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GRADE/GRAAD 12

JUNE/JUNIE 2022

**TECHNICAL MATHEMATICS P2/TEGNIESE WISKUNDE V2
MARKING GUIDELINE/NASIENRIGLYN**

MARKS/PUNTE: 150

This marking guideline consists of 18 pages./
Hierdie nasienriglyn bestaan uit 18 bladsye.

NOTE:

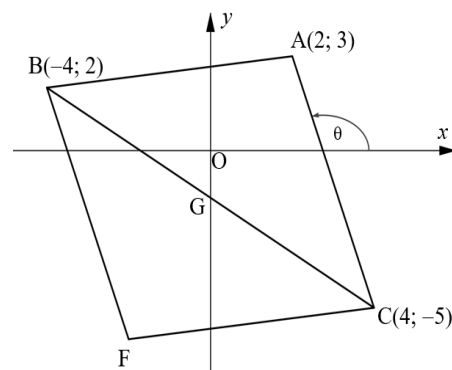
- Continuous accuracy (CA) applies only where indicated in this marking guideline.
- Assuming values/answers in order to solve a problem is unacceptable.

LET WEL:

- *Volgehoue akkuraatheid (CA) is slegs van toepassing soos aangedui in hierdie nasienriglyn.*
- *Aanvaarding van waardes/antwoorde om 'n probleem op te los, is onaanvaarbaar.*

MARKING CODES / NASIENKODES	
M	Method/Metode
A	Accuracy/Akkuraatheid
AO	Answer only/Slegs antwoord
CA	Consistent accuracy/Deurlopende akkuraatheid
F	Formula/Formule
I	Identity/Identiteit
R	Rounding/Afronding
S	Simplification/Vereenvoudiging
ST	Statement/Bewering
RE	Reason/Rede
ST RE	Statement and correct reason/Bewering en korrekte rede
SF	Substitution correctly in correct formula/Korrekte vervanging in die korrekte formule
NPU	No penalty for omitting units/Geen penalisering vir eenhede uitgelaat

