



Education and Sports Development

Department of Education and Sports Development
Department van Onderwys en Sport Ontwikkeling
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NORTH WEST PROVINCE

NATIONAL SENIOR CERTIFICATE

GRADE 12

TECHNICAL MATHEMATICS P2/TEGNIIESE WISKUNDE V2

SEPTEMBER 2019

MARKING GUIDELINES/NASIENRIGLYNE

MARKS: 150

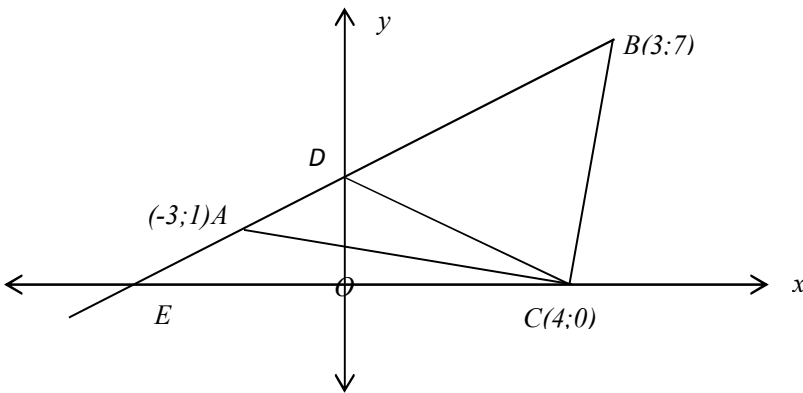
PUNTE: 150

**These marking guidelines consist of 18 page
*Hierdie nasienriglyne bestaan uit 18 bladsye.***

GENERAL GUIDELINES FOR MARKING/ALGEMENE RIGLYNE OM TE MERK

- If a learner makes **more than one attempt** at answering a question and **does not cancel** any of them out, only the **first attempt will be marked** irrespective of which of the attempt(s) may be the correct answer. / *As 'n leerder meer as een poging aanwend om 'n vraag te beantwoord en nie een van hulle word uitgeskakel nie, sal slegs die eerste poging gemerk word ongeag watter van die poging(s) die regte antwoord kan wees.*
- Consistent accurate marking regarding calculations will be followed in the following cases / *Konsekwente akkurate nasien met betrekking tot berekeninge sal in die volgende gevalle gevolg word:*
 - Sub question to sub question: When a certain variable is incorrectly calculated in one sub question and needs to be substituted into another sub question full marks can be awarded for the subsequent sub questions provided the methods used are correct and the calculations are correct. / *Subvraag na subvraag: Wanneer 'n sekere veranderlike verkeerd in een subvraag bereken word en in 'n ander subvraag vervang moet word, kan volpunte toegeken word vir die daaropvolgende subvrae, mits die metodes wat gebruik is, korrek is en die berekeninge korrek is.*
 - Assuming values/answers to solve a problem is unacceptable. / *Aanvaar waardes / antwoorde om 'n probleem op te los, is onaanvaarbaar.*
- If a learner did a question in pencil, and did not write it over in pen, the pencil must be marked. Draw a line through and make note of it. / *As 'n leerder 'n vraag in potlood gedoen het en dit nie in pen oorgeskryf het nie, moet die potlood gemerk word. Trek 'n lyn deur en maak 'n nota daarvan.*

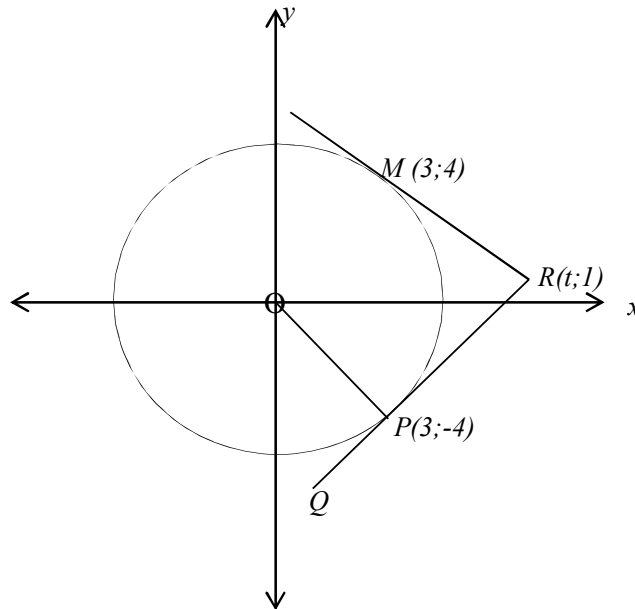
Marking Codes / Nasienkodes	
A	Accuracy / Akkuraatheid
CA	Consistent Accuracy / Volgehoue Akkuraatheid
M	Method / Metode
R	Rounding / Afronding
NPR	No Penalty for Rounding / Geen penalisering vir Afronding
NPU	No Penalty for Units omitted / Geen penalisering vir eenhede weggelaat
S	Simplification / Vereenvoudiging
SF	Substitution in correct Formula / Vervanging in korrekte formule
AO	Answer only / Antwoord alleenlik

