basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE 12/*GRAAD 12*

MATHEMATICS P2/*WISKUNDE V2*

NOVEMBER 2022

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

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APPROVED MARKING GUIDELINE
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These marking guidelines consist of 24 pages.
Hierdie nasienriglyne bestaan uit 24 bladsye.

Approved by Umalusi External Moderator
16/11/2002

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NOTE:

- **If a candidate answers a question TWICE, only mark the FIRST attempt.**
- **If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.**
- **Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking at the second calculation error.**
- **Assuming answers/values in order to solve a problem is NOT acceptable.**

NOTA:

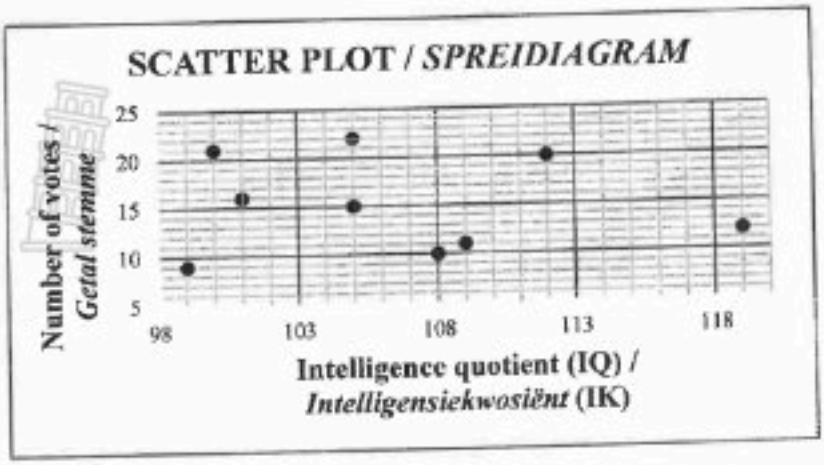
- ***As 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.***
- ***As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, merk die doodgetrekte poging.***
- ***Volgehoue akkuraatheid word in ALLE aspekte van die memorandum toegepas. Hou op nasien by die tweede berekeningsfout.***
- ***Aanvaar van antwoorde/waardes om 'n probleem op te los, word NIE toegelaat nie.***

GEOMETRY/*MEETKUNDE*	
S	**A mark for a correct statement** **(A statement mark is independent of a reason)**
	'n Punt vir 'n korrekte bewering ***('n Punt vir 'n bewering is onafhanklik van die rede)***
R	**A mark for the correct reason** **(A reason mark may only be awarded if the statement is correct)**
	'n Punt vir 'n korrekte rede ***('n Punt word slegs vir die rede toegeken as die bewering korrek is)***
S/R	**Award a mark if statement AND reason are both correct**
	Ken 'n punt toe as die bewering EN rede beide korrek is

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QUESTION/*VRAAG* 1



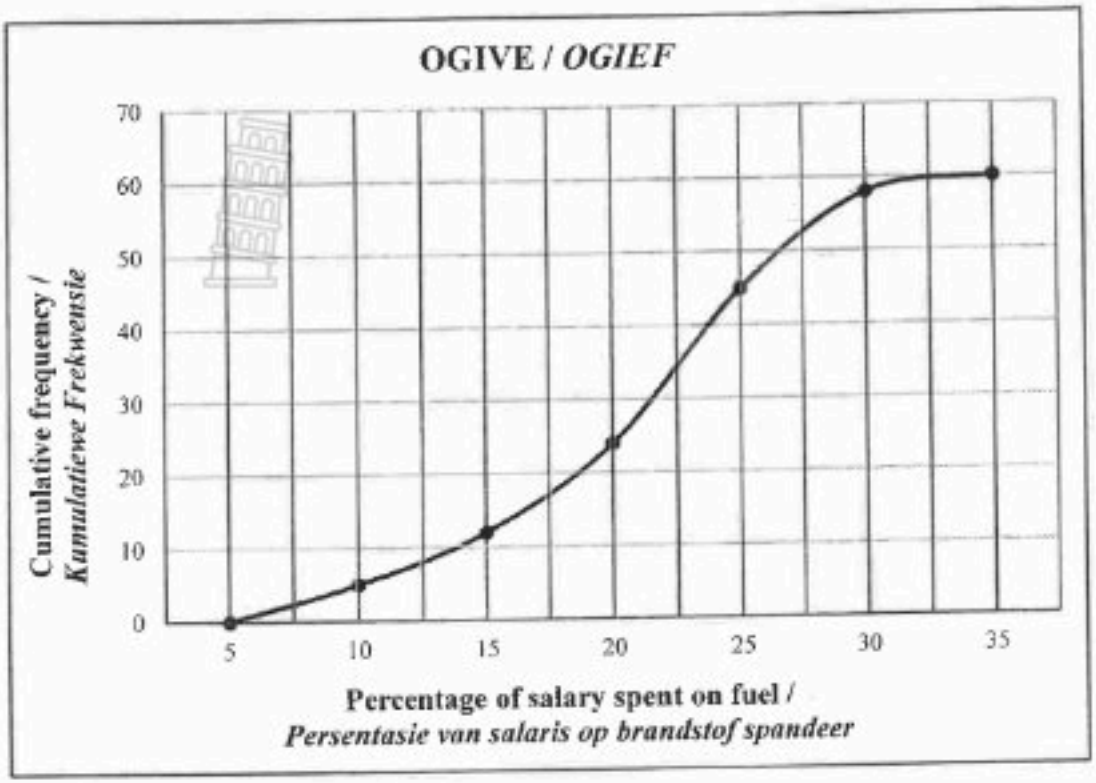
Popularity score (x) *Gewildheidspunt (x)*	32	89	35	82	50	59	81	40	79	65
Number of votes (y) *Getal stemme (y)*	9	22	10	21	11	15	20	12	19	16