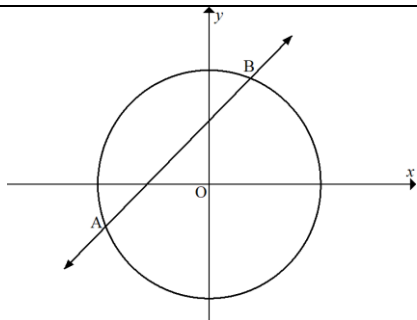
QUESTION/VRAAG 1

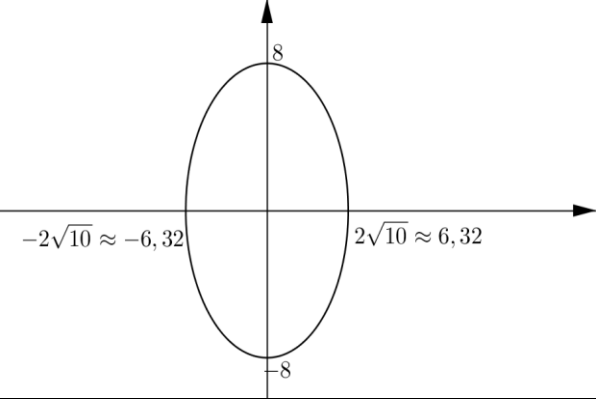


1.1	$AC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(2 - (-4))^2 + (3 - (-5))^2} = \sqrt{(4 - (-2))^2 + (-5 - 3)^2}$ $= \sqrt{68}$ $= 2\sqrt{17}$ AO: Full marks / Volpunte	✓ SF A ✓ S C (2)
1.2	$m_{AC} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{3 - (-5)}{2 - (-4)} = \frac{-5 - 3}{4 - 2}$ $= -4$ Equation of / Vergelyking van AC: Substitute / Vervang (2;3) or / of (4; -5) into / in $y - y_1 = m(x - x_1)$ $y - 3 = -4(x - 2) \qquad y + 5 = -4(x - 4)$ $y = -4x + 8 + 3 \qquad \text{OR / OF} \qquad y = -4x + 16 - 5$ $y = -4x + 11 \qquad y = -4x + 11$	✓ SF A ✓ m_{AC} CA ✓ SF CA ✓ S CA (4)
1.3	$\tan \theta = m_{AC} = -4$ $\therefore \text{Ref. / Verw. } \angle = 75,96^\circ$ $\therefore \theta = 180^\circ - 75,96^\circ \approx 104,04^\circ$	✓ M ✓ Ref / Verw $\angle$. ✓ Obtuse $\angle$ / stomphoekige $\angle$ NPU (3)
1.4	$G\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right) = \left(\frac{-4 + 4}{2}; \frac{2 - 5}{2}\right) = \left(0; -\frac{3}{2}\right)$ AO: Full marks / Volpunte	✓ x-coordinate / afsnit ✓ y-coordinate / afsnit (2)
1.5	$\left(\frac{x_F + x_A}{2}; \frac{y_F + y_A}{2}\right) = (x_G; y_G)$ $\therefore \frac{x_F + 2}{2} = 0 \quad \text{and/en} \quad \frac{y_F + 3}{2} = -\frac{3}{2}$ $\therefore x_F = -2 \quad \text{and/en} \quad y_F = -6$	✓ M ✓ x_F CA ✓ y_F CA (3)

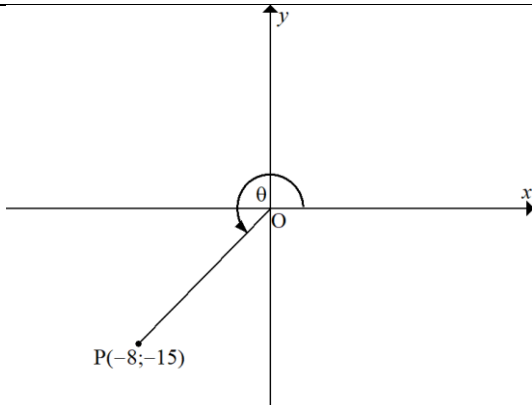
1.6	$m_{AG} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{3 - (\frac{3}{2})}{2 - 0} = \frac{-\frac{3}{2} - 3}{0 - 2}$ $= \frac{9}{4}$ $m_{BC} \times m_{AG} = -\frac{7}{8} \times \frac{9}{4} \neq -1$ $\therefore BC \text{ not / nie } \perp AG$	$m_{BC} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{2 - (-5)}{-4 - 4} = \frac{-5 - 2}{4 - (-4)}$ $= -\frac{7}{8}$	✓ m_{AG} CA ✓ m_{BC} CA ✓ M ✓ conclusion/ gevolgtrekking (4)
			[18]

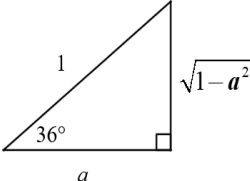
QUESTION/VRAAG 2

2.1		
2.1.1	$x^2 + (x + 3)^2 = 29$ $x^2 + x^2 + 6x + 9 - 29 = 0$ $2x^2 + 6x - 20 = 0$ $x^2 + 3x - 10 = 0$ $(x + 5)(x - 2) = 0$ $x = -5 \text{ or / of } x = 2$ $y = -2 \text{ or / of } y = 5$	✓ substitution / vervanging ✓ expansion / uitbreiding ✓ standard form / standaardvorm ✓ Factorise / faktoriseer ✓ values of x / waardes van x ✓✓ values of y / waardes van y (7)
2.1.2 (a)	Substitute (-5;2) into circle equation <i>Vervang (-5;2) in sirkel vergelyking:</i> $r^2 = (-5)^2 + (2)^2 = 25 + 4 = 29$ $\therefore$ the point lie on the circle / <i>die punt lê op die sirkel</i>	✓ M ✓ conclusion / gevolgtrekking (2)
2.1.2 (b)	$xx_1 + yy_1 = r^2$ $x(-5) + y(2) = 29$ $-5x + 2y = 29$ $y = \frac{5}{2}x + \frac{29}{2}$ OR / OF $m_{rad} = \frac{2}{-5}$ $m_{tan} = \frac{5}{2} \text{ (rad } \perp \text{ tan)}$ Equation / Vergelyking: $y - y_1 = m(x - x_1)$ $y - 2 = \frac{5}{2}(x + 5)$ $y = \frac{5}{2}x + \frac{29}{2}$	✓ F ✓ SF A ✓ S CA ✓ eq of line / vergl van lyn OR / OF ✓ m_{rad} A ✓ m_{tan} CA ✓ SF CA ✓ eq of line / vergl van lyn (4)

