



Province of the  
**EASTERN CAPE**  
EDUCATION



**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE  
SENIORSERTIFIKAAT**

**GRADE/*GRAAD* 12**

***JUNE/JUNIE 2024***

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

**MARKS/*PUNTE*: 150**

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This marking guideline consists of 17 pages./  
*Hierdie nasienriglyn bestaan uit 17 bladsye.*

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**NOTE:**

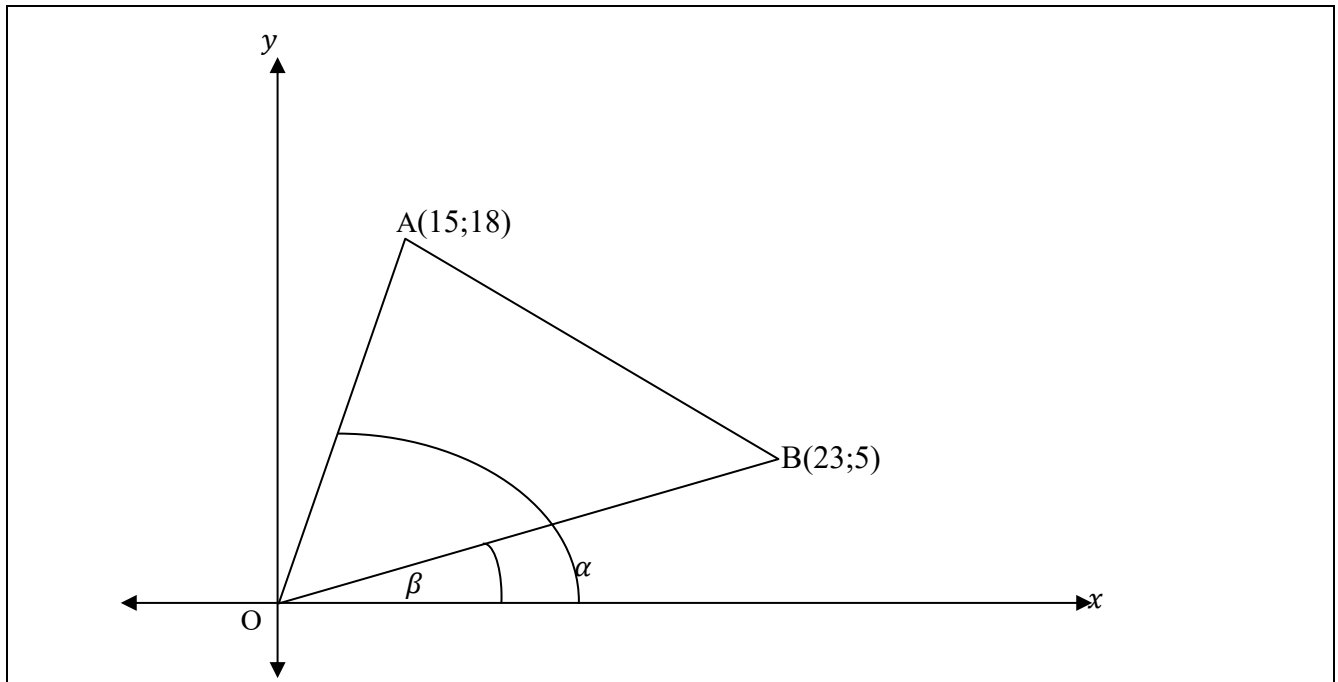
- Continuous accuracy (CA) applies only where indicated in this marking guideline.
- Assuming values/answers in order to solve a problem is unacceptable.

