ANALITIESE MEETKUNDE

Oplossings

Die DBE se eie nasienriglyne, in boekvolgorde

Elke oplossing hier is 'n uitknipsel van die amptelike DBE-nasienriglyn wat saam met die vraestel gepubliseer is waaruit die vraag kom. Die bewerking, die punt-merke en die aanvaarde alternatiewe is die DBE se eie. Niks is oorgeskryf of oor afgelei nie.

Die nommers pas by die vraeboek: oplossing 34 antwoord vraag 34, en die hoofstukke is in dieselfde volgorde.

Die DBE skryf een riglyn vir albei tale, so hierdie bladsye is tweetalig en hul nasienaantekeninge is grootliks in Engels. Dit is die DBE se eie bladsy, presies soos gedruk weergegee.

'n Nasienriglyn word vir nasieners geskryf, nie vir leerders nie. Dit wys die kortste pad na die punte, so waar 'n stap saamgepers lyk, is dit die riglyn wat bondig is eerder as 'n stap wat ontbreek.

1. 'n Regte hoek by Q, en 'n lyn ewewydig aan LQ getrek

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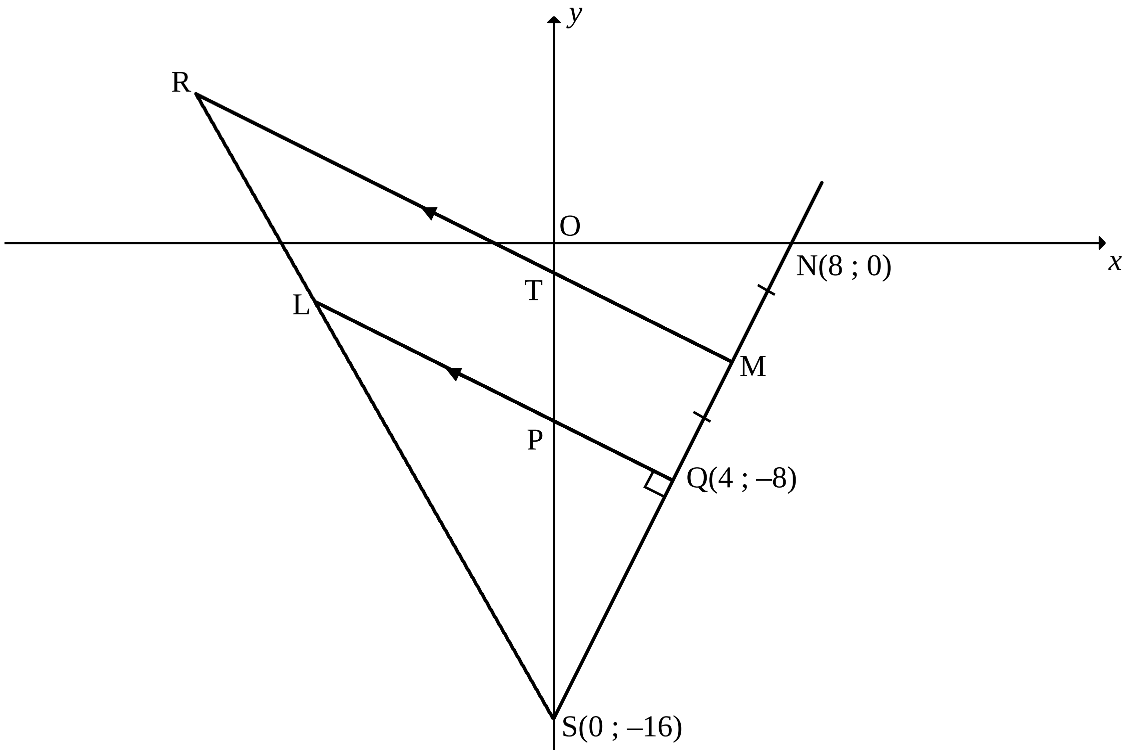
QUESTION/VRAAG 3



3.1	$M\left(\frac{4+8}{2};\frac{-8+0}{2}\right)$ $M(6;-4)$	✓ x_M ✓ y_M (2)
3.2	$m_{NS}=\frac{0-(-16)}{8-0}$ or $m_{NQ}=\frac{0-(-8)}{8-4}$ or $m_{QS}=\frac{-8-(-16)}{4-0}$ $=2$	✓ subst N and Q or N and Q or Q and S into gradient formula ✓ answer (2)
3.3	$m_{LQ}\times 2=-1$ [LQ $\perp$ NS] $\therefore m_{LQ}=-\frac{1}{2}$ $-8=-\frac{1}{2}(4)+c$ **OR** $y+8=-\frac{1}{2}(x-4)$ $c=-6$ $y+8=-\frac{1}{2}x+2$ $\therefore y=-\frac{1}{2}x-6$	✓ m_{LQ} ✓ substitution of Q ✓ calculation of *c* or simplification (3)
3.4	OS is the radius of circle passing through S $(x-0)^2+(y-0)^2=(16)^2$ $x^2+y^2=256$ Answer only: Full marks	✓ identifying radius = 16 ✓ Equation of circle (2)

3.5	$m_{\text{RM}} = m_{\text{LQ}} = -\frac{1}{2}$ [RM ∥ LQ] $-4 = -\frac{1}{2}(6) + c$ **OR** $y + 4 = -\frac{1}{2}(x-6)$ $c = -1$ $y + 4 = -\frac{1}{2}x + 3$ $\therefore y = -\frac{1}{2}x - 1$ $\text{T}(0; -1)$	✓ m_{RM} ✓ substitution of $\text{M}(6; -4)$ ✓ coordinates of T (3)
3.6	$\text{T}(0;-1)$, $\text{P}(0;-6)$ and $\text{S}(0;-16)$ ∴ PS = 10 units and TS = 15 units $\frac{\text{LS}}{\text{RS}} = \frac{\text{PS}}{\text{TS}} = \frac{2}{3}$ [prop theorem; RM ∥ LP] **OR** [line ∥ one side of Δ/*lyn* ∥ *een sy v Δ*] Answer only: Full marks **OR** M(6 ; –4), Q(4 ; –8) and S(0 ; –16) MS = $\sqrt{180} = 6\sqrt{5}$ and QS = $\sqrt{80} = 4\sqrt{5}$ $\frac{\text{LS}}{\text{RS}} = \frac{\text{QS}}{\text{MS}} = \frac{2}{3}$ [prop theorem; RM ∥ LQ] **OR** [line ∥ one side of Δ/*lyn* ∥ *een sy v Δ*] Answer only: Full marks	✓ PS = 10 units ✓ TS = 15 units ✓ answer (3) ✓ MS $= 6\sqrt{5}$ units ✓ QS $= 4\sqrt{5}$ units ✓ answer (3)
3.7	area of PTMQ = area of ΔTSM – area of ΔPSQ $= \frac{1}{2}.\text{ST}.\perp h_M - \frac{1}{2}.\text{PS}.\perp h_Q$ $= \frac{1}{2}(15)(6) - \frac{1}{2}(10)(4)$ = 45 – 20 = 25 square units **OR** $\text{TM} = \sqrt{45} = 3\sqrt{5} = 6{,}71$ $\text{MQ} = \sqrt{20} = 2\sqrt{5} = 4{,}47$ $\text{PQ} = \sqrt{20} = 2\sqrt{5} = 4{,}47$ area of trapezium PTMQ = $\frac{1}{2}\left(3\sqrt{5} + 2\sqrt{5}\right)\left(2\sqrt{5}\right)$ $= \frac{1}{2}\left(5\sqrt{5}\right)\left(2\sqrt{5}\right)$ = 25 square units	✓ area of ΔTSM – area of ΔPSQ ✓ area ΔTSM = 45 ✓ area ΔPSQ = 20 ✓ answer (4) ✓ $\text{TM} = 3\sqrt{5}$ $\text{MQ} = 2\sqrt{5}$ $\text{PQ} = 2\sqrt{5}$ ✓ area of trapezium = $\frac{1}{2}$ (sum of ∥sides)(height) ✓ substitute into formula ✓ answer (4)

