be. <i>Die histogram het nie die wydte van die klasse in ag geneem nie. Die eerste klas is dubbel die wydte van die ander klasse. Die oppervlakte van die reghoeke vir die klas $500 \leq x < 700$, is dubbel wat dit behoort te wees.</i></p> <p>OR</p> <p>Area of each rectangle is not in the same ratio as the frequencies. <i>Die area van elke reghoek is nie in dieselfde verhouding as die frekwensies nie.</i></p>	<p>✓✓ heights / frequency incorrect (2)</p> <p>✓✓ width not taken into account (2)</p> <p>✓✓ area of rectangle not in same ratio as frequencies (2)</p>
5.2	<p>The interval $500 \leq x < 700$ should have a frequency of 5. <i>Die frekwensie behoort 5 vir die klas $500 \leq x < 700$ te wees.</i></p>	<p>✓ frequency should be 5 ✓ keep interval the same (2)</p> <p>[4]</p>

QUESTION/VRAAG 6

<p>6.1</p>		<p>(6)</p>
<p>6.2</p>	$x + 80 + 40 + 70 + 470 + 100 + 670 = 2140$ $x + 1430 = 2140$ $x = 710$ <p>Number said lack of parental support $= 710 + 80 + 40 + 70$ $= 900$</p>	<p>✓ sum of values in Venn diagram = 2140 ✓ answer for x (must not be negative) ✓ answer</p> <p>(3)</p>
<p>6.3</p>	<p>P(exactly 2 problems)</p> $= \frac{80 + 100 + 70}{2140}$ $= \frac{250}{2140}$ $= \frac{25}{214}$ $= 0,12 \quad (0,1168224299\dots)$	<p>✓ $80 + 100 + 70 = 250$ ✓ 2140</p> <p>✓ answer</p> <p>(3) [12]</p>

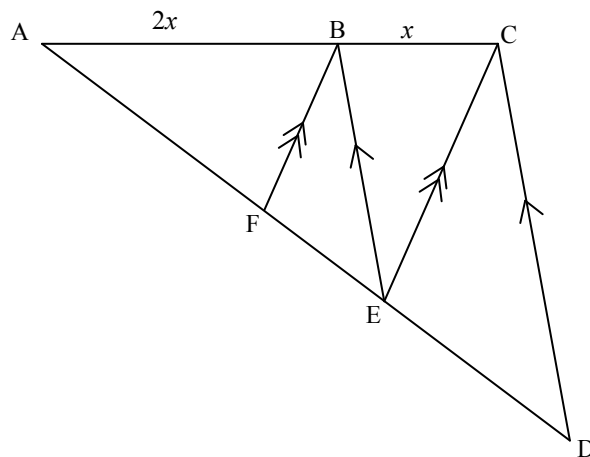
QUESTION/VRAAG 7



7.1.1	$16 = 10 + 2(3)$ $P(\text{More than 16 point}) = 2\%$	✓ 2 std deviations from mean. ✓ 2% (2)
7.1.2	$\frac{84}{100} \times 200 = 168$ learners NOTE: If 16% is used: max 1 mark	✓ 84% ✓ answer (2)
7.2	<p>Mathematics test $\bar{x} + \sigma = 55 + 15$ $= 70$</p> <p>English test $\bar{x} + \sigma = 55 + (7,5)$ $= 62,5$ $\bar{x} + 2\sigma = 55 + 2(7,5)$ $= 70$</p> <p>Matilda scored better relative to her classmates in the English test as she scored between the 1st and the 2nd deviation from the mean.</p> <p><i>Matilda het beter as die res van haar klasmaats in die Engelse toets gevaar aangesien haar punt tussen die 1^{ste} en die 2^{de} afwyking van die gemiddeld was.</i></p> <p>OR</p> <p>A mark of 67% in Maths lies within 1 standard deviation to the right of the mean. Hence it is approximately at the 76th percentile of distribution of the Maths marks.</p> <p>A mark of 67% in English lies between 1 and 2 standard deviations to the right of the mean. Hence it is approximately at the 95th percentile of distribution of the English marks.</p> <p>Matilda scored better relative to her classmates in the English test as she has outperformed more learners in English than in Maths.</p> <p><i>'n Punt van 67% in Wiskunde lê binne 1 standaardafwyking aan die regterkant van die gemiddeld. Vervolgens is dit ongeveer by die 76 ste persentiel van die verspreiding van die Wiskunte. 'n Punt van 67% in Engels lê tussen die 1ste en 2de standaardafwyking regs van die gemiddeld. Vervolgens is die Engelse punt ongeveer by die 95 ste persentiel van die verspreiding van die Engelse punte. Matilda het relatief tot haar klasmaats beter in die Engelse toets gevaar. Sy het beter gevaar as meer van die leerders in Engels as in Wiskunde.</i></p>	✓ $\bar{x} + \sigma = 70$ ✓ $\bar{x} + \sigma = 62,5$ ✓ answer (3) ✓ 76 th percentile ✓ 95 th percentile ✓ answer (3) [7]