**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.*

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

## QUESTION/VRAAG 1

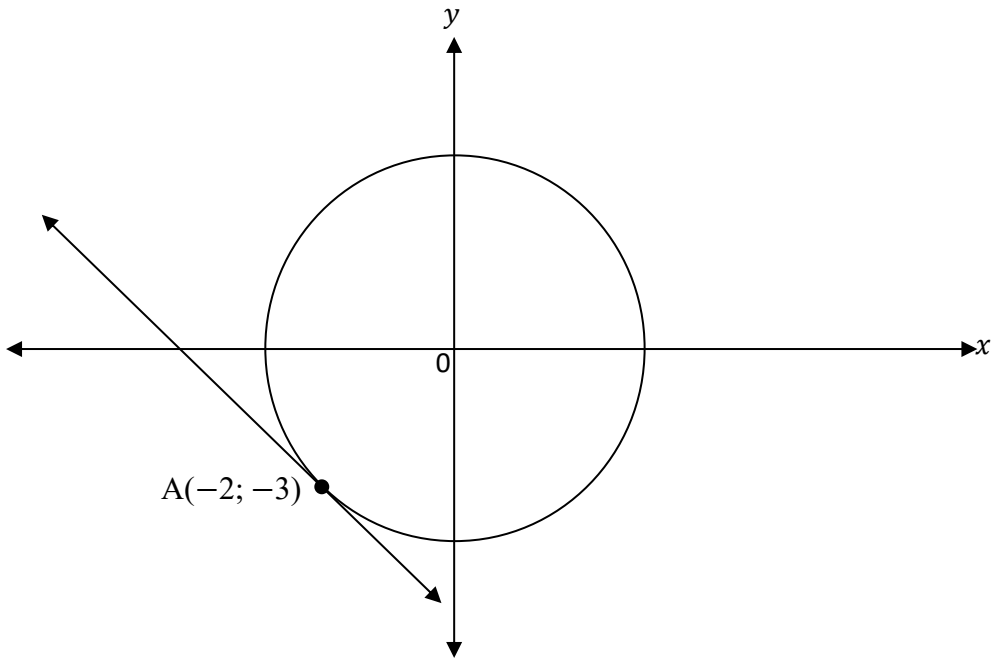


1.1	$m_{OA} = \frac{18-0}{15-0}$ $m_{OA} = \frac{6}{5}$ $m_{OB} = \frac{5-0}{23-0}$ $m_{OB} = \frac{5}{23}$	✓ M ✓ S      A ✓ M ✓ S      A
	<b>AO: Full marks / Volpunte</b>	<b>(4)</b>
1.2	$\tan \beta = m_{OB}$ $\tan \beta = \frac{5}{23}$ $\therefore \beta = 12,26^\circ$	✓ M ✓ Subst./Vervang A ✓ S      CA
		<b>(3)</b>
1.3	$\tan \alpha = m_{OA}$ $\tan \alpha = \frac{6}{5}$ $\therefore \alpha = 50,19^\circ$ $\therefore \hat{AOB} = 50,19^\circ - 12,26^\circ = 37,93^\circ \approx 38^\circ$	✓ M ✓ Subst.      A ✓ S      CA ✓ Answer/Antwoord      CA
		<b>(4)</b>

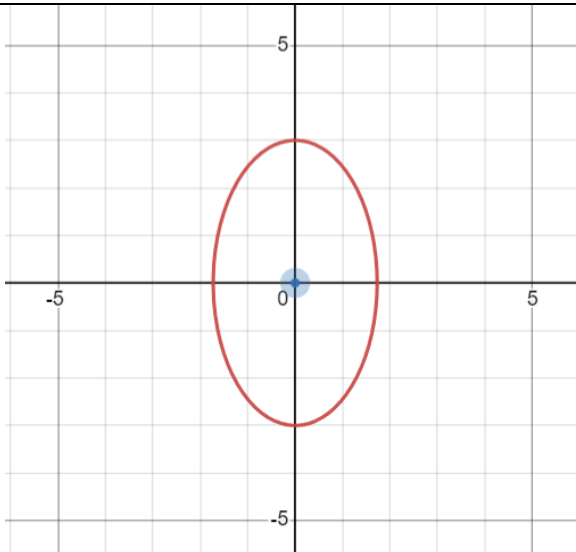
1.4	$M_{OM} = M_{AB}$ $\left(\frac{x_O + x_M}{2}, \frac{y_O + y_M}{2}\right) = \left(\frac{x_A + x_B}{2}, \frac{y_A + y_B}{2}\right)$ $\left(\frac{0 + x_M}{2}, \frac{0 + y_M}{2}\right) = \left(\frac{15 + 23}{2}, \frac{18 + 5}{2}\right)$ $\therefore \frac{x_M}{2} = \frac{38}{2} \text{ and/en}$ $\frac{y_M}{2} = \frac{23}{2}$ $\therefore x_M = 38 \text{ and/en}$ $y_M = 23$ $\therefore M(38; 23)$	<p><math>x</math>-coordinate of /<i>koördinate van</i> M = 23+15 =38</p> <p><math>y</math>-coordinate of /<i>koördinate</i> M = 23 + 15 =38 M(38;23)</p> <p><b>(If learner used this method award full marks/Indien leerling hierdie metode gebruik ken volpunte toe.)</b></p>	<p>✓ M</p> <p>✓ Subst.      A</p> <p>✓ M              CA</p> <p>✓ S              CA</p> <p>✓ Answer/<i>Antwoord</i>                     CA</p> <p style="text-align: right;">(5)</p>
			<b>[16]</b>