1.1.1	$\overline{y} = \frac{155}{10}$ $= 15{,}5$ ANSWER ONLY: Full marks	✓155 ✓answer (2)
1.1.2	SD = 4,59	✓ answer (1)
1.2	$\overline{y} - \text{SD}$ $= 15{,}5 - 4{,}59$ $= 10{,}91$ $\therefore 10 - 2 = 8$ learners	✓ value of $\overline{y} - \text{SD}$ ✓ answer (2)
1.3	$a = 1{,}7709\ldots$ $b = 0{,}2243\ldots$ $\hat{y} = 1{,}77 + 0{,}22x$	✓ a ✓ b ✓ equation (3)
1.4	$\hat{y} = 1{,}77 + 0{,}22(72)$ $= 17{,}61$ ≈ 18 votes **OR/*OF*** $\hat{y} = 17{,}92 \approx 18$ votes	✓ substitution ✓ answer (2) ✓✓ answer (2)
1.5.1	Points are all scattered therefore low correlation and unrealistic prediction./*Punte is versprei daarom 'n lae korrelasie en onrealistiese voorspelling.*	✓ R (1)
1.5.2	$r = 0{,}98$/correlation very strong/*korrelasie baie sterk* $\therefore$ a reliable prediction/*'n betroubare voorspelling*	✓ S (1)
		[12]

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QUESTION/*VRAAG* 2

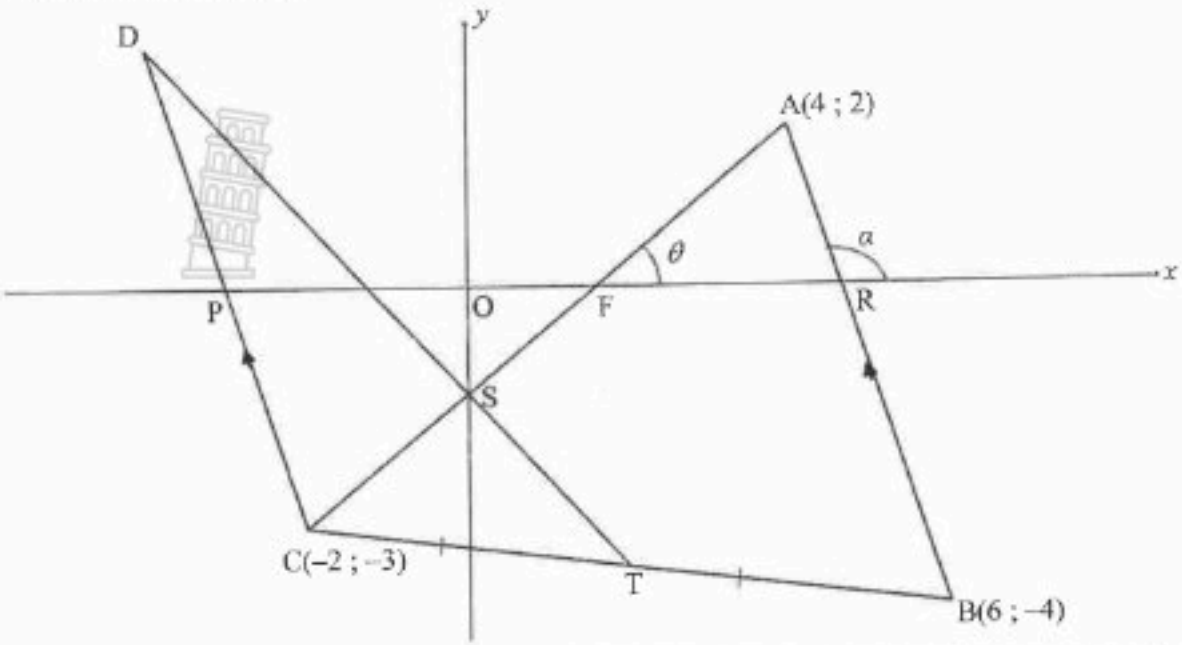


2.1	60 employees		✓ answer (A) (1)
2.2	$20 < x \leq 25$		✓ answer (1)
2.3	60 – 34 = 26 employees	ANSWER ONLY: Full marks	✓ 34 ✓ answer (2)
2.4	Salary $= \frac{100}{7} \times 2400$ Salary = R34 285,71	ANSWER ONLY: Full marks	✓ method ✓ answer (2)
2.5	∴ Ogive/Cumulative frequency graph will shift to the right/will become steeper. ∴ *Ogief/Kumulatiewe frekwensie grafiek sal na regs skuif/sal steiler wees.*		✓✓ answer (2)
			[8]

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QUESTION/*VRAAG* 3



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3.1.1	$m_{AB}=\frac{2-(-4)}{4-6}$ **OR** $m_{AB}=\frac{-4-2}{6-4}$ $m_{AB}=-3$ ANSWER ONLY: Full marks	✓ substitution ✓ answer (2)
3.1.2	$\tan\alpha = m_{AB} = -3$ $\alpha = 108{,}43°$ ANSWER ONLY: Full marks	✓ $\tan\alpha = m_{AB} = -3$ ✓ answer (2)
3.1.3	$T\left(\frac{x_1+x_2}{2};\frac{y_1+y_2}{2}\right)$ $T\left(\frac{-2+6}{2};\frac{-3-4}{2}\right)$ $T\left(2;\frac{-7}{2}\right)$	✓ $x_T = 2$ ✓ $y_T=\frac{-7}{2}$ (2)
3.1.4	$5(0)-6y=8$ $y=-\frac{4}{3}$ $S\left(0;\frac{-4}{3}\right)$	✓ $x_S = 0$ ✓ $y_S=\frac{-4}{3}$ (2)
3.2	$m_{CD} = m_{AB} = -3$ $-3=-3(-2)+c$ OR $y-(-3)=-3(x-(-2))$ $c=-9$ $y=-3x-9$ $y=-3x-9$	✓ gradient ✓ substitution of C(–2 ; –3) ✓ equation (3)

