GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION/ *JUNIE EKSAMEN* GRADE/*GRAAD* 12

2026

MARKING GUIDELINES/ *NASIENRIGLYNE*

MATHEMATICS/ *WISKUNDE*

(PAPER/*VRAESTEL* 2)

27 pages/*bladsye*

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 guidelines. Stop marking at the second calculation error.
- Assuming answers/values to solve a problem is NOT acceptable.

LET WEL:

- *As 'n kandidaat 'n vraag TWEE KEER beantwoord het, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en dit nie oordoen nie, sien die doodgetrekte poging na.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.*
- *Aannames 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 'n rede.)*
R	A mark for a 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 the statement AND reason are both correct.
	Ken 'n punt toe indien beide die bewering EN rede korrek is.

AMENDMENT TO MARKING GUIDELINES

JUNE 2026 PROVINCIAL COMMON EXAMINATION

FOR ATTENTION: THE CHIEF INVIGILATOR

SUBJECT / *VAK*	**MATHEMATICS/*WISKUNDE***
PAPER / *VRAESTEL*	**2**
DATE OF EXAMINATION	**8 JUNE/*JUNIE* 2026**

The errata for the Marking Guidelines of **MATHEMATICS P2/*WISKUNDE* V2** has reference.

There was an error in **QUESTION 2.4** which affected the possible candidate responses on BOTH the English AND Afrikaans versions of the question paper. This matter was addressed at the Marking Standardisation Meeting.

To ensure that candidates are not disadvantaged nor prejudiced in any way, you are advised to ask your Mathematics Educator to please **ignore QUESTION 2.4** when marking. This question carries 5 marks.

In other words, the paper must be marked out of a total of 145 instead of 150 and then the learners' marks must be converted to a mark out of 150. E.g. Should a learner attain $\frac{29}{145}$ then that mark is recalculated as $\frac{30}{150}$.

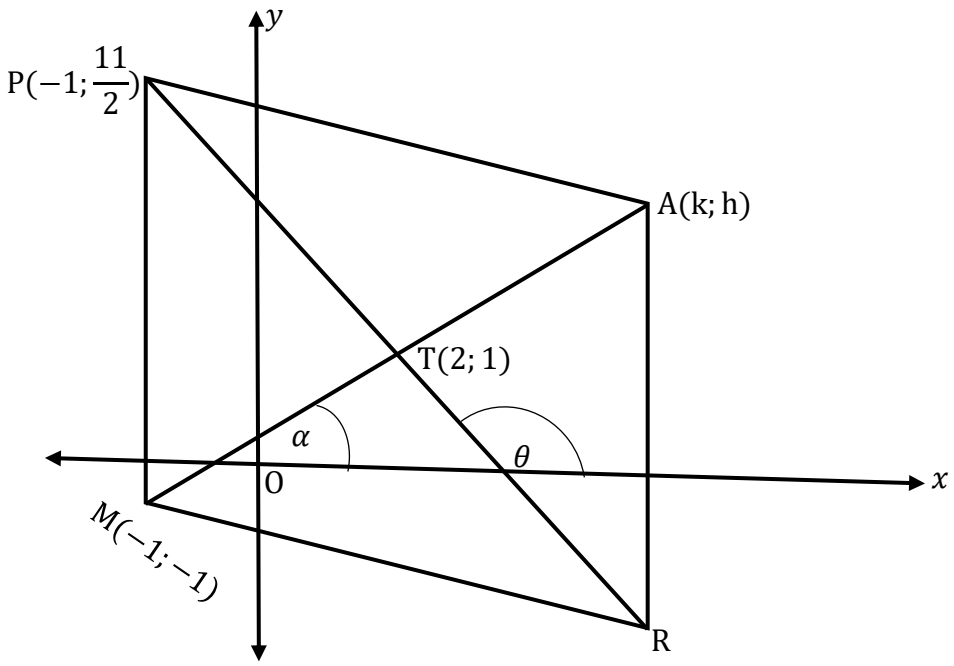
Use the formula: $\frac{a}{145} \times 100 = b$. *Then,* $\frac{b}{100} \times 150 = c$

C is the mark that is entered into SASAMS ***out of 150****.*

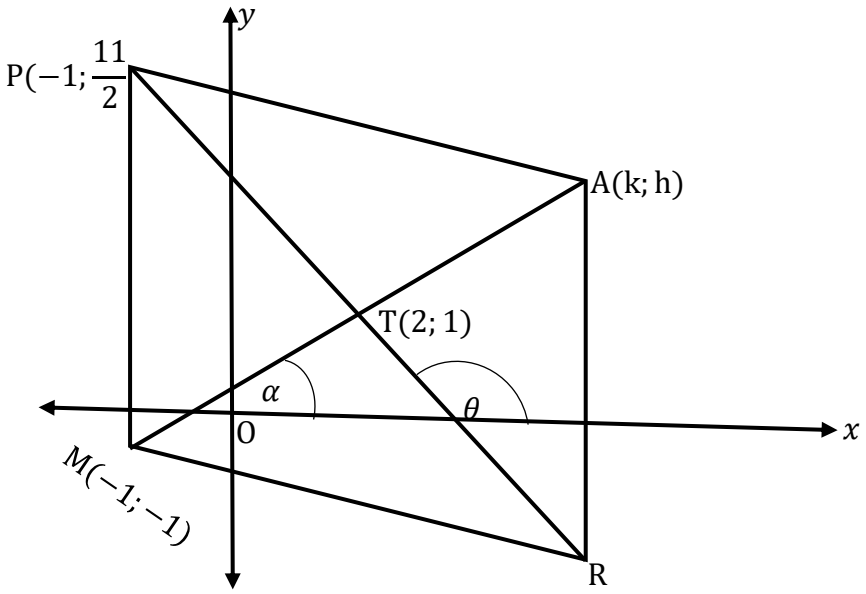
MR JONATHAN WILLIAMS

DIRECTOR: EXAMINATIONS MANAGEMENT
9 JUNE 2026

QUESTION/*VRAAG* 1



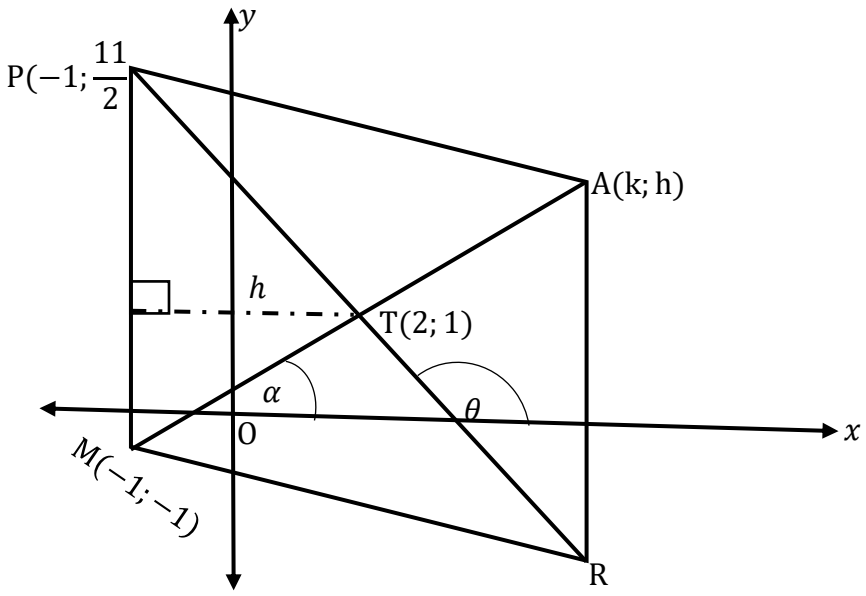
1.1	$m_{MT} = \frac{-1-1}{-1-2}$ $= \frac{2}{3}$	✓substitution into gradient formula/ *substitusie in die gradiënt formule* ✓answer/*antwoord* (2)
1.2	$y = \frac{2}{3}x + c$ $\frac{11}{2} = \frac{2}{3}(-1) + c$ $c = \frac{37}{6}$ $\therefore y = \frac{2}{3}x + \frac{37}{6}$ **OR/*OF*** $y - \frac{11}{2} = \frac{2}{3}(x - (1))$ $\therefore y = \frac{2}{3}x + \frac{37}{6}$	✓ $m_{line/lyn} = \frac{2}{3}$ ✓ substitution into equation formula/ *substitusie in die vergelykings-formule* ✓ answer/*antwoord* (3) **OR/*OF*** ✓ $m_{line/lyn} = \frac{2}{3}$ ✓ substitution into equation formula/ *substitusie in die vergelykings-formule* ✓ answer/*antwoord* (3)
1.3	$\frac{-1+k}{2} = 2$ $\therefore k = 5$ $\frac{-1+h}{2} = 1$ $\therefore h = 3$ Answer only: Full marks *Slegs antwoord: Volpunte*	✓substitution into midpoint formula/ *substitusie in die middelpuntsformule* ✓ $k = 5$ ✓ $h = 3$ (3)



