



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE/
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 11

MATHEMATICS P2/WISKUNDE V2

NOVEMBER 2013

MEMORANDUM

MARKS/PUNTE: 150

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

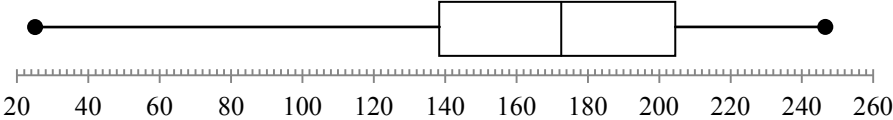
NOTE:

- If a candidate answered a question TWICE, mark the FIRST attempt ONLY.
- 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 memorandum.
- Assuming answers/values in order to solve a problem is NOT acceptable.

LET WEL:

- As 'n kandidaat 'n vraag TWEE keer beantwoord het, merk SLEGS die EERSTE poging.
- As 'n kandidaat 'n antwoord deurgehaal het en nie oorgedoen het nie, merk die deurgehaalde antwoord.
- Volgehoue akkuraatheid (werk met die fout) moet op ALLE aspekte van die memorandum toegepas word.
- Om antwoorde/waardes om 'n probleem op te los te aanvaar, is ONAANVAARBAAR.

QUESTION/VRAAG 1

1.1	$\text{Mean/Gemiddelde} = \frac{\sum_{i=1}^n x_i}{n} = \frac{3404}{21} = 162,1 \text{ km}$	✓✓ $\frac{3404}{21}$ ✓ answer/antw (3)
1.2	Standard deviation = 61,5	✓✓ 61,5 (2)
1.3	The one standard deviation limits are $(\bar{x} - 1\sigma; \bar{x} + 1\sigma)$ The interval is [100,6 ; 223,6] ∴ 5 stages are beyond one interval of the mean.	✓ interval ✓ answer/antw (2)
1.4	Minimum : 25 Lower quartile : 139 Median: 173 Upper quartile : 204,5 Maximum: 247 (25 ; 139 ; 173 ; 204,5 ; 247)	✓ 25 and 247 ✓ 139 ✓ 173 ✓ 204,5 (4)
1.5		✓ box/mond ✓ whiskers/snor (2)
1.6	Yes. It can be observed from the data that the three lowest values are far removed from the rest of the data and hence are classified as outliers. Ja. Waarneming van die data toon dat die drie laagste waardes ver verwyderd van die res van die data is en dus as uitskieters geklassifiseer kan word. OR/OF Yes. The whisker on the left is longer than the whisker on the right. That implies that the values near the minimum value are outliers. Ja. Die snor aan die linkerkant is langer as die snor aan die regterkant. Dit impliseer dat die waardes na aan die minimum waarde uitskieters is. OR/OF	✓ yes/ja ✓ reason/rede (2) ✓ yes/ja ✓ reason/rede (2)

	<p>Yes. The range from the median to the minimum value is greater than the range from the maximum value to the median, therefore it seems that the first 3 data items are outliers.</p> <p><i>Ja. Die wydte van die mediaan na die minimum waarde is groter as die wydte van die maksimum waarde na die mediaan, dus blyk dit dat die eerste 3 data-items uitskieters is.</i></p> <p>OR/OF</p> <p>Yes.</p> <p>The limits for the outliers are $(Q_1 - 1,5 \times IQR ; Q_3 + 1,5 \times IQR)$ $= (139 - 98,25 ; 204,5 + 98,25)$ $= (40,75 ; 302,75)$</p> <p>Any value below 40,75 is an outlier, therefore the first 3 data items are outliers.</p>	<p>✓ yes/ja ✓ reason/rede (2)</p> <p>✓ yes/ja</p> <p>✓ interval (2)</p> <p>[15]</p>
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QUESTION/VRAAG 2

2.1	100 data points	✓ 100 (1)
2.2	$32000 < x \leq 40000$	✓ $32000 < x \leq 40000$ (1)
2.3	Approximately 36 000 kilometres	✓ 36 000 (1)
2.4	Upper quartile is at approximately 44 000 kilometres. Lower quartile is at approximately 30 000 kilometres. Interquartile range is approximately 14 000 kilometres	✓ $Q_3 = 44\ 000$ ✓ $Q_1 = 30\ 000$ ✓ $IQR/IKO = 14\ 000$ (3) [6]