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	$y=\frac{5}{6}x-\frac{8}{6}$ $\tan\theta = m_{AC} = \frac{5}{6}$ $\theta = 39{,}81°$ $\hat{A} = 108{,}43° - 39{,}81°$ $= 68{,}62°$ $D\hat{C}A = 68{,}62°$ [alt ∠s ; DC∥AB]	✓ $\tan\theta = m_{AC} = \frac{5}{6}$ ✓ $\theta = 39{,}81°$ ✓ $\hat{A} = 68{,}62°$ ✓ answer (4)
3.3.2	P(−3;0) and F(1,6 ; 0) Area POSC = Area ΔFPC − Area ΔOFS $= \frac{1}{2}(4,6)(3) - \frac{1}{2}(1,6)\left(\frac{4}{3}\right)$ $= 6{,}9 - 1{,}07$ $= 5{,}83 \text{ units}^2$	✓ P(−3;0) ✓ method ✓ $\frac{1}{2}(4,6)(3)$ ✓ $\frac{1}{2}(1,6)\left(\frac{4}{3}\right)$ ✓ answer (5)
	OR/*OF* P(−3;0) $FC = \sqrt{\left(-2-\frac{8}{5}\right)^2 + (-3-0)^2} = \frac{3\sqrt{61}}{5}$ Area $\Delta PFC = \frac{1}{2}(PF)(FC)\sin O\hat{F}S$ $= \frac{1}{2}\left(\frac{23}{5}\right)\left(\frac{3\sqrt{61}}{5}\right)\sin 39{,}81°$ $= 6{,}90$ Area $\Delta OFS = \frac{1}{2}\left(\frac{8}{5}\right)\left(\frac{4}{3}\right)$ $= 1{,}07$ Area POSC $= 6{,}90 - 1{,}07$ $= 5{,}83 \text{ units}^2$	✓ P(−3;0) ✓ $\frac{1}{2}\left(\frac{23}{5}\right)\left(\frac{3\sqrt{61}}{5}\right)\sin 39{,}81°$ ✓ $\frac{1}{2}\left(\frac{8}{5}\right)\left(\frac{4}{3}\right)$ ✓ method ✓ answer (5)
	OR/*OF*	

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$P(-3;0)$ ✓ $P(-3;0)$

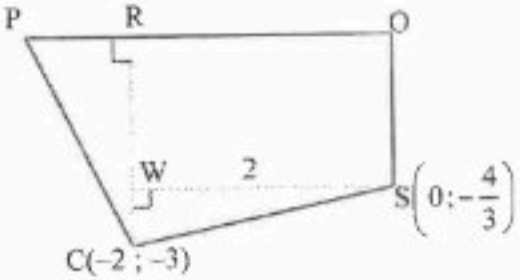
Area of POSC = Area of OSCR + Area of ΔPRC ✓ method

$$=\frac{1}{2}\left(\frac{4}{3}+3\right)\times 2+\frac{1}{2}(1\times 3)$$ ✓ $\frac{1}{2}\left(\frac{4}{3}+3\right)\times 2$ ✓ $\frac{1}{2}(1\times 3)$

$$=\frac{35}{6}$$

$=5,83\text{ units}^2$ ✓ answer (5)

OR/OF



$P(-3;0)$ ✓ $P(-3;0)$

Area POSC = Area ROSW + Area ΔPRC + Area ΔWSC ✓ method

$$=\left(\frac{4}{3}\right)(2)+\frac{1}{2}(1)(3)+\frac{1}{2}(2)\left(\frac{5}{3}\right)$$ ✓ $\frac{1}{2}(1)(3)$ ✓ $\left(\frac{4}{3}\right)(2)+\frac{1}{2}(2)\left(\frac{5}{3}\right)$

$$=\frac{35}{6}$$

$=5,83\text{units}^2$ ✓ answer (5)

OR/OF

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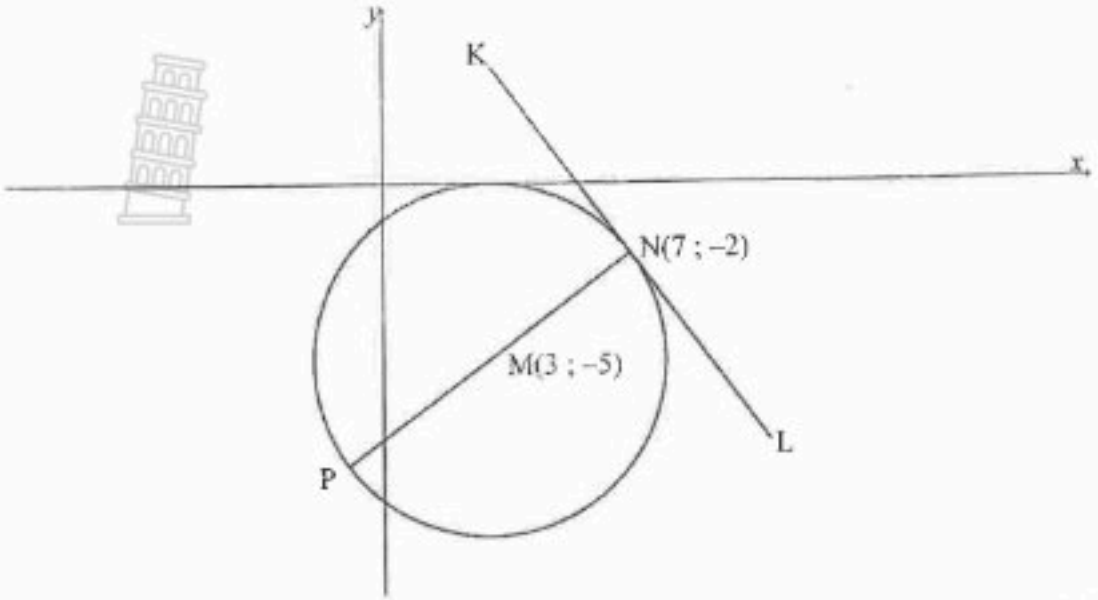
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	$P(-3;0)$	✓ $P(-3;0)$
	Area of $\Delta PSC = \frac{1}{2}(PC)(CS)\sin D\hat{C}A$	
	$= \frac{1}{2}\left(\sqrt{10}\right)\left(\frac{\sqrt{61}}{3}\right)\sin 68,62°$	✓ $\frac{1}{2}\left(\sqrt{10}\right)\left(\frac{\sqrt{61}}{3}\right)\sin 68,62°$
	$= 3,833..$	
	Area of $\Delta POS = \frac{1}{2}(PO)(OS)$	
	$= \frac{1}{2}(3)\left(\frac{4}{3}\right)$	✓ $\frac{1}{2}(3)\left(\frac{4}{3}\right)$
	$= 2$	
	Area POSC = 3,833… + 2	✓ method
	$= 5,83 \text{units}^2$	✓ answer (5)
		[20]