1.4	AM=$\sqrt{(-1-5)^2+(-1-3)^2}$ $= 2\sqrt{13}$ units/*eenhede* (*Accept* $\sqrt{52}$) **OR/*OF*** MT=$\sqrt{(-1-2)^2+(-1-1)^2}$= $\sqrt{13}$ ∴ AM = 2MT = $2\sqrt{13}$ units/*eenhede*	✓ substitution into distance formula/ *substitusie in afstandsformule* ✓ answer **in surd form**/ *antwoord in* ***wortelvorm*** (2) ✓ substitution into distance formula/ *substitusie in afstandsformule* ✓ answer **in surd form**/ *antwoord in* ***wortelvorm*** (2)
1.5	ARMP is a parallelogram/*is 'n parallelogram* (2 pairs of opp sides || /*2 pare oorst sye* ||) $\frac{x_R+(-1)}{2}=2$ $x_R = 5$ $\frac{y_R+\frac{11}{2}}{2}=1$ $y_R=-\frac{7}{2}$ ∴ $R(5;-\frac{7}{2})$ Answer only: Full marks *Slegs antwoord: Volpunte* *Translation implied* *Translasie* geïmpliseer	✓ method/*metode* ✓ $x_R = 5$ ✓ $y_R=-\frac{7}{2}$ (3)

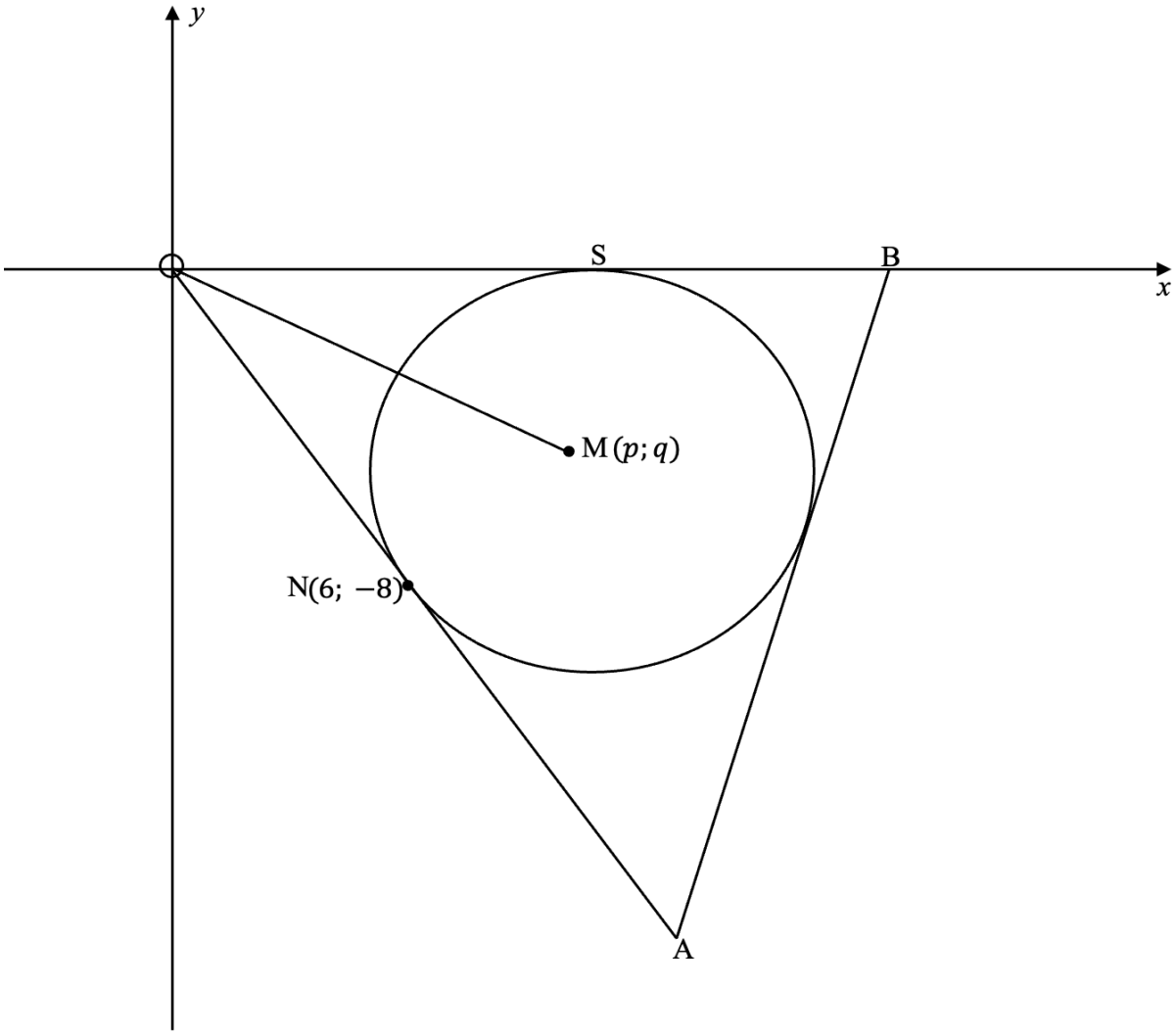
1.6	$m_{AM} = \frac{2}{3}$	✓$m_{AM} = \frac{2}{3}$
	$\alpha = \tan^{-1}(\frac{2}{3})$	✓$\alpha = 33{,}69°$
	$\propto = 33{,}69°$	
	$m_{PR} = \frac{\frac{11}{2} - 1}{-1 - 2} = -\frac{3}{2}$	✓$m_{PR} = -\frac{3}{2}$
	$\theta = \tan^{-1}\left(-\frac{3}{2}\right) + 180$	
	$\theta = 123{,}69°$	✓$\theta = 123{,}69°$
	$M\hat{T}R = 123{,}69° - 33{,}69° = 90°$	
	$\therefore P\hat{T}A = 90°$ (vert opp <s)/(*regoorst* <e)	✓answer/*antwoord* (5)
	OR/*OF*	**OR/*OF***
	$m_{AM} = \frac{2}{3}$	✓$m_{AM} = \frac{2}{3}$
	$m_{PR} = \frac{\frac{11}{2} - 1}{-1 - 2} = -\frac{3}{2}$	✓$m_{PR} = -\frac{3}{2}$
	$m_{AM} \times m_{PR} = \frac{2}{3} \times -\frac{3}{2} = -1$	✓ $m_{AM} \times m_{PR} = -1$
	$\therefore AM \perp PR$	✓ $AM \perp PR$
	$\therefore\ P\hat{T}A = 90°$	✓answer/*antwoord* (5)
	OR/*OF*	**OR/*OF***
	$PT = \sqrt{(1-2)^2 + (\frac{11}{2} - 1)^2} = \frac{3\sqrt{13}}{2} = 5{,}41$	✓ $PT = \frac{3\sqrt{13}}{2}$
	$AT = \sqrt{(5-2)^2 + (3-1)^2} = \sqrt{13} = 3{,}61$	✓ $AT = \sqrt{13}$
	$AP = \sqrt{(5-(-1))^2 + (3 - \frac{11}{2})^2} = 6{,}5$	✓$AP = \frac{13}{2}$
	$P\hat{T}A = \cos^{-1}(\frac{(\frac{3\sqrt{13}}{2})^2 + (\sqrt{13})^2 - (\frac{13}{2})^2}{2\left(\frac{3\sqrt{13}}{2}\right)(\sqrt{13})})$	✓substitution into cosine formula/ *substitution in cos-formule*
	$\therefore\ P\hat{T}A = 90°$	✓answer/*antwoord* (5)

If one < is rounded off and the other one not, then penalize 1 mark/ *as een < afgerond is, penalieer een punt*