QUESTION/VRAAG 1

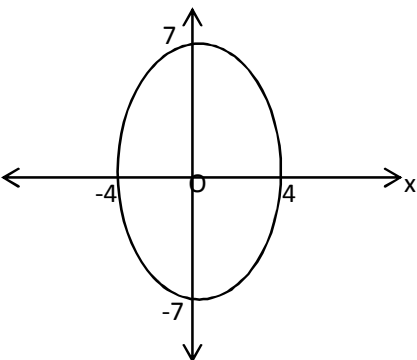
1.1	$m_{AB} = \frac{y_B - y_A}{x_B - x_A}$ $= \frac{7-1}{3-(-3)}$ $= 1$ <p>Equation / vergelyking AB</p> $y - y_1 = m(x - x_1)$ $y - 1 = 1(x - (-3))$ $y = x + 4$ <p>or / of</p> $y - 7 = 1(x - 3)$ $y = x + 4$	<p>✓ SF</p> <p>✓ Answer/Antwoord</p> <p>✓ SF</p> <p>✓ Answer in std form/ Antwoord in std vorm</p> <p>or/of</p> <p>✓ SF</p> <p>✓ Answer in std form/ Antwoord in std vorm</p>	(4)
1.2	<p>D is the y-axis intercept/ D is die y-as afsnit</p> $x = 0$ $y = 0 + 4$ $D(0;4) \therefore OD = 4 \text{ units}$	<p>✓ $x = 0$</p> <p>✓ SF in equation/ in vgl AB</p>	(2)
1.3	$m_{DC} = \frac{y_C - y_D}{x_C - x_D}$ $= \frac{0-4}{4-0}$ $= -1$ $m_{AB} \times m_{DC} = 1 \times -1 = -1$ $\therefore AB \perp DC$	<p>✓ Gradient of DC/Gradiënt van DC</p> <p>✓ Gradient of AB/Gradiënt van AB</p> <p>CA van 1.1</p> <p>✓ product is -1/ produk is -1 CA</p> <p>✓ Conclusion/gevolgtrekking CA</p>	(4)

1.4	$\tan \theta = m_{DC}$ $\theta_{ref} = \tan^{-1}(-1)$ $\theta_{ref} = 45^\circ / -45^\circ$ $\theta = 135^\circ$	✓ SF ✓ Ref \angle CA eksponent eienskap ✓ Answer/Antwoord CA	(3)
1.5	<i>E is the x – intercept of AB</i> <i>E is die x – afsnit van AB</i> $y = 0$ $0 = x + 4$ $x = -4$ $\therefore E(-4;0)$	CA equation from 1.1 CA vergelyking van 1.1 ✓ SF $y = 0$ ✓ Coordinates of E/ koördinaat van E CA	(2)
1.6	$D_{AC} = \sqrt{(x_c - x_A)^2 + (y_c - y_A)^2}$ $D_{AC} = \sqrt{(4 - (-3))^2 + (0 - 1)^2}$ $D_{AC} = 5\sqrt{2}$ $\therefore AC = DC$ $\therefore \Delta ABC$ is an isosceles Δ $\therefore \Delta ABC$ is 'n gelykbenige Δ	✓ SF ✓ Answer/Antwoord A ✓ Conclusion/ gevolgtrekking A	(3)
			[18]