QUESTION/VRAAG 3

3.1	$m_{BD} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{-4 - (-10)}{-8 - (-14)}$ $= \frac{6}{6}$ $= 1$ <p>OR/OF</p> $m_{BD} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{(-10) - (-4)}{(-14) - (-8)}$ $= \frac{-6}{-6}$ $= 1$	<p>✓ substitution into formula /substitusie in formule</p> <p>✓ answer/antw (2)</p> <p>✓ substitution into formula /substitusie in formule</p> <p>✓ answer/antw (2)</p>
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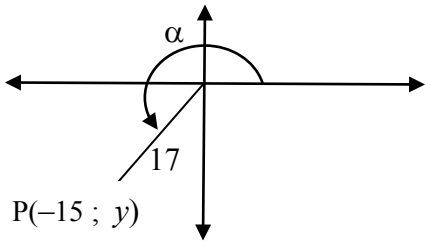
3.2	$m_{AC} \times m_{BD} = -1$ $m_{AC} \times 1 = -1$ $m_{AC} = -1$	✓ gradient of AC. (1)
3.3	Equation of line AC: $y - y_1 = m(x - x_1)$ $y - (-1) = -1(x - 4)$ $y = -x + 3$ OR/OF $y = mx + c$ $y = -x + c$ $-1 = -1(4) + c$ $c = 3$ $y = -x + 3$	✓ substitution into str line eq. <i>/substitusie in rt lynvgl</i> ✓ answer/antw (2) ✓ substitution into str line eq. <i>/substitusie in rt lynvgl</i> ✓ answer/antw (2)
3.4	If the points are collinear then their gradients are equal. $m_{BG} = m_{AB}$ $\frac{-10 - (-5)}{-14 - p} = \frac{-10 - (-1)}{-14 - 4}$ $\frac{-5}{-14 - p} = \frac{1}{2}$ $-14 - p = -10$ $p = -4$ OR/OF $m_{BG} = m_{AG}$ $\frac{-5 - (-10)}{-p - (-14)} = \frac{-1 - (-5)}{4 - p}$ $\frac{5}{p + 14} = \frac{4}{4 - p}$ $20 - 5p = 4p + 56$ $-9p = 36$ $p = -4$	✓ equal gradients/ <i>gelyke gradiënte</i> ✓ simplification/ <i>vereenvoudiging</i> ✓ answer/rede (3) ✓ equal gradients/ <i>gelyke gradiënte</i> ✓ simplification/ <i>vereenvoudiging</i> ✓ answer/rede (3)
3.5	At C, the lines $y = -x + 3$ and $4y - 5x + 30 = 0$ intersect. $\therefore 4(-x + 3) - 5x - 30 = 0$ $-4x + 12 - 5x - 30 = 0$ $-9x = 18$ $x = -2$ $y = -(-2) + 3$ $= 5$ $C(-2 ; 5)$	✓ substitution/ <i>substitusie</i> ✓ simplification/ <i>vereenvoudiging</i> ✓ $x = -2$ ✓ $y = 5$ (4) [12]