	OR $MQ=\sqrt{20}=2\sqrt{5}$ $PQ=\sqrt{20}=2\sqrt{5}$ $TP=5$ area of PTMQ= area of ΔMTP+ area of ΔPQM $\boxed{\text{area of PTMQ}=\frac{1}{2}TP\times\perp h_M+\frac{1}{2}MQ\times PQ}$ area of $PTMQ=\frac{1}{2}(5)\times6+\frac{1}{2}\left(2\sqrt{5}\right)\left(2\sqrt{5}\right)$ area of $PTMQ=10+15=25$	✓ area of ΔMTP + area of ΔPQM ✓ area ΔMTP = 10 ✓ area ΔPQM = 15 ✓ answer (4)
		[19]

2. Die gradiënt van DC, dan 'n punt wat daarop moet lê

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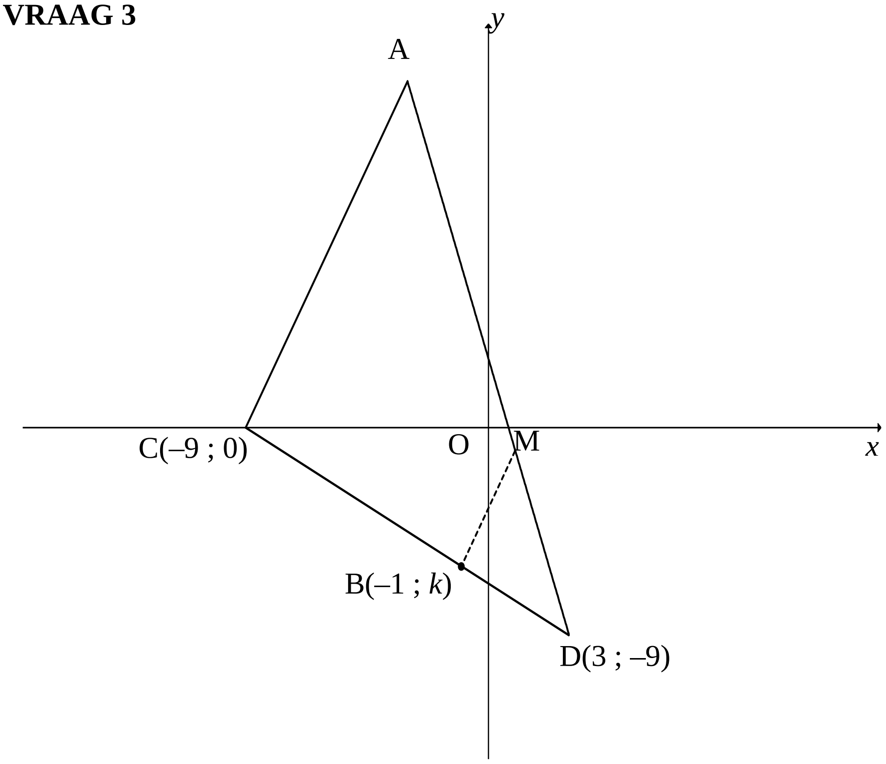
QUESTION / VRAAG 3



3.1	$m_{DC}=\frac{-9-0}{3-(-9)}$ **OR/*OF*** $m_{DC}=\frac{0-(-9)}{-9-3}$ $m_{DC}=-\frac{3}{4}$ $\quad$ $m_{DC}=-\frac{3}{4}$	✓ correct substitution of $D(3;-9)$ & $C(-9;0)$ into gradient formula ✓ answer (2)
3.2	Equation of DC: $0=-\frac{3}{4}(-9)+c$ **OR/*OF*** $y-0=-\frac{3}{4}(x-(-9))$ $c=\frac{-27}{4}$ or $-6\frac{3}{4}$ $\quad$ $y=-\frac{3}{4}(x+9)$ $y=-\frac{3}{4}x-\frac{27}{4}$ $\quad$ $y=-\frac{3}{4}x-\frac{27}{4}$	✓ correct substitution of $C(-9;0)$ or $D(3;-9)$ into equation of line ✓ answer (2)
3.3	$k=-\frac{3}{4}(-1)-\frac{27}{4}$ **OR/*OF*** $\frac{k-(-9)}{-1-3}=\frac{-3}{4}$ **OR/*OF*** $\frac{k-0}{-1-(-9)}=\frac{-3}{4}$ $k=\frac{3}{4}-\frac{27}{4}$ **OR/*OF*** $k+9=3$ **OR/*OF*** $k=-\frac{3}{4}(8)$ $k=-6$ $\quad$ $k=-6$ $\quad$ $k=-6$	✓ substitution of $B(-1;k)$ (1)
3.4	$DC=\sqrt{(3+9)^2+(-9-0)^2}$ DC = 15 units	✓ correct substitution of $D(3;-9)$ & $C(-9;0)$ into distance formula ✓ answer (2)

3.5	$DB=\sqrt{\left(3-(-1)\right)^2+\left(-9-(-6)\right)^2}$ $DB = 5$ $\therefore \frac{DB}{DC}=\frac{5}{15}=\frac{1}{3}$	✓ $DB = 5$ ✓ answer (2)
3.6	$\frac{DM}{DA}=\frac{DB}{DC}=\frac{1}{3}$ $\frac{\text{Area } \Delta MBD}{\text{Area } \Delta ACD}=\frac{\frac{1}{2}(DM)(DB)\left(\sin\hat{D}\right)}{\frac{1}{2}(DA)(DC)\left(\sin\hat{D}\right)}$ $=\frac{1}{3}\times\frac{1}{3}$ $=\frac{1}{9}$	✓ $\frac{DM}{DA}=\frac{DB}{DC}$ ✓ correct use of area rule ✓ subst. for $\frac{BD}{DC}$ and $\frac{DM}{DA}$ into correct formula ✓ answer (4)
3.7	$y = -4x + c$ $m_{AD} = -4$ $-9=-4(3)+c$ **OR/*OF*** $\frac{y+9}{x-3}=-4$ $c = 3$ $\quad$ $y+9=-4x+12$ $y=-4x+3$ $\quad$ $y=-4x+3$ $(x-3)^2+(y+9)^2=612$ $(x-3)^2+(-4x+3+9)^2=\left(\sqrt{612}\right)^2$ $(x-3)^2+(-4x+12)^2=612$ $x^2-6x+9+16x^2-96x+144=612$ $17x^2-102x-459=0$ $x^2-6x-27=0$ $(x-9)(x+3)=0$ $x=9$ or $x=-3$ N/A $y = -4(-3) + 3$ $y = 15$ $A(-3;15)$	✓ correct substitution of $m_{AD} = -4$ and D(3 ; –9) ✓ $(x-3)^2+(y+9)^2=612$ ✓ substitution of equation AD into distance formula ✓ standard form ✓ x values with rejection ✓ y coordinate (6)

	OR/*OF* $-9=-4(3)+c$ $c=3$ $y=-4x+3$ N(0 ; 3) ND $=\sqrt{(3-0)^2+(-9-3)^2}$ $=3\sqrt{17}$ AD $=6\sqrt{17}$ $\text{ND}=\frac{1}{2}\text{AD}$ N is the midpoint of AD A(–3 ; 15)	**OR/*OF*** ✓ correct substitution of $m_{AD}=-4$ and D(3 ; –9) ✓ N(0 ; 3) ✓ substitution into distance formula to calculate ND ✓ $\text{ND}=\frac{1}{2}\text{AD}$ ✓ x – value ✓ y – value (6)
		[19]