1.7	$m_{AP} = \frac{\frac{11}{2}-3}{-1-5} = -\frac{5}{12}$ $m_{AM} = \frac{2}{3}$ $m_{AP} \times m_{AM} = -\frac{5}{12} \times \frac{2}{3} \neq -1$ $\therefore \ P\hat{A}M \neq 90°$	✓ $m_{AP} = -\frac{5}{12}$ ✓ $m_{AM} = \frac{2}{3}$ ✓ $m_{AP} \times m_{AM} \neq -1$ (3)
1.8		
	$h = 3$ units/*eenhede* $MP = \frac{11}{2} - (-1) = \frac{13}{2}$ $= 6{,}5$ units/*eenhede* Area of /*opp* $\Delta MPT = \frac{1}{2} \times \frac{13}{2} \times 3$ units^2/*eenhede*^{2} $= \frac{39}{4}$ units^2/*eenhede*^{2} $= 9{,}75$ units^2/*eenhede*^{2}	✓ $h = 3$ units/$h = 3$ *eenhede* ✓ length of MP/ *lengte van MP* ✓ substitution into area formula /*substitusie in oppervlakformule* ✓ answer/*antwoord* (4)

	OR/*OF*	**OR/*OF***
	$P\widehat{T}M = 90°$ (<s on a str line) /$(< e\ op\ 'n\ reguitlyn)$	
	$PT = \sqrt{(-1-2)^2 + (\frac{11}{2}-1)^2} = \frac{3\sqrt{13}}{2} = 5{,}41$ $MT = \sqrt{(-1-2)^2 + (-1-1)^2} = \sqrt{13} = 3{,}61$ Area of / $(opp\ van)$ ΔMPT $= \frac{1}{2} \times \frac{3\sqrt{13}}{2} \times \sqrt{13}$ units^2/*eenhede*^{2} $= \frac{39}{4}$ units^2/*eenhede*^{2} $= 9{,}75$ units^2/*eenhede*^{2}	✓ PT $= \frac{3\sqrt{13}}{2}$ ✓ MT $= \sqrt{13}$ ✓ substitution into area formula *substitusie in opp. formule* ✓ answer/*antwoord* (4)
	OR/*OF*	**OR/*OF***
	$P\widehat{T}M = 90°$ (<s on a str line) /$(< e\ op\ 'n\ reguitlyn)$	
	$PT = \sqrt{(1-2)^2 + (\frac{11}{2}-1)^2} = \frac{3\sqrt{13}}{2} = 5{,}41$ $MT = \sqrt{(-1-2)^2 + (-1-1)^2} = \sqrt{13} = 3{,}61$ Area of/Opp van ΔMPT $= \frac{1}{2} \times \frac{3\sqrt{13}}{2} \times \sqrt{13} \sin(90°)$ units^2/*eenhede*^{2} $= \frac{39}{4}$ units^2/*eenhede*^{2} $= 9{,}75$ units^2/*eenhede*^{2}	✓ PT $= \frac{3\sqrt{13}}{2}$ ✓ MT $= \sqrt{13}$ ✓ substitution into area formula *substitusie in opp. formule* ✓ answer/*antwoord* (4)
		[25]

QUESTION/*VRAAG* 2

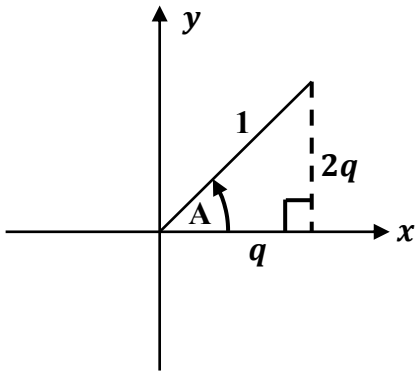


2.1.1	ON $= \sqrt{(6-0)^2+(-8-0)^2}$ ON $= \sqrt{100}$ $\therefore$ ON $= 10$ units/*eenhede*	✓ substitution/*substitusie* ✓ answer/*antwoord* (2)
2.1.2	ON = OS tangents from the same point/ *raaklyne vanuit dieselfde punt* $\therefore p = 10$ **ANSWER ONLY: FULL MARKS** ***SLEGS ANTWOORD: VOLPUNTE***	✓ S ✓ answer/*antwoord* (2)
2.1.3	ON ⊥ NM tangent ⊥ radius/*raaklyn* ⊥ *radius* $m_{ON} = \frac{-8-0}{6-0}$ $\therefore m_{ON} = -\frac{4}{3}$ $\therefore m_{NM} = \frac{3}{4}$	✓ $-\frac{4}{3}$ ✓ $\frac{3}{4}$ (2)

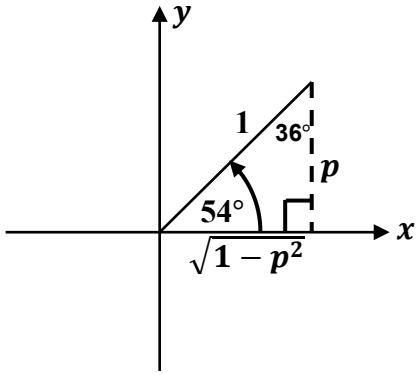
2.1.4	$m_{NM} = \frac{3}{4}$ $\frac{q-(-8)}{10-6} = \frac{3}{4}$ $\frac{q+8}{4} = \frac{3}{4}$ $q = -5$ **OR/*OF*** $y = \frac{3}{4}x + c$ $-8 = \frac{3}{4}(6) + c$ $c = -\frac{25}{2}$ $y = \frac{3}{4}x - \frac{25}{2}$ $q = \frac{3}{4}(10) - \frac{25}{2}$ $q = -5$	✓ equating and simplifying/ *gelykstelling en vereenvoudiging* ✓ answer/*antwoord* ***OR*/OF** ✓ substitution/*vervanging* ✓answer/*antwoord* (2)
2.2	MS $= r = 5$ units/*eenhede* $(x-10)^2 + (y+5)^2 = 25$	✓ radius ✓ subs centre coordinates/ *subst middelpuntkoördinate* ✓ equation/*vergelyking* (3)
2.3	$(x-10)^2 + (-5+5)^2 = 25$ $(x-10)^2 = 25$ $\therefore k = 5$ or/*of* $k = 15$ $k = 5$ or/*of* $k = 15$	✓ substitution/*vervanging* ✓ both answer/*beide antwoord* (2)
2.4	Coordinates of the point directly opposite N is C. / *Koördinate van die punt direk teenoor N is C.* $\frac{x+6}{2} = 10$ $\quad \frac{y-8}{2} = -5$ $x + 6 = 10 \times 2$ $\quad y - 8 = -5 \times 2$ $\therefore x = 14$ $\quad \therefore y = -2$ $\therefore C(14; -2)$ equation of the tangent at C/ *vergelyking van raaklyn by C* $y + 2 = -\frac{4}{3}(x - 14)$ $\therefore y = -\frac{4}{3}x + \frac{50}{3}$ $\therefore 0 < t < \frac{50}{3}$ DO NOT MARK THIS QUESTION	✓ substitution into correct midpoint formula/*subst in korrekte middelpuntsformule* ✓ x – value/*waarde* ✓ y – value/*waarde* ✓ equation of tangent at C/ *vergelyking van raaklyn by C* ✓ value of t/*waarde van t* (5)

2.5	They will not touch./*Hulle sal nie raak nie* The new circle is the old circle shifted up by 11 units/ *Die nuwe sirkel is die ou sirkel wat met 11 eenhede opwaarts gekuif het.* **OR/*OF*** sum of radii/*som van radiusse = 10* distance between centres/*afstand tussen middelpunte* $= \sqrt{(10-10)^2+(6+5)^2}$ $= 11$ $\therefore$ the circles do not touch or cut/*die sirkels raak of sny nie*	✓ answer/*antwoord* ✓ any valid reason/ *enige geldige rede* (2) ✓distance between centres> sum of radii /*afstand tussen middelpunte > som van radiusse* ✓the circles do not touch or cut/*die sirkels raak of sny nie.* (2)
		[15]