QUESTION/VRAAG 4

4.1	$AC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(3 - (-8))^2 + (2 - 0)^2}$ $= \sqrt{125}$ $= 11,18$	✓ substitution into correct formula/ <i>substitusie in korrekte formule</i> ✓ answer/antw (2)
4.2	$AB = 5$ $\sqrt{(0 - 3)^2 + (k - 2)^2} = 5$ $9 + k^2 - 4k + 4 = 25$ $k^2 - 4k - 12 = 0$ $(k - 6)(k + 2) = 0$ $k = 6 \text{ and } k \neq -2$	✓ substitution into correct formula/ <i>substitusie in korrekte formule</i> ✓ equation/vgl ✓ factorising/ <i>faktorisering</i> ✓ answer/antw $(k \neq -2)$ (4)
4.3	$m_{BC} = \frac{6 - 0}{0 - (-8)}$ $= \frac{3}{4}$ <p>Equation of BC is $y = \frac{3}{4}x + 6$</p>	✓ substitution/ <i>substitusie</i> $\frac{3}{4}$ ✓ equation/vgl (3)
4.4	$m_{AD} = m_{BC} \quad AD // BC$ $= \frac{3}{4}$ $\therefore \tan \theta = \frac{3}{4}$ $\theta = 36,87^\circ$	✓ equal gradients/ <i>gelyke gradiënte</i> $\tan \theta = \frac{3}{4}$ $36,87^\circ$ (3)
4.5	$BC = \sqrt{(0 - (-8))^2 + (6 - 0)^2}$ $= \sqrt{64 + 36}$ $= 10$ <p>Area ABCD = $10 \times 5 = 50$ units²</p>	✓ substitution/ <i>substitusie</i> ✓ 10 ✓ 50 (3)
4.6	$\tan \hat{BAC} = \frac{10}{5}$ $\hat{BAC} = 63,43^\circ$ <p>OR/OF</p> $\cos \hat{BAC} = \frac{5}{11,18}$ $\hat{BAC} = 63,43^\circ$ <p>OR/OF</p>	✓ $\tan \hat{BAC} = \frac{10}{5}$ ✓ $63,43^\circ$ (2) ✓ $\cos \hat{BAC} = \frac{5}{11,18}$ ✓ $63,43^\circ$ (2)

	<p>Area of $\triangle ABC = 25$</p> $\frac{1}{2}(5)(11,18) \sin \hat{BAC} = 25$ $\sin \hat{BAC} = \frac{25}{\frac{1}{2}(5)(11,18)}$ $= 0,894\dots$ $\hat{BAC} = 63,44^\circ$	<p>✓ correct subst into area formula / korrekte subst in opp formule</p> <p>✓ 63,44°</p> <p>(2) [17]</p>
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QUESTION/VRAAG 5

<p>5.1.1</p>	 $x^2 + y^2 = r^2$ $(-15)^2 + y^2 = (17)^2$ $y^2 = 289 - 225 = 64$ $y = \pm 8$ $y = -8$	<p>✓ substitution into formula/subst in formule</p> <p>✓ $y = -8$</p> <p>(2)</p>
<p>5.1.2</p>	$\sin(90^\circ + \alpha)$ $= \cos \alpha$ $= -\frac{15}{17}$	<p>✓ $\cos \alpha$</p> <p>✓ answer/antw</p> <p>(2)</p>
<p>5.1.3</p>	<p>If $\alpha + \beta = 540^\circ$ then $\beta = 540^\circ - \alpha$ $\therefore \tan(540^\circ - \alpha)$ $= \tan(180^\circ - \alpha)$ $= -\tan \alpha$ $= -\frac{8}{15}$</p>	<p>✓ $\beta = 540^\circ - \alpha$</p> <p>✓ reduction formula/ reduksieformule</p> <p>✓ answer/antw</p> <p>(3)</p>

