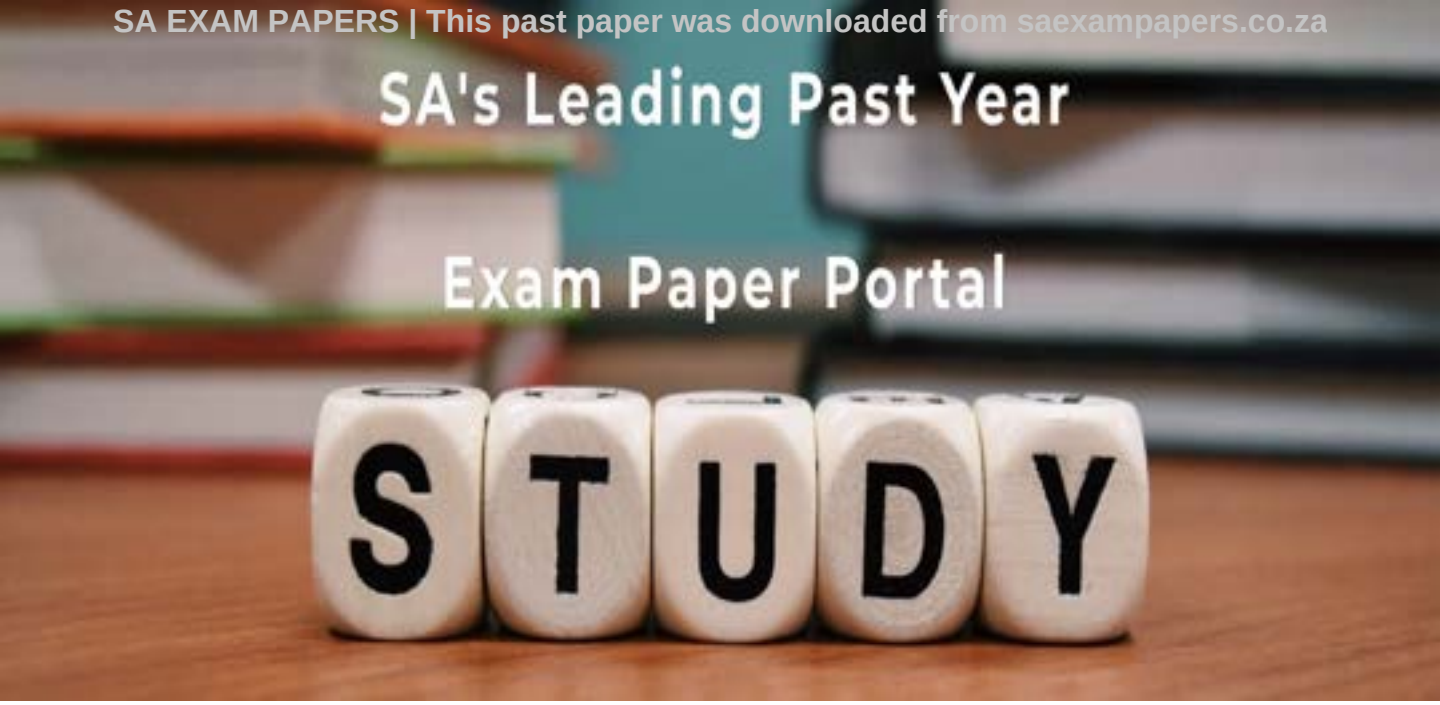

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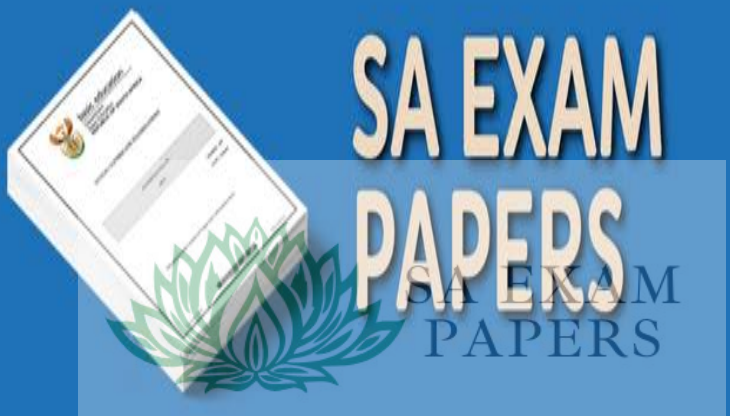

Province of the
EASTERN CAPE
EDUCATION

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Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE/*NASIONALE SENIORSERTIFIKAAT*

GRADE/*GRAAD* 12

SEPTEMBER 2024

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

MARKS/*PUNTE*: **150**

This marking guideline consists of 21 pages./
Hierdie nasienriglyn bestaan uit 21 bladsye.