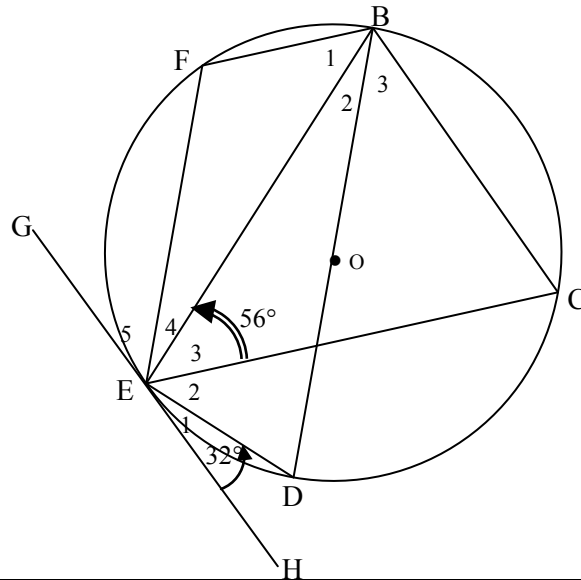
QUESTION/VRAAG 8

8.1	$T_1 = -5$ $T_2 = -5 + 3(2) - 4 = -3$ $T_3 = -3 + 3(3) - 4 = 2$ $T_4 = 2 + 3(4) - 4 = 10$	$\checkmark T_2 = -3$ $\checkmark T_3 = 2$ $\checkmark T_4 = 10$ (3)
8.2	$T_{30} = T_1 + S_{29 \text{ of the linear pattern}}$ $= -5 + \frac{29}{2}[2(2) + 28(3)]$ $= -5 + 1276$ $= 1271$ <p>OR</p> $2a = 3$ $a = \frac{3}{2}$ $3\left(\frac{3}{2}\right) + b = 2$ $b = -\frac{5}{2}$ $\left(\frac{3}{2}\right) + \left(-\frac{5}{2}\right) + c = -5$ $c = -4$ $T_n = \frac{3}{2}n^2 - \frac{5}{2}n - 4$ $T_{30} = \frac{3}{2}(30)^2 - \frac{5}{2}(30) - 4$ $= 1271$ <p>OR By expanding the formula:</p> <p>-5 ; -3 ; 2 ; 10 ; 21 ; 35 ; 52 ; 72 ; 95 ; 121 ; 150 ; 182 ; 217 ; 255 ; 296 ; 340 ; 387 ; 437 ; 490 ; 546 ; 605 ; 667 ; 732 ; 800 ; 871 ; 945 ; 1 022 ; 1 102 ; 1 185 ; 1 271</p> <p>The 30th term = 1 271</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> <p>NOTE: Answer only: 4 marks</p> </div>	$\checkmark T_1 + S_{29 \text{ of the linear pattern}}$ $\checkmark a = 2$ $\checkmark d = 3$ \checkmark answer (4) $\checkmark a = \frac{3}{2}$ $\checkmark b = -\frac{5}{2}$ $\checkmark c = -4$ \checkmark answer (4) $\checkmark\checkmark\checkmark$ expansion \checkmark answer (4) [7]