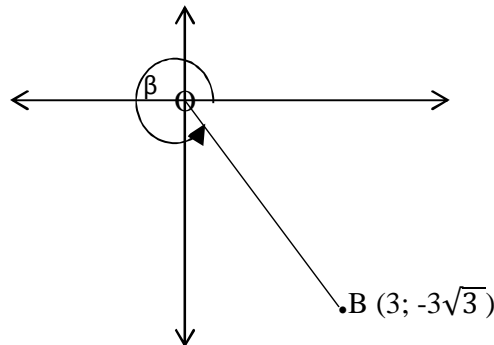
QUESTION/VRAAG 2



2.1.1 $r^2 = (3)^2 + (4)^2$ $r^2 = 25$ $r = 5$ <i>or / of</i> $r^2 = (3)^2 + (-4)^2$ $r^2 = 25$ $r = 5$ $\therefore x^2 + y^2 = 25$	\checkmark Value of r/waarde van r A \checkmark equation of circle/vgl van sirkel A	(2)
2.1.2 $m_{OP} = \frac{y_p - y_o}{x_p - x_o}$ $= \frac{-4-0}{3-0}$ $= -\frac{4}{3}$ $m_{RQ} = \frac{3}{4}$ <i>Equation / vergelyking RQ</i> $y - y_1 = m(x - x_1)$ $y - (-4) = \frac{3}{4}(x - 3)$ $y = \frac{3}{4}x - \frac{25}{4}$	\checkmark m of/van OP A \checkmark m of/van RQ A \checkmark Substitution/vervanging CA \checkmark Answer/antwoord CA	(4)

2.2		<p>✓ <i>y</i>–intercepts / afsnitte A</p> <p>✓ <i>x</i>–intercepts / afsnitte A</p> <p>✓ Shape/vorm A</p>	(3)
			[9]

QUESTION/VRAAG 3



3.1.1	$OB = \sqrt{(3)^2 + (-3\sqrt{3})^2}$ $OB = 6$	<p>✓ SF (pythagoras) A</p> <p>✓ Length of OB/ Lengte van OB A</p>	(2)
3.1.2	$\sec^2 \beta = \left(\frac{r}{x} \right)^2$ $= \left(\frac{6}{3} \right)^2$ $= 4$	<p>CA from 3.1.1 (value of r/waarde van r)</p> <p>✓ Ratio of sec/ verhouding van sec A</p> <p>✓ SF CA</p> <p>✓ Answer/antwoord CA</p>	(3)
3.1.3	$3\cot^2 \beta - \sin^2 \beta$ $= 3 \left(\frac{3}{-3\sqrt{3}} \right)^2 - \left(\frac{-3\sqrt{3}}{6} \right)^2$ $= 3 \left(\frac{1}{3} \right) - \frac{3}{4}$ $= \frac{1}{4}$	<p>CA from 3.1.1 (value of r/waarde van r)</p> <p>✓ Ratio of cot/ verhouding van cot A</p> <p>✓ Ratio of sin/ verhouding van sin CA</p> <p>✓ Answer/antwoord CA</p>	(3)

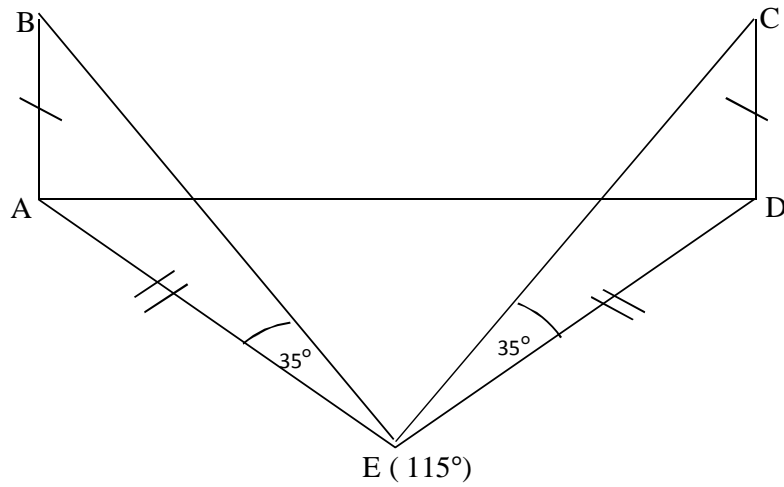
3.2	$\cos\left(\frac{2\pi}{3} \times \frac{180^\circ}{\pi}\right)$ $= \cos 120^\circ$ $= -\frac{1}{2}$	✓ Conversion/ <i>herleiding</i> A ✓ Answer/antwoord A	(2)
3.3	$15 \cos x = -12$ $\cos x = -\frac{12}{15}$ $y = \sqrt{(15)^2 - (-12)^2}$ $y = 9$ $\cos ec x = \frac{15}{9} / \frac{5}{3}$	✓ pythagoras ✓ value of y/waarde van y A ✓ SF A ✓ Answer/antwoord CA	(4)
3.4.1	Second quadrant / <i>tweede kwadrant</i>	✓ Answer/antwoord A	(1)
3.4.2	$\tan \theta = -\frac{2}{5}$ $\theta_{ref} = \tan^{-1}\left(-\frac{2}{5}\right)$ $\theta_{ref} = 21,8^\circ$ $\theta = 180^\circ - 21,8^\circ$ $= 158,2^\circ$	✓ Ratio of tan/ <i>verhouding van tan</i> A ✓ Ref \angle A ✓ Quadrant/ <i>kwadrant</i> CA ✓ Answer/antwoord CA	(4)
			[19]