NOTE:

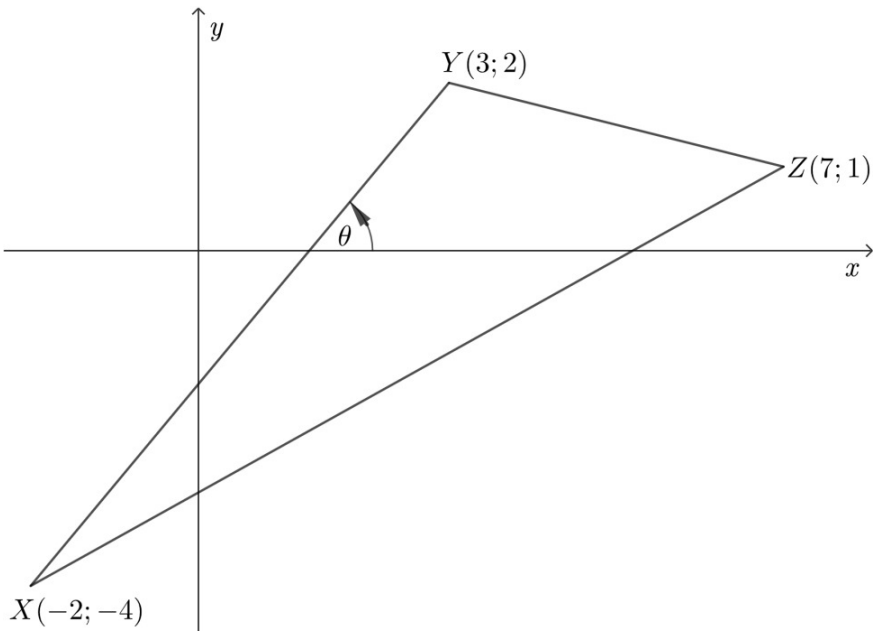
- Continuous accuracy (CA) applies only where indicated in this marking guideline.
- Assuming values/answers in order to solve a problem is unacceptable.

LET WEL:

- *Volgehoue akkuraatheid (CA) is slegs van toepassing soos aangedui in hierdie nasienriglyn.*
- *Aanvaarding van waardes/antwoorde om 'n problem 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*

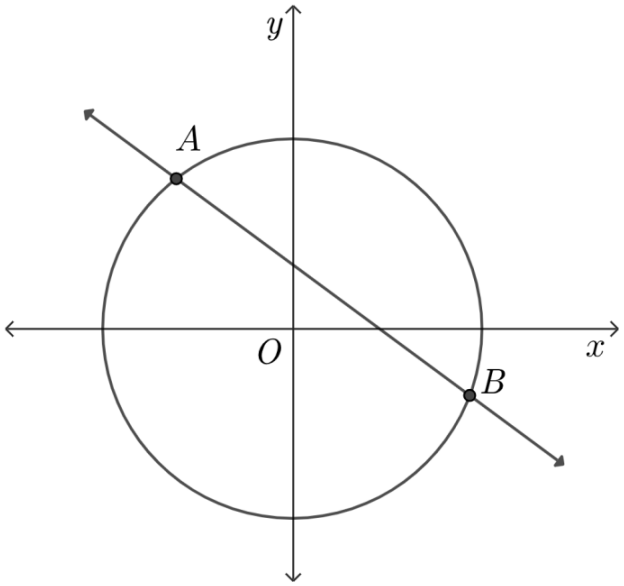
QUESTION/*VRAAG* 1

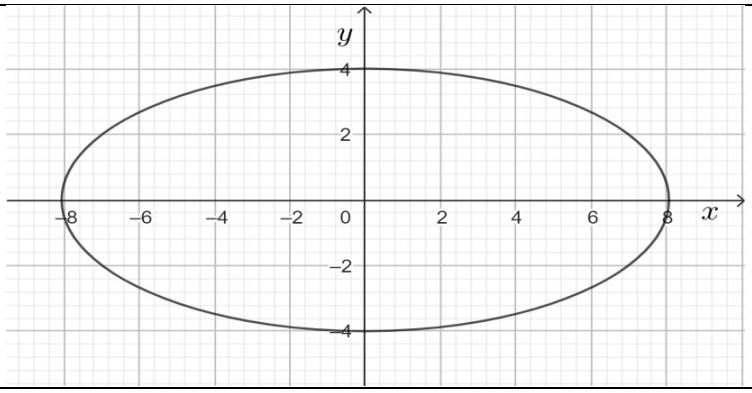


1.1	$m = \frac{y_2 - y_1}{x_2 - x_1}$ $m_{XY} = \frac{2+4}{3+2}$ $= \frac{6}{5}$	✓Subst. **A** ✓Ans/*Antw.* **CA**	(2)
1.2	$XY = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(3+2)^2 + (2+4)^2}$ $= \sqrt{5^2 + 6^2}$ $= \sqrt{61}$ $= 7{,}81$ units/*eenhede*	✓F **A** ✓Subst. **A** ✓Ans/*Antw.* **CA**	(3)
1.3	$\tan\theta = m_{XY}$ $\tan\theta = \frac{6}{5}$ $\theta = \tan^{-1}\left(\frac{6}{5}\right)$ $\theta = 50{,}19^{\circ}$	✓M **A** ✓Subst. **CA** ✓Ans/*Antw.* **CA**	(3)