3. 'n Middelpunt, 'n hellingshoek, en 'n ewewydige driehoek

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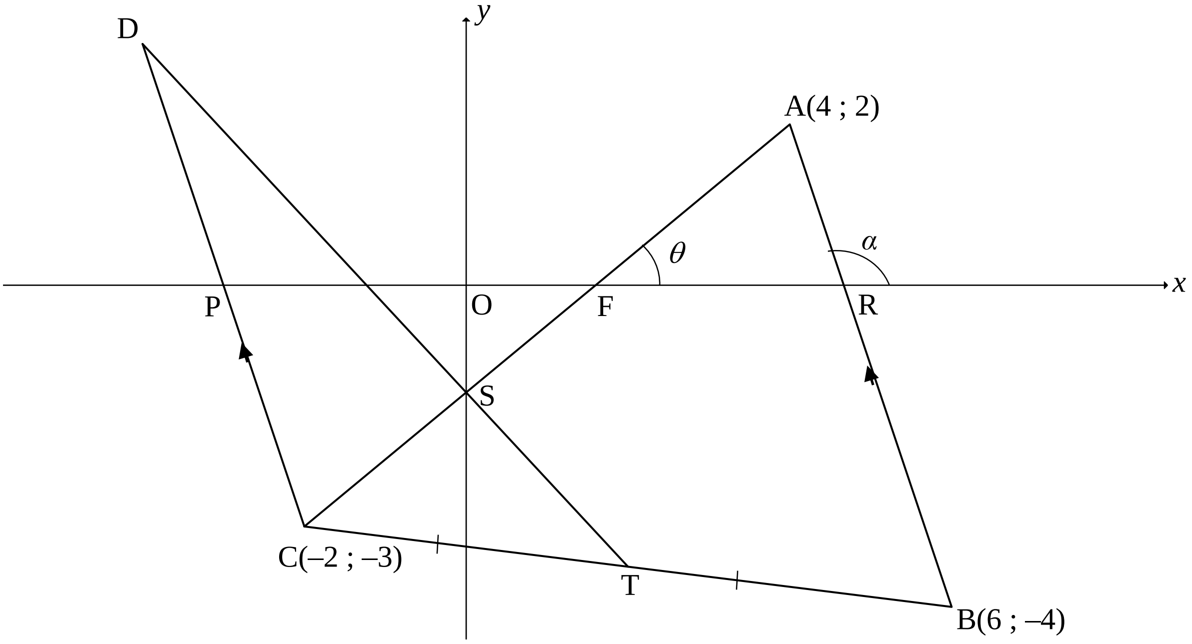
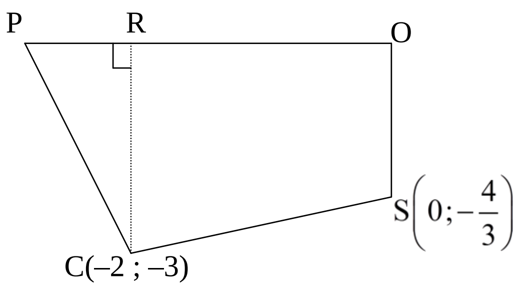
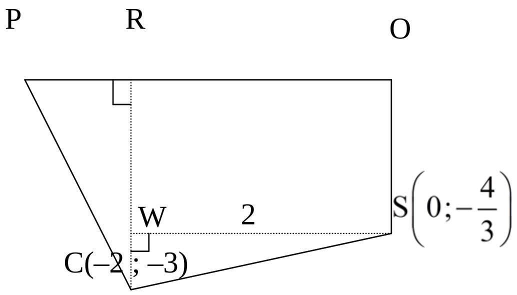
QUESTION/*VRAAG* 3



3.1.1	$m_{AB}=\frac{2-(-4)}{4-6}$ **OR** $m_{AB}=\frac{-4-2}{6-4}$ $m_{AB}=-3$ ANSWER ONLY: Full marks	✓ substitution ✓ answer (2)
3.1.2	$\tan\alpha=m_{AB}=-3$ $\alpha=108{,}43°$ ANSWER ONLY: Full marks	✓ $\tan\alpha=m_{AB}=-3$ ✓ answer (2)
3.1.3	$T\left(\frac{x_1+x_2}{2};\frac{y_1+y_2}{2}\right)$ $T\left(\frac{-2+6}{2};\frac{-3-4}{2}\right)$ $T\left(2\ ;\frac{-7}{2}\right)$	✓ $x_T=2$ ✓ $y_T=\frac{-7}{2}$ (2)
3.1.4	$5(0)-6y=8$ $y=-\frac{4}{3}$ $S\left(0;\frac{-4}{3}\right)$	✓ $x_S=0$ ✓ $y_S=\frac{-4}{3}$ (2)
3.2	$m_{CD}=m_{AB}=-3$ $-3=-3(-2)+c$ OR $y-(-3)=-3(x-(-2))$ $c=-9$ $\quad$ $y=-3x-9$ $y=-3x-9$	✓ gradient ✓ substitution of C(–2 ; –3) ✓ equation (3)

3.3.1	$5x-6y=8$ $y=\frac{5}{6}x-\frac{8}{6}$ $\tan\theta=m_{AC}=\frac{5}{6}$ $\theta=39{,}81°$ $\hat{A}=108{,}43°-39{,}81°$ $=68{,}62°$ $D\hat{C}A=68{,}62°$ [alt ∠s ; DC‖AB]	✓ $\tan\theta=m_{AC}=\frac{5}{6}$ ✓ $\theta=39{,}81°$ ✓ $\hat{A}=68{,}62°$ ✓ answer (4)
3.3.2	$P(-3;0)$ and F(1,6 ; 0) Area POSC = Area ΔFPC – Area ΔOFS $=\frac{1}{2}(4{,}6)(3)-\frac{1}{2}(1{,}6)\left(\frac{4}{3}\right)$ = 6,9 – 1,07 = 5,83 units^2 **OR/*OF*** $P(-3;0)$ $FC=\sqrt{\left(-2-\frac{8}{5}\right)^2+(-3-0)^2}=\frac{3\sqrt{61}}{5}$ $\text{Area }\Delta PFC=\frac{1}{2}(PF)(FC)\sin O\hat{F}S$ $=\frac{1}{2}\left(\frac{23}{5}\right)\left(\frac{3\sqrt{61}}{5}\right)\sin 39{,}81°$ $=6{,}90$ $\text{Area }\Delta OFS=\frac{1}{2}\left(\frac{8}{5}\right)\left(\frac{4}{3}\right)$ = 1,07 Area POSC = 6,90 – 1,07 = 5,83 units^2 **OR/*OF***	✓ $P(-3;0)$ ✓ method ✓ $\frac{1}{2}(4{,}6)(3)$ ✓ $\frac{1}{2}(1{,}6)\left(\frac{4}{3}\right)$ ✓ answer (5) ✓ $P(-3;0)$ ✓ $\frac{1}{2}\left(\frac{23}{5}\right)\left(\frac{3\sqrt{61}}{5}\right)\sin 39{,}81°$ ✓ $\frac{1}{2}\left(\frac{8}{5}\right)\left(\frac{4}{3}\right)$ ✓ method ✓ answer (5)

		
	$P(-3;0)$	✓ $P(-3;0)$
	Area of POSC = Area of OSCR + Area of ΔPRC	✓ method
	$=\frac{1}{2}\left(\frac{4}{3}+3\right)\times 2+\frac{1}{2}(1\times 3)$	✓ $\frac{1}{2}\left(\frac{4}{3}+3\right)\times 2$ ✓ $\frac{1}{2}(1\times 3)$
	$=\frac{35}{6}$	
	$=5,83\text{units}^2$	✓ answer
		(5)
	OR/ ***OF***	
		