QUESTION/VRAAG 4

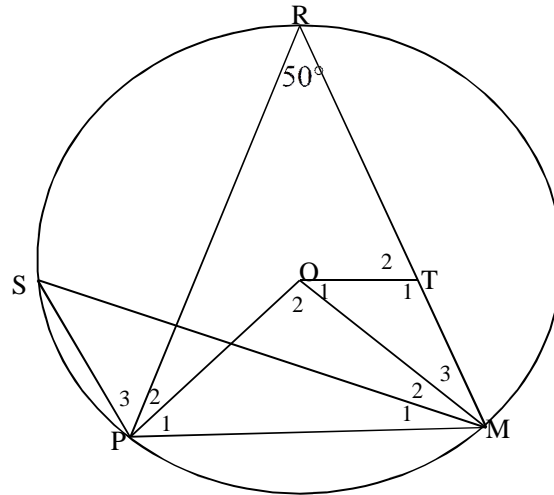
4.1	$\frac{\tan^2(180^\circ - x) \cdot \cos^2(180^\circ + x) \cdot \operatorname{cosec}(360^\circ - x)}{\sin(180^\circ + x)}$ $= \frac{-\tan^2(x) \cdot -\cos^2(x) \cdot \operatorname{cosec}(x)}{-\sin(x)}$ $= \frac{-\frac{\sin^2 x}{\cos^2 x} \cdot \frac{-\cos^2(x)}{1} \cdot \frac{1}{\sin x}}{-\sin(x)}$ $= \frac{\sin x}{-\sin x}$ $= -1$	$\checkmark -\tan^2 x$ $\checkmark -\cos^2 x$ $\checkmark \operatorname{cosec} x$ $\checkmark -\sin x$ $\checkmark -\frac{\sin^2 x}{\cos^2 x}$ $\checkmark -\sin x$ $\checkmark \frac{\sin x}{-\sin x}$ $\checkmark \text{Answer/antwoord}$	(8)
4.2	1	$\checkmark \text{Answer/antwoord}$	(1)
4.3	$\sin^2 \theta + \frac{1}{\sec^2 \theta} + \frac{\tan \theta}{\cot \theta}$ $= \sin^2 \theta + \cos^2 \theta + \left(\frac{\sin \theta}{\cos \theta} \right) \left(\frac{\cos \theta}{\sin \theta} \right)$ $= 1 + \frac{\sin \theta}{\cos \theta} \times \frac{\sin \theta}{\cos \theta}$ $= 1 + \frac{\sin^2 \theta}{\cos^2 \theta}$ $= 1 + \tan^2 \theta$ $= \sec^2 \theta$	$\checkmark \cos^2 \theta$ $\checkmark \frac{\sin \theta}{\cos \theta}$ $\checkmark \frac{\cos \theta}{\sin \theta}$ $\checkmark 1$ $\checkmark \frac{\sin^2 \theta}{\cos^2 \theta}$ $\checkmark \tan^2 \theta$ $\checkmark \sec^2 \theta$	(7)
			[16]

QUESTION/VRAAG 5

5.1		f ✓ Shape/vorm ✓ x -intercepts/afsnitte ✓ Turning points/ Draaipunte g ✓ Shape/vorm ✓ x -intercepts/afsnitte ✓ Turning points/ Draaipunte	(6)
5.2.1	1	✓ Answer/antwoord A	(1)
5.2.2	360°	✓ Answer/antwoord A	(1)
5.2.3	120° and / en 300°	✓ Reading from graph/lesing van grafiek CA ✓ Reading from graph/lesing van grafiek CA	(2)
5.2.4	$[120^\circ; 300^\circ]$	✓ Answer/antwoord CA ✓ Notation/notasie A	(2)
			[12]