2.2	$\frac{x^2}{(2\sqrt{10})^2} + \frac{y^2}{8^2} = 1$ 	✓ elliptical shape with vertical axis as major / <i>Elliptiese vorm met groter-as die vertikale as</i> ✓ x-intercepts/ x- afsnitte A ✓ y-intercepts/ y- afsnitte A (3)
		[16]

QUESTION/VRAAG 3

3.1		
3.1.1	$OP^2 = r^2 = (-8)^2 + (-15)^2 = 289$ $\therefore OP = 17$	✓ Subst/Vervang P A ✓ OP^2 A ✓ OP CA (3)
3.1.2	$\tan \theta = \frac{-15}{-8} = \frac{15}{8}$	✓ A (1)
3.1.3	$\cos^2 \theta - 1 = \cot^2 \theta$ $= \left(\frac{-8}{-15} \right)^2$ $= \frac{64}{225}$ OR / OF $\cos^2 \theta - 1 = \left(\frac{17}{-15} \right)^2 - 1$ $= \frac{289}{225} - 1$ $= \frac{64}{225}$	✓ I A ✓ ratio / verh A ✓ S CA OR/OF ✓ ratio / verh A ✓ S CA ✓ S CA (3)
3.2.1	$\sin \left(\frac{180^\circ}{2} - 15,7^\circ \right) \approx 0,963$ Penalty for units / Penaliseer vir eenhede AO: Full marks / Volpunte	✓ $\pi = 180^\circ$ ✓ answer / antwoord A (2)
3.2.2	$\sec(135,5^\circ + 15,7^\circ) \approx -1,141$ Penalty for rounding / Penaliseer vir afronding	✓✓ answer / antwoord (2)
3.3.1	$\sin x + 1 = 0,587$ $\sin x = -0,413$ $\therefore \text{Ref. / Verw. } \angle = 24,4^\circ$ $\therefore x = 180^\circ + 24,9^\circ \text{ or / of } 360^\circ - 24,9^\circ$ $\therefore x = 204,4^\circ \text{ or / of } 335,6^\circ$	✓ S A ✓ Ref / Verw $\angle$ CA ✓ $204,4^\circ$ CA ✓ $335,6^\circ$ CA NPU (4)

3.3.2	$\tan 2x = \frac{1}{2,114} = 0,473$ $\therefore \text{Ref. / Verw. } \angle = 25,3^\circ$ $2x = 180^\circ + 25,3^\circ$ $x = 102,7^\circ$	✓ S A ✓ Ref/Verw $\angle$ CA ✓ Quadrant / Kwadrant A ✓ value of x / waarde van x CA (4)
3.4.1	 $\tan 36^\circ = \frac{\sqrt{1-a^2}}{a}$ OR/OF $\tan 36^\circ = \frac{\sin 36^\circ}{\cos 36^\circ}$ $= \frac{\sqrt{1-\cos^2 36^\circ}}{\cos 36^\circ}$ $= \frac{\sqrt{1-a^2}}{a}$	✓✓ M complete Δ / voltooi Δ A ✓ ratio / verh CA OR/OF $\checkmark \frac{\sin 36^\circ}{\cos 36^\circ} \text{ I A}$ $\checkmark \sqrt{1-\cos^2 36^\circ} \text{ I A}$ ✓ ratio i.t.o a / verh i.t.v a CA (3)
3.4.2	$\sec^2 144^\circ = \sec^2 36^\circ$ $= \frac{1}{a^2}$	✓ $\sec^2 36^\circ$ A ✓ ratio / verh. CA (2)
		[24]