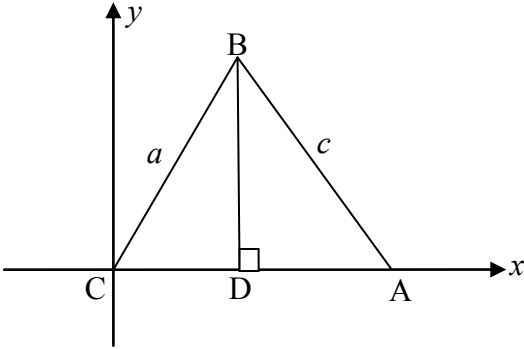
<p>5.2</p>	$\frac{\sin(180^\circ - x) - 2 \cos(90^\circ - x) \cos x}{2 \cos^2(360^\circ + x) - \cos(-x)}$ $= \frac{\sin x - 2 \sin x \cos x}{2 \cos^2 x - \cos x}$ $= \frac{\sin x(1 - 2 \cos x)}{\cos x(2 \cos x - 1)}$ $= \frac{\sin x(1 - 2 \cos x)}{-\cos x(1 - 2 \cos x)}$ $= -\tan x$	<ul style="list-style-type: none"> ✓ $\sin x$ ✓ $\sin x$ ✓ $\cos^2 x$ ✓ $\cos x$ ✓ factorising numerator and denominator / <i>fakt teller en noemer</i> ✓ $-\tan x$ <p style="text-align: right;">(6)</p>
<p>5.3.1</p>	$LHS = \frac{1 - \tan x}{1 + \tan x}$ $= \frac{1 - \frac{\sin x}{\cos x}}{1 + \frac{\sin x}{\cos x}}$ $= \frac{\cos x - \sin x}{\cos x} \div \frac{\cos x + \sin x}{\cos x}$ $= \frac{\cos x - \sin x}{\cos x + \sin x}$ <p>= RHS</p> <p>OR/OF</p> $RHS = \frac{\cos x - \sin x}{\cos x + \sin x} \times \frac{1}{\frac{\cos x}{1}}$ $= \frac{\cos x - \sin x}{\cos x} \frac{1}{\frac{\cos x}{\cos x}}$ $= \frac{1 - \tan x}{1 + \tan x}$ <p>= LHS</p>	<ul style="list-style-type: none"> ✓ $\tan x = \frac{\sin x}{\cos x}$ ✓ $\frac{\cos x - \sin x}{\cos x}$ ✓ $\frac{\cos x + \sin x}{\cos x}$ ✓ $\frac{1}{\frac{\cos x}{1}}$ ✓ $\frac{\cos x - \sin x}{\cos x} \frac{1}{\frac{\cos x}{\cos x}}$ ✓ $\frac{\cos x}{\cos x} + \frac{\sin x}{\cos x}$ <p style="text-align: right;">(3)</p>
<p>5.3.2</p>	<p>Identity is undefined when:</p> $\tan x + 1 = 0$ $\tan x = -1$ $x = 135^\circ$ <p>AND/EN</p> <p>$\tan x$ is undefined in the interval $[0^\circ ; 180^\circ]$ for $x = 90^\circ$</p> <p>OR/OF</p>	<ul style="list-style-type: none"> ✓ $x = 135^\circ$ ✓ $x = 90^\circ$ <p style="text-align: right;">(2)</p>

	<p>Identity is undefined when: $\cos x + \sin x = 0$ $\cos x = -\sin x$ $\tan x = -1$ $x = 135^\circ$ AND/EN $\tan x$ is undefined in the interval $[0^\circ ; 180^\circ]$ for $x = 90^\circ$</p>	<p>✓ $x = 135^\circ$ ✓ $x = 90^\circ$ (2)</p>
<p>5.4</p>	<p>$2 \tan x = 5 \sin x$ $2 \left(\frac{\sin x}{\cos x} \right) = 5 \sin x$ $2 \sin x = 5 \sin x \cos x$ $2 \sin x - 5 \sin x \cos x = 0$ $\sin x (2 - 5 \cos x) = 0$ $\sin x = 0$ or $\cos x = \frac{2}{5}$ $x = 0^\circ + k.180^\circ; k \in Z$ or/of $x = 66,42^\circ + k.360^\circ; k \in Z$ $x = 293,58^\circ + k.360^\circ; k \in Z$</p>	<p>✓ $\tan x = \frac{\sin x}{\cos x}$ ✓ $2 \sin x = 5 \sin x \cos x$ ✓ $\sin x = 0$ ✓ $\cos x = \frac{2}{5}$ ✓ $x = 0^\circ + k.180^\circ$ ✓ $x = 66,42^\circ + k.360^\circ$ ✓ $x = 293,58^\circ + k.360^\circ$ ✓ $k \in Z$ (8) [26]</p>

QUESTION/VRAAG 6

<p>6.1</p>		<p><u>graph f/grafiek f:</u> ✓ shape/vorm ✓ intercepts/afsnitte ✓ turning points/ draaipunte</p> <p><u>graph g/grafiek g:</u> ✓ shape/vorm ✓ intercepts/afsnitte ✓ turning points/ draaipunte</p> <p style="text-align: right;">(6)</p>
<p>6.2</p>	<p>Period of graph f is 180°</p>	<p>✓ 180°</p> <p style="text-align: right;">(1)</p>
<p>6.3</p>	<p>$x = -90^\circ$</p>	<p>✓ $x = -90^\circ$</p> <p style="text-align: right;">(1)</p>
<p>6.4</p>	<p>$h(x) = \cos 2(x - 45^\circ)$ $= \cos (2x - 90^\circ)$ $= \sin 2x$</p>	<p>✓ $\cos 2(x - 45^\circ)$</p> <p>✓ $\sin 2x$</p> <p style="text-align: right;">(2) [10]</p>