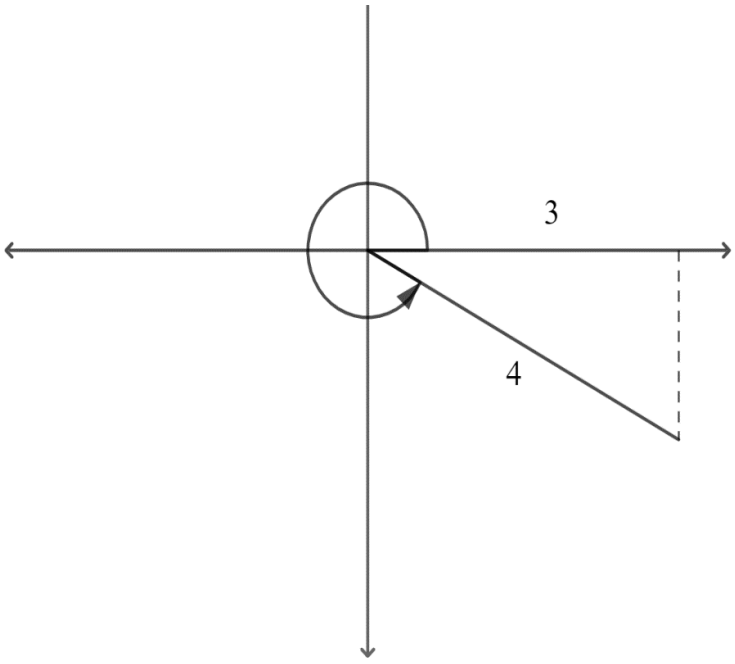
1.4	$M\left(\frac{x_1+x_2}{2};\frac{y_1+y_2}{2}\right)$ $=M\left(\frac{3+7}{2};\frac{2+1}{2}\right)$ $=M\left(5;\frac{3}{2}\right)$	✓*x*-value/*waarde* **A** ✓*y*-value/*waarde* **A**	
	$m_{XY}=\frac{6}{5}$		
	$y-y_1=m(x-x_2)$ $y-\frac{3}{2}=\frac{6}{5}(x-5)$ $y=\frac{6}{5}x-6+\frac{3}{2}$ $y=\frac{6}{5}x-\frac{9}{2}$	✓Subst . **CA** ✓S **CA** ✓Ans/*Antw.* **CA**	
	OR/*OF*		
	$M\left(\frac{x_1+x_2}{2};\frac{y_1+y_2}{2}\right)$ $=M\left(\frac{3+7}{2};\frac{2+1}{2}\right)$ $=M\left(5;\frac{3}{2}\right)$	✓*x*-value/*waarde* **A** ✓*y*-value/*waarde* **A**	
	$m_{XY}=\frac{6}{5}$		
	$y=mx+c$ $\frac{3}{2}=\frac{6}{5}(5)+c$ $\frac{3}{2}-6=c$ $c=-\frac{9}{2}$	✓Subst. **CA** ✓S **CA**	
	$y=\frac{6}{5}x-\frac{9}{2}$	✓Ans/*Antw.* **CA**	(5)
			[13]

QUESTION/*VRAAG* 2

2.1			
2.1.1	Secant/*sekant*	✓Ans/*Antw.* **A**	(1)
2.1.2	$y=-x+4,\quad x^2+y^2=40$ $x^2+(-x+4)^2=40$ $x^2+x^2-8x+16=40$ $2x^2-8x-24=0$ $x^2-4x-12=0$ $(x-6)(x+2)=0$ $x=6 \text{ or } x=-2$ $y=-6+4 \qquad y=-(-2)+4$ $y=-2 \qquad y=6$ $A(-2\ ;\ 6),\quad B(6\ ;\ -2)$	✓Subst. **A** ✓Standard Form/*Vorm* **CA** ✓ A (-2 ; 6) **CA** ✓ B (6 ; -2) **CA**	(4)
2.1.3	$x\cdot x_2+y\cdot y_2=r^2$ $x(-2)+y(6)=40$ $-2x+6y=40$ $6y=2x+40$ $y=\frac{2}{6}x+\frac{40}{6}$ $y=\frac{1}{3}x+\frac{20}{3}$ **OR/*OF***	✓F **A** ✓SF **A** ✓S **CA** ✓Equation/*Vgl.* **CA**	(4)

	$m_{OA} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{6-0}{-2-0}$ $= -3$	✓ m_{OA} **A**	
	$m_{\text{tan gent}} = -1 \times -\frac{1}{3} = \frac{1}{3}$	✓ $m_{\text{tan gent}}$ **CA**	
	$y - y_1 = m(x - x_1)$ $y - 6 = \frac{1}{3}(x+2)$		
	$y = \frac{1}{3}x + \frac{2}{3} + 6$	✓S **CA**	
	$y = \frac{1}{3}x + \frac{20}{3}$	✓Equation/*Vgl*.**CA**	(4)
2.2.1	Ellipse/*Ellips* or/*of* Oval/*Ovaal*	✓Ans/*Antw.* **A**	(1)
2.2.2	$16x^2 + 64y^2 = 1024$ $\frac{16x^2}{1024} + \frac{64y^2}{1024} = \frac{1024}{1024}$ $\frac{x^2}{64} + \frac{y^2}{16} = 1$	✓M **A**	
	$\frac{x^2}{8^2} + \frac{y^2}{4^2} = 1$	✓Equation/*Vgl.* **CA**	(2)
2.2.3		✓elliptical shape /*elliptiese vorm* **A** ✓*x*-int/*as* **A** ✓ *y*-int/*as* **A**	(3)
			[15]