QUESTION/VRAAG 9

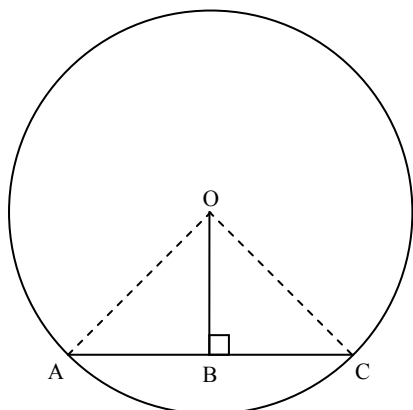
9.1	$AF : FE$ $= 2 : 1$ (Prop Th; $FB \parallel EC$) (Eweredigheid St; $FB \parallel EC$)	✓ answer ✓ reason (2)
9.2	$\frac{AF}{FE} = \frac{2}{1}$ $FE = \frac{AF}{2} = \frac{8}{2} = 4 \text{ cm}$ $AE = 12 \text{ cm}$ $\frac{ED}{AE} = \frac{1}{2}$ (BE \parallel DC; Prop Th) / (BE \parallel DC; Eweredigheid St) $\frac{ED}{12} = \frac{1}{2}$ $ED = 6 \text{ cm}$	✓ FE = 4 cm ✓ AE = 12 cm ✓ $\frac{ED}{AE} = \frac{1}{2}$ ✓ answer (4) [6]

QUESTION/VRAAG 10



10.1	$\hat{E}_2 = 90^\circ - 56^\circ$ (\angle s in a semi circle) $\hat{E}_2 = 34^\circ$ (\angle e in 'n halwe sirkel)	✓ $\hat{E}_2 = 34^\circ$ ✓ \angle s in a semi circle (2)
10.2	$\hat{C}\hat{E}H = \hat{E}_1 + \hat{E}_2 = 66^\circ$ $\therefore \hat{E}\hat{B}C = \hat{B}_2 + \hat{B}_3 = 66^\circ$ (tan ch th) (raaklyn koord) OR $\hat{B}_2 = 32^\circ$ (tan ch th) (raaklyn koord) $\hat{B}_3 = 34^\circ$ (\angle s in the same segment) (\angle e in selfde seg) $\hat{E}\hat{B}C = 66^\circ$	✓ $\hat{C}\hat{E}H = 66^\circ$ ✓ $\hat{E}\hat{B}C = 66^\circ$ ✓ tan ch th (3) ✓ tan ch th ✓ $\hat{B}_3 = 34^\circ$ ✓ answer (3)
10.3	$\hat{E}_1 + \hat{E}_2 + \hat{E}_3 = 122^\circ$ $\hat{F} = 122^\circ$ (tan ch th) / (raaklyn koord) OR $\hat{C} = 58^\circ$ (sum of int \angle s of Δ) / (som van binne \angle e Δ) $\hat{F} = 122^\circ$ (opp \angle s cyclic quad) / (oorst \angle koordevierhoek) OR $\hat{D} = 58^\circ$ (sum of int \angle s of Δ) / (som van binne \angle e Δ) $\hat{F} = 122^\circ$ (opp \angle s cyclic quad) / (oorst \angle koordevierhoek)	✓✓ $\hat{F} = 122^\circ$ ✓✓ reason (4) ✓ $\hat{C} = 58^\circ$ ✓ \angle sum Δ ✓ $\hat{F} = 122^\circ$ ✓ opp \angle s cyclic quad (4) ✓ $\hat{D} = 58^\circ$ ✓ \angle sum Δ ✓ $\hat{F} = 122^\circ$ ✓ opp \angle s cyclic quad (4) [9]

QUESTION/VRAAG 11



Construct radii OA and OC.

In $\triangle OAB$ and $\triangle OCB$

- i. OB is common
- ii. $OA = OC$ (radii)
- iii. $\hat{O}BA = \hat{O}BC = 90^\circ$ (given)

$\triangle OAB \equiv \triangle OCB$ (90°HS)

$AB = BC$ ($\equiv \Delta s$)

OR

Construct radii OA and OC.

In $\triangle OAB$ and $\triangle OCB$

- i. OB is common **OR** $OA = OC$ (radii)
- ii. $\hat{A} = \hat{C}$ ($\angle s$ opp = radii)
- iii. $\hat{O}BA = \hat{O}BC = 90^\circ$ (given)

$\triangle OAB \equiv \triangle OCB$ (SAA)

$AB = BC$ ($\equiv \Delta s$)

OR

Construct radii OA and OC.