QUESTION/VRAAG 7

<p>7.1</p>	<p>Place $\triangle ABC$ with C at the origin and AC along the x-axis. Draw $BD \perp AC$</p>  <p>In $\triangle CBD$:</p> $\cos C = \frac{CD}{a} \quad \text{and} \quad \sin C = \frac{BD}{a}$ $CD = a \cos C \quad \text{and} \quad BD = a \sin C$ <p>The coordinates of the vertices are: $C(0 ; 0)$ $A(b ; 0)$ $B(a \cos C ; b \sin C)$</p> <p>Using the distance formula: $AB^2 = (a \cos C - b)^2 + (a \sin C - 0)^2$ $= a^2 \cos^2 C - 2ab \cos C + b^2 + a^2 \sin^2 C$ $= a^2 (\cos^2 C + \sin^2 C) + b^2 - 2ab \cos C$ $= a^2 (1) + b^2 - 2ab \cos C$ $= a^2 + b^2 - 2ab \cos C$</p>	<p>✓ construction/ konstruksie</p> <p>✓ coordinates of B/ koördinate van B</p> <p>✓ subst into dist formula/subst in afstandformule</p> <p>✓ multiplication/ vermenigvuldig</p> <p>✓ fact/fakt</p> <p>✓ identity/identiteit (6)</p>
<p>7.2.1</p>	$AC^2 = AB^2 + BC^2 - 2 \cdot AB \cdot BC \cdot \cos B$ $= (60)^2 + (160)^2 - 2(60)(160) \cos 60^\circ$ $= 3600 + 25600 - 9600$ $= 19600$ $AC = 140\text{mm}$	<p>✓ using the cosine rule correctly/ gebruik die cos- reël korrek</p> <p>✓ substitution/ substitusie</p> <p>✓ 140 (3)</p>
<p>7.2.2</p>	$\frac{\sin A}{BC} = \frac{\sin B}{AC}$ $\frac{\sin A}{160} = \frac{\sin 60^\circ}{140}$ $\sin A = \frac{160 \sin 60^\circ}{140}$ $= \frac{4\sqrt{3}}{7}$	<p>✓ substitution into the sine rule/ subst in die sin reël</p> <p>✓ sin A subject/ onderwerp</p> <p>✓ $\frac{4\sqrt{3}}{7}$ (3)</p>

7.2.3	<p>Area of $\triangle ABC$</p> $= \frac{1}{2} \cdot AB \cdot AD \cdot \sin A$ $= \frac{1}{2} (60)(70) \left(\frac{4\sqrt{3}}{7} \right)$ $= 1200\sqrt{3} \text{ units}^2$ $= 2078,5 \text{ units}^2$	<p>✓ correct use of area rule/korrekte gebruik v opp-reël</p> <p>✓ subst</p> <p>✓ answer/antw</p> <p>(3)</p>
7.3	<p>O is the midpoint of SR. PQRS will be a square when SR = PS.</p> $OS = \frac{1}{2} SR$ $\tan \alpha = \frac{PS}{OS} = \frac{2OS}{OS} = \frac{2}{1}$ $\alpha = 63,43^\circ$	<p>✓ $OS = \frac{1}{2} SR$</p> <p>✓ $\tan \alpha = \frac{2}{1}$</p> <p>✓ $63,43^\circ$</p> <p>(3)</p> <p>[18]</p>

QUESTION/VRAAG 8

	<p>Volume of ball</p> $= \left[\frac{4}{3} \pi r^3 \right]$ $= \frac{4}{3} \pi (6)^3$ $= 288\pi \text{ cm}^3$ <p>Volume of box</p> $= (12)^3$ $= 1728 \text{ cm}^3$ <p>\therefore Volume of box remaining = $1728 - 288\pi = 823,22 \text{ cm}^3$.</p>	<p>✓ subst into correct formula/ubst in korrekte formule</p> <p>✓ 288π</p> <p>✓ 12^3</p> <p>✓ 1728</p> <p>✓ 823,22</p> <p>[5]</p>
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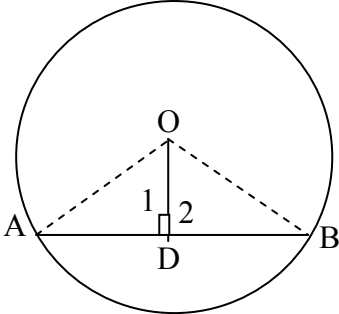
QUESTION/VRAAG 9