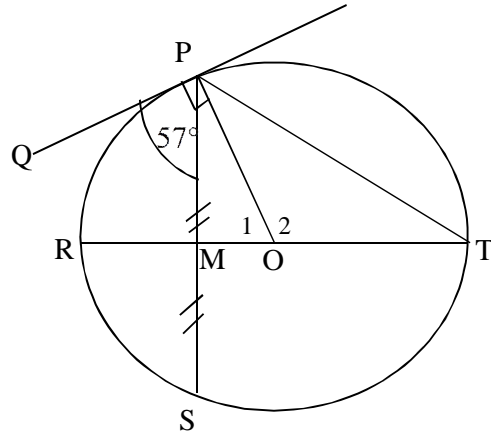
QUESTION/VRAAG 6


6.1	$\tan 35^\circ = \frac{AB}{AE}$ $AB = 15 \tan 35^\circ$ $AB = 10,5m$ Height of both buildings/ <i>Hoogte van beide geboue</i> 10,5 m	✓ Ratio/ <i>verhouding</i> A ✓ SF A ✓ Answer/ <i>antwoord</i> CA	(3)
6.2	$e^2 = d^2 + a^2 - 2da \cos \hat{E}$ $e^2 = 15^2 + 15^2 - 2 \cdot 15 \cdot 15 \cos 115^\circ$ $e = \sqrt{640}$ $e = 25,3m$	✓ Correct formula/ <i>Korrekte formule</i> A ✓ SF ✓ Value of/ <i>waarde van</i> e	(3)
			[6]

QUESTION/VRAAG 7
7.1


7.1			
7.1.1	$\widehat{O}_2 = 100^\circ$ (angle at centre = 2 x angle at circf/midpunts hoek = 2 x omtrekshoek)	✓ SA ✓ R	(2)
7.1.2	$OP = OM$ (radii) $\widehat{P}_1 = (180^\circ - 100^\circ) / 2$ (angles opp equal sides/hoekte teenoor gelyke) $\widehat{P}_1 = 40^\circ$	✓ S,R ✓ R ✓ A	(3)
7.1.3	sye) $\widehat{S} = 50^\circ$ (angles sub by same chord/hoekte onderspan deur dieselfde koord)	✓ S ✓ R	(2)