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UESTION/*VRAAG* 4



4.1	$P(x;y)$; $N(7;-2)$; $M(3;-5)$ $\frac{x+7}{2}=3$ $\quad$ $\frac{y-2}{2}=-5$ $x=-1$ $\quad$ $y=-8$ $P(-1;-8)$	✓ $x_P=-1$ ✓ $y_P=-8$ (2)
4.2.1	$r^2=(7-3)^2+(-2-(-5))^2$ **OR/*OF*** $r^2=(-1-3)^2+(-8-(-5))^2$ $r^2=25$ $(x-3)^2+(y+5)^2=25$	✓ substitution into distance formula ✓ $(x-3)^2+(y+5)^2$ ✓ $r^2=25$ (3)
4.2.2	$m_{radius}=\frac{-5-(-2)}{3-7}=\frac{3}{4}$ $m_{tangent}=-\frac{4}{3}$ [radius ⊥ tangent/*raaklyn ⊥ radius*] $-2=-\frac{4}{3}(7)+c$ **OR** $y-(-2)=-\frac{4}{3}(x-7)$ $c=\frac{22}{3}$ $\quad$ $y=-\frac{4}{3}x+\frac{22}{3}$ $y=-\frac{4}{3}x+\frac{22}{3}$	✓ substitution ✓ $m_{radius}=\frac{-3}{-4}=\frac{3}{4}$ ✓ $m_{tangent}=-\frac{4}{3}$ ✓ substitution of m and N(7 ; –2) ✓ equation (5)
4.3	$-8=-\frac{4}{3}(-1)+c$ $\therefore\ c=-\frac{28}{3}$ $-\frac{28}{3}<k<\frac{22}{3}$	✓ subst m and P ✓ value of c ✓✓ answer (4)

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4.4.1	$AB^2 = AM^2 - MB^2$ $AB^2 = \left[(t-3)^2 + (t+5)^2\right] - 5^2$ $= t^2 - 6t + 9 + t^2 + 10t + 25 - 25$ $AB = \sqrt{2t^2 + 4t + 9}$	✓ substitution into Pythagoras ✓ simplification (A) (2)
4.4.2	$t = \frac{-4}{2(2)}$ $= -1$ Minimum at $t = -1$ $AB = \sqrt{2(-1)^2 + 4(-1) + 9}$ $AB = \sqrt{7}$	✓ substitution into correct formula ✓ $t = -1$ ✓ substitution ✓ answer (4)
	OR/*OF*	
	$4t + 4 = 0$ $t = -1$ Minimum at $t = -1$ $AB = \sqrt{2(-1)^2 + 4(-1) + 9}$ $AB = \sqrt{7}$	✓ derivative = 0 ✓ $t = -1$ ✓ substitution ✓ answer (4)
	OR/*OF* Length of $AB = \sqrt{2t^2 + 4t + 9}$ $= \sqrt{2\left(t^2 + 2t + \frac{9}{2}\right)}$ $= \sqrt{2\left[(t+1)^2 + \frac{7}{2}\right]}$ $= \sqrt{2(t+1)^2 + 7}$ Minimum at $t = -1$ $AB = \sqrt{2(-1)^2 + 4(-1) + 9}$ $AB = \sqrt{7}$	✓ completing of the square ✓ $t = -1$ ✓ substitution ✓ answer (4)
		[20]

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QUESTION/*VRAAG* 5

5.1.1	$\sin(360°+x)$ $=\sin x$	✓ + ✓ $\sin x$ (2)
5.1.2	$x-\text{coordinate} = \sqrt{\left(\sqrt{13}\right)^2-(-3)^2}$ $=-2$ $\tan x = \frac{-3}{-2}$ $=\frac{3}{2}$ **OR/*OF*** $x-\text{coordinate} = \sqrt{\left(\sqrt{13}\right)^2-(3)^2}$ $=2$ $\tan x = \frac{3}{2}$	✓✓ substitution ✓ method (3) ✓✓ substitution ✓ method (3)
5.1.3	$\cos(180°+x)$ $=-\cos x$	✓ – ✓ $\cos x$ (2)
5.2	$\frac{\cos(90°+\theta)}{\sin(\theta-180°)+3\sin(-\theta)}$ $=\frac{-\sin\theta}{\sin(-(180°-\theta))-3\sin\theta}$ $=\frac{-\sin\theta}{-\sin\theta-3\sin\theta}$ $=\frac{-\sin\theta}{-4\sin\theta}$ $=\frac{1}{4}$	✓ $-\sin\theta$ ✓ $-3\sin\theta$ ✓ $-\sin\theta$ ✓ simplification ✓ answer (5)

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5.3	$(\cos x + 2\sin x)(3\sin 2x - 1) = 0$ $\cos x + 2\sin x = 0$ or $3\sin 2x - 1 = 0$ $\tan x = -\frac{1}{2}$ $\sin 2x = \frac{1}{3}$ ref $\angle = 26{,}565\ldots°$ ref $\angle = 19{,}471\ldots°$ $x = 153{,}43° + k.180°\ ;\ k \in Z$ $x = 9{,}74° + k.180°;\ k \in Z$ **OR/*OF*** $x = 153{,}43° + k.360°\ ;\ k \in Z$ or $x = 80{,}26° + k.180°;$ $k \in Z$ or $x = 333{,}43° + k.360°\ ;\ k \in Z$	✓ both equations ✓ $\tan x = -\frac{1}{2}$ ✓ $\sin 2x = \frac{1}{3}$ ✓ $x = 153{,}43°$ **OR** $x = 153{,}43°$ &$333{,}43°$ ✓ $x = 9{,}74°$ & $80{,}26°$ ✓ $+k.180°\ ;\quad k \in Z$ (6)
5.4.1	$\text{LHS} = \cos(x+y).\cos(x-y)$ $= [\cos x.\cos y - \sin x.\sin y][\cos x.\cos y + \sin x.\sin y]$ $= \cos^2 x.\cos^2 y - \sin^2 x.\sin^2 y$ $= (1-\sin^2 x)(1-\sin^2 y) - \sin^2 x.\sin^2 y$ $= 1 + \sin^2 x.\sin^2 y - \sin^2 x - \sin^2 y - \sin^2 x.\sin^2 y$ $= 1 - \sin^2 x - \sin^2 y \quad = \text{RHS}$	✓ expansion ✓ simplification ✓ square identity ✓ product (4)
5.4.2	$1 - \sin^2 45° - \sin^2 15°$ $= \cos(45°+15°).\cos(45°-15°)$ $= \cos 60°.\cos 30°$ $= \left(\frac{1}{2}\right)\left(\frac{\sqrt{3}}{2}\right)$ $= \frac{\sqrt{3}}{4}$ **OR/*OF***	✓ identifying x and y ✓ substitution ✓ answer (3)