9.1.1	$\hat{D}AC = 40^\circ$	\angle at centre = $2\angle$ at circumference \angle by midpt = $2\angle$ by omtrek	✓ $\hat{D}AC = 40^\circ$ ✓ reason/rede (2)
9.1.2	$\hat{D}AB = \hat{B}CE = 80^\circ$	Ext \angle of cyclic quad Buite \angle van koordevh	✓ $\hat{D}AB = 80^\circ$ ✓ reason/rede (2)
9.1.3	$\hat{B}AC = \hat{D}AB - \hat{D}AC$ $= 40^\circ$		✓ $\hat{B}AC = 40^\circ$ (1)
9.2	$\hat{D}AC = 40^\circ$ and $\hat{B}AC = 40^\circ$ $\therefore DC = BC$	\angle 's subtended by DC and BC are equal \angle e onderspan deur DC en BC gelyk	✓ $\hat{D}AC = \hat{B}AC = 40^\circ$ ✓ reason/rede (2) [7]

QUESTION/VRAAG 10

10.1	$\hat{R}PT = 34^\circ$	PR bisects angle QPS PR halveer hoek QPS	✓ $\hat{R}PT = 34^\circ$ (1)
10.2	$\hat{T}QS = \hat{R}PS = 34^\circ$	\angle 's in the same segment \angle e in dieselfde segment	✓ $\hat{T}QS = 34^\circ$ ✓ reason/rede (2)
10.3	$\hat{P}QR + \hat{P}SR = 180^\circ$ $\hat{P}QR = 88^\circ$ $\hat{P}QS = 88^\circ - 34^\circ = 54^\circ$	opposite \angle 's of cyclic quad teenoorst \angle e van koordevh	✓ $\hat{P}QR = 88^\circ$ ✓ reason/rede ✓ $\hat{P}QS = 54^\circ$ (3)
10.4	$\hat{R}_3 = \hat{Q}PS = 68^\circ$ $\hat{T} + \hat{R}_3 = \hat{P}SR$ $\hat{T} = 92^\circ - 68^\circ = 24^\circ$	ext \angle of cyclic quad buite \angle van koordevh ext \angle of Δ / buite \angle van Δ	✓ $\hat{R}_3 = 68^\circ$ ✓ reason/rede ✓ $\hat{T} = 24^\circ$ ✓ reason/rede (4) [10]