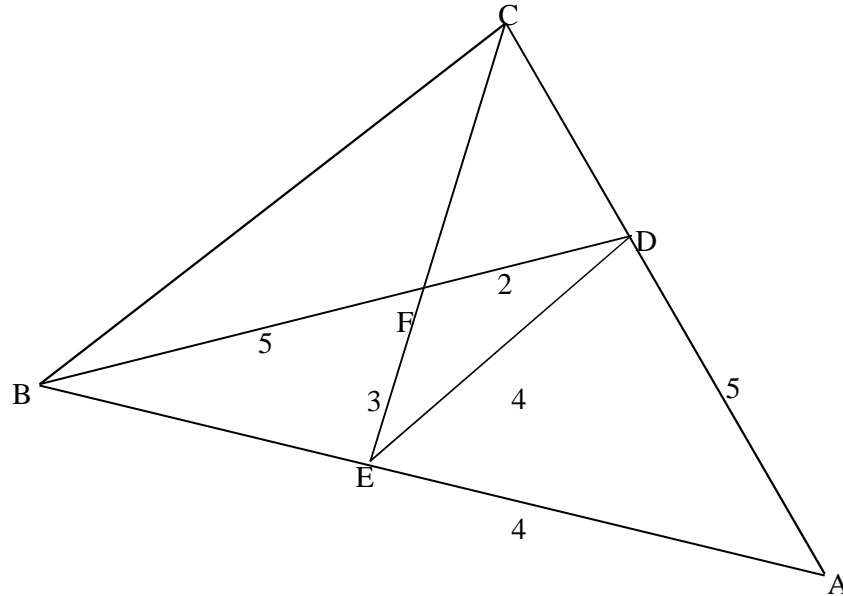
7.3



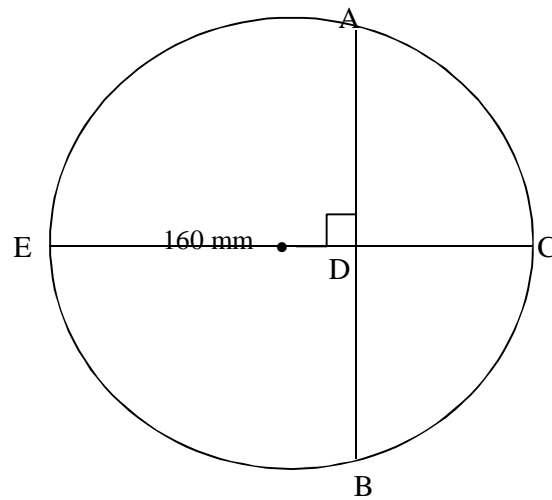
7.3.1	Perpendicular / Loodreg	✓ A	(1)
7.3.2 a)	$\widehat{SPO} = 90^\circ - 57^\circ$ (radius \perp tangent / radius \perp raaklyn) $\widehat{SPO} = 33^\circ$	✓ S,R ✓ A ✓	(2)
b)	$\widehat{O_1} = 180^\circ - (90^\circ + 33^\circ)$ (int angles of \hat{c} / binne hoeke v Δ) $\widehat{O_1} = 57^\circ$	✓ S ✓ A	(2)
			[23]

QUESTION/VRAAG 8

8.1	Equiangular / <i>Gelykhoekig</i> Corresponding sides in proportion / <i>Ooreenstemmende sye in verhouding</i>	✓ R ✓ R	(2)
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8.2


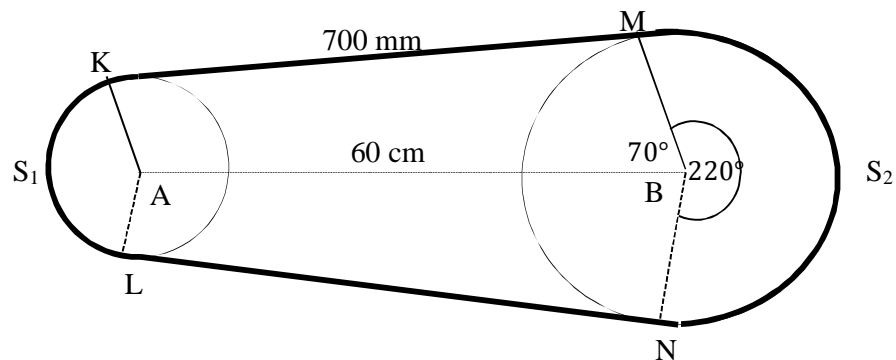
8.2			
8.2.1	∠ BFC (Equiangular / <i>Gelykhoekig</i>)	✓ A	(1)
8.2.2			
a)	$\frac{DE}{BC} = \frac{EF}{FC} = \frac{FD}{BF} \quad (\angle BFC)$ <p>sim/gelykvê DFE)</p> $\frac{4}{BC} = \frac{2}{5}$ $BC = 10$	✓ A(Proportionality/ <i>eweredigheid</i>) ✓ SF (Correct values / <i>korrekte waardes</i>) ✓ A	(3)
b)	$\frac{FE}{FC} = \frac{DF}{FB}$ $\frac{3}{FC} = \frac{2}{5}$ $FC = \frac{15}{2}$ $FC = 7,5$	✓ A(Proportionality/ <i>eweredigheid</i>) ✓ A (length of FC/ <i>lengte van FC</i>)	(2)
			[8]