QUESTION/VRAAG 4

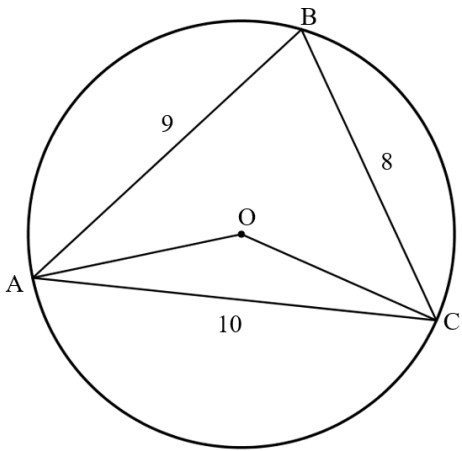
4.1	1	✓ A (1)
4.2	$\frac{\sec x}{\cos(360^\circ - x)} + \frac{\tan^2(180^\circ - x)}{\sin(180^\circ + x) \operatorname{cosec}(180^\circ - x)}$ $= \frac{\sec x}{\cos x} + \frac{\tan^2 x}{(-\sin x)(\operatorname{cosec} x)}$ $= \frac{\sec x}{\frac{1}{\sec x}} - \frac{\tan^2 x}{(\sin x)\left(\frac{1}{\sin x}\right)} \quad \text{OR/OR} \quad \frac{\frac{1}{\cos x}}{\cos x} - \frac{\tan^2 x}{(\sin x)\left(\frac{1}{\sin x}\right)} = \frac{1}{\cos^2 x} - \tan^2 x$ $= \sec^2 x - \tan^2 x$ $= 1$	✓ $\cos x$ A ✓ $\tan^2 x$ A ✓ $-\sin x$ A ✓ $\operatorname{cosec} x$ A ✓ $\frac{1}{\sec x}$ I A ✓ $\frac{1}{\sin x}$ I A ✓ $\sec^2 x - \tan^2 x$ CA ✓ 1 CA (8)
4.3	LHS/LK = $\sin(360^\circ - x) \cot(180^\circ - x)$ $= (-\sin x)(-\cot x)$ $= \sin x \times \frac{\cos x}{\sin x}$ $= \cos x$ $= \text{RHS/RK}$	✓ $-\sin x$ A ✓ $-\cot x$ A ✓ $\frac{\cos x}{\sin x}$ A ✓ S CA (4)
		[13]

QUESTION/VRAAG 5

5.1	$a = 2$	✓ A (1)
5.2	$x = 90^\circ$ or/of $x = 270^\circ$	✓ $x = 90^\circ$ A ✓ $x = 270^\circ$ A (2)
5.3	180°	✓ A (1)

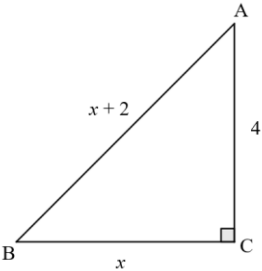
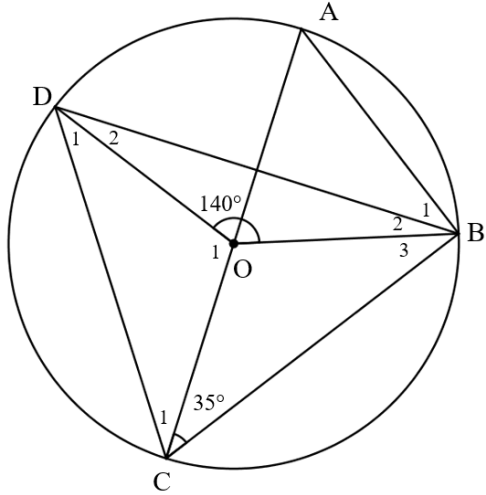
5.4		✓ shape with end points / vorm met eindpunte A ✓ x-intercepts / x-afsnitte A ✓ turning points / draaipunte A (3)
5.5	1	✓ A (1)
5.6.1	for f / vir: $x \in \{0^\circ; 180^\circ; 360^\circ\}$ for/vir g : $x \in \{150^\circ; 330^\circ\}$	✓ set of values for f / versameling van waardes vir f A ✓ set of values for g / versameling van waardes vir g CA (2)
5.6.2	$0^\circ \leq x < 90^\circ$ or/of $180^\circ \leq x < 270^\circ$ OR/OF $x \in (0^\circ; 90^\circ)$ or/of $x \in (180^\circ; 270^\circ)$	$0^\circ \leq x < 90^\circ$ ✓ end points / eindpunte A ✓ interval notation / notasie A $180^\circ \leq x < 270^\circ$ ✓ end points / eindpunte A ✓ interval notation / notasie A (4)
		[14]