QUESTION/*VRAAG* 3

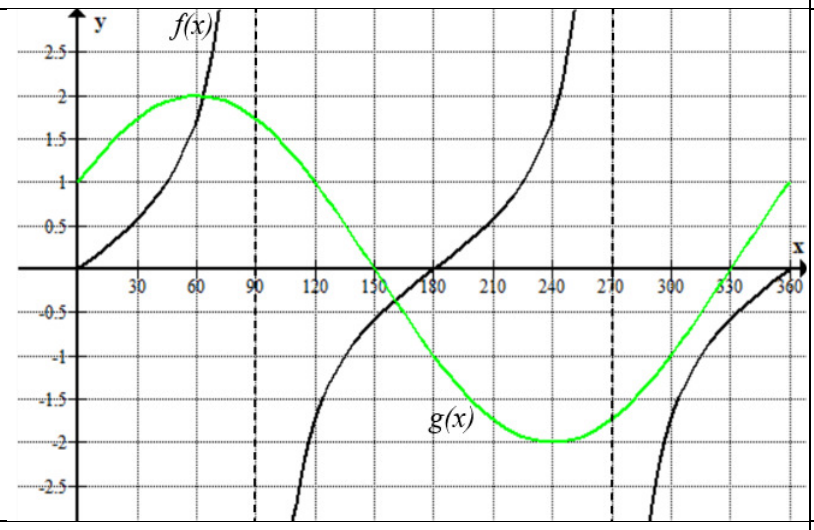
3.1	$\theta = 22,51^{o} \quad \beta = 231,21^{o}$ $\cos(\theta + 20^{o}) - \tan(3\beta)$ $= \cos(22,51^{o} + 20^{o}) - \tan(3 \times 231,21^{o})$ $= 1,23$	✓Subst. **A** ✓Ans/*Antw.* **A**	(2)
3.2.1		✓Diagram **A**	
	$x^2 + y^2 = r^2$ $3^2 + y^2 = 4^2$ $y^2 = 16 - 9$ $y = \pm\sqrt{7}$ $y = -\sqrt{7}$ $\sin\alpha = \frac{-\sqrt{7}}{4}$	✓Subst. **CA** ✓*y*-value/*waarde* **CA** ✓ $\sin\alpha = \frac{-\sqrt{7}}{4}$ **CA**	(4)

3.2.2	$\tan\alpha + \frac{\text{cosec}^2\alpha}{3}$ $= \frac{-\sqrt{7}}{3} + \frac{\left(\frac{4}{-\sqrt{7}}\right)^2}{3}$ $= \frac{16-7\sqrt{7}}{21}$ $= -0,12$	✓$\tan\alpha = \frac{-\sqrt{7}}{3}$ **CA** ✓$\text{cosec}\alpha = \frac{4}{-\sqrt{7}}$ **CA** ✓Ans/*Antw.* **CA** ***NPR***	(3)
3.3	$3\sin x = -2$ $\sin x = \frac{-2}{3}$ $x = \sin^{-1}\left(\frac{2}{3}\right)$ Ref$\angle = 41,81^\circ$ 3^{rd} Quad/3^{de} kwadrant $x = 180 + 41,81^\circ$ $x = 221,81^\circ$ 4^{th} Quad/4^{de} kwadrant $x = 360^\circ - 41,81^\circ$ $x = 318,18^\circ$	✓$\sin x = \frac{-2}{3}$ **A** ✓$\sin^{-1}\left(\frac{2}{3}\right)$ **CA** ✓Ref $\angle$ **CA** ✓x in 3$^{\text{nd}}$ quad/*3de kwadrant* **CA** ✓x in 4$^{\text{th}}$ Quad/*4de kwadrant* **CA**	(5)
			[14]