QUESTION/*VRAAG* 3

3.1			
	3.1.1	$\tan A = \frac{2q}{q}$ $\therefore \tan A = 2$ **OR/*OF*** $\frac{\sin A}{\cos A} = \frac{2q}{q} = 2 = \tan A$	✓ correct diagram/ *korrekte diagram* ✓ answer/*antwoord* (2) **OR/*OF*** ✓ quotient identity/ *kwosiënt identiteit* ✓ answer/*antwoord* (2)
	3.1.2	$(2q)^2 + q^2 = 1$ $5q^2 = 1$ $q^2 = \frac{1}{5}$ $q = \frac{1}{\sqrt{5}}$ $q = \frac{\sqrt{5}}{5}$	✓ Pythagoras ✓ simplification/ *vereenvoudiging* ✓ answer in any form/ *antwoord in enige vorm* (3)

3.2



$x^2 + y^2 = r^2$
$\therefore x = \sqrt{1-(p)^2}$

3.2.1

$\sin 594°$
$= \sin 234°$
$= -\sin 54°$
$= -p$

✓ $-\sin 54°$
✓ $-p$ (2)

3.2.2

$\cos 36° = p$

or/*of*

$\cos 36°$
$= \cos(90° - 54°)$
$= \sin 54$
$= p$

✓✓ answer/*antwoord* (2)

3.2.3

$\cos 18° \sin 2(36°)$
$= \sin 72°$
$= \sin 2(36°)$
$= 2\sin 36° . \cos 36°$
$= 2\left(\frac{\sqrt{1-(p)^2}}{1}\right)\left(\frac{p}{1}\right)$
$= 2p\sqrt{1-(p)^2}$

OR/*OF*

$cos18° = \cos(54° - 36°)$
$= cos54°cos36° + sin54°sin36°$
$= \sqrt{1-p^2} \times p + p \times \sqrt{1-p^2}$
$= 2p\sqrt{1-(p)^2}$

✓ $\sin 72°$
✓ $\sin 2(36°)$
✓ $2\sin 36° . \cos 36°$
✓ $2p\sqrt{1-(p)^2}$ (4)

OR/*OF*

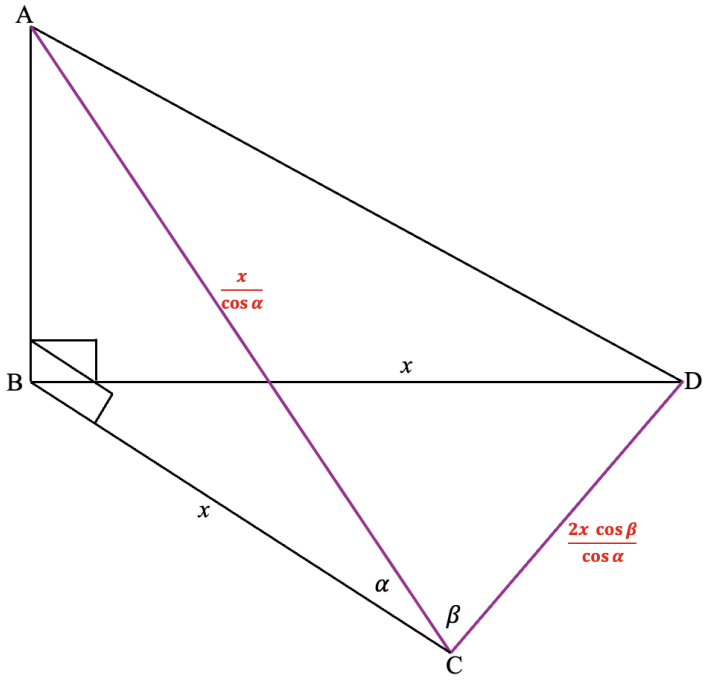
✓$cos18° = \cos(54° - 36°)$
✓ $cos54°cos36° + sin54°sin36°$
✓ $\sqrt{1-p^2} \times p + p \times \sqrt{1-p^2}$
✓$2p\sqrt{1-(p)^2}$ (4)

3.3	$= \frac{\cos(90°+50°)-\cos\theta}{\sin 50°+\cos\theta}$ $= \frac{-\sin 50°-\cos\theta}{\sin 50°+\cos\theta}$ $= \frac{-(\sin 50°+\cos\theta)}{\sin 50°+\cos\theta}$ $= -1$	✓ $-\sin 50°$ ✓ $\cos\theta$ ✓ $\sin 50°$ ✓ $\cos\theta$ ✓ common factor/ *gemeenskaplike faktor* ✓ answer/*antwoord*	(6)

3.4	$\cos(x+65°).\cos(x+20°) - \sin(x+245°).\sin(x+20°)$ $= \cos(x+65°).\cos(x+20°) + \sin(x+65°).\sin(x+20°)$ $= \cos[(x+65°) - (x+20°)]$ $= \cos 45°$ $= \frac{1}{\sqrt{2}}$ or/*of* $\frac{\sqrt{2}}{2}$	✓ reduction/*reduksie of herleiding* ✓ compound angles/ *saamgestelde hoeke* ✓ $\cos 45°$ ✓ answer/*antwoord* (4)
3.5	$\cos^2 x - \sin^2 x = \frac{1}{2}$ $\cos 2x = \frac{1}{2}$ ref angle/*verwysingshoek*: $2x = \cos^{-1}\left(\frac{1}{2}\right)$ $\therefore 2x = 60° + k.360°$ 1st Quad/*1ste Kwad*: $2x = 60° + k.360°$ $\therefore x = 30° + k.180°, k \in \mathbb{Z}$ 4th Quad/*4de Kwad*: $2x = 360° - 60° + k.360°$ $2x = 300° + k.360°$ $\therefore \quad x = 150° + k.180°\ , k \in \mathbb{Z}$ **OR/*OF*** $\cos^2 x - \sin^2 x = \frac{1}{2}$ $2\cos^2 x - 2\sin^2 x = 1$ $2\cos^2 x - 2\sin^2 x = \sin^2 x + \cos^2 x$ $2\sin^2 x + \sin^2 x = 2\cos^2 x - \cos^2 x$ $3\sin^2 x = \cos^2 x$ $\therefore \tan^2 x = \frac{1}{3}$ $\therefore \tan x = \frac{1}{\sqrt{3}}$ $\therefore x = 30°$ #ref angle/ *#verw hoek* $\therefore x = 30° + k.180°\ ;\ k \in \mathbb{Z}$ $x = 180° + 30° + k.180°\ k \in \mathbb{Z}$ $x = 210° + k.180°\ k \in \mathbb{Z}$	✓ $\cos 2x = \frac{1}{2}$ ✓ $2x = 60° + k.360°$ ✓ $x = 30° + k.180°, k \in \mathbb{Z}$ (4) ✓ $x = 150° + k.180°$, $k \in \mathbb{Z}$ **OR/*OF*** ✓ multiplying by 2 and using identity/ *vermenigvuldig met 2 en gebruik identiteit* ✓ $3\sin^2 x = \cos^2 x$ ✓ $\tan x = \frac{1}{\sqrt{3}}$ ✓ answer/*antwoord* (4)

3.6		$\frac{\sin 2\theta \,.\tan\theta}{\cos 2\theta + 1} = \tan^2\theta$	
	3.6.1	LHS $= \frac{\sin 2\theta.\tan\theta}{\cos 2\theta+1}$ $= \frac{2\sin\theta\cos\theta.\frac{\sin\theta}{\cos\theta}}{2\cos^2\theta-1+1}$ $= \frac{2\sin^2\theta}{2\cos^2\theta}$ $= \tan^2\theta$ $\therefore$ LHS = RHS/*LK=RK*	✓ $2\sin\theta\cos\theta$ ✓ $\frac{\sin\theta}{\cos\theta}$ ✓ $2\cos^2\theta - 1$ ✓ $\frac{2\sin^2\theta}{2\cos^2\theta}$ (4)
	3.6.2	$\cos 2\theta + 1 = 0$ $\cos 2\theta = -1$ $2\theta = 180°$ $\theta = 90°$ If only $\theta = 90°$ for tanθ undefined ($\frac{1}{4}$) */as slegs* $\theta = 90°$*vir* tanθ*ongedefinieërd* tanθ($\frac{1}{4}$)	✓ denominator/*noemer* = 0 ✓ $\cos 2\theta = -1$ ✓ $2\theta = 180°$ ✓ $\theta = 90°$ (4)
			[35]