QUESTION/VRAAG 2

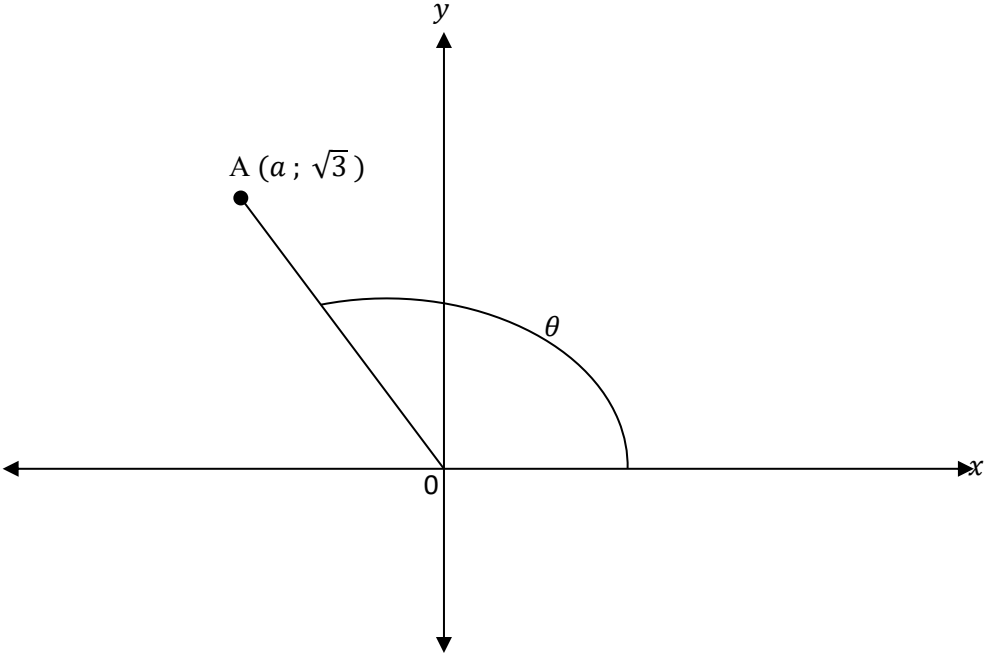
2.1



2.1.1	$r = \sqrt{13}$	✓ A (1)
2.1.2	$x \cdot x_1 + y \cdot y_1 = r^2$ $x(-2) + y(-3) = 13$ $-3y = 2x + 13$ $y = -\frac{2}{3}x - \frac{13}{3}$  <b>OR/OF</b>  $m_{radius} = \frac{3}{2}$ $\therefore m_{tangent/raaklyn} = -\frac{2}{3}$ $y - y_1 = m(x - x_1)$ $y - (-3) = -\frac{2}{3}(x - (-2))$ $y + 3 = -\frac{2}{3}(x + 2)$  $\therefore y = -\frac{2}{3}x - \frac{13}{3}$	✓ F ✓ SF A ✓ S ✓ equation / vergelyking CA <b>OR/OF</b>  ✓ grad. radius A ✓ grad. tan / raaklyn CA ✓ SF A  ✓ equation / vergelyking CA  (4)
2.1.3	(3 ; 2)	✓ x-value/waarde A ✓ y-value/ waarde A (2)

2.2		<p>✓ elliptical shape / elliptiese vorm A</p> <p>✓ x-intercepts / afsnitte A</p> <p>✓ y-intercepts / afsnitte A</p> <p>(3)</p>
		<b>[10]</b>

## QUESTION/VRAAG 3

3.1		
		
3.1.1	$a^2 + (\sqrt{3})^2 = (3)^2$ $a^2 = 9 - 3$ $a^2 = 6$ $a = \pm\sqrt{6}$ $\therefore a = -\sqrt{6}$	✓ M ✓ S  ✓ value of / waarde van $a$  (3)
3.1.2	$\frac{-\sqrt{6}}{3}$	✓ Answer/Antwoord  (1)
3.1.3	$\operatorname{cosec}(\theta + 360^\circ) = \operatorname{cosec} \theta$ $\therefore \operatorname{cosec} \theta = \frac{3}{\sqrt{3}}$	✓ Reduction/ Reduksie A ✓✓ cosec ratio / verh. CA (3)
3.2	$\tan(x - 30^\circ) = -0,982$ $\text{Ref. / Verw. } < = \tan^{-1}(0,982)$ $\text{Ref. / Verw. } < = 44,48^\circ$ $\therefore \text{I: } x - 30^\circ = 180^\circ - 44,48^\circ$ $\therefore x = 165,52^\circ$ <p style="text-align: center;"><b>AND/EN</b></p> $\therefore \text{IV: } x - 30^\circ = 360^\circ - 44,48^\circ$ $\therefore x = 345,52^\circ$	✓ Ref. / Verw. $\angle$ CA ✓ Quadrants / kwadrante A ✓✓ values of $x$ / waardes van $x$ CA  (4)
		<b>[11]</b>