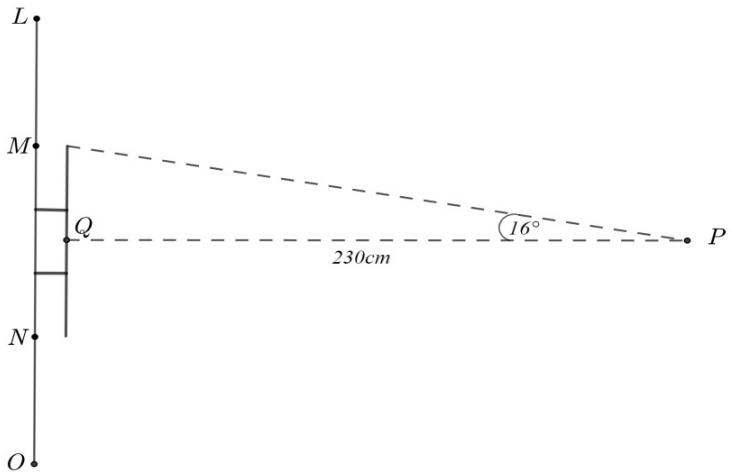
QUESTION/*VRAAG* 4

4.1.1	$\cot(2\pi-\theta)=-\cot\theta$ **OR / *OF*** $\cot(2\pi-\theta)=-\dfrac{\cos\theta}{\sin\theta}$	✓Ans/*Antw.* **A**	(1)
4.1.2	$=\dfrac{-\tan\theta.\cos\theta.\sin\theta}{\sin\theta.-\dfrac{\cos\theta}{\sin\theta}.\dfrac{1}{\cos\theta}}$ $=\dfrac{\dfrac{\sin\theta}{\cos\theta}.\cos\theta}{\dfrac{1}{\sin\theta}}$ $=\dfrac{\sin\theta}{\cos\theta}.\cos\theta.\sin\theta$ $=\sin^2\theta$	✓ $-\tan\theta$ **A** ✓ $\cos\theta$ **A** ✓ $\sin\theta$ **A** ✓ $\frac{1}{cos\theta}$ **A** ✓ $\frac{sin\theta}{cos\theta}$ **A** ✓ S **CA** ✓Ans/*Antw.* **CA**	(7)
4.2	LHS / $LK=\dfrac{\sin x}{\cos x}.\sin^2 x+\sin x.\cos x$ $=\dfrac{\sin^3 x}{\cos x}+\sin x.\cos x$ $=\dfrac{\sin^3 x+\sin x.\cos^2 x}{\cos x}$ $=\dfrac{\sin x(\sin^2 x+\cos^2 x)}{\cos x}$ $=\dfrac{\sin x.(1)}{\cos x}$ $=\tan x$ = RHS / *RK*	✓ $\dfrac{\sin x}{\cos x}$ **A** ✓**S** **A** ✓Factors/*Faktore* **A** ✓ $\sin^2 x+\cos^2 x=1$ **A** ✓ $\dfrac{\sin\theta}{\cos\theta}$ **A**	(5)
			[13]

QUESTION/*VRAAG* 5

5.1	$f(x) = \tan(x)$ and/*en* $g(x) = 2\sin(x + 30°)$ for/*vir* $x \in (0° ; 360°)$		
		*g*: ✓*y*-intercept/*as* **A** ✓*x*-intercept/*as* **A** ✓TP/*DP* **A**	(3)
5.2.1	180°	✓180° **A**	(1)
5.2.2	$x = 90°$ and/*en* $x = 270°$	✓$x = 90°$ **A** ✓$x = 270°$ **A**	(2)
5.2.3	$y \in [-2; 2]$	✓values/*waardes* **A** ✓notation/*notasie* **A**	(2)
5.2.4	Amplitude of/*van* $g = 2$	✓Answer/*Antwoord* **A**	(1)
5.3	$0° < x < 90°$, $150° < x < 180°$, $270° < x < 330°$	✓$0° < x < 90°$ **CA** ✓$150° < x < 180°$ **CA** ✓$270° < x < 330°$ **CA**	(3)
			[12]

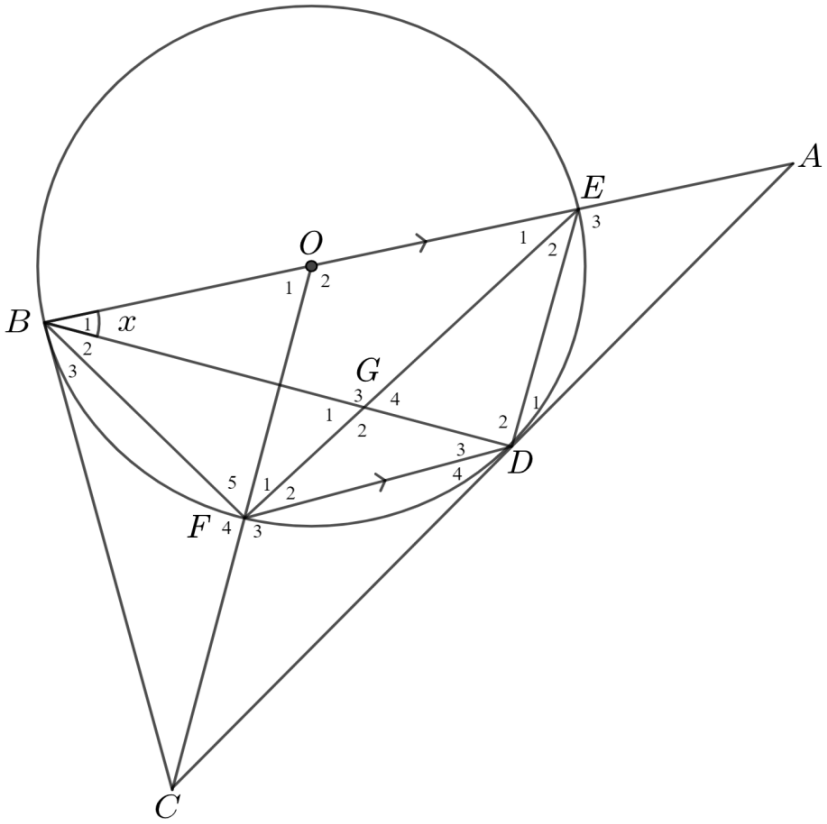
QUESTION/*VRAAG* 6



6.1	$\tan\theta = \frac{\text{opposite/}teenoorstaande}{\text{adjacent/}aangrensend}$	✓Ans/*antw.* **A**	(1)
6.2	$\tan 16° = \frac{MQ}{PQ}$ $MQ = PQ\tan 16°$ $= 230 \times \tan 16°$ $= 65{,}95$ cm $MN = 65{,}95 \times 2$ $= 131{,}9$ cm $= 132$ cm	✓$\tan 16^o = \frac{MQ}{PQ}$ **A** ✓*MQ* **CA** ✓*MN* **CA** **NPR**	(3)
6.3	Area of/*Oppervlakte* van $\Delta MNP = \left(\frac{1}{2} \times PQ \times MQ\right)$ $= \left(\frac{1}{2} \times 230 \times 65{,}95\right) \times 2$ $= 15\ 168{,}5$ cm^2 **OR/*OF*** $Area = \frac{1}{2}a \cdot b\sin\hat{C}$ $= \frac{1}{2}PM \times PN \times \sin\hat{P}$ $= \frac{1}{2}\left(\frac{230}{\cos 16^o}\right)\left(\frac{230}{\cos 16^o}\right)\sin 32^o$ $= 15168{,}83 cm^2$	✓F **A** ✓SF **CA** ✓Area/*Oppervl.* **CA** ✓F **A** ✓SF **CA** ✓Area/*Oppervl.* **CA** ***NRP***	(3)