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	$1-\sin^2 45°-\sin^2 15°$ $=\sin^2 15°+\cos^2 15°-\sin^2 45°-\sin^2 15°$	✓ identity
	$=\cos^2 15°-\left(\frac{\sqrt{2}}{2}\right)^2$	
	$=\cos^2 15°-\frac{1}{2}$	
	$=\frac{2\cos^2 15°-1}{2}$	
	$=\frac{\cos 30°}{2}$	
	$=\frac{\sqrt{3}}{2}\times\frac{1}{2}$	✓ substitution
	$=\frac{\sqrt{3}}{4}$	✓ answer (3)
	OR	
	$1-\sin^2 45°-\sin^2 15°$ $=\cos^2 45°-\sin^2(45°-30°)$	
	$=\left(\frac{1}{\sqrt{2}}\right)^2-(\sin 45°\cos 30°-\cos 45°\sin 30°)^2$	✓ expansion
	$=\frac{1}{2}-\left(\frac{1}{\sqrt{2}}\times\frac{\sqrt{3}}{2}-\frac{1}{\sqrt{2}}\times\frac{1}{2}\right)^2$	✓ substitution
	$=\frac{1}{2}-\left(\frac{\sqrt{3}}{2\sqrt{2}}-\frac{1}{2\sqrt{2}}\right)^2$	
	$=\frac{1}{2}-\left(\frac{\sqrt{3}}{2\sqrt{2}}-\frac{1}{2\sqrt{2}}\right)^2$	
	$=\frac{1}{2}-\left(\frac{3}{8}-\frac{\sqrt{3}}{4}+\frac{1}{8}\right)$	
	$=\frac{\sqrt{3}}{4}$	✓ answer (3)
5.5.1	$16\sin x.\cos^3 x-8\sin x.\cos x$ $=8\sin x.\cos x(2\cos^2 x-1)$ $=4\sin 2x(\cos 2x)$ $=2\sin 4x$	✓ factorisation ✓ $4\sin 2x$ ✓ $\cos 2x$

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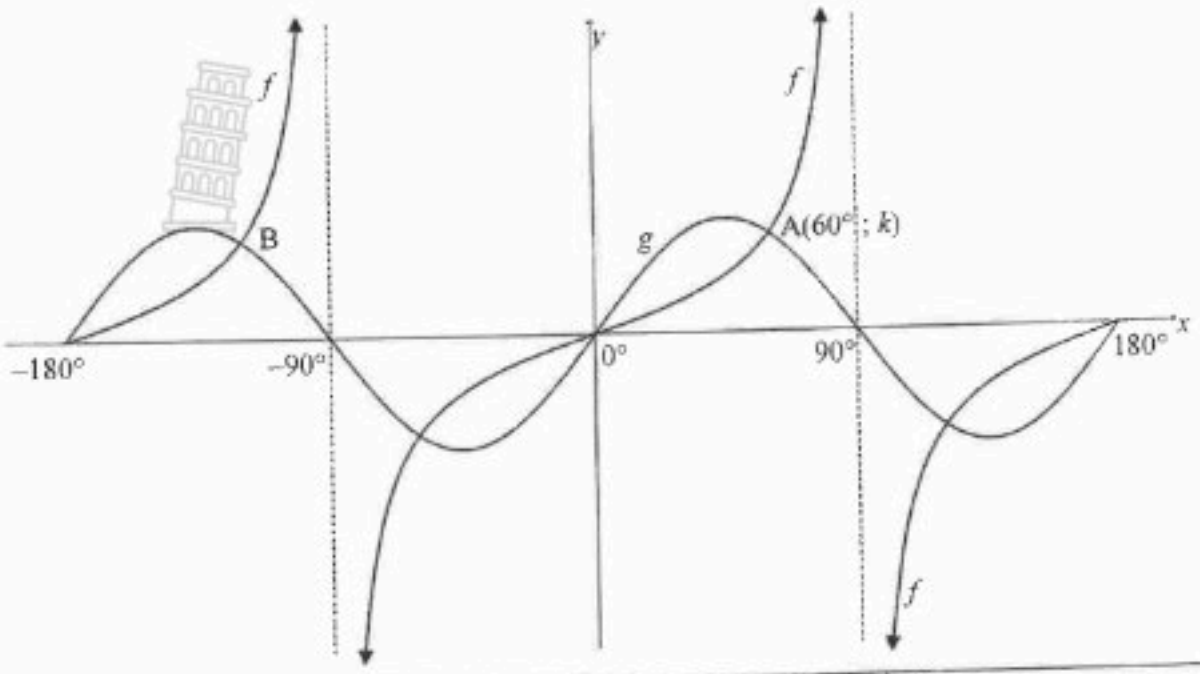
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	OR/*OF* $16\sin x.\cos^3 x - 8\sin x.\cos x$ $= 16\cos^2 x\left(\frac{1}{2}\sin 2x\right) - 8\left(\frac{1}{2}\sin 2x\right)$ $= 8\left(2\cos^2 x - 1\right)\left(\frac{1}{2}\sin 2x\right)$ $= 4\sin 2x.\cos 2x$ $= 2\sin 4x$	✓ double angle (4) ✓ factorisation ✓ $4\sin 2x$ ✓ $\cos 2x$ ✓ double angle (4)
5.5.2	$16\sin x.\cos^3 x - 8\sin x.\cos x = 2\sin 4x$ Minimum at $x = 67{,}5°$	✓ answer (1)
		[30]