	$P(-3;0)$	✓ $P(-3;0)$
	Area POSC = Area ROSW + Area ΔPRC + Area ΔWSC	✓ method
	$=\left(\frac{4}{3}\right)(2)+\frac{1}{2}(1)(3)+\frac{1}{2}(2)\left(\frac{5}{3}\right)$	✓ $\frac{1}{2}(1)(3)$ ✓ $\left(\frac{4}{3}\right)(2)+\frac{1}{2}(2)\left(\frac{5}{3}\right)$
	$=\frac{35}{6}$	
	$=5,83\text{units}^2$	✓ answer
		(5)
	OR/*OF*	

	$P(-3;0)$ Area of $\Delta PSC = \frac{1}{2}(PC)(CS)\sin D\hat{C}A$ $= \frac{1}{2}\left(\sqrt{10}\right)\left(\frac{\sqrt{61}}{3}\right)\sin 68,62°$ = 3,833.. Area of $\Delta POS = \frac{1}{2}(PO)(OS)$ $= \frac{1}{2}(3)\left(\frac{4}{3}\right)$ = 2 Area POSC = 3,833… + 2 $= 5,83 \text{units}^2$	✓ $P(-3;0)$ ✓ $\frac{1}{2}\left(\sqrt{10}\right)\left(\frac{\sqrt{61}}{3}\right)\sin 68,62°$ ✓ $\frac{1}{2}(3)\left(\frac{4}{3}\right)$ ✓ method ✓ answer (5)
		[20]

4. 'n Regte hoek by L, en waar LN die x-as sny

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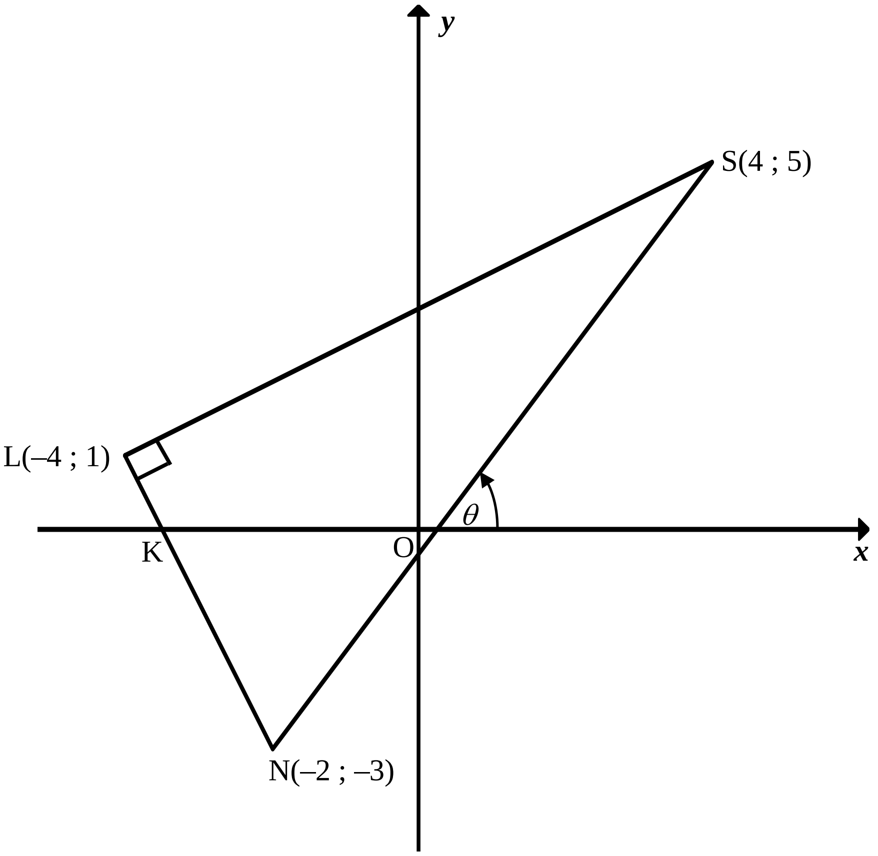
QUESTION/*VRAAG 3*



3.1	$SL = \sqrt{(x_S - x_L)^2 + (y_S - y_L)^2}$ $SL = \sqrt{(4-(-4))^2 + (5-1)^2}$ $SL = \sqrt{80} = 4\sqrt{5} = 8{,}94$ units	✓ substitution of S and L into correct formula ✓ answer (2)
3.2	$m_{SN} = \dfrac{5-(-3)}{4-(-2)}$ $m_{SN} = \dfrac{4}{3}$	✓ substitution of S and N into correct formula ✓ answer (2)
3.3	$m = \tan\theta = \dfrac{4}{3}$ $\theta = 53{,}13°$	✓ $\tan\theta = m_{SN}$ ✓ answer (2)
3.4	$m_{LN} = \dfrac{1-(-3)}{-4-(-2)}$ $m_{LN} = -2$ $L\hat{K}O = 116{,}565...°$ $L\hat{N}S = 116{,}565...° - 53{,}13°$ $L\hat{N}S = 63{,}44°$	✓ $m_{LN} = -2$ ✓ size of $L\hat{K}O$ ✓ answer (3)

	OR SN = 10 units $\sin L\hat{N}S = \frac{4\sqrt{5}}{10}$ $L\hat{N}S = 63{,}44°$	✓ SN = 10 units ✓ correct trig ratio ✓ answer (3)
	OR $LN = 2\sqrt{5}$ units $\tan L\hat{N}S = \frac{4\sqrt{5}}{2\sqrt{5}}$ $L\hat{N}S = 63{,}44°$	✓ $LN = 2\sqrt{5}$ units ✓ correct trig ratio ✓ answer (3)
	OR SN = 10 units $LN = 2\sqrt{5}$ units $\cos L\hat{N}S = \frac{2\sqrt{5}}{10}$ $L\hat{N}S = 63{,}44°$	✓ SN = 10 units and $LN = 2\sqrt{5}$ units ✓ correct trig ratio ✓ answer (3)
3.5	$m = \frac{4}{3}$ $1 = \frac{4}{3}(-4) + c$ **OR** $y - 1 = \frac{4}{3}(x - (-4))$ $c = \frac{19}{3}$ $y - 1 = \frac{4}{3}x + \frac{16}{3}$ $y = \frac{4}{3}x + \frac{19}{3}$ $y = \frac{4}{3}x + \frac{19}{3}$	✓ m_{SN} ✓ substitution of m_{SN} & L ✓ equation (3)
3.6	$SL = 4\sqrt{5}$ $LN = \sqrt{(-4-(-2))^2 + (1-(-3))^2}$ $LN = \sqrt{20} = 2\sqrt{5}$ Area $\Delta LSN = \frac{1}{2}(4\sqrt{5})(2\sqrt{5})$ $= 20 \text{ units}^2$ **OR**	✓ $LN = \sqrt{20} = 2\sqrt{5}$ ✓ substitution into formula ✓ answer (3)