QUESTION/VRAAG 11

<p>11.1</p>	<div style="text-align: center;">  </div> <p>Construction: Draw OA and OB. Proof: In $\triangle AOD$ and $\triangle BOD$:</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">$\hat{A}_1 = \hat{A}_2$</td> <td style="text-align: center;">Given 90°</td> </tr> <tr> <td style="text-align: center;">$AO = BO$</td> <td style="text-align: center;">Equal radii</td> </tr> <tr> <td style="text-align: center;">$OD = OD$</td> <td style="text-align: center;">Common side</td> </tr> <tr> <td style="text-align: center;">$\therefore \triangle AOD \equiv \triangle BOD$</td> <td style="text-align: center;">$(90^\circ ; \text{h/ss} ; \text{s})$</td> </tr> <tr> <td style="text-align: center;">$AD = DB$</td> <td style="text-align: center;">deduction from congruency</td> </tr> </table>	$\hat{A}_1 = \hat{A}_2$	Given 90°	$AO = BO$	Equal radii	$OD = OD$	Common side	$\therefore \triangle AOD \equiv \triangle BOD$	$(90^\circ ; \text{h/ss} ; \text{s})$	$AD = DB$	deduction from congruency	<p>✓ construction/ <i>konstruksie</i></p> <p>✓✓ S/R for $\equiv /$ <i>S/R vir \equiv</i></p> <p>✓ $(90^\circ ; \text{h/ss} ; \text{s})$ ✓ $AD = DB$</p> <p style="text-align: right;">(5)</p>
$\hat{A}_1 = \hat{A}_2$	Given 90°											
$AO = BO$	Equal radii											
$OD = OD$	Common side											
$\therefore \triangle AOD \equiv \triangle BOD$	$(90^\circ ; \text{h/ss} ; \text{s})$											
$AD = DB$	deduction from congruency											
<p>11.2.1</p>	<table style="width: 100%; border: none;"> <tr> <td style="width: 30%; vertical-align: top;"> <p>In $\triangle NOP$, $NO = OP$ $NS = SR$</p> <p>$\therefore TO \parallel RP$ OR/OF $\hat{N}RP = 90^\circ$ $\hat{N}SO = 90^\circ$ $\therefore \hat{N}RP = \hat{N}SO$ $\therefore TO \parallel RP$</p> </td> <td style="width: 70%; vertical-align: top;"> <p>equal radii/<i>gelyke radiusse</i> line from centre perpendicular to chord/ <i>lyn van midpt loodreg op koord</i> midpoint theorem/<i>middelpuntstelling</i></p> <p>\angle in a semi circle/<i>\angle in halfsirkel</i> $TO \perp NQ$ Both/<i>beide</i> $= 90^\circ$ Corresponding \angle's equal/<i>ooreenkomstige</i> \angle'e gelyk</p> </td> </tr> </table>	<p>In $\triangle NOP$, $NO = OP$ $NS = SR$</p> <p>$\therefore TO \parallel RP$ OR/OF $\hat{N}RP = 90^\circ$ $\hat{N}SO = 90^\circ$ $\therefore \hat{N}RP = \hat{N}SO$ $\therefore TO \parallel RP$</p>	<p>equal radii/<i>gelyke radiusse</i> line from centre perpendicular to chord/ <i>lyn van midpt loodreg op koord</i> midpoint theorem/<i>middelpuntstelling</i></p> <p>\angle in a semi circle/<i>\angle in halfsirkel</i> $TO \perp NQ$ Both/<i>beide</i> $= 90^\circ$ Corresponding \angle's equal/<i>ooreenkomstige</i> \angle'e gelyk</p>	<p>✓ $NO = OP$ (S/R) ✓ $NS = SR$ (S/R)</p> <p>✓ reason/<i>rede</i></p> <p style="text-align: right;">(3)</p> <p>✓ $\hat{N}RP = 90^\circ$ (S/R) ✓ $\hat{N}SO = 90^\circ$ (S/R) ✓ reason/<i>rede</i></p> <p style="text-align: right;">(3)</p>								
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<p>11.2.2</p>	<table style="width: 100%; border: none;"> <tr> <td style="width: 30%; vertical-align: top;"> <p>$\hat{P} = \hat{TRN} = x$ $\hat{N}OT = \hat{P} = x$ OR/OF $\hat{ORP} = \hat{P} = x$</p> </td> <td style="width: 70%; vertical-align: top;"> <p>tan-chord theorem/<i>raakl-koord-stelling</i> corr \angle's/<i>ooreenk\angle'e</i> ; $TO \parallel RP$</p> <p>\angle's opp equal sides ($OP = OR$) \angle'e teenoor gelyke sye</p> </td> </tr> </table>	<p>$\hat{P} = \hat{TRN} = x$ $\hat{N}OT = \hat{P} = x$ OR/OF $\hat{ORP} = \hat{P} = x$</p>	<p>tan-chord theorem/<i>raakl-koord-stelling</i> corr \angle's/<i>ooreenk\angle'e</i> ; $TO \parallel RP$</p> <p>\angle's opp equal sides ($OP = OR$) \angle'e teenoor gelyke sye</p>	<p>✓ $\hat{P} = \hat{TRN} = x$ ✓ reason/<i>rede</i> ✓ $\hat{N}OT = \hat{P} = x$ (S/R) OR/OF ✓ $\hat{ORP} = \hat{P} = x$ (S/R)</p> <p style="text-align: right;">(3)</p>								
<p>$\hat{P} = \hat{TRN} = x$ $\hat{N}OT = \hat{P} = x$ OR/OF $\hat{ORP} = \hat{P} = x$</p>	<p>tan-chord theorem/<i>raakl-koord-stelling</i> corr \angle's/<i>ooreenk\angle'e</i> ; $TO \parallel RP$</p> <p>\angle's opp equal sides ($OP = OR$) \angle'e teenoor gelyke sye</p>											
<p>11.2.3</p>	<table style="width: 100%; border: none;"> <tr> <td style="width: 30%; vertical-align: top;"> <p>$\hat{N}OT = \hat{TRN} = x$ $NTRO$ is a cyclic quadrilateral <i>NTRO is 'n koordevh</i></p> </td> <td style="width: 70%; vertical-align: top;"> <p>proven/ <i>bewys</i> ...equal \angle's subtended by NT ...<i>gelyke \angle'e onderspan deur NT</i></p> </td> </tr> </table>	<p>$\hat{N}OT = \hat{TRN} = x$ $NTRO$ is a cyclic quadrilateral <i>NTRO is 'n koordevh</i></p>	<p>proven/ <i>bewys</i> ...equal \angle's subtended by NT ...<i>gelyke \angle'e onderspan deur NT</i></p>	<p>✓ $\hat{N}OT = \hat{TRN} = x$ ✓ reason/<i>rede</i></p> <p style="text-align: right;">(2)</p>								
<p>$\hat{N}OT = \hat{TRN} = x$ $NTRO$ is a cyclic quadrilateral <i>NTRO is 'n koordevh</i></p>	<p>proven/ <i>bewys</i> ...equal \angle's subtended by NT ...<i>gelyke \angle'e onderspan deur NT</i></p>											