## QUESTION/VRAAG 4

4.1	$\frac{\sin(180^\circ - \theta) \tan(180^\circ + \theta) \sin(270^\circ)}{\cos(360^\circ - \theta) \tan(180^\circ - \theta)}$ $= \frac{\sin(\theta) \cdot \tan(\theta) \cdot (-1)}{\cos(\theta) \cdot -\tan(\theta)}$ $= -\tan\theta$	$\checkmark \sin(\theta)$ A $\checkmark \tan(\theta)$ A $\checkmark -1$ A $\checkmark \cos(\theta)$ A $\checkmark -\tan(\theta)$ A $\checkmark -\tan(\theta)$ A (6)
4.2	$(\operatorname{cosec} B - \cot B)^2 = \frac{1 - \cos B}{1 + \cos B}$ $LHS = (\operatorname{cosec} B - \cot B)^2$ $LHS = \left( \frac{1}{\cos B} - \frac{1}{\tan B} \right)^2$ $LHS = \left( \frac{1}{\sin B} - \frac{\cos B}{\sin B} \right)^2$ $LHS = \left( \frac{1 - \cos B}{\sin B} \right)^2$ $LHS = \frac{(1 - \cos B)^2}{\sin^2 B}$ $LHS = \frac{(1 - \cos B)^2}{1 - \cos^2 B}$ $LHS = \frac{(1 - \cos B)^2}{(1 - \cos B)(1 + \cos B)}$ $LHS = \frac{1 - \cos B}{1 + \cos B} = \text{RHS}$	$\checkmark \frac{1}{\cos B}$ A $\checkmark \frac{1}{\tan B}$ A $\checkmark \frac{\cos B}{\sin B}$ A $\checkmark \frac{1 - \cos B}{\sin B}$ S $\checkmark \frac{(1 - \cos B)^2}{1 - \cos^2 B}$ S $\checkmark (1 - \cos B)(1 + \cos B)$ S (6)
		[12]



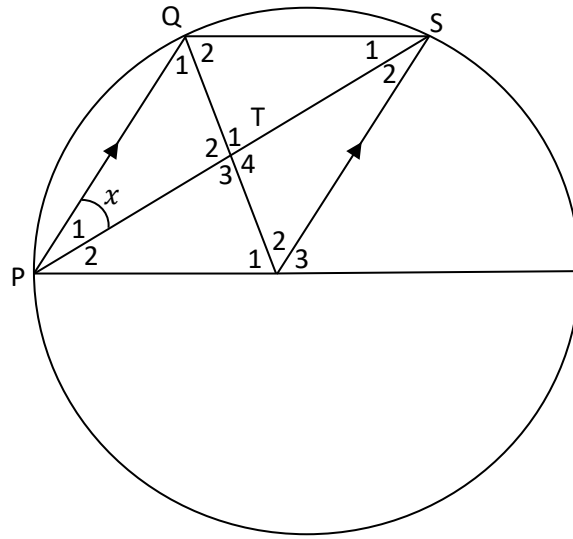
QUESTION/VRAAG 5

	$f(x) = \cos(x - 30)$ and /en $g(x) = 2 \sin x$ for/ vir $x \in (0^\circ ; 360^\circ)$	
5.1	$Period_f = 360^\circ$	✓ A (1)
5.2	$Amplitude_g = 2$	✓ A (1)
5.3		<p><math>f</math>:</p> <ul style="list-style-type: none"> <li>✓ <math>y</math>-intercept at / <math>y</math>-afsnit by 0,87</li> <li>✓ <math>x</math>-intercepts at <math>120^\circ</math> and <math>300^\circ</math></li> <li><math>x</math>-afsnitte by <math>120^\circ</math> en <math>300^\circ</math></li> <li>✓✓ turning point at / draaipunt by <math>(30^\circ; 1)</math> and/en <math>(210^\circ; -1)</math></li> </ul> <p><math>g</math>:</p> <ul style="list-style-type: none"> <li>✓ <math>y</math>-intercept at / <math>y</math>-afsnit by 0</li> <li>✓ <math>x</math>-intercept at <math>180^\circ</math> and <math>360^\circ</math> / <math>x</math>-afsnit by <math>180^\circ</math> en <math>360^\circ</math></li> <li>✓✓ turning point at / draaipunt by <math>(90^\circ; 1)</math> and/en <math>(270^\circ; -1)</math></li> </ul>
5.4.1	$0^\circ \leq x \leq 180^\circ$	<ul style="list-style-type: none"> <li>✓ <math>0^\circ \leq x</math> CA</li> <li>✓ <math>x \leq 180^\circ</math> CA</li> </ul> (2)
5.4.2	$120^\circ < x < 180^\circ$ and/en $300^\circ < x < 360^\circ$	<ul style="list-style-type: none"> <li>✓ <math>120^\circ &lt; x &lt; 180^\circ</math> CA</li> <li>✓ <math>300^\circ &lt; x &lt; 360^\circ</math> CA</li> </ul> (2)
		[14]