	SN = 10 units LN = $\sqrt{\left(-4-(-2)\right)^2+\left(1-(-3)\right)^2}$ LN = $\sqrt{20} = 2\sqrt{5}$ Area ΔLSN = $\frac{1}{2}(10)\left(2\sqrt{5}\right)\sin 63{,}44°$ = 20 units^2	✓ LN = $\sqrt{20} = 2\sqrt{5}$ ✓ substitution into formula ✓ answer (3)
3.7	$\hat{L} = 90°$ SN is a diameter of circle S, L, N [chord subtends 90° **OR** converse $\angle$ in semi-circle] Centre of circle = P$\left(\frac{4+(-2)}{2};\frac{5+(-3)}{2}\right)$ = P$(1\,;1)$ **OR** Let the coordinates of P be (a ; b). Then, PL = PN: $(-4-a)^2+(1-b)^2=(-2-a)^2+(-3-b)^2$ $a-2b=-1$ …..equation 1 If PS = PN, then: $4a+2b=6$………….. equation 2 Solving simultaneously yields: $a=1$ and $b=1$ and P$(1\,;1)$ **OR** If PL = PN, then: $a-2b=-1$ …..equation 1 If PS = PL, then: $2a+b=3$.....equation 2 Solving simultaneously yields: $a=1$ and $b=1$ and P$(1\,;1)$	✓ SN is a diameter of circle S, L, N ✓ x-value ✓ y-value (3) ✓ 2 correct linear equations ✓ x-value ✓ y-value (3) ✓ 2 correct linear equations ✓ x-value ✓ y-value (3)
3.8	L$\hat{P}$N = $\theta = 53{,}13°$ [alt $\angle$s; LP ‖ x –axis] $\therefore$ L$\hat{P}$S = 126,87° **OR** L$\hat{N}$S = 63,44° $\therefore$ L$\hat{P}$S=126,88° [$\angle$ at centre = 2 ×$\angle$ at circumference] **OR** L$\hat{S}$N = 26,56° [sum of $\angle$s in Δ] S$\hat{L}$P = 26,56° [$\angle$s opp equal radii] $\therefore$ L$\hat{P}$S = 126,88° [sum of $\angle$s in Δ] **OR** $\left(4\sqrt{5}\right)^2 = 5^2+5^2-2(5)(5)\cos \mathrm{L\hat{P}S}$ $\cos \mathrm{L\hat{P}S} = -\frac{3}{5}$ $\therefore$ L$\hat{P}$S = 126,87°	✓ L$\hat{P}$N ✓ answer (2) ✓ L$\hat{N}$S ✓ answer (2) ✓ L$\hat{S}$N ✓ answer (2) ✓ correct substitution into cosine formula ✓ answer (2)
		[20]

5. 'n Trapesium met een paar ewewydige sye

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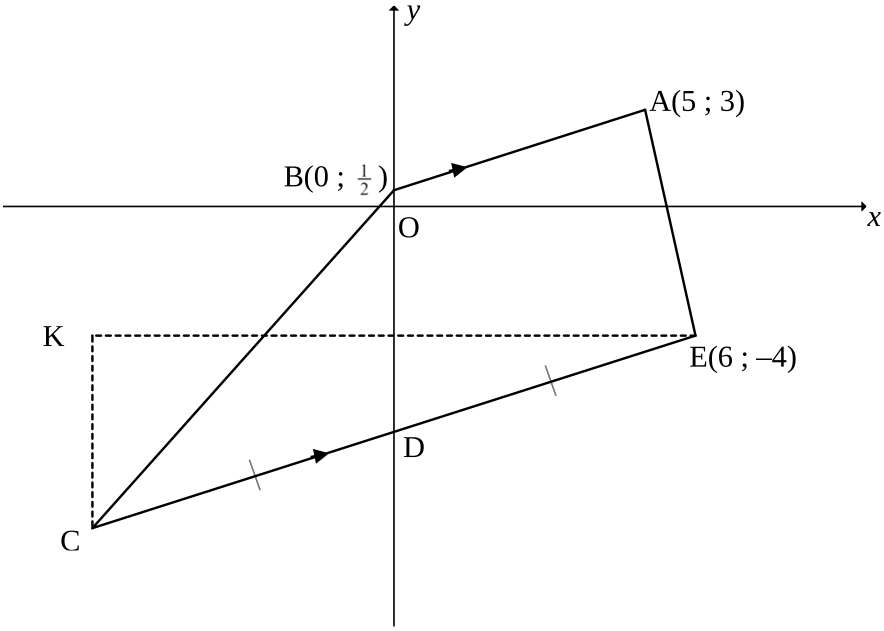
QUESTION/*VRAAG* 3



3.1	$m_{AB} = \dfrac{3-\frac{1}{2}}{5-0}$ $m_{AB} = \dfrac{1}{2}$ Answer only 2/2	✓ substitution ✓ answer (2)
3.2	$m_{CE} = m_{BA} = \dfrac{1}{2}$ $-4 = \dfrac{1}{2}(6) + c$ **OR/*OF*** $y-(-4) = \dfrac{1}{2}(x-6)$ $c = -7$ $y = \dfrac{1}{2}x - 7$	✓ gradient ✓ substitution of E ✓ answer (3)
3.3.1	D(0 ; –7) $\dfrac{x_C + 6}{2} = 0$ $\dfrac{y_C + (-4)}{2} = -7$ $x_C = -6$ $y_C = -10$ C(–6 ; –10) Answer only 3/3	✓ D(0 ; –7) ✓ $x_C = -6$ ✓ $y_C = -10$ (3)
3.3.2	Area Δ BCD $= \dfrac{1}{2}(7{,}5)(6)$ $= 22{,}5$ Area Δ ABD $= \dfrac{1}{2}(7{,}5)(5)$ $= 18{,}75$ Area ABCD $= 22{,}5 + 18{,}75 = 41{,}25$ units^2	✓ subst of correct base and height into the area formula ✓ area ΔBCD = 22,5 ✓ area ΔABD = 18,75 ✓ answer (4)

3.4.1	K(–6 ; –4)	✓ $x_K = -6$ ✓ $y_K = -4$ (2)
3.4.2a	KC = 6 units; KE = 12 units; $CE = \sqrt{(6)^2 + (12)^2}$ [Pythagoras] $CE = \sqrt{180} = 6\sqrt{5} = 13,42$ Perimeter ΔKEC = 6 + 12 + $\sqrt{180}$ = 31,42 units	✓ KC = 6 units ✓ KE = 12 units ✓ CE ✓ answer (4)
3.4.2b	$\tan K\hat{C}E = \frac{KE}{KC} = \frac{12}{6} = 2$ $K\hat{C}E = 63{,}43°$ **OR/*OF*** $\sin K\hat{C}E = \frac{KE}{CE} = \frac{12}{\sqrt{180}} = \frac{2\sqrt{5}}{5}$ $K\hat{C}E = 63{,}43°$ **OR/*OF*** $m_{CE} = \frac{1}{2}$ $\tan\theta = \frac{1}{2}$ $\theta = 26{,}57°$ $K\hat{C}E = 90° - 26{,}57°$ $K\hat{C}E = 63{,}43°$ **OR/*OF*** $KE^2 = KC^2 + CE^2 - 2(KC)(CE)\cos K\hat{C}E$ $(12)^2 = (6)^2 + (\sqrt{180})^2 - 2(6)(\sqrt{180})(\cos K\hat{C}E)$ $\cos K\hat{C}E = \frac{\sqrt{5}}{5}$ $K\hat{C}E = 63{,}43°$	✓ trig ratio ✓ $\tan K\hat{C}E = 2$ ✓ answer (3) ✓ trig ratio ✓ $\sin K\hat{C}E = \frac{12}{\sqrt{180}}$ ✓ answer (3) ✓ $\tan\theta = \frac{1}{2}$ ✓ $\theta = 26{,}57°$ ✓ answer (3) ✓ substitution into cosine rule ✓ trig ratio ✓ answer (3)
		[21]