6.4.1	$125 \times 15 = 1\ 875$ min. $1\ \frac{\text{hr}}{\text{uur}} = 60$ min $\frac{1\ 875}{60} = 31{,}25\ \frac{\text{hrs}}{\text{ure}}$ 1 day/dag = 8 hrs/ure $\frac{31{,}25}{8} = 3{,}90 = 4$ days/dae	✓1 875 min **A** ✓31,25 hrs/*ure* **CA** ✓ 4 days/*dae* **CA**	(3)
6.4.2	Payment/*Betaling* = R350,00 × 8 × 4 = R11 200,00	✓Payment/*Betaling* **CA**	(1)
			[11]

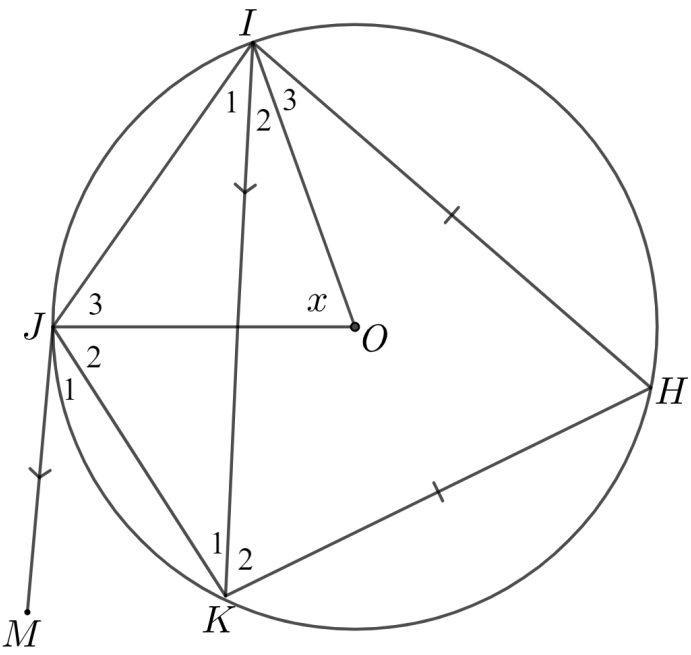
QUESTION/*VRAAG* 7



7.1	1. $\hat{D}_3 = \hat{B}_1 = x$, (alt. < 's / *verw.* < *'e; BA FD*) 2. $\hat{E}_1 = \hat{D}_3 = x$ (< 's in the same seg./ < *'e in dieselfde seg.*) 3. $\hat{F}_2 = \hat{E}_1 = x$ (alt. < 's / *verw.* < *'e; BA FD*) 4. $\hat{F}_1 = \hat{E}_1 = x$ (< '*s* opp = sides/ < *'e teenoor = sye*) 5. $\hat{F}_1 = \hat{D}_1 = x$ (tan chord/*raaklyn koord*)	✓ ST ✓ RE **A** ✓ ST ✓ RE **A** ✓ ST ✓ RE **A**	(6)
7.2	$O\hat{B}C = 90^\circ$ tan ⊥ rad $B\hat{F}E = 90^\circ$ **OR / *OF*** $B\hat{D}E = 90^\circ$	✓RE **A** ✓$B\hat{F}E$ **A**	(2)

7.3	$D\hat{B}O + B\hat{D}A + \hat{A} = 180^\circ$ (int. <'s of Δ/*binne < 'e van* Δ) $x + (90^\circ + x) + \hat{A} = 180^\circ$ $\hat{A} = 180^\circ - (90^\circ + 2x)$ $\hat{A} = 90^\circ - 2x$ $\hat{A} = 90^\circ - 2(23^\circ)$ $= 44^\circ$	✓ ST ✓ RE **A** ✓**S** **CA** ✓Subst. **A** ✓Ans/*Antw.* **CA**	(5)
			[13]