## QUESTION/VRAAG 6

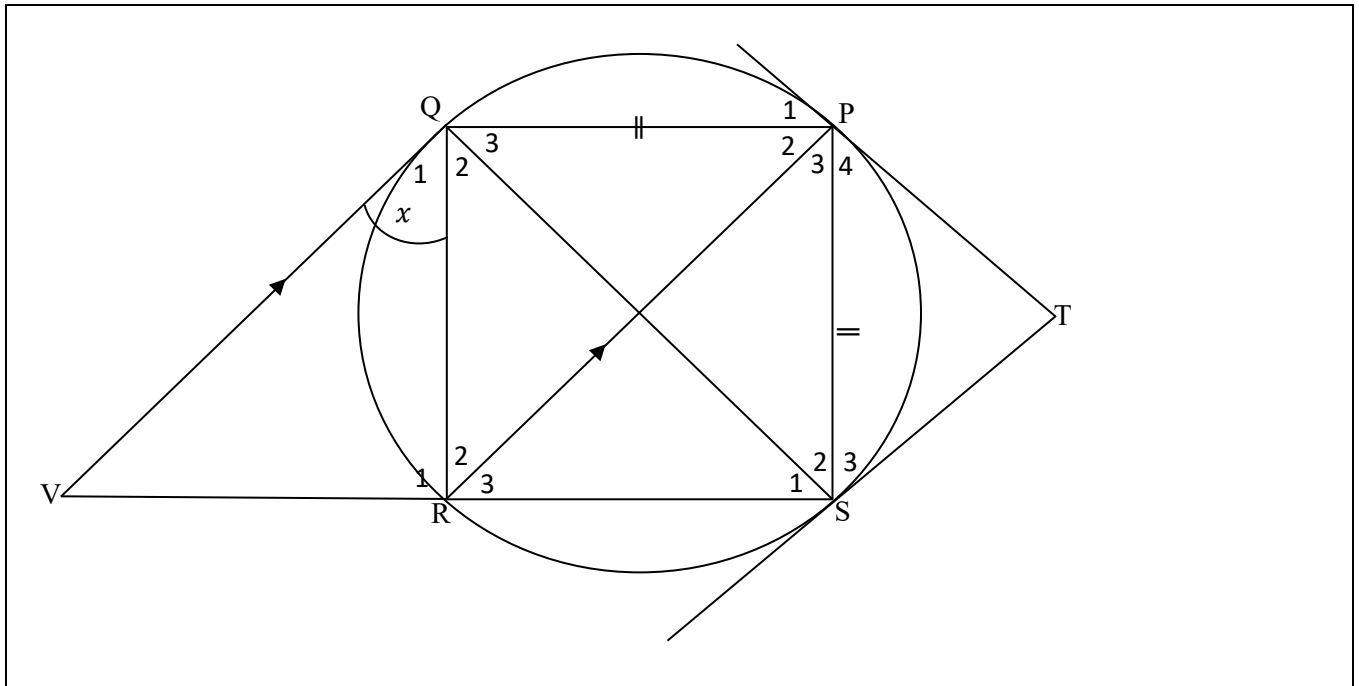
6.1	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{d}{\sin D}$	✓ A	(1)
6.2			
6.2.1	$\hat{BAC} = 9^\circ - 7^\circ = 2^\circ$ (given/gegee)	✓ ST ✓ RE	A (2)
6.2.2	$\hat{ABD} = 180^\circ - 9^\circ - 90^\circ = 81^\circ$ (int. <'s of $\Delta$ / binne <'e van $\Delta$ )	✓ ST ✓ RE	A (2)
6.2.3	$\frac{AC}{\sin B} = \frac{BC}{\sin \hat{BAC}}$ $\frac{AC}{\sin 81^\circ} = \frac{48}{\sin 2^\circ}$ $AC = \frac{48}{\sin 2^\circ} \times \sin 81^\circ$ $AC = 1358,44 \text{ m}$	✓ F ✓ SF ✓ S ✓ AC value / waarde	A CA (4)
6.2.4	$\cos \hat{CAD} = \frac{AD}{AC}$ $\cos 7^\circ = \frac{AD}{1358,44}$ $\cos 7^\circ \times 1358,44 = AD$ $1348,31 \text{ m} = AD$	✓ ratio / verh. ✓ value / waarde	A CA (2)
6.2.5	$AC^2 = AD^2 + CD^2$ $(1358,44)^2 = (1348,31)^2 + CD^2$ $27419,3775 = CD^2$ $165,59 \text{ m} = CD$	✓ F ✓ SF ✓ height / hoogte	CA CA (3)
			[14]