QUESTION/VRAAG 6

6.1	$p^2 = q^2 + r^2 - 2qr \cos P$ OR/OF $q^2 = p^2 + r^2 - 2pr \cos Q$ OR/OF $r^2 = q^2 + p^2 - 2qp \cos R$	✓ A (1)
6.2		
6.2.1	In $\triangle ABC$: $b^2 = a^2 + c^2 - 2ac \cos B$ $10^2 = 8^2 + 9^2 - 2(8)(9)\cos B$ $\cos B = \frac{64 + 81 - 100}{144} = 0,3125$ $\hat{B} = 71,79^\circ$	✓ F A ✓ SF A ✓ value of / waarde van $\cos B$ CA ✓ answer / antwoord CA NPU (4)
6.2.2	$\angle AOC = 143,58^\circ \dots$ $\left(\begin{array}{l} \angle \text{a centre} = 2 \times \angle \text{at circum.} \\ \angle \text{midpts} \angle = 2 \times \text{omtreks. } \angle \end{array} \right)$	✓ ST CA ✓ RE A (2)

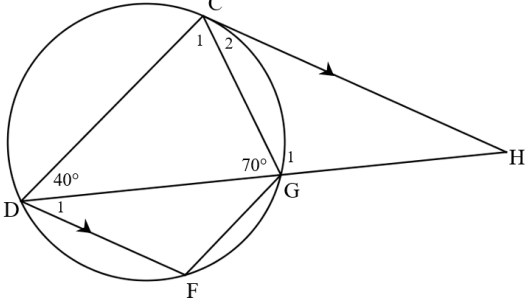
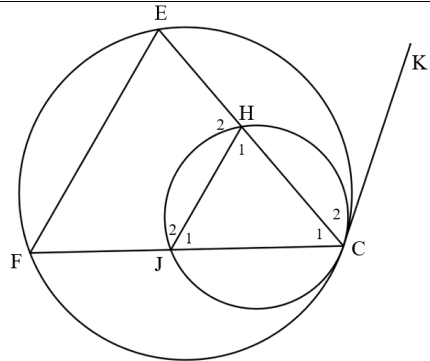
6.2.3	$\widehat{OAC} = \widehat{OCA}$ $\left[\begin{array}{l} \angle s \text{ opp.} = \text{sides} \\ \angle e \text{ teenoor.} = \text{sye} \end{array} \right]$ $\widehat{OAC} = \frac{180^\circ - 143,58^\circ}{2} \dots \left[\begin{array}{l} \text{int. } \angle s \text{ of } \Delta \\ \text{binne } \angle e \text{ of } \Delta \end{array} \right]$ $= 18,2^\circ$ In ΔAOC: $\frac{a}{\sin A} = \frac{o}{\sin O}$ $\frac{a}{\sin 18,2^\circ} = \frac{o}{\sin 143,58^\circ}$ $a = \frac{10 \sin 18,2^\circ}{\sin 143,58^\circ}$ $a = 5,26$ $\therefore \text{diameter / middellyn} = 10,52 \text{ units / eenhede}$ OR/OF In ΔAOB: $10^2 = r^2 + r^2 - 2r \cdot r \cos 143,58^\circ$ $= 2r^2 - 2r^2 \cos 143,58^\circ$ $100 = 2r^2 (1 - \cos 143,58^\circ)$ $2r^2 = \frac{100}{1 - \cos 143,58^\circ} = 55,4112\dots$ $r^2 = 27,7056\dots$ $r = \sqrt{27,7056\dots} \approx 5,26$ $\therefore \text{diameter / middellyn} = 10,52 \text{ units/eenhede}$	$\checkmark \widehat{OAC} = 18,2^\circ = \widehat{OCA}$ $\checkmark \sin \text{rule/reël} \quad \mathbf{M}$ $\checkmark \text{SF} \quad \mathbf{CA}$ $\checkmark \text{value of / waarde van } a \quad \mathbf{CA}$ $\checkmark \text{value of diameter / waarde van middellyn} \quad \mathbf{CA}$ $\mathbf{NPU}$ OR/OF $\checkmark \cos \text{rule/reël} \quad \mathbf{M}$ $\checkmark \text{SF} \quad \mathbf{CA}$ $\checkmark \text{simplification / vereenvoudiging}$ $\checkmark \text{value of / waarde van } r \quad \mathbf{CA}$ $\checkmark \text{value of diameter / waarde van middellyn} \quad \mathbf{CA}$ (5)
6.2.4	$\text{Area } \Delta ABC = \frac{1}{2} ac \sin B$ $= \frac{1}{2} (8)(9) \sin 71,79^\circ$ $= 34,20 \text{ units}^2/\text{eenhede}^2$	$\checkmark \mathbf{F}$ $\checkmark \text{SF} \quad \mathbf{CA}$ $\checkmark \text{answer / antwoord} \quad \mathbf{NPU}$ (3)
	[15]	