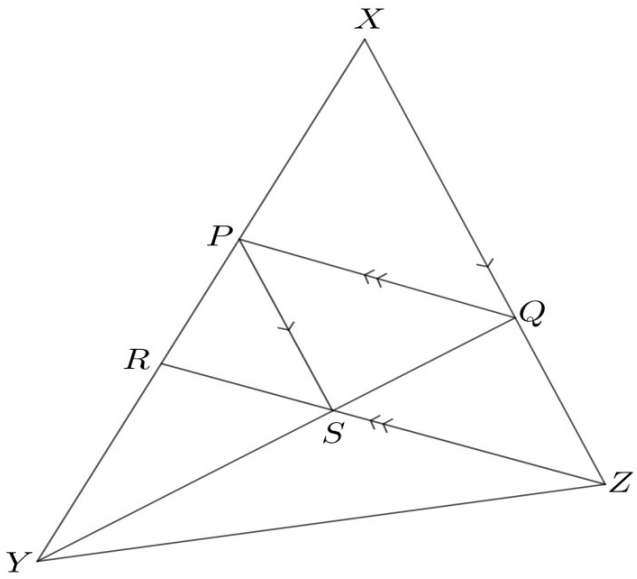
QUESTION/*VRAAG* 8



8.1	$\hat{O} = 2\hat{K}_1$ (< at centre = 2× < at circumf / *midpts <= 2 × omtreks* <) $\hat{K}_1 = \frac{x}{2}$	✓ RE **A** ✓ ST **A**	(2)
8.2.1	$\hat{K}_1 = \hat{J}_1$ (alt. < 's / *verw.* < *'e; JM ∥ IM*) $\hat{J}_1 = \hat{I}_1$ (tan - chord/*raaklyn koord*) $\therefore JK = JI$ (sides opp = <'s/*sye teenoor* = < *'e*)	✓ ST **A** ✓ RE **A** ✓ RE **A**	(4)
8.2.2	$\hat{K}_1 = \hat{J}_1 = \frac{x}{2}$ (alt. < 's/*verw.* < *'e; JM ∥ IM*) $\hat{I}_1 = \hat{J}_1$ (proved/*bewys*) $\hat{J}_{2+3} = 180^\circ - (\hat{K}_1 + \hat{I}_1)$ (int <'s of Δ / *binne* < *'e van* Δ) $= 180^\circ - x$ $\therefore \hat{H} + J = 180^\circ$ (opp <'s of cq/*teenoorst.* < *'e van kvh*) $\hat{H} = 180^\circ - (180^\circ - x)$ $\hat{H} = x$	✓ RE **A** ✓ $180^\circ - x$ **CA** ✓RE **A** ✓*H* **CA**	(3)

8.3	$\hat{O} = \hat{H} = x$	(proved/*bewys*)	✓ ST **A**	
	in ΔIHK			
	$I\hat{K}H = K\hat{I}H$	(< 's opp = sides/ < *'e teenoor = sye*)		
	$\hat{K}_2 = \frac{180^\circ - x}{2}$	(int. <'s of Δ / *binne < 'e van* Δ)	✓ST **A**	
	in ΔIOJ			
	$I\hat{J}O = J\hat{I}O$	(< 's opp = sides/ < *'e teenoor = sye*)	✓ ST **A**	
	$\hat{J}_3 = \frac{180^\circ - x}{2}$	(int. <'s of Δ / *binne < 'e van* Δ)	✓ RE **A**	
	$\therefore \hat{J}_3 = \hat{K}_2$			
	$\hat{I}_{1+2} = \hat{I}_{2+3}$	(third < of Δ/*derde < van* Δ)		
	$\Delta IOJ \,\|\|\| \,\Delta IHK$	($\angle\angle\angle$)		(4)
8.4	$\frac{HK}{OJ} = \frac{IK}{IJ}$	$\Delta IOJ \,\|\|\| \,\Delta IHK$ $\angle\angle\angle$	✓ ST ✓ RE **A**	
	$\frac{10}{5} = \frac{8}{IJ}$		✓Subst. **CA**	
	$IJ = \frac{8 \times 5}{10}$		✓S **CA**	
	$IJ = 4cm$		✓*IJ* **CA**	(5)
				[18]

QUESTION/*VRAAG* 9

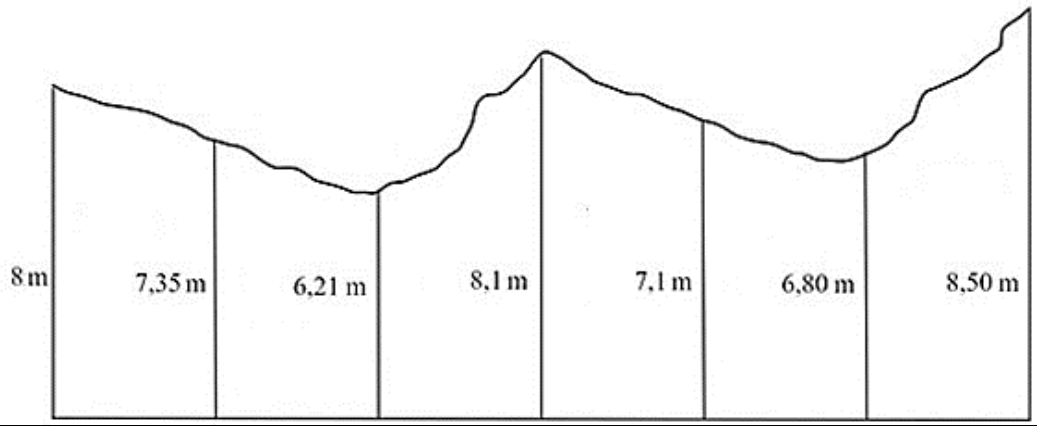
9.1	Parallel/*eweredig*	✓ **ST** **A**	(1)
9.2			
9.2.1	In ΔYPQ $\frac{YR}{RP}=\frac{YS}{SQ}$ $(SR \parallel QP)$ In ΔYXQ $\frac{YP}{PX}=\frac{YS}{SQ}$ $(PS \parallel XQ)$ $\therefore \frac{YR}{RP}=\frac{YP}{PX}$	✓ ST ✓ RE **A** ✓ ST **A**	(3)
9.2.2	In ΔYXQ $\frac{XY}{PY}=\frac{QY}{SY}$ $(XQ \parallel PS)$ In ΔYPQ $\frac{PY}{RY}=\frac{QY}{SY}$ $(SR \parallel QP)$ $\therefore \frac{XY}{PY}=\frac{PY}{RY}$ $XY \cdot RY = PY^2$	✓ ST ✓ RE **A** ✓ ST **A** ✓S **CA**	(4)
			[8]