QUESTION/VRAAG 7



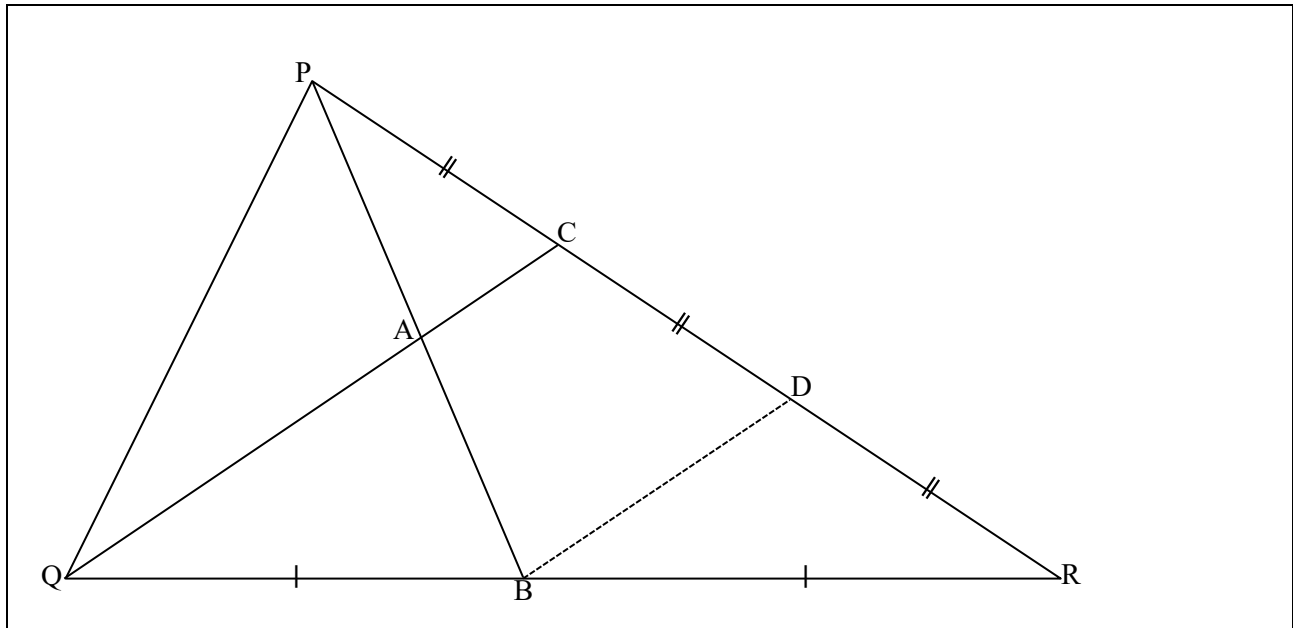
7.1	$\hat{S}_2 = x$ (alt. $\angle$ 's = / verw. $\angle$ 'e =; $PQ \parallel SO$ ) $\hat{O}_2 = 2x$ ( $\angle$ at centre = $2 \times \angle$ at circumf. / midpts $\angle = 2 \times$ omtreks $\angle$ ) $\hat{T}_1 = 3x$ (ext. $\angle$ of $\Delta$ / buite $\angle$ van $\Delta$ )	✓ ST    ✓ RE    A ✓ ST    ✓ RE    A ✓ ST    ✓ RE    A (6)
7.2	$\hat{T}_1 = 3x$ $\hat{T}_1 = 3(30^\circ) = 90^\circ$ $\hat{O}_2 = 2x$ $\hat{O}_2 = 2(30^\circ) = 60^\circ$ $\therefore \hat{Q}_2 = 60^\circ$ (OQ = OS; Radii) $\therefore \hat{S}_1 = 30^\circ$	✓ $\hat{T}_1$ CA ✓ $\hat{O}_2$ CA ✓ $\hat{Q}_2$ ✓ RE       CA ✓ $\hat{S}_1$ CA (5)
7.3	In $\Delta PQS$ and/en $\Delta SOP$ :  1. $\hat{S}_2 = \hat{S}_1$ (proven / bewys) 2. $QS = PO$ (given / gegee) 3. $\hat{P}_1 = \hat{P}_2$ (given / gegee) $\therefore \Delta PQS \equiv \Delta SOP$ ( $\lll S$ )	✓ ST                    A ✓ ST                    A ✓ ST                    A (3)
		<b>[14]</b>