QUESTION/*VRAAG* 4

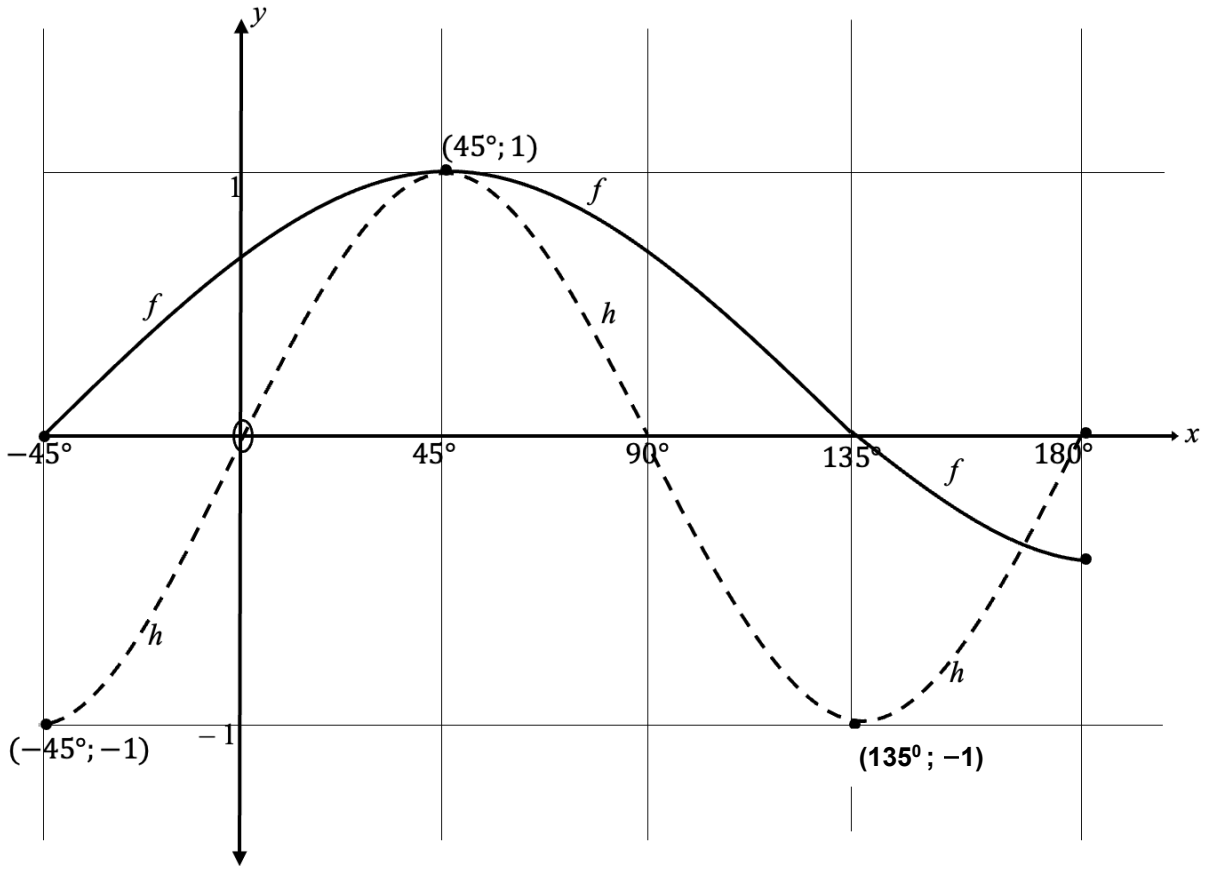


4.1	$\Delta ABC \equiv \Delta ABD$ (S.A.S)/(*S∠S*)	✓ **R** (1)
4.2	$\cos\alpha = \frac{x}{AC}$ $\therefore AC = \frac{x}{\cos\alpha}$	✓ correct ratio/*korrekte verhouding* ✓ AC simplified as subject/ *AC vereenvoudig as onderwerp* (2)
4.3	$CD^2 = \left(\frac{x}{\cos\alpha}\right)^2 + \left(\frac{x}{\cos\alpha}\right)^2 - 2\left(\frac{x}{\cos\alpha}\right)\left(\frac{x}{\cos\alpha}\right)\cos(180° - 2\beta)$ $CD^2 = \frac{2x^2}{\cos^2\alpha} - 2\left(\frac{x^2}{\cos^2\alpha}\right)\cos 2\beta$ $CD^2 = \frac{2x^2}{\cos^2\alpha}(1 + \cos 2\beta)$ $CD^2 = \frac{2x^2}{\cos^2\alpha}(1 + (1 - 2\sin^2\beta))$ $CD^2 = \frac{2x^2}{\cos^2\alpha}(1 + (1 - 2(1 - \cos^2\beta)))$ $CD^2 = \frac{2x^2}{\cos^2\alpha}(2\cos^2\beta)$ $CD^2 = \frac{4x^2\cos^2\beta}{\cos^2\alpha}$ $\therefore CD = \frac{2x\cos\beta}{\cos\alpha}$	✓ correct use of cos rule/ *korrekte gebruik van cos-reël* ✓ simplification/ *vereenvoudig* ✓ applying double angles/ *gebruik dubbelhoeke* ✓ identity/*identiteit* (4)

	OR/*OF* $A\hat{D}C = \beta$ $C\hat{A}D = 180° - 2\beta$ $\frac{CD}{\sin(180°-2\beta)} = \frac{AC}{\sin\beta}$ $CD = \frac{AC.\sin 2\beta}{\sin\beta}$ but $AC = \frac{x}{\cos\alpha}$ $CD = \frac{\left(\frac{x}{\cos\alpha}\right).\sin 2\beta}{\sin\beta}$ $CD = \frac{x\,.2\sin\beta.\cos\beta}{\cos\alpha.\sin\beta}$ $\therefore CD = \frac{2x\,.\cos\beta}{\cos\alpha}$	**OR/*OF*** ✓ $A\hat{D}C = \beta$ and/*en* $C\hat{A}D = 180° - 2\beta$ ✓ correct use of sin rule/ *korrekte gebruik van sin-reël* ✓ substituting AC/ *substitusie van AC* ✓ double angle/*dubbelhoek* (4)
4.4	$CD = \frac{2(25)\cos 65{,}62°}{\cos 30°}$ $CD = 23{,}83$ cm penalize 1 mark for incorrect rounding */penaliseer 1 punt vir foutiewe afronding*	✓ substitution/*substitusie* ✓ answer/*antwoord* (2)
		[9]

QUESTION/*VRAAG* 5

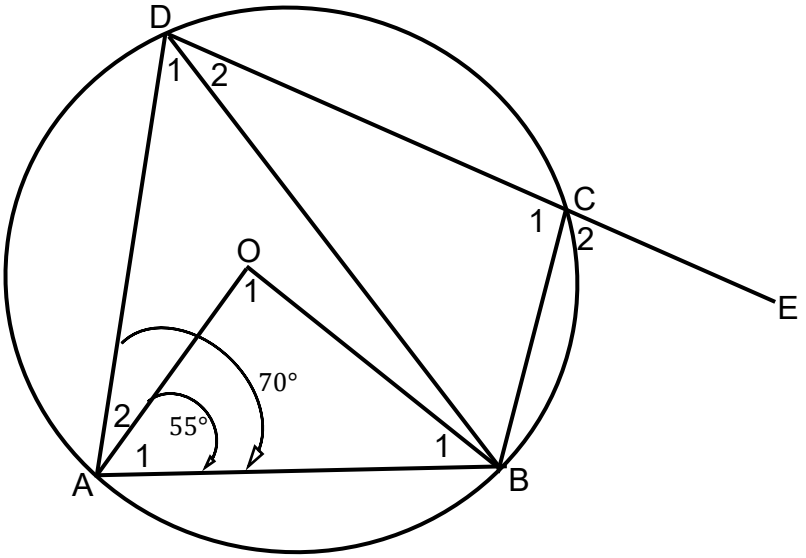
5.1	$f(180°) = \cos(180° - 45°)$ $= -0{,}71$ **ANSWER ONLY: FULL MARKS** *SLEGS ANTWOORD: VOLPUNTE* $\therefore -0{,}71 \leq y \leq 1$ **OR/*OF*** $\therefore y \in [-0{,}71; 1]$ **OR/*OF*** $-\frac{\sqrt{2}}{2} \leq y \leq 1$	✓ $f(180°)$ ✓ answer/*antwoord* (2)
5.2	**SEE THE GRAPH BELOW AND ALLOCATE MARKS ACCORDINGLY**: ***SIEN DIE GRAFIEK HIERONDER EN KEN PUNTE TOE DAARVOLGENS:*** ✓ intercepts/*afsnitte* ✓ shape/*vorm* ✓turning points/*draaipunte* (3)	