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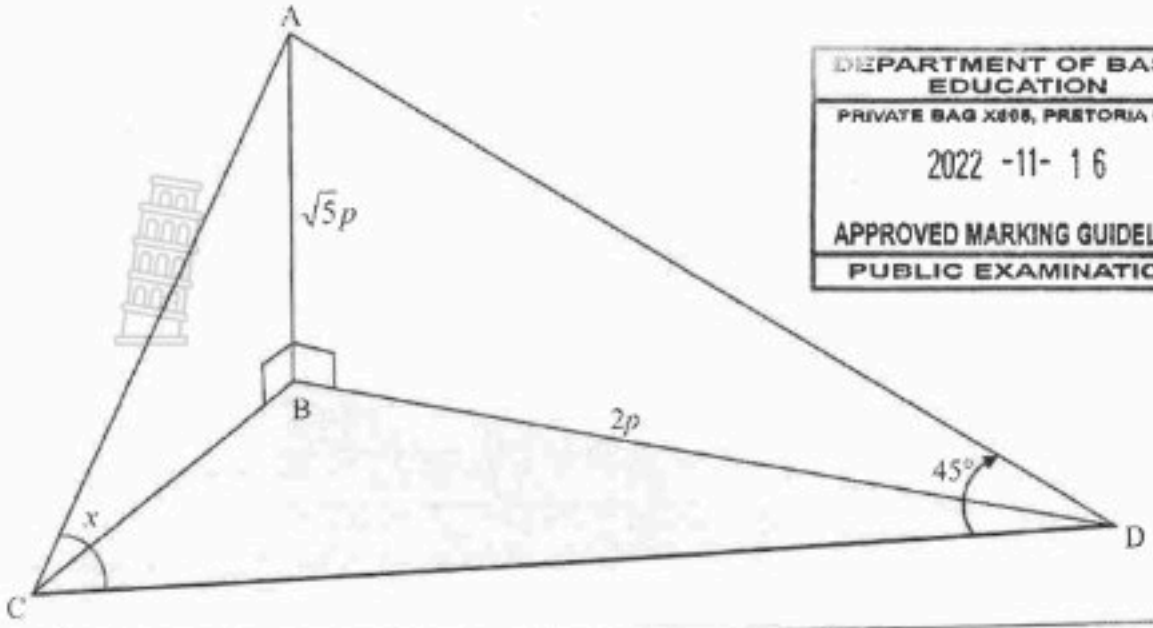
QUESTION/VRAAG 6



6.1	180°	✓ answer (1)
6.2.1	$k=\sqrt{3}=1,73$	✓ answer (1)
6.2.2	$B(-120°;\sqrt{3})$	✓ $x=-120°$ (1)
6.3	Range of g: $y\in[-2;2]$ Range of $2g(x)$: $y\in[-4;4]$ **OR/OF** Range of g: $-2\le y\le 2$ Range of $2g(x)$: $-4\le y\le 4$ ANSWER ONLY: Full marks	✓ $y\in[-2;2]$ ✓ answer (2) ✓ $-2\le y\le 2$ ✓ answer (2)
6.4	$x\in[-65°;-5°]$ **OR/OF** $-65°\le x\le -5°$	✓✓ $x\in[-65°;-5°]$ (2) ✓✓ $-65°\le x\le -5°$ (2)
6.5	$\sin x.\cos x=p$ $4\sin x.\cos x=4p$ $2\sin 2x=4p$ $4p=\pm 2$ $\therefore p=-\frac{1}{2}$ or $\frac{1}{2}$ ANSWER ONLY: Full marks	✓ $2\sin 2x=4p$ ✓ $4p=\pm 2$ ✓ answers (3)
		[10]

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7.1	$AD^2 = AB^2 + BD^2$ $AD^2 = \left(\sqrt{5}p\right)^2 + (2p)^2$ $AD^2 = 9p^2$ $AD = 3p$	✓ substitution in Pythagoras ✓ answer (2)
7.2	$\frac{CD}{\sin(135° - x)} = \frac{3p}{\sin x}$ $CD = \frac{3p\sin(135° - x)}{\sin x}$ $CD = \frac{3p(\sin 135°\cos x - \cos 135°\sin x)}{\sin x}$ $CD = \frac{3p(\sin 45°\cos x + \cos 45°\sin x)}{\sin x}$ $CD = \frac{3p\left(\frac{\sqrt{2}}{2}\cos x + \frac{\sqrt{2}}{2}\sin x\right)}{\sin x}$ $CD = \frac{3p\left(\frac{\sqrt{2}}{2}\right)(\cos x + \sin x)}{\sin x}$ $CD = \frac{3p(\sin x + \cos x)}{\sqrt{2}\sin x}$	✓ correct use of sine rule ✓ $135° - x$ ✓ compound angle ✓ special values ✓ factorisation (5)

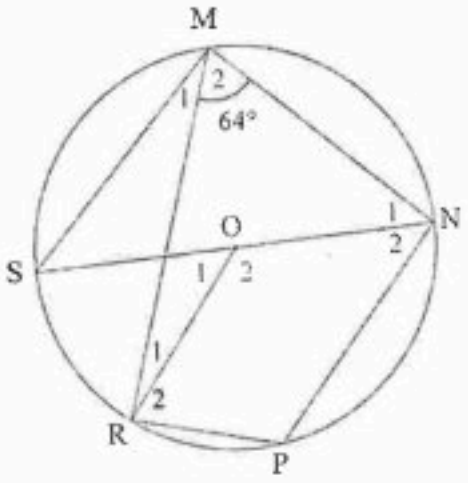
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	$\text{Area } \Delta ABC = \frac{1}{2}(\quad)(\quad)\sin\quad$	
	$= \frac{1}{2}(3p)\left(\frac{3p(\sin x + \cos x)}{\sqrt{2}\sin x}\right)(\sin 45°)$	
	$= \frac{1}{2}(30)\left(\frac{30(\sin 110° + \cos 110°)}{\sqrt{2}\sin 110°}\right)\sin 45°$	✓ substitution in area rule
	$= 143{,}11\,m^2$	✓ answer (3)
		[10]