QUESTION/VRAAG 8



8.1	$\hat{S}_1 = x$ (tan-chord thm / <i>stelling</i> ) $\hat{P}_2 = x$ ( $\angle$ 's in same segment / $\angle$ 'e in dieselfde segment) $\hat{R}_2 = x$ (alt. $\angle$ 's = / <i>verw. <math>\angle</math>'e =</i> ; $VQ \parallel RP$ ) $\hat{S}_2 = x$ ( $\angle$ 's in same segment / $\angle$ 'e in dieselfde segment)	✓ ST ✓ RE A ✓ ST ✓ RE A ✓ ST ✓ RE A ✓ ST ✓ RE A
8.2	Tangents from same point / <i>Raaklyne vanuit dieselfde punt</i>	✓ RE A (1)
8.3	$\hat{P}_4 = \hat{R}_3 = x$ (tan-chord thm / <i>stelling</i> ) $\therefore \hat{T} = 180^\circ - 2x$ (int. $\angle$ 's of $\Delta$ / <i>binne <math>\angle</math>'e van <math>\Delta</math></i> ) $\hat{P}_2 + \hat{P}_3 = 180^\circ - 2x$ (int. $\angle$ 's of $\Delta$ / <i>binne <math>\angle</math>'e van <math>\Delta</math></i> ) $\therefore \hat{T} = Q\hat{P}S$	✓ ST ✓ RE A ✓ ST ✓ RE A ✓ ST A (5)
		<b>[14]</b>

QUESTION/VRAAG 9


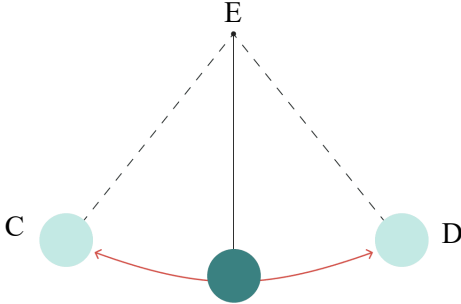



9.1	In $\triangle CRQ$ : $RD = DC$ (given / gegee) $RB = BQ$ (given / gegee) $\therefore BD \parallel CQ$ and/en $BD = \frac{1}{2} CQ$ (midpt thm / stelling)	✓ ST      A ✓ ST      A ✓ RE      A (3)
9.2	In $\triangle PBD$ : $PC = CD$ (given / gegee) $BD \parallel CQ$ (given / gegee) $\therefore PA = AB$ and/en $AC = \frac{1}{2} BD$ (midpt thm / stelling)	✓ ST      A ✓ ST      A ✓ RE      A (3)
9.3	$\triangle PAC$ and/en $\triangle PBD$ : 1. $\hat{P} = \hat{P}$ (common $\sphericalangle$ / gemene $\sphericalangle$ ) 2. $\hat{PAC} = \hat{PBD}$ (Corresp. $\sphericalangle$ 's = / ooreenk. $\sphericalangle$ 'e =; $AC \parallel BD$ ) 3. $\hat{PCA} = \hat{PDB}$ ( $3^{rd}$ $\sphericalangle$ of $\triangle$ / $3^{de}$ $\sphericalangle$ van $\triangle$ ) $\therefore \triangle PAC \parallel \triangle PBD$ ( $\lll$ ) $\therefore \frac{PA}{PB} = \frac{AC}{BD} = \frac{PC}{PD}$ $\therefore \frac{10}{20} = \frac{AC}{BD} = \frac{5}{10}$ $\therefore \frac{AC}{BD} = \frac{1}{2}$ $\therefore BD : AC = 2 : 1$	✓ ST      A ✓ ST      A ✓ ST      A ✓ ST      A ✓ Subst./Vervang      A ✓ Answer/Antwoord      A (6)
		<b>[12]</b>

## QUESTION/VRAAG 10

10.1	$568 \text{ m/s} = \frac{568 \text{ m}}{1 \text{ sec}} \times \frac{1 \text{ km}}{1000 \text{ m}} \times \frac{3600 \text{ sec}}{1 \text{ h}} = 2044,8 \text{ km/h}$	✓ conversion factors / <i>herleidingsfaktore</i> ✓ answer / <i>antwoord</i> (2)
10.2	$v = \pi Dn$ $2044,8 \text{ km/h} = \pi(0,0034 \text{ km})n$ $\therefore n = \frac{2044,8}{0,0034\pi}$ $\therefore n \approx 601411,76 \text{ rev/h}$	✓F ✓ conversion / <i>herleiding</i> ✓ SF           A ✓ S ✓ answer / <i>antwoord</i> (5)
10.3	$\omega = 2\pi n$ $= 2\pi \times 38,20$ $\approx 240,02 \text{ rad/s}$	✓F ✓ SF           CA ✓ answer / <i>antwoord</i> (3)
10.4	$s = vt$ <b>OR</b> / <b>OF</b> $D = ST$ $s = 0,568 \times 15$ $s = 8,52 \text{ km}$	✓F ✓ SF           CA ✓ answer / <i>antwoord</i> (3)
10.5	$n = \frac{\text{number of revolutions}}{\text{time}} / \frac{\text{aantal revolusies}}{\text{tyd}}$ $53,18 = \frac{1/2}{t}$ $\therefore t \approx 0,009 \text{ sec/sek}$	✓ SF           CA ✓ answer / <i>antwoord</i> (2)
		[15]