QUESTION/*VRAAG* 10			
10.1.1	$50\text{ mm} = \frac{50\text{ mm}}{1} \times \frac{1\text{ m}}{1\,000\text{ mm}} = \frac{1}{20}\text{m} = 0{,}05\text{ m}$	✓conv/*herleid* **A** ✓ans/*antw* **CA** ***NPU, NPR***	(2)
10.1.2	$\frac{8000}{1\text{min}} \times \frac{1}{60\text{sec}} = \frac{400}{3} rev/s \approx 133{,}33 rev/s$	✓conv/*herleid* **A** ✓ans/*antw* **CA** ***NPU, NPR***	(2)
10.1.3	$\omega = 2\pi n$ $\omega = 2\pi(133{,}33)$ $\omega \approx 266{,}67\pi\ rad/s$ **OR/*OF*** $\omega \approx 837{,}75\ rad/s$	✓**F** **A** ✓**SF** **CA** ✓Ans/*antw* **CA**	(3)
10.1.4	$v = \pi Dn$ $v = \pi(0{,}05)(133{,}33)$ $v = 6{,}67\pi\ m/s$ $v = 20{,}94\ m/s$	✓F **A** ✓SF **CA** ✓Ans/*antw.* **CA** ✓unit/*eenhede* **A**	(4)
10.2.1	$38^\circ \times \frac{\pi}{180^\circ} = \frac{19\pi}{90} rad$ $\approx 0{,}66 rad$	✓Ans/*antw.* **A** ***NPU, NPR***	(1)
10.2.2	$s = r\theta$ $r = \frac{s}{\theta} = \frac{15}{\left(19\pi/90\right)}$ $OP = 22{,}62m$	✓F **A** ✓**SF** **CA** ✓Ans/*antw.* **CA**	(3)
10.2.3	*Area of* sector $OPQ = \frac{1}{2}r^2\theta$ $= \frac{1}{2} \times (22{,}62)^2 \times \left(\frac{19\pi}{90}\right)$ $= 169{,}67m^2$ **OR/*OF***	✓F **A** ✓SF **CA** ✓Area/*Oppervl.* **CA** ***NPU, NPR*** **AO Full marks**	

	Area of sector/*van sektor OPQ* $= \frac{rs}{2}$ $= \frac{22,62 \times 15}{2}$ $= 169,65\ m^2$	✓F **A** ✓SF **CA** ✓Area/*Oppervl.* **CA** ***NPU, NPR*** **AO Full marks**	(3)
10.3	$4h^2 - 4dh + x^2 = 0$ $h = 5cm, d = 23cm$ $4(5)^2 - 4(23)(5) + x^2 = 0$ $x^2 = 460 - 100$ $x^2 = 360$ $x = \pm\sqrt{360}$ $x = 18,97cm$	✓F **A** ✓SF **CA** ✓**S** **CA** ✓*Ans/Antw.* **A**	(4)
			[22]

QUESTION/*VRAAG* 11

11.1



$A_T = a\left(\frac{o_1 + o_7}{2} + o_2 + o_3 + o_4 + o_5 + o_6\right)$

$= \frac{36}{6}\left(\frac{8 + 8{,}5}{2} + 7{,}35 + 6{,}21 + 8{,}1 + 7{,}5 + 6{,}8\right)$

$= 6\left(\frac{4\,421}{100}\right)$

$= 265{,}26\ m^2$

✓F **A**
✓SF **A**
✓$a = \frac{36}{6}$ **A**
✓S **CA**
✓Area/*Oppervl.* **CA**

OR/*OF*

$A_T = a(m_1 + m_2 + m_3 + m_4 + \ldots\ldots + m_n)$

$= \frac{36}{6}\left(\frac{8+7{,}35}{2} + \frac{7{,}35+6{,}21}{2} + \frac{6{,}21+8{,}1}{2} + \frac{8{,}1+7{,}5}{2} + \frac{7{,}5+6{,}8}{2} + \frac{6{,}8+8{,}5}{2}\right)$

$= 6\left(\frac{4\,421}{100}\right)$

$= 265{,}26\ m^2$

✓F **A**
✓SF **A**
✓$a = \frac{36}{6}$ **A**
✓S **CA**
✓Area/*Oppervl.* **CA** (5)

11.2.1

Area of rectangular prism/
oppervlakte van reghoekige prisma = $2lh + 2lw + 2wh$

$1\,790 = (50 \times x) + 2(8 \times x) + 2(8 \times 50)$ (one side is open/een kant is oop)

$1\,790 = 50x + 16x + 800$

$66x = 1\,790 - 800$

$x = \frac{990}{66}$

$x = 15$ cm

✓SF **A**
✓S **CA**
✓value of/*waarde van x* **CA** (3)

11.2.2	Volume of cylinder $= \pi r^2 h$ Vol. of/*van* $\frac{1}{4}$ *c*ircle/*sirkel* $= \frac{1}{4}\pi r^2 h$ $= \frac{1}{4} \times \pi \times (15)^2 \times 50$ $= 8\,835{,}72\ cm^3$	✓**F** **A** ✓Subst. **CA** ✓Ans/*Antw.* **CA**	(3)
			[11]
		TOTAL /*TOTAAL*:	**150**