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8.1

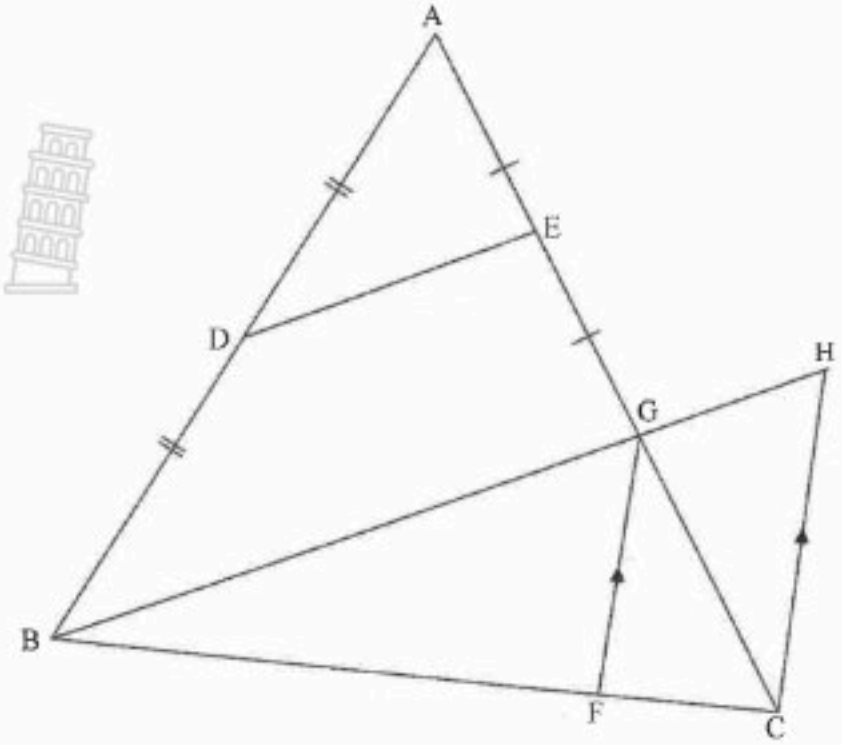


8.1.1	$\hat{P} = 116°$	[opp ∠s of cyclic quad/*teenoorst. ∠e van kvh*]	✓ S ✓ R (2)
8.1.2	$\hat{M}_1 + 64° = 90°$ $\hat{M}_1 = 26°$	[∠ in semi-circle/∠ *in halwe sirkel*]	✓ R ✓ S (2)
8.1.3	$\hat{O}_1 = 52°$	[∠ at centre = 2 x ∠ at circumference/*midpts. ∠ = 2 x omtreks. ∠*]	✓ S ✓R (2)

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8.2



8.2.1	Midpt theorem/*Midpt. Stelling* **OR/*OF*** Converse prop intercept theorem	✓ R (1) ✓ R (1)
8.2.2	BG = 2DE or $6x - 2$ [Midpt theorem/*Midpt. stelling*] BG = $6x - 2$ $\frac{GH}{BG} = \frac{FC}{BF}$ [line ∥ one side of Δ **OR** prop theorem; FG ∥ CH / *lyn ∥ een sy v. Δ*] $\frac{x+1}{6x-2} = \frac{1}{4}$ $4x + 4 = 6x - 2$ $2x = 6$ $x = 3$ **OR/*OF***	✓ S ✓ R ✓ S ✓R ✓ equation into x ✓ answer (6)

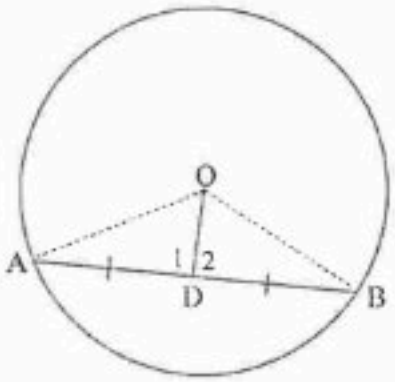
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	$\frac{}{FC} = \frac{}{GH}$	[line ∥ one side of Δ etc prop theorem]	✓ S ✓ R
		lyn ∥ een sy v. Δ]	
	$\frac{AE}{AG} = \frac{DE}{BG}$	[ΔADE ||| ΔABG]	✓ S ✓R
	$BG = 4x + 4$		
	$\frac{1}{2} = \frac{3x-1}{4x+4}$		✓ equation into x
	$\therefore 4x + 4 = 6x - 2$		
	$\therefore x = 3$		✓ answer (6)
			[13]

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9.1

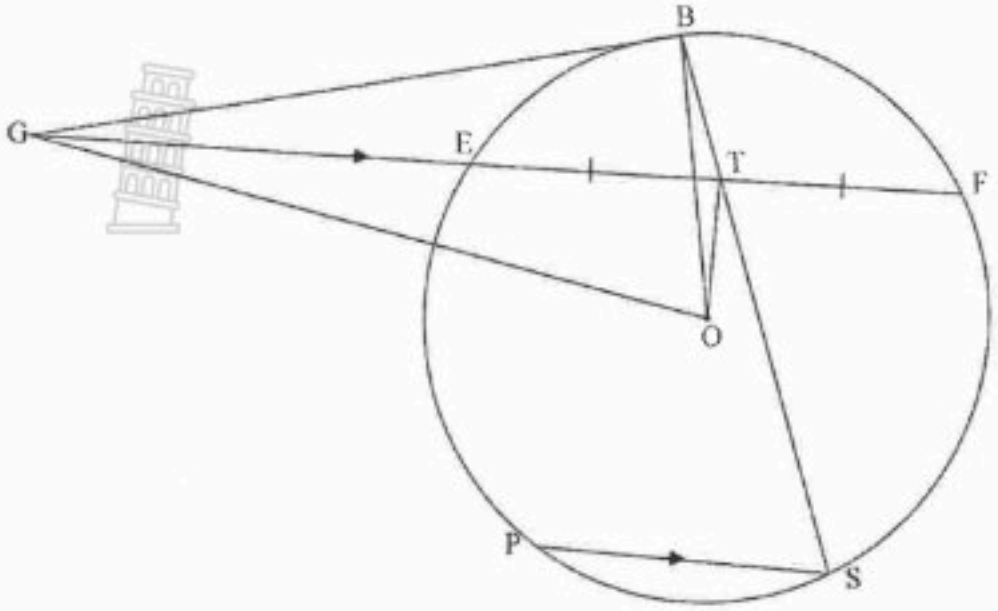


9.1.1	Construction: Draw OA and OB In ΔADO and ΔBDO OA = OB OD = OD AD = DB ∴ ΔADO ≡ ΔBDO ADB is a straight line ∴ $\hat{D}_1 = \hat{D}_2$ ∴ OD ⊥ AB	 [radii/*radiusse*] [common side/*gemeenskaplike sy*] [given/*gegee*] [S;S;S] ΔADO = ΔBDO [∠s on a str line/*∠e op 'n reguitlyn*]	✓ construction ✓ first pair of sides ✓ other 2 pairs ✓ R ✓ R (5)
	OR/*OF* Construction: Draw OA and OB In ΔADO and ΔBDO AD = DB $\hat{A} = \hat{B}$ OA = OB ∴ ΔADO ≡ ΔBDO ADB is a straight line ∴ $\hat{D}_1 = \hat{D}_2$ ∴ OD ⊥ AB	 [given/*gegee*] [∠s opp; ∠s sides /*∠e teenoor gelyke sye*] [radii/*radiusse*] [S;∠;S] ΔADO ≡ ΔBDO [∠s on a str line/*∠e op 'n reguitlyn*]	✓ construction ✓ first pair of sides ✓ other 2 pairs ✓ R ✓ R (5)