$\hat{O}BA = \hat{O}BC = 90^\circ$ (given)
 $OA^2 = OB^2 + AB^2$ (Pythagoras)
 $OC^2 = OB^2 + BC^2$ (Pythagoras)
 $OC = OA$ (radii)
 OB is common
 $AB^2 = BC^2$
 $AB = BC$

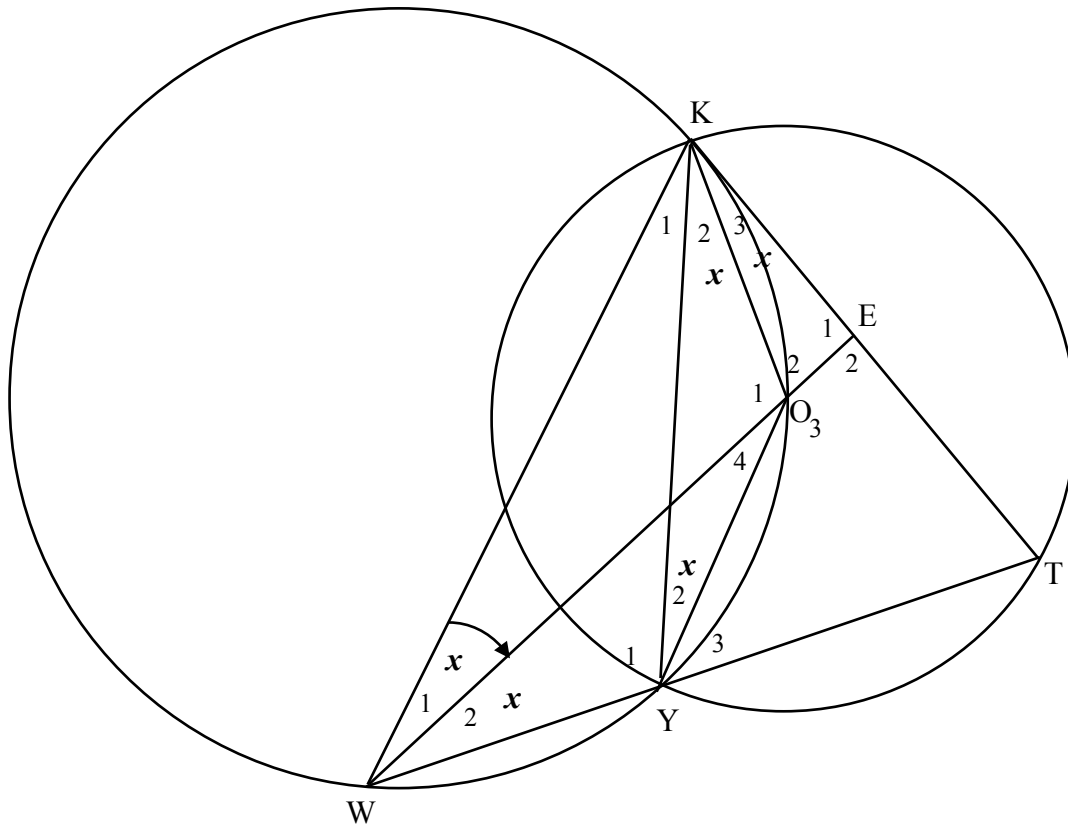
- ✓ construction
- ✓ OB common
- ✓ radii
- ✓ $\hat{O}BA = \hat{O}BC = 90^\circ$
- ✓ 90°HS

- ✓ construction
- ✓ OB common /
OA = OC
- ✓ $\angle s$ opp = radii
- ✓ $\hat{O}BA = \hat{O}BC = 90^\circ$
- ✓ SAA

- ✓ construction
- ✓ $OA^2 = OB^2 + AB^2$
- ✓ $OC^2 = OB^2 + BC^2$
- ✓ $OA = OC$ / radii
- ✓ $AB^2 = BC^2$

[5]