6. 'n Hele driehoek gebou uit een lyn se vergelyking

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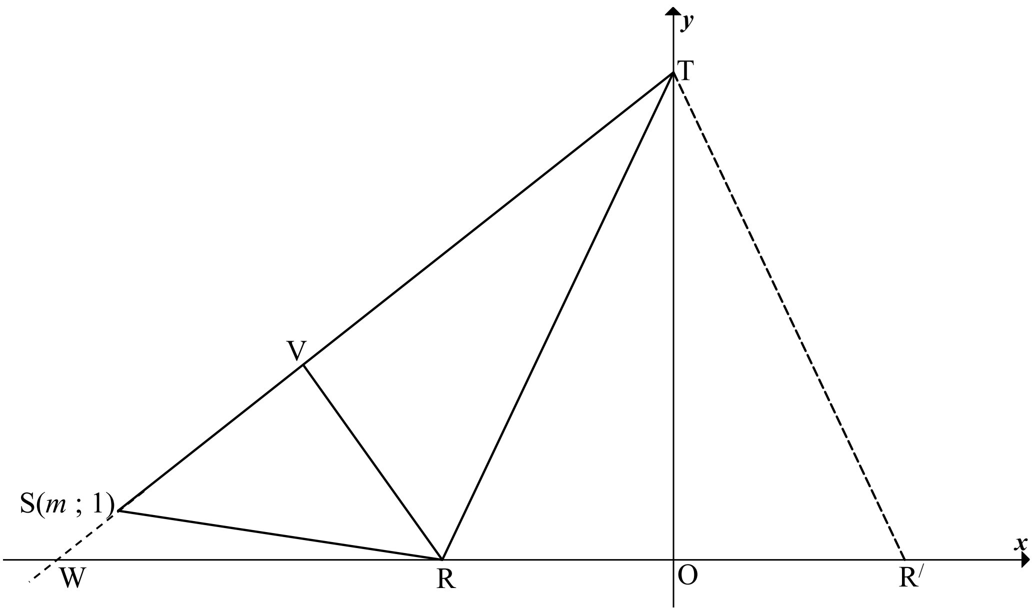
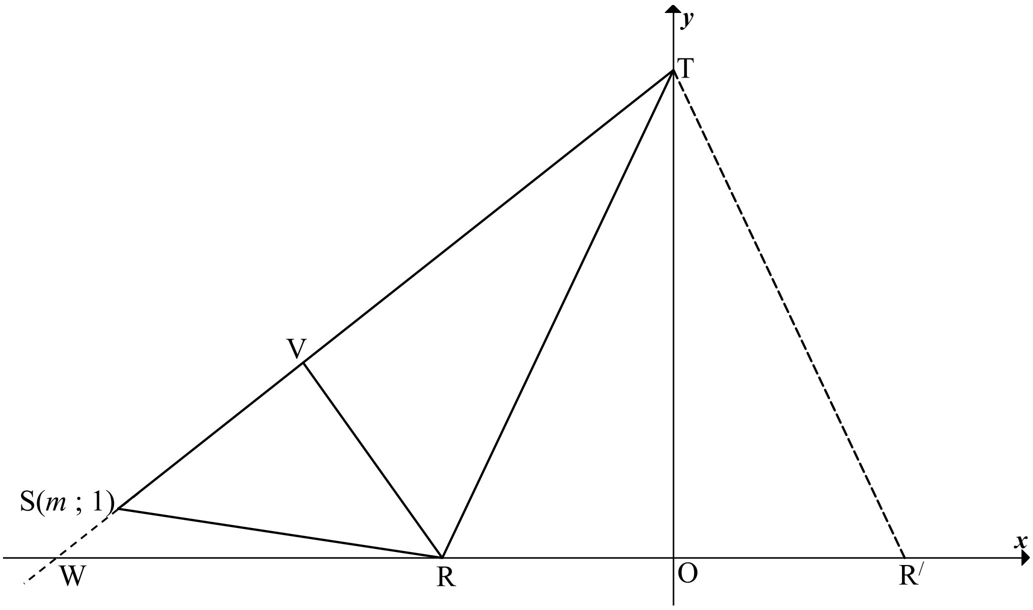
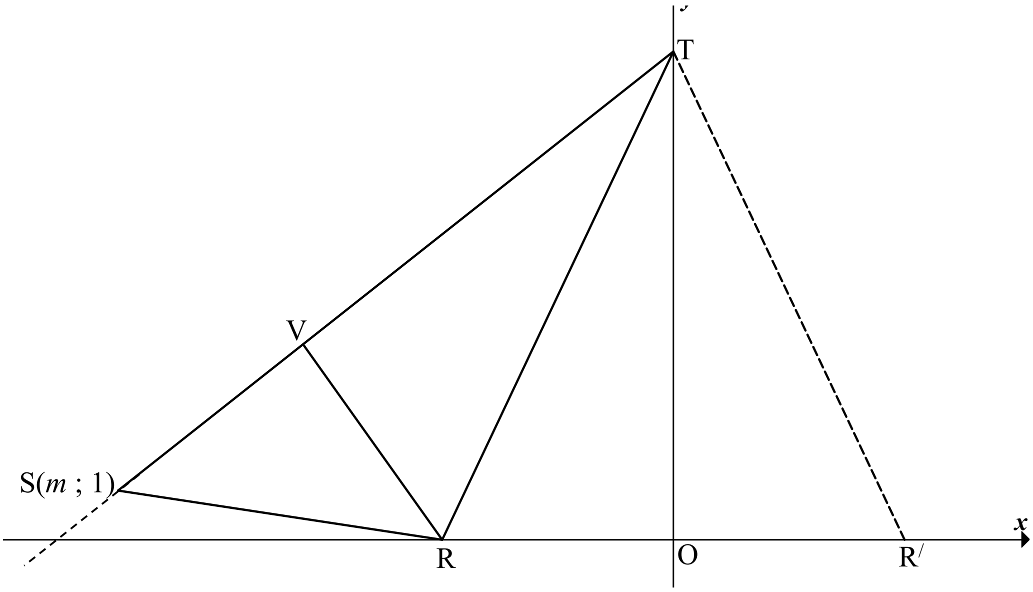
QUESTION/*VRAAG* 3



3.1	$2x - y + 10 = 0$ $2x - 0 + 10 = 0$ $x = -5$ R(–5 ; 0)	✓ $y = 0$ ✓ $x = -5$ (2)
3.2	R(–5 ; 0) T(0 ; 10) $(RT)^2 = (-5-0)^2 + (0-10)^2$ **OR** $(RT)^2 = 5^2 + 10^2$ (Pythag) $RT = \sqrt{125}$ units **OR/*OF*** $RT = 5\sqrt{5}$ units	✓ T(0 ; 10) ✓ subst of R & T into distance formula or Pythagoras ✓ answer (3)
3.3	$2RT^2 = 5SR^2$ $2(125) = 5[(m-(-5))^2 + (1-0)^2]$ $5[(m+5)^2 + (1)^2] = 250$ $(m+5)^2 + 1 = 50$ $m^2 + 10m - 24 = 0$ **OR/*OF*** $(m+5)^2 = 49$ $(m-2)(m+12) = 0$ $\quad m + 5 = \pm 7$ $m = -5 \pm 7$ $m = 2$ or $m = -12$ $\quad m = 2$ or $m = -12$ N/A $\quad$ N/A $\therefore m = -12$ $\quad \therefore m = -12$	✓ length of $2RT^2$ ✓ length of $5SR^2$ ✓ standard form or isolating square ✓ negative answer (4)