<p>11.2.4</p>	<p>$\hat{N}\hat{R}\hat{P} = 90^\circ$ $\hat{P} = \hat{TR}\hat{N} = x$ $\hat{M} + \hat{MR}\hat{P} + \hat{P} = 180^\circ$ sum of \angle's of a Δ/som van \anglee van Δ $\hat{M} = 180^\circ - x - 90^\circ - x$ $\hat{M} = 90^\circ - 2x$</p>	<p>✓ S ✓ reason/rede ✓ $\hat{M} = 90^\circ - 2x$ (3)</p>
<p>11.2.5</p>	<p>$\hat{O}\hat{R}\hat{P} = \hat{P} = x$ OP = OR $\hat{O}\hat{R}\hat{P} = \hat{R}\hat{O}\hat{T} = x$ alt \angle's/verwiss\angle'e ; TO PR $\hat{R}\hat{O}\hat{T} = \hat{R}\hat{N}\hat{T} = x$ \angle's in same segment/\anglee in dieselfde segm $\Rightarrow \hat{P} = \hat{R}\hat{N}\hat{T} = x$ \therefore NT is a tangent at N converse tan-chord theorem \therefore NT is 'n raaklyn by N omgekeerde raakl-koord-stelling</p>	<p>✓ $\hat{O}\hat{R}\hat{P} = \hat{R}\hat{O}\hat{T} = x$ (S/R) ✓ $\hat{R}\hat{O}\hat{T} = \hat{R}\hat{N}\hat{T} = x$ (S/R) ✓ reason/rede (3) [19]</p>

QUESTION/VRAAG 12

	<p>$\hat{E}\hat{F}\hat{C} = \hat{A}\hat{B}\hat{C}$ ext \angle of cyclic quad = int opp \angle <i>buite \angle van koordevh = teenoorst binne \angle</i> $\hat{A}\hat{B}\hat{C} = \hat{B}\hat{D}\hat{C}$ tan-chord theorem/ raakl-koord-stelling $\hat{E}\hat{F}\hat{C} = \hat{B}\hat{D}\hat{C}$ \therefore CDEF is a cyclic quadrilateral/is 'n koordevierhoek ext \angle of quadrilateral = int opp \angle <i>buite \angle van koordevh = teenoorst binne \angle</i></p>	<p>✓ $\hat{E}\hat{F}\hat{C} = \hat{A}\hat{B}\hat{C}$ ✓ reason/rede ✓ $\hat{A}\hat{B}\hat{C} = \hat{B}\hat{D}\hat{C}$ ✓ reason/rede ✓ reason/rede (5) [5]</p>
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TOTAL/TOTAAL: 150