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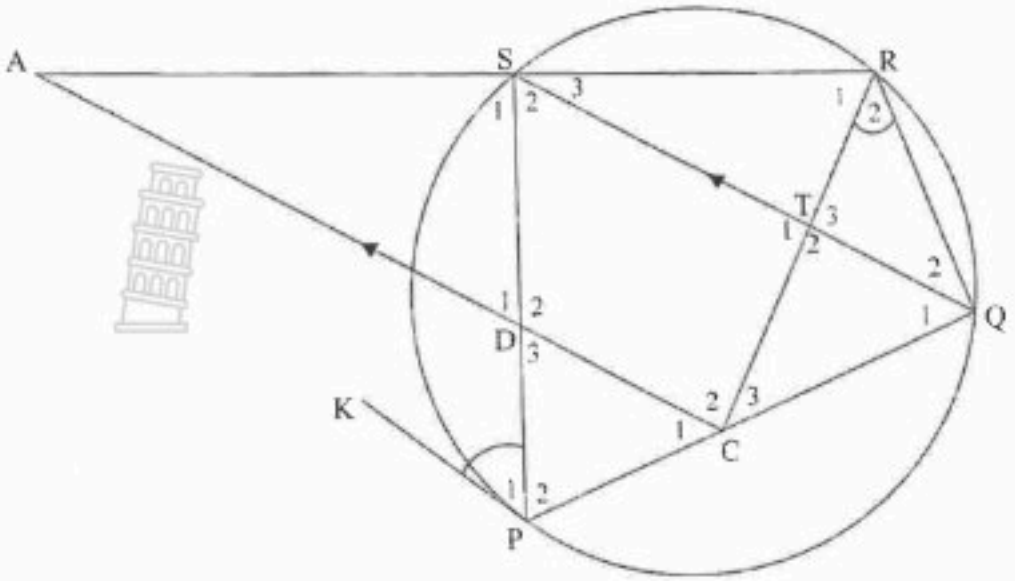
9.2



9.2.1	$O\hat{T}G = 90°$	[line from centre to midpt of chord/ *midpt. sirkel; midpt. koord*]	✓S ✓R
	$O\hat{B}G = 90°$	[tan ⊥ radius/*raaklyn ⊥ radius*]	✓S ✓R
	$\therefore O\hat{T}G = O\hat{B}G = 90°$		
	∴OTBG is a cyclic quadrilateral	[line subtends equal ∠s **OR** converse ∠s in the same segment/ *lyn onderspan gelyke ∠e*]	✓R (5)
9.2.2	$\hat{S} = B\hat{T}G$	[corresp ∠s; GF ∥ PS / *ooreenk. ∠s; GF ∥ PS*]	✓S ✓R
	But $B\hat{T}G = G\hat{O}B$	[∠s in the same segment/*∠e in dies. sirkelsegment*]	✓S ✓R
	$G\hat{O}B = \hat{S}$		(4)
			[14]

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10.1	$\hat{P}_1 = \hat{Q}_1$	[tan-chord theorem/∠ *tussen raaklyn en koord*]	✓ S
	$\hat{S}_1 = \hat{Q}_1 + \hat{Q}_2$	[ext ∠ of cyclic quad/*buite ∠ v. kvh*]	✓ S / R
	$\therefore \hat{S}_1 = \hat{P}_1 + \hat{Q}_2$		
	$\hat{T}_2 = \hat{R}_2 + \hat{Q}_2$	[ext ∠ of Δ/*buite ∠ v. Δ*]	✓ S
	but $\hat{P}_1 = \hat{R}_2$	[given/*gegee*]	
	$\hat{T}_2 = \hat{P}_1 + \hat{Q}_2$		✓ S
	$\therefore \hat{S}_1 = \hat{T}_2 = \hat{P}_1 + \hat{Q}_2$		(4)
10.2	In Δ ASD and ΔACR		✓ identifying Δ's
	$\hat{A} = \hat{A}$	[common ∠/*gemeenskaplike ∠*]	✓ S
	$\hat{S}_2 = \hat{T}_2$	[proven/*reeds bewys*]	
	$\hat{T}_2 = \hat{C}_2$	[alt ∠s; QS ∥ CA/verw. ∠*e*; QS ∥ CA]	✓ S / R
	$\therefore \hat{S}_1 = \hat{C}_2$		✓ S
	$\hat{D}_1 = \hat{R}_1$	[sum of ∠s in Δ/*∠e v. Δ*]	✓ S
	ΔASD ||| ΔACR		
	$\therefore \frac{AD}{AR} = \frac{AS}{AC}$	[corresponding sides in proportion/ *ooreenstemmende sy in dies. verhouding*]	
	OR/*OF*		(5)

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	In Δ ASD and ΔACR $\hat{A} = \hat{A}$ [common ∠/*gemeenskaplike ∠*] $\hat{S}_1 = \hat{T}_2$ [proven/*gegee*] $\hat{T}_2 = \hat{C}_2$ [alt ∠s; QS ∥ CA/verw. ∠*e*; QS ∥ CA] $\therefore \hat{S}_1 = \hat{C}_2$ ΔASD ||| ΔACR [∠;∠;∠] $\therefore \frac{AD}{AR} = \frac{AS}{AC}$ [corresponding sides in proportion/ *ooreenstemmende sy in dies. verhouding*]	✓ identifying Δ's ✓ S ✓ S/R ✓ S ✓ R (5)
10.3	$\frac{AS}{AC} = \frac{SD}{CR}$ [ΔASD ||| ΔACR] $\therefore AS = \frac{AC \times SD}{CR}$ $\frac{AS}{AR} = \frac{CT}{CR}$ [line ∥ one side of Δ OR prop theorem; TS ∥ CA/*lyn ∥ een sy v.* Δ] $\therefore AS = \frac{AR \times CT}{CR}$ $\therefore \frac{AC \times SD}{CR} = \frac{AR \times CT}{CR}$ $\therefore AC \times SD = AR \times CT$	✓ S ✓ S ✓ R ✓ equating (4)
		[13]

TOTAL/*TOTAAL*: 150

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