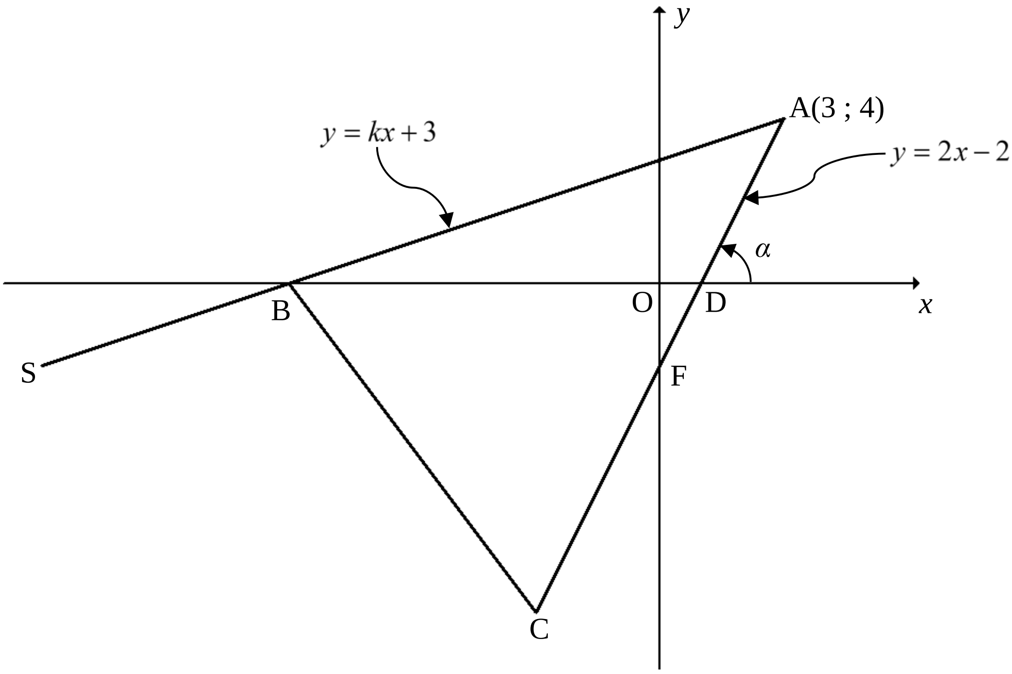


3.4	$m_{ST} = \frac{1-10}{-12-0}$ $m_{ST} = \frac{3}{4}$ $\therefore m_{VR} = -\frac{4}{3}$ $y = -\frac{4}{3}x + c$ **OR/*OF*** $y - y_1 = -\frac{4}{3}(x - x_1)$ $0 = -\frac{4}{3}(-5) + c$ $\quad$ $y - 0 = -\frac{4}{3}(x - (-5))$ $c = -\frac{20}{3}$ $\quad$ $y = -\frac{4}{3}(x+5)$ $y = -\frac{4}{3}x - \frac{20}{3}$ $\quad$ $y = -\frac{4}{3}x - \frac{20}{3}$	✓ substitution of S & T into gradient formula ✓ m_{ST} ✓ $m_{VR} = -\frac{1}{m_{ST}}$ ✓ substitution of R ✓ equation (5)
3.5	VR: $y = -\frac{4}{3}x - \frac{20}{3}$ ST: $y = \frac{3}{4}x + 10$ $\frac{3}{4}x + 10 = -\frac{4}{3}x - \frac{20}{3}$ $9x + 120 = -16x - 80$ $25x = -200$ $x = -8$ $y = 4$ $\therefore V(-8 ; 4)$	✓ equating VR and ST ✓ simplification leading to $x = -8$ (2)



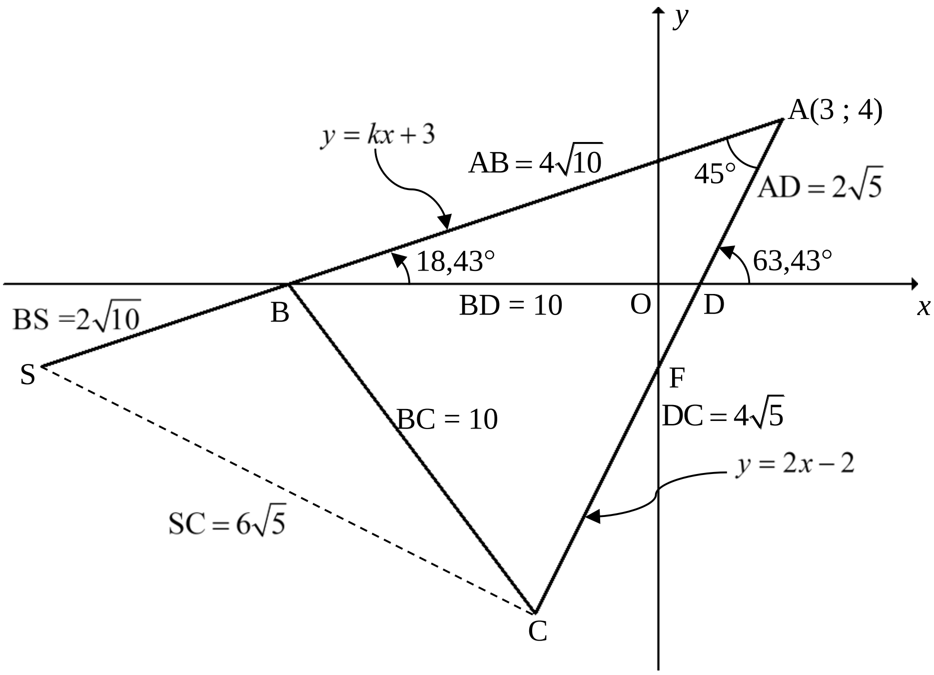
3.6	$R'(5;0)$ $VR = \sqrt{[-8-(-5)]^2+(4-0)^2} = 5$ $VT = \sqrt{(-8-0)^2+(4-10)^2} = 10$ Area of $RVTR' = \frac{1}{2}(VR)(VT) + \frac{1}{2}(RR')(OT)$ $= \frac{1}{2}(5)(10) + \frac{1}{2}(10)(10)$ $= 25 + 50$ $= 75 \text{ units}^2$ **OR/*OF*** ST: $y = \frac{3}{4}x + 10$ $0 = \frac{3}{4}x + 10$ $x = -\frac{40}{3}$ or $-13\frac{1}{3}$ $W\left(-\frac{40}{3}\ ;\ 0\right)$ $WR' = 5 - \left(-\frac{40}{3}\right) = \frac{55}{3} = 18\frac{1}{3}$ Area of $RVTR'$ = Area of $\Delta TWR'$ − Area of ΔWVR $= \frac{1}{2}\left(5+\frac{40}{3}\right)(10) - \frac{1}{2}\left(-5+\frac{40}{3}\right)(4)$ $= 75 \text{ units}^2$	✓ length of VR ✓ length of VT ✓ area ΔVRT ✓ area $\Delta RTR'$ ✓ answer (5) ✓ x-intercept of ST ✓ length of WR' ✓ area $\Delta TWR'$ ✓ area ΔWVR ✓ answer (5)
		[21]

QUESTION/*VRAAG* 3



3.1	$y = kx + 3$ $4 = k(3) + 3$ $3k = 1$ $\therefore k = \frac{1}{3}$ **OR** y-intercept of AB: (0 ; 3) $m_{AB} = \frac{4-3}{3-0}$ $= \frac{1}{3}$ $\therefore k = \frac{1}{3}$	✓ substitution (3 ; 4) (1) ✓ substitution (0 ; 3) (1)
3.2	$0 = \frac{1}{3}x + 3$ $-3 = \frac{1}{3}x$ $x = -9$ $B(-9\ ;\ 0)$	✓ $y = 0$ ✓ answer (2)