QUESTION/VRAAG 7

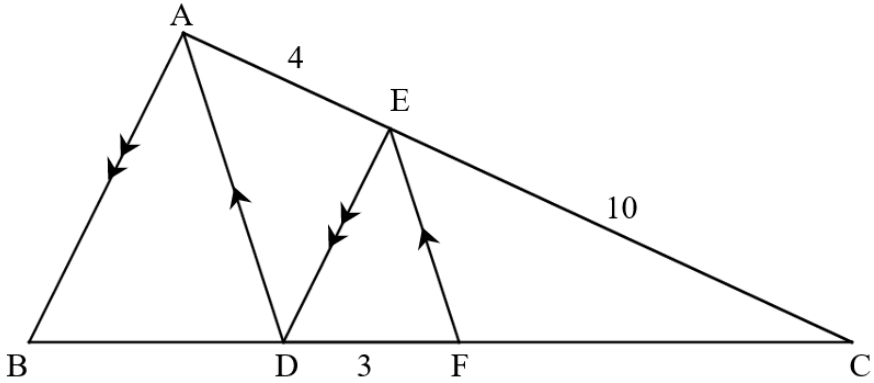
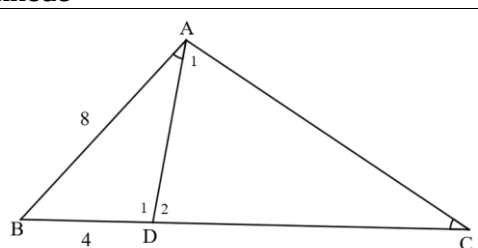
7.1		
7.1.1	$(x + 2)^2 = x^2 + 4^2$...Pythagoras $x^2 + 4x + 4 = x^2 + 16$ $4x = 12$ $x = 3$ BC = 3 units/eenhede	✓ Pythagoras ✓ S CA ✓ answer /antwoord NPU (3)
7.1.2	AB (chord) subtends a 90° angle / koord onderspan 90° hoek OR/OF Converse $\angle$ in semi-circle / omgekeerde $\angle$ in semi-sirkel	✓ reason / rede (1)
7.2		
7.2.1	$\hat{B}_3 = 35^\circ$... $\left(\begin{array}{l} \angle s \text{ opp} = \text{sides} / \\ \angle e \text{ teenoor} = \text{sye} \end{array} \right)$ $\widehat{BOC} = 110^\circ$ $\left(\begin{array}{l} \text{Int } \angle s \text{ of } \Delta / \\ \text{Binne } \angle e \text{ van } \Delta \end{array} \right)$ $\hat{O}_1 = 110^\circ$ $\left(\begin{array}{l} \text{Revolutions} / \\ \text{Omwenteling} \end{array} \right)$	✓ ST RE ✓ ST RE ✓ ST RE (3)
7.2.2	$\hat{B}_2 = \frac{180^\circ - 140^\circ}{2}$... $\left(\begin{array}{l} \text{Int } \angle \text{ of } \Delta \text{ and } \angle s \text{ opp} - \text{sides} / \\ \text{Binne } \angle e \text{ van } \Delta \text{ en } \angle e \text{ teenoor} = \text{sye} \end{array} \right)$ $= 20^\circ$ $\hat{B}_1 = 90^\circ - (35^\circ - 20^\circ)$ $\left(\begin{array}{l} \angle \text{ in semi-circle} / \\ \angle \text{ in semi-sirkel} \end{array} \right)$ $= 35^\circ$	✓ ST RE ✓ ST ✓ RE (3)