5.3	Period/*periode* $= 180°$	✓ answer/*antwoord* (1)
5.4	$-45° < x < 45°$ **OR/*OF*** $x \in (-45°; 45°)$ **ACCEPT/ *AANVAAR*:** $-45° \leq x \leq 45°$	✓✓ answer/*antwoord* (2)
5.5	$x = -45°$ or/*of* $x = 135°$	✓ $-45°$ ✓ $135°$ (2)
5.6	$g(x) = \cos(x + 15°)$	✓ answer/*antwoord* (1)
		[11]

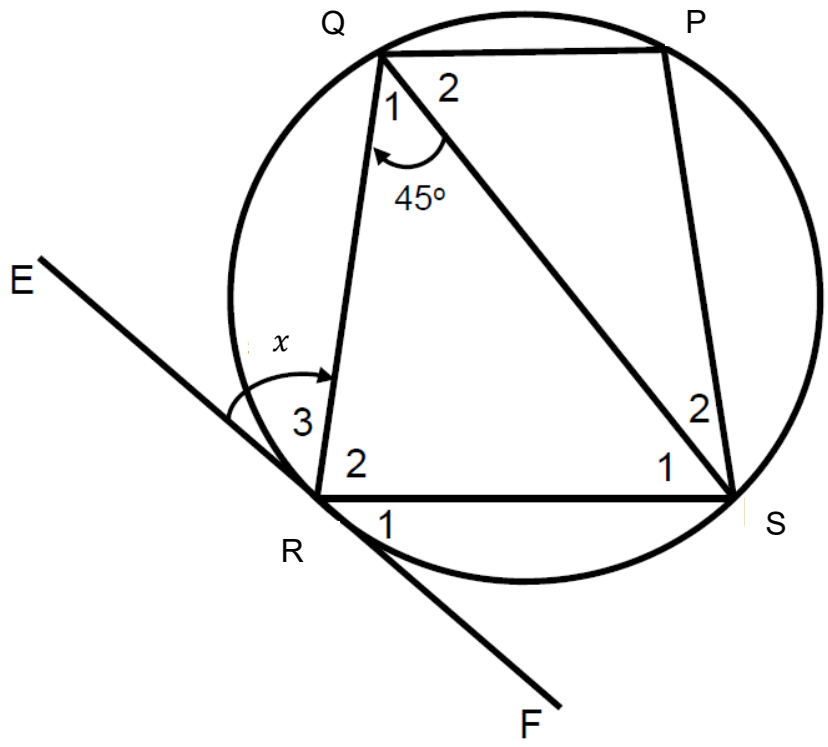
QUESTION/*VRAAG 6*

6.1



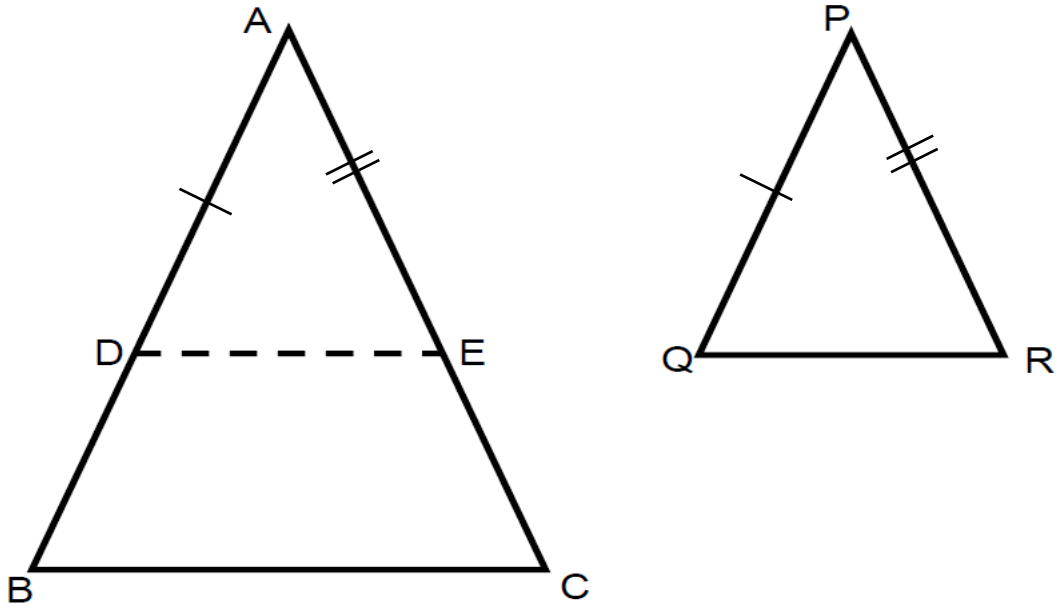
	6.1.1	$\hat{B}_1 = 55°$ (<s opp equal radii)*/(<e teenoor gelyke radiusse)* **OR/*OF*** OA = OB (radii)(*radiusse)* $\hat{B}_1 = 55°$ (<s opp equal sides)*/(<e teenoor gelyke radiusse)*	✓S ✓R (2) ✓ OA = OB (radii) *(radiusse}* ✓ S (2)
	6.1.2	$\hat{O}_1 = 70°$ (sum of/*som van* < s in Δ)*/(<e van Δ)*	✓ S ✓R (2)
	6.1.3	$\hat{D}_1 = 35°$ (< at centre = 2 ×< at circumference) *(midpts <= 2 × omtreks<)*	✓S ✓R (2)
	6.1.4	$\hat{C}_2 = 70°$ (ext < of a cyclic quad)*/(buite< van kvh)* **OR** $\hat{C}_1 = 110°$ (opp <s of a cyclic quad)/ *(teenooorst<e kvh)* $\hat{C}_2 = 70°$ (<s on a st line)*/(<e op reguitlyn)*	✓S ✓R (2) ✓S/R ✓ S (2)

6.2

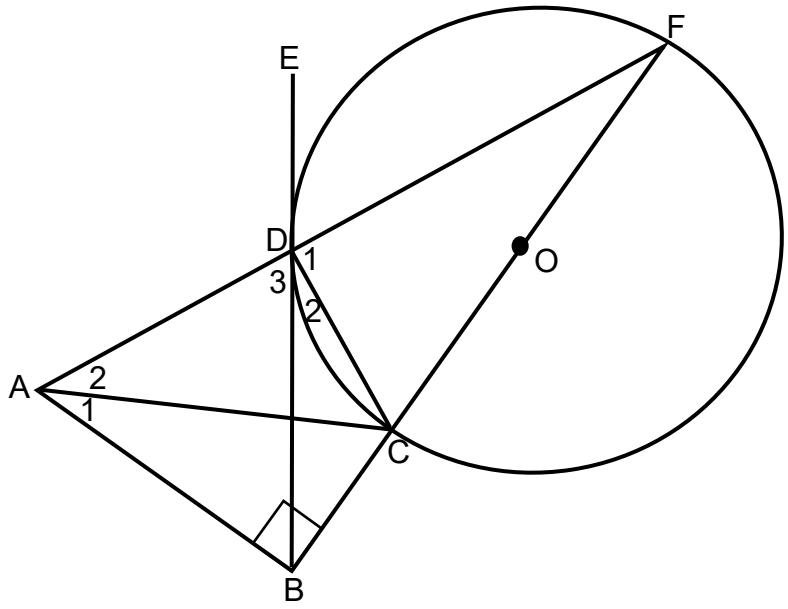


	6.2.1	$\hat{S}_1 = x$ (tan chord theorem)/*(∠tussen raaklyn en koord)*	✓ S ✓ R	(2)
	6.2.2	$\hat{R}_2 = 180° - (\hat{S}_1 + 45°)$ (sum of <s in Δ)/(<e van Δ) $= 180° - (x + 45°)$ $\hat{R}_2 + \hat{P} = 180°$ (opp <s of cyclic quad)/*(teenooorst<e kvh)* $\therefore 180° - (x + 45°) + \hat{P} = 180°$ $\hat{P} = x + 45°$ **OR/*OF*** $\hat{R}_1 = 45°$ (tan chord theorem)*(∠ tussen rlyn en koord)* $\hat{R}_2 = 180° - (x + 45°)$ (<s on st line)/*(<e op reguitlyn)* $\hat{R}_2 + \hat{P} = 180°$ (opp <s of cyclic quad)/*teenooorst<e kvh* $\therefore 180° - (x + 45°) + \hat{P} = 180°$ $\hat{P} = x + 45°$	✓S ✓R ✓S ✓R **OR/*OF*** ✓S ✓ R ✓S ✓R	(4) (4)
				[14]