QUESTION/VRAAG 12



12.1	$\hat{K}_3 = x$ (tan ch th) <i>(raaklyn koord)</i> $\hat{Y}_2 = x$ (\angle s in same seg) <i>(\anglee in selfde seg)</i> $\hat{K}_2 = x$ (\angle s opp = radii) / (= chs subt = \angle s) <i>(\anglee oork = radiusse) / (= koorde = \anglee)</i> $\hat{W}_2 = x$ (\angle s in same seg) / (= chs subt = \angle s) <i>(\anglee in selfde seg) / (= koorde = \anglee)</i>	✓ $\hat{K}_3 = x$ ✓ tan ch th ✓ $\hat{Y}_2 = x$ ✓ \angle s in same seg ✓ $\hat{K}_2 = x$ ✓ reason ✓ $\hat{W}_2 = x$ ✓ reason (8)
12.2	$\hat{O}_1 + \hat{O}_4 = 180^\circ - 2x$ (sum of int \angle 's of Δ) / (opp \angle cyclic quad) <i>(som van binne \anglee Δ) / (oorst \angle koordevierhoek)</i> $\hat{T} = 90^\circ - x$ (\angle at circ cent = 2 \angle at circumference)	✓ $\hat{O}_1 + \hat{O}_4 = 180^\circ - 2x$ ✓ reason ✓ reason (3)

<p>12.3</p>	<p>$\hat{E}_2 = 90^\circ$ (sum of int \angle's of Δ) / (som van binne \anglee Δ) $KE = ET$ (\perp from centre to chord bisects chord) (\perp van middelpunt tot koord halveer koord)</p> <p>OR</p> <p>$\hat{K}_1 + \hat{K}_2 + \hat{K}_3 = 90^\circ - x$ (sum of int \angle's of Δ) In ΔKWE and ΔTEW 1. $\hat{K}_1 + \hat{K}_2 + \hat{K}_3 = \hat{T} = 90^\circ - x$ (proven above) 2. $\hat{W}_1 = \hat{W}_2 = x$ (Proven in 12.1) 3. WE is common $\therefore \Delta KWE \equiv \Delta TEW$ ($\angle\angle S$)</p> <p>$KE = ET$</p>	<p>$\checkmark \hat{E}_2 = 90^\circ$ \checkmark sum of int \angle's of Δ $\checkmark \perp$ from centre to chord bisects chord (3)</p> <p>$\checkmark \hat{K}_1 + \hat{K}_2 + \hat{K}_3 = 90^\circ - x$ \checkmark sum of int \angle's of Δ</p> <p>$\checkmark \Delta KWE \equiv \Delta TEW$ (3)</p>
<p>12.4</p>	<p>In ΔKOE and ΔWTE i. $\hat{K}_3 = \hat{W}_2 = x$ (proven) ii. $\hat{E}_2 = \hat{E}_1 = 90^\circ$ (\angles on str line / sum of int \angle's of Δ) (\anglee op reguit lyn / som van binne \anglee Δ) iii. $\hat{O}_2 = \hat{T} = 90^\circ - x$ (3^{rd} \angle of Δ) $\Delta KOE \parallel \Delta WTE$ ($\angle\angle\angle$)</p> <p>$\frac{KE}{WE} = \frac{OE}{TE}$ ($\parallel \Delta$s) $KE = TE$ (proven) $KE \cdot TE = OE \cdot WE$ $KE^2 = OE \cdot WE$</p> <p>OR</p> <p>In ΔKOE and ΔKWE i. $\hat{K}_3 = \hat{W}_1 = x$ (proven) ii. \hat{E}_1 is common iii. $\hat{O}_2 = \hat{K}_1 + \hat{K}_2 + \hat{K}_3$ (3^{rd} \angle of Δ) $\Delta KOE \parallel \Delta WKE$ ($\angle\angle\angle$)</p> <p>$\frac{KE}{WE} = \frac{OE}{KE}$ ($\parallel \Delta$s) $KE^2 = OE \cdot WE$</p>	<p>$\checkmark \Delta KOE$ and ΔWTE $\checkmark \hat{K}_3 = \hat{W}_2 = x$ $\checkmark \hat{E}_2 = \hat{E}_1 = 90^\circ$ $\checkmark \hat{O}_2 = \hat{T} = 90^\circ - x$</p> <p>$\checkmark \frac{KE}{WE} = \frac{OE}{TE}$ $\checkmark KE = TE$ (6)</p> <p>$\checkmark \Delta KOE$ and ΔWTE $\checkmark \hat{K}_3 = \hat{W}_1 = x$ $\checkmark \hat{E}_1$ is common $\checkmark \angle\angle\angle$</p> <p>$\checkmark \checkmark \frac{KE}{WE} = \frac{OE}{KE}$</p> <p>(6) [20]</p>

TOTAL/TOTAAL: 100