3.3	$F(0\,;-2)$ $F\left(\frac{x+3}{2}\ ;\ \frac{y+4}{2}\right)$ $\frac{x+3}{2}=0 \qquad \frac{y+4}{2}=-2$ $x=-3 \qquad y=-8$ $C(-3\,;-8)$	✓ $F(0\,;-2)$ ✓ $\frac{x+3}{2}=0\ ;\ \frac{y+4}{2}=-2$ ✓ x-value ✓ y-value (4)
	OR by translation $F(0;-2)$ $A\rightarrow F\ (x;y)\rightarrow(x-3;y-6)$ $F\rightarrow C(0;-2)\rightarrow(0-3;-2-6)=(-3;-8)$	✓ $F(0;-2)$ ✓ $(x-3\ ;y-6)$ ✓ x-value ✓ y-value (4)
3.4	$m_{BC}=\frac{0-(-8)}{-9-(-3)}$ OR $m_{BC}=\frac{-8-0}{-3-(-9)}$ $m_{BC}=-\frac{4}{3}$ $y=-\frac{4}{3}x+c$ $(-2)=-\frac{4}{3}(-15)+c$ $c=-22$ $y=-\frac{4}{3}x-22$	✓ substitution of B and C into the gradient formula ✓ m_{BC} ✓ $m_{line}=m_{BC}$ ✓ substitution of $S(-15;-2)$ ✓ equation (5)
	OR $m_{BC}=\frac{0-(-8)}{-9-(-3)}$ OR $m_{BC}=\frac{-8-0}{-3-(-9)}$ $m_{BC}=-\frac{4}{3}$ $y-y_1=-\frac{4}{3}(x-x_1)$ $y-(-2)=-\frac{4}{3}(x-(-15))$ $y+2=-\frac{4}{3}x-20$ $y=-\frac{4}{3}x-22$	✓ substitution into the gradient formula ✓ m_{BC} ✓ $m_{line}=m_{BC}$ ✓ substitution of $S(-15;-2)$ ✓ equation (5)



3.5	$\tan\alpha = m_{AC} = 2$	✓ $\tan\alpha = m_{AC} = 2$
	$\alpha = 63,43°$	✓ $\alpha = 63,43°$
	$\tan \hat{ABD} = m_{AS} = \frac{1}{3}$	✓ $\tan \hat{ABD} = m_{AS} = \frac{1}{3}$
	$\hat{ABD} = 18,43°$	✓ $\hat{ABD} = 18,43°$
	$\hat{BAC} = \alpha - \hat{ABD}$	
	$\hat{BAC} = 63,43° - 18,43°$	
	$\hat{BAC} = 45°$	✓ answer
		(5)
	OR	
	$AB = \sqrt{(-9-3)^2 + (0-4)^2}$	✓ length of AB
	$AB = 4\sqrt{10}$	
	BD = 10	✓ calculation of remaining 2 lengths
	$AD = \sqrt{(3-1)^2 + (4-0)^2}$	
	$AD = 2\sqrt{5}$	
	$BD^2 = AB^2 + AD^2 - 2AB.AD\cos \hat{BAC}$	✓ substitution into cosine-rule
	$(10)^2 = \left(4\sqrt{10}\right)^2 + \left(2\sqrt{5}\right)^2 - 2\left(4\sqrt{10}\right)\left(2\sqrt{5}\right)\cos \hat{BAC}$	
	$\cos \hat{BAC} = \frac{\sqrt{2}}{2}$	✓ rewriting in terms of $\cos \hat{BAC}$
	$\hat{BAC} = 45°$	✓ answer
		(5)

3.6	A(3 ; 4) and S(–15 ; – 2) $AS=\sqrt{(x_A-x_S)^2+(y_A-y_S)^2}$ $AS=\sqrt{(3-(-15))^2+(4-(-2))^2}$ $AS=\sqrt{360}=6\sqrt{10}=18,97$ $\frac{\text{Area of }\Delta ABD}{\text{Area of }\Delta ASC}=\frac{\frac{1}{2}(BD)(\perp h)}{\frac{1}{2}(AS)(AC)\sin B\hat{A}C}$ $\frac{\text{Area of }\Delta ABD}{\text{Area of }\Delta ASC}=\frac{\frac{1}{2}(10)(4)}{\frac{1}{2}(6\sqrt{10})(6\sqrt{5})\sin 45°}$ $\frac{\text{Area of }\Delta ABD}{\text{Area of }\Delta ASC}=\frac{2}{9}$ **OR** $AS=\sqrt{(3-(-15))^2+(4-(-2))^2}$ $AS=\sqrt{360}=6\sqrt{10}=18,97$ $AB=\sqrt{(-9-3)^2+(0-4)^2}=4\sqrt{10}$ $AD=\sqrt{(3-1)^2+(4-0)^2}=2\sqrt{5}$ $\frac{\text{Area of }\Delta ABD}{\text{Area of }\Delta ASC}=\frac{\frac{1}{2}(AB)(AD)\sin\hat{A}}{\frac{1}{2}(AS)(AC)\sin\hat{A}}$ $=\frac{\frac{1}{2}(4\sqrt{10})(2\sqrt{5})\sin\hat{A}}{\frac{1}{2}(6\sqrt{10})(6\sqrt{5})\sin\hat{A}}$ $=\frac{2}{9}$	✓ $AS=\sqrt{(3-(-15))^2+(4-(-2))^2}$ ✓ length of AS ✓ Area ΔABD ✓ Area ΔASC ✓ answer (5) ✓ $AS=\sqrt{(3-(-15))^2+(4-(-2))^2}$ ✓ length of AS ✓ Area ΔABD ✓ Area ΔASC ✓ answer (5)
		[22]

8. Vind k, dan drie lyne wat almal die x-as sny

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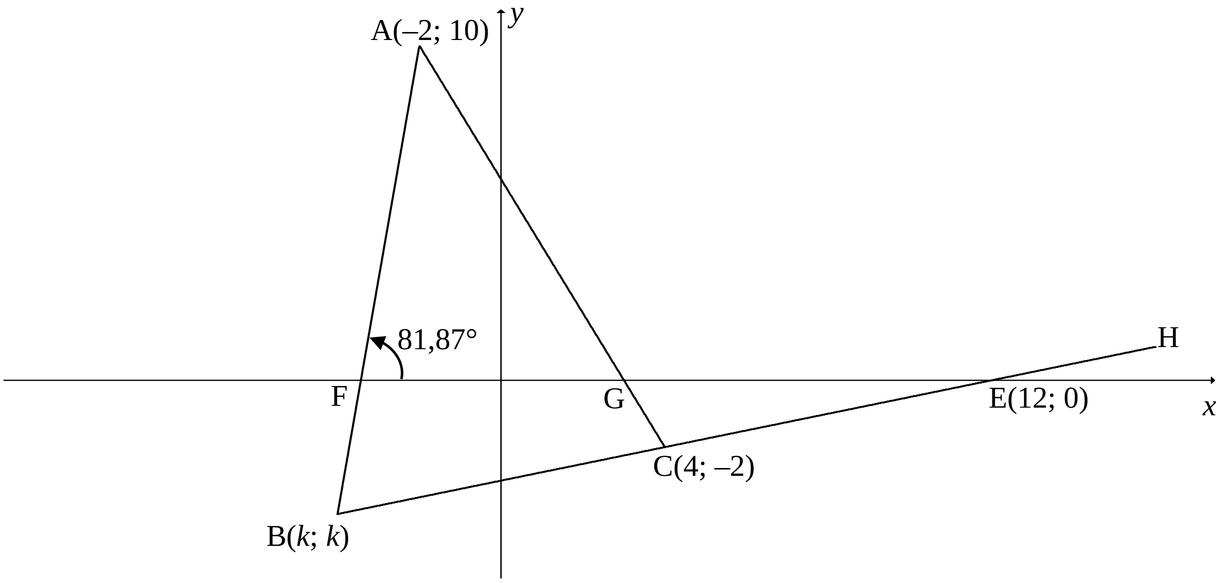
QUESTION/*VRAAG* 3



3.1.1	$m_{BE} = m_{CE} = \frac{0-(-2)}{12-4}$ **OR/*OF*** $m_{BE} = m_{CE} = \frac{-2-0}{4-12}$ $= \frac{1}{4}$ $\qquad= \frac{1}{4}$	✓ substitution C & E ✓ answer (2)
3.1.2	$m_{AB} = \tan 81{,}87°$ $m_{AB} = 7$ Answer only: Full marks *Slegs antw: Volpunte*	✓ substitution ✓ answer (2)
3.2