QUESTION/*VRAAG 7*

7.1.1	SAS/*(S<S)*	✓ R	(1)
7.1.2			
	$A\hat{D}E = \hat{Q}$ (≡ Δs)/*(≡ Δe)* $A\hat{D}E = \hat{B}$ (both $= \hat{Q}$)/*(beide $= \hat{Q}$)* ∴ DE||BC (corresp <s =)/*(ooreenk <e =)* $\frac{AB}{AD} = \frac{AC}{AE}$ (prop theorem; DE||BC)/*(lyn || een sy van Δ; DE||BC)* But/*Maar* AD = PQ and/*en* AE = PR (given)/*(gegee)* ∴ $\frac{AB}{PQ} = \frac{AC}{PR}$	✓ S ✓ S ✓ R ✓ S ✓ R	(5)
	OR/OF In ΔABC and ΔPQR: $\hat{A} = \hat{P}$ *(given/gegee)* $\hat{B} = \hat{Q}$ *(given/gegee)* $\hat{C} = \hat{R}$ *(given/gegee)* $\Delta ABC \,\|\|\| \,\Delta PQR$ (<<<) $\frac{AB}{PQ} = \frac{AC}{PR}$	✓ S ✓ S ✓ R ✓ S ✓ R	(5)

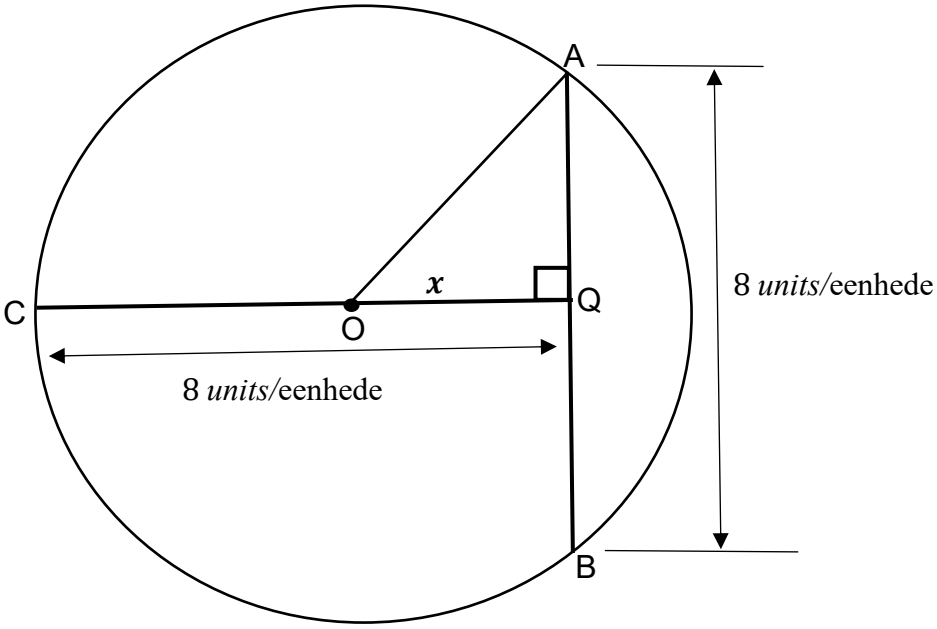
7.2



7.2.1	$\hat{B} = 90°$ (given)/*(gegee)* $\hat{D}_1 = 90°$ (< in a semi − circle)/*(< in halwe sirkel)* ∴ ABCD is a cyclic quadrilateral (converse: ext < of a cyclic quad) / *ABCD is 'n kvh (buite < van vierhoek = teenoorst binne <)* **OR/*OF*** $\hat{B} = 90°$ (given) */(gegee)* $\hat{D}_1 = 90°$ (< in a semicircle)/*(< in 'n halwe sirkel)* $\hat{D}_2 + \hat{D}_3 = 90°$ (< s on a st line)/*(<e op reguitlyn)* ∴ ABCD is a cyclic quadrilateral (converse: opp < s of a cyclic quad)/ *ABCD is 'n kvh (buite < van vierhoek =teenoorst binne <)*	✓S ✓R ✓R (3) **OR/*OF*** ✓S ✓R ✓R (3)
7.2.2	$\hat{A}_1 = \hat{D}_2$ (< s in the same seg)/(< *e in dies sirkel segm*) $\hat{D}_2 = \hat{F}$ (tan chord theorem)/*(< tussen raaklyn en koord)* ∴ $\hat{A}_1 = \hat{F}$ (both $= \hat{D}_2$) /(*beide* $= \hat{D}_2$) ∴ AB is a tangent/*is 'n raaklyn* (converse: tan − chord thrm **OR** < between line and chord) *(omg < e in dies sirkel segm **OF** < tussen lyn en koord = < in teenoorst sirkel segm)*	✓S ✓R ✓ S/R ✓ R (4)
		[13]