7.2.3	$\hat{C}_1 = \hat{B}_1$ ($\angle$ s in same segm. / $\angle$ e in dies. segm.) $= 35^\circ$ $= \widehat{ACB}$ $\therefore AC$ bisect/halveer $\widehat{DCB}$	✓ ST RE ✓ ST (2)
		[12]

QUESTION/VRAAG 9

9.1	Radius / diameter <i>Radius / middellyn</i>	✓ A (1)
9.2		
9.2.1	$\widehat{C}_2 = 40^\circ \dots (\text{tan} - \text{chord/koord})$	✓ ST ✓ RE (2)
9.2.2	$\widehat{C}_1 = 70^\circ \dots \left(\begin{array}{l} \text{Int } \angle \text{s of } \Delta \\ \text{Binne } \angle \text{e van } \Delta \end{array} \right)$ $\widehat{F} = 110^\circ \dots \left(\begin{array}{l} \text{opp } \angle \text{s of cyclic quad} \\ \text{teenoorst. } \angle \text{e van kdvk} \end{array} \right)$	✓ ST RE ✓ ST ✓ RE (3)
9.2.3	$\widehat{H} = 30^\circ \dots \left(\begin{array}{l} \text{Int. } \angle \text{s of } \Delta \\ \text{Binne } \angle \text{e van } \Delta \end{array} \right)$ $\widehat{D}_1 = 30^\circ \dots (\text{alt/verw. } \angle \text{s; CH} \parallel \text{DF})$ OR/OF $\widehat{C} + \widehat{D} = 180^\circ \dots (\text{co-int/ko-binne } \angle \text{s; CH} \parallel \text{DH})$ $\widehat{D}_1 = 30^\circ$	✓ ST RE ✓ ST RE OR/OF ✓ RE ✓ ST (2)
9.3		
	$\widehat{C}_2 = \widehat{F} \dots (\text{tan} - \text{chord/koord})$ $\widehat{C}_2 = \widehat{J}_1 \dots (\text{tan} - \text{chord/koord})$ $\therefore \widehat{F} = \widehat{J}_1$ $\therefore EF \parallel JH \dots \left(\begin{array}{l} = \text{corrsp. } \angle \text{s} \\ = \text{ooreenk. } \angle \text{e} \end{array} \right)$	✓ ST ✓ RE ✓ ST RE ✓ RE (4)
		[12]

QUESTION/VRAAG 10

10.1	Parallel to the third side / ewewydig aan die derde sy	✓ A (1)
10.2		
10.2.1	$\frac{FC}{DF} = \frac{EC}{AE} \dots$ (prop th/ewerh.; EF $\parallel$ AD) $\frac{FC}{3} = \frac{10}{4}$ $FC = 7,5$ units/eenhede	✓ ST ✓ RE ✓ ST (3)
10.2.2	$\frac{BD}{DC} = \frac{AE}{EC}$ (prop th/ewerh.; AD $\parallel$ ED) $\frac{BD}{10,5} = \frac{4}{10}$ $BD = 4,2$ units/eenhede	✓ ST ✓ RE ✓ ST CA ✓ ST CA (4)
10.3		
10.3.1	In $\triangle ABD$ and/en $\triangle CBA$: (1) $\hat{B}$ is common/gemeen (2) $\hat{BAD} = \hat{C} \dots$ (given / gegee) $\therefore \triangle ABD \parallel \triangle CBA \dots (AAA)$	✓ ST ✓ ST ✓ RE (3)
10.3.2	$\frac{AB}{CB} = \frac{BD}{BA} = \frac{AD}{CA} \dots (/// \Delta s)$ $\therefore \frac{8}{4 + DC} = \frac{4}{8}$ $\therefore 4(4 + DC) = 64$ $\therefore 4 + DC = 16$ $\therefore DC = 12$ units/eenhede	✓ ST ✓ RE ✓ ST ✓ ST (4)
		[15]
	TOTAL/TOTAAL:	150