QUESTION/VRAAG 9


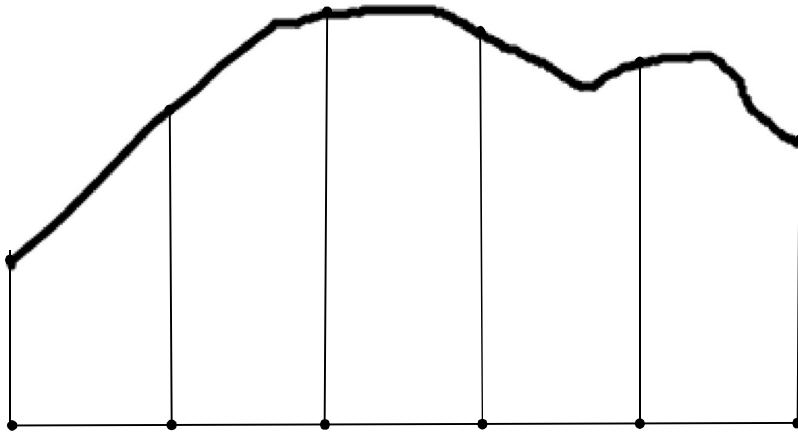
9.1.1	$r = 120 \text{ mm}$	✓ A	(1)
9.1.2	$240 - 160 = 80 \text{ mm}$	✓ A	(1)
9.1.3	$4h^2 - 4dh + x^2 = 0$ $4(80)^2 - 4(240)(80) + x^2 = 0$ $25600 - 76800 + x^2 = 0$ $x^2 = 51200$ $x = 226,27 \text{ mm}$	✓ F ✓ SF ✓ A (length of chord / lengte van koord)	(3)
9.2			
9.2.1	$3 \times 20 = 60 \text{ m}$	✓ X 20 ✓ A	(1) (1)
9.2.2	$V = \pi Dn$ $3 = \pi \times 0,6 \times n$ $n = \frac{3}{\pi \times 0,6}$ $n = 1,59 \text{ rev/s}$	✓ F ✓ SF ✓ A	(3)

9.2.3	$t = \frac{rev}{n} \text{ from}$ $n = \frac{rev}{t}$ $t = \frac{12}{1,59}$ $t = 7,55$	✓ SF ✓ A	(2)
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9.3

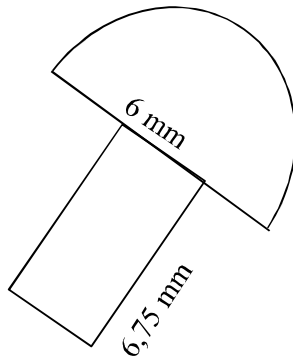


9.3.1	$\widehat{KAB} = 110^\circ$ Supl angles, Given /Supl hoeke, Gegee(KA MB)	✓ 110° ✓ R	(2)
9.3.2	$Arc\ length\ S_2 = r \times \theta$ $Arc\ length\ S_2 = 20 \times \frac{220^\circ \times \pi}{180^\circ}$ $Arc\ length\ S_2 = 76,8\ cm$ $length\ of\ belt = S_1 + LN + S_2 + KM$ $length\ of\ belt = 38,4 + 70 + 76,8 + 70$ $length\ of\ belt = 255,2\ cm$	✓ F ✓ $r = 20$ ✓ Conversion degrees to radians/Herleiding grade na radiale ✓ CA (length/lengte S_2) ✓ M (adding/ optel) ✓ C (Conversion / Herleiding) ✓ CA (Penalty unit/Penalisasie eenh) ✓ R	(8)
			[22]

QUESTION/VRAAG 10
10.1


10.1.1	$a = 30 \div 5$ $a = 6 \text{ cm}$	✓ A	(1)
10.1.2	$A = a(m_1 + m_2 + m_3 + \dots + m_n)$ $A = 6\left(\frac{3,1+6,2}{2} + \frac{6,2+8,3}{2} + \frac{8,3+7,2}{2} + \frac{7,2+6,5}{2} + \frac{6,5+6}{2}\right)$ $A = 196,5 \text{ cm}^2$	✓ F ✓ SF ✓ S ✓ CA	(4)

10.2



10.2.1	$V = \left(\frac{4}{3} \pi r^3 \right) \div 2$ $V = \left(\frac{4}{3} \pi (3)^3 \right) \div 2$ $V = 113,097 \div 2$ $V = 56,55 \text{ mm}^3$ $V = \pi r^2 h$ $V = \pi (2)^2 6,75$ $V = 84,82 \text{ mm}^3$ $\text{Total } V = 56,55 + 84,82$ $\text{Total } V = 141,37 \text{ mm}^3$	✓ F ✓ $\div 2$ ✓ SF ✓ A unit/eenheid ✓ SF ✓ M(adding / optel) ✓ CA	(8)
10.2.2	$V = s^3$ $V = 70^3$ $V = 343\,000 \text{ mm}^3$ $\text{No. rivets} = 343\,000 \text{ mm}^3 \div 141,37 \text{ mm}^3$ $\text{No. rivets} = 2426$	✓ A(volume of cube / - van kubus) ✓ M(\div) ✓ CA ✓ R (whole number / Telgetal)	(4)
			[17]

TOTAL/TOTAAL 150