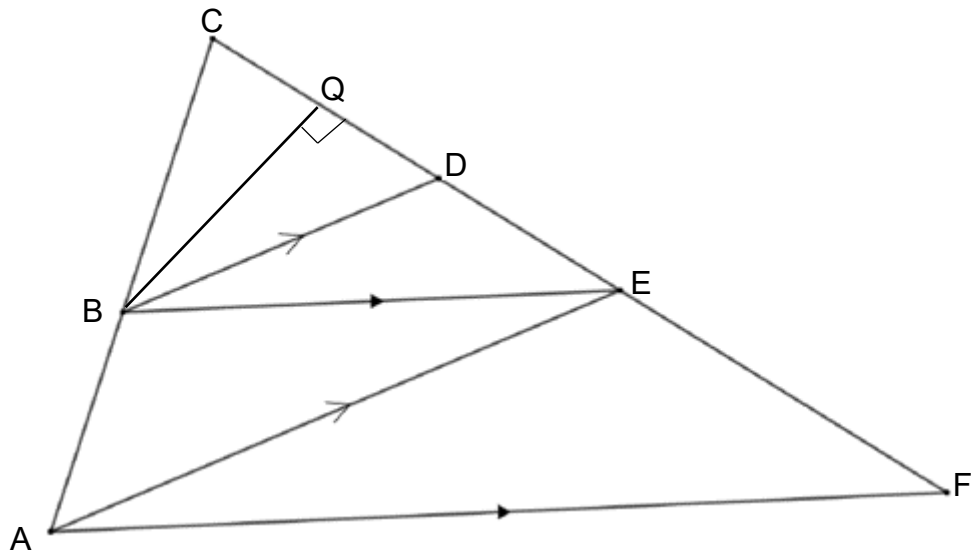
QUESTION/*VRAAG* 8

8.1



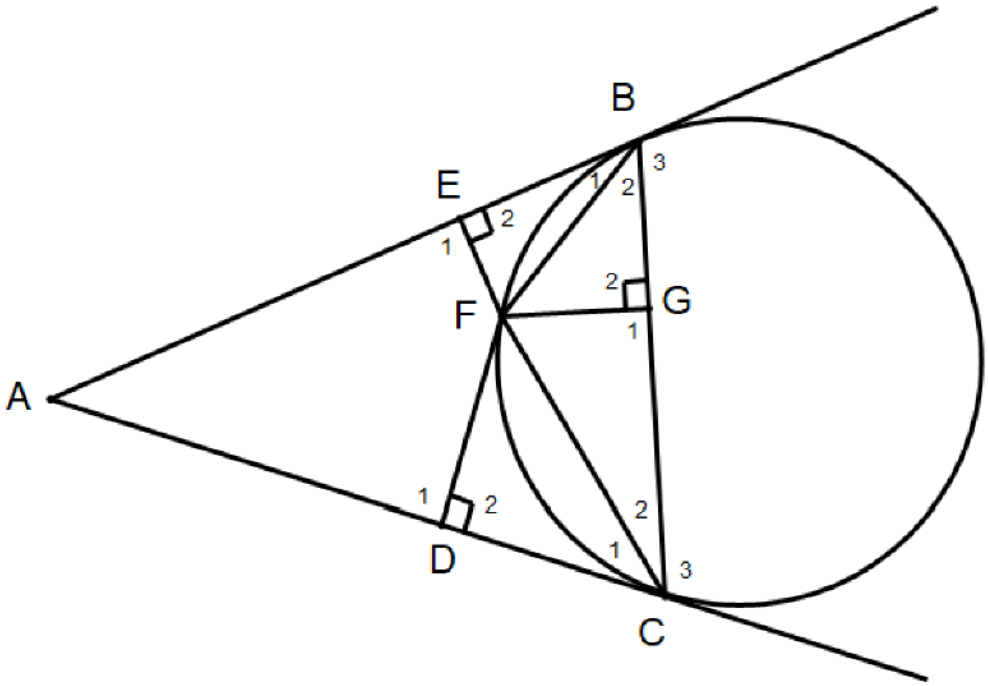
	$AQ = 4$ units/*eenhede* (line from centre ⊥ chord) / (*loodlyn uit midpt O na koord)*	✓ S ✓ R
	$OC = OA = 8 - x$ (radii)/*(radiusse)*	✓ $OA = 8 - x$
	$OA^2 = x^2 + AQ^2$ (Pythagoras)	
	$(8 - x)^2 = x^2 + 4^2$	
	$64 - 16x + x^2 = x^2 + 16$	✓ S
	$16x = 48$	
	$\therefore x = 3$	(5)
	$\therefore OC = 5$ units/*eenhede*	✓ $OC = 5$ units/ *eenhede*
	OR/*OF*	**OR/*OF***
	$OC = OA$ (radii)/*(radiusse)*	✓ $OQ = 8 - OC$
	$OQ = 8 - OC$	
	$AQ = 4$ units/*eenhede* (line from centre ⊥ chord) / (*loodlyn uit midpt O na koord)*	✓ S ✓ R
	$OA^2 = OQ^2 + 4^2$ (Pythagoras)	
	$OC^2 = (8 - OC)^2 + 4^2$	✓ S
	$OC^2 = 64 - 16OC + OC^2 + 16$	
	$16OC = 80$	
	$\therefore OC = 5$ units/*eenhede*	✓ S (5)

8.2

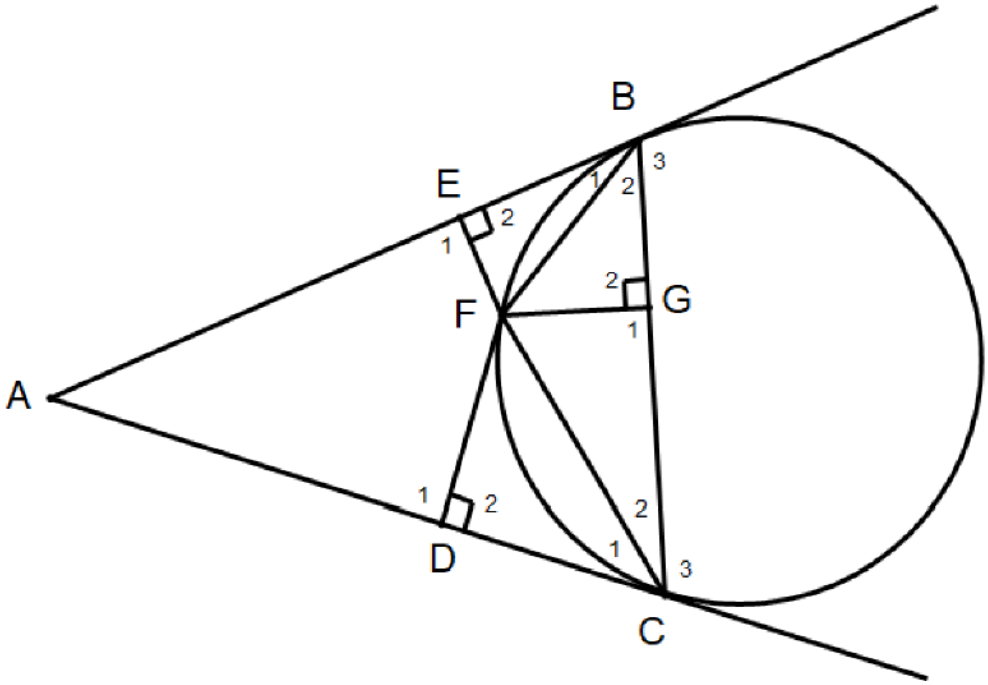


8.2.1	4 : 5	✓ S (1)
8.2.2	$\frac{AC}{AB} = \frac{9}{4}$ (given/*gegee*) $AC = \frac{9}{4} \times 6$ units/*eenhede* $AC = \frac{27}{2}$ units/*eenhede* $= 13{,}5$ units/*eenhede*	✓ substitution /*substitusie* ✓answer/*antwoord* (2)
8.2.3	$\frac{\text{Area of } \Delta BDC}{\text{Area of } \Delta BED} = \frac{\frac{1}{2} \times CD \times BQ}{\frac{1}{2} \times DE \times BQ}$ $= \frac{CD}{DE}$ $= \frac{5}{4}$ (prop theorem; BD||AE)/ line|| one side of Δ *(lyn || een sy van Δ)*	✓ $\frac{\text{Area of } \Delta BDC}{\text{Area of } \Delta BED} = \frac{CD}{DE}$ $\frac{Opp\ \Delta BDC}{Opp\ \Delta BED} = \frac{CD}{DE}$ ✓ S/R (2)
8.2.4	$\frac{EC}{FC} = \frac{BC}{AC} = \frac{5}{9}$ (prop theorem; BE||AF) / line|| one side of Δ *(lyn||een sy van Δ)* $\frac{EC}{15} = \frac{5}{9}$ $EC = \frac{25}{3} = 8{,}33$ $\frac{DE}{EC} = \frac{4}{9}$ (prop theorem; BD||AE)/ line|| one side of Δ *(lyn||een sy van Δ)* $DE = \frac{4}{9} \times EC$ $= \frac{4}{9} \times \frac{25}{3}$ ∴ DE $= \frac{100}{27}$ units/*eenhede* = 3,70 units/*eenhede*	✓ $\frac{EC}{FC} = \frac{5}{9}$ ✓ $EC = \frac{25}{3} = 8{,}33$ ✓ $\frac{DE}{EC} = \frac{4}{9}$ ✓ answer/*antwoord* (4)
		[14]

QUESTION/*VRAAG 9*



9.1	In ΔBEF and/*en* ΔCGF, $\hat{E}_2 = \hat{G}_1$ (both $= 90°$, given)/$(beide = 90°, gegee)$ $\hat{B}_1 = \hat{C}_2$ (tan chord theorem)/(< *tussen raaklyn en koord)* $E\hat{F}B = C\hat{F}G$ (sum of/*som van* < s in Δ)/(< *e van* Δ) $\therefore$ ΔBEF|||ΔCGF (<<<)	✓ $\hat{E}_2 = \hat{G}_1$ ✓ S/R ✓ <<< **OR/*OF*** Sum of/*som van* <s in Δ/ (< *e van* Δ) (3)



9.2	In ΔCDF and/*en* ΔBGF, $\hat{D}_2 = \hat{G}_2$ (both $= 90°$, given)/(*beide* $= 90°$, *gegee*) $\hat{C}_1 = \hat{B}_2$ (tan chord theorem)/(< *tussen raaklyn en koord)* $C\hat{F}D = B\hat{F}G$ (sum of < s in Δ)/(< *e van* Δ) $\therefore\ \Delta CDF\|\|\|\Delta BGF$ (<< <) $\Delta BEF\|\|\|\Delta CGF$ (proven) $\frac{FD}{FG} = \frac{FC}{FB}(\Delta CDF\|\|\|\Delta BGF)$ $\frac{FG}{FE} = \frac{FC}{FB}(\Delta BEF\|\|\|\Delta CGF)$ $\frac{FD}{FG} = \frac{FG}{FE}$ $(both\ /beide = \frac{FC}{FB})$ $\therefore\ FG^2 = FE \times FD$	✓ S ✓ R ✓ $\Delta CDF\|\|\|\Delta BGF$ ✓ S/R ✓ S ✓ $\frac{FD}{FG} = \frac{FG}{FE}$ (6)
		[9]

TOTAL/*TOTAAL:* 145