QUESTION/VRAAG 11

	<p style="text-align: center;">FIGURE/FIGUUR A</p> 	<p style="text-align: center;">FIGURE /FIGUUR B</p> 
<p>11.1.1</p>	<p><math>s = r\theta</math></p> <p><math>s = (30) \left( 60^\circ \times \frac{\pi}{180^\circ} \right)</math></p> <p><math>\therefore CD = 10\pi \approx 31,42 \text{ cm}</math></p>	<p>✓F</p> <p>✓ SF            A</p> <p>✓ RT length / lengte</p> <p style="text-align: right;">(3)</p>
<p>11.1.2</p>	<p><math>Area = \frac{rs}{2}</math></p> <p><math>Area = \frac{(30)(10\pi)}{2}</math></p> <p><math>Area = 150\pi \approx 471,24 \text{ cm}^2</math></p> <p style="text-align: center;"><b>OR / OF</b></p> <p><math>Area = \frac{r^2\theta}{2}</math></p> <p><math>Area = \frac{(30)^2 \left( 60^\circ \times \frac{\pi}{180^\circ} \right)}{2}</math></p> <p><math>Area = 150\pi \approx 471,24 \text{ cm}^2</math></p>	<p>✓F</p> <p>✓ SF            A</p> <p>✓ Area</p> <p style="text-align: center;"><b>OR / OF</b></p> <p>✓F</p> <p>✓ SF            A</p> <p>✓ Area</p> <p style="text-align: right;">(3)</p>
<p>11.1.3</p>	<p><math>D = 2r</math></p> <p><math>D = 2(30)</math></p> <p><math>\therefore D = 60 \text{ cm}</math></p>	<p>✓M</p> <p>✓Subst./Vervang</p> <p>✓ Answer/Antwoord</p> <p style="text-align: right;">(3)</p>

11.2		
	$4h^2 - 4dh + x^2 = 0$ $4h^2 - 4(30)h + (20)^2 = 0$ $4h^2 - 120h + 400 = 0$ $h^2 - 30h + 100 = 0$ $h = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $h = \frac{-(-30) \pm \sqrt{(30)^2 - 4(1)(100)}}{2(1)}$ $\therefore h = 26,18 \text{ cm of } h = 3,82 \text{ cm}$ $\therefore h = 3,82 \text{ cm}$ <p><math>\therefore</math> h hour hand length/lengte van uur aanwyser = radius        –height of minor segment/hoogte van kleiner segment</p> $\therefore \text{hour hand length/lengte van uur aanwyser} = \left(\frac{30}{2}\right) - 3,82$ $\therefore \text{hour hand length/lengte van uuraanwyser} = 11,2 \text{ cm}$	$\checkmark$ F $\checkmark$ SF      A  $\checkmark$ S  $\checkmark$ value of / waarde van h  $\checkmark$ length/lengte  (5)



<p>11.3</p>		
	$A_T = a \left( \frac{o_1 + o_n}{2} + o_2 + o_3 + o_4 + \dots + o_{n-1} \right)$ $63,525 = \left( \frac{11,55}{7} \right) \left( \frac{7+3}{2} + 6,5 + x + 5 + 7,5 + 6 + 4 \right)$ $63,525 = (1,64)(34 + x)$ $38,734 \dots = 34 + x$ $4,73 = x$ <p style="text-align: center;"><b>OR/ OF</b></p> $A_T = a(m_1 + m_2 + m_3 + \dots + m_{n-1})$ $63,525 = \left( \frac{11,55}{7} \right) \left( 6,75 + \frac{6,5+x}{2} + \frac{x+5}{2} + 6,25 + 6,75 + 5 + 3,5 \right)$ $63,525 = (1,64) \left( 28,25 + \frac{11,5+2x}{2} \right)$ $38,734 \dots = 28,25 + \frac{11,5+2x}{2}$ $10,484 \dots = \frac{11,5+2x}{2}$ $20,969 \dots = 11,5 + 2x$ $20,969 \dots = 11,5 + 2x$ $9,469 \dots = 2x$ $4,73 = x$	<p>✓F</p> <p>✓SF      A</p> <p>✓S ✓ value of/waarde van a</p> <p style="text-align: center;">OR/ OF</p> <p>✓F</p> <p>✓SF      A</p> <p>✓S ✓ value of/ waarde van a</p> <p style="text-align: right;">(4)</p>
		<p>[18]</p>
	<p><b>TOTAL/TOTAAL:</b></p>	<p><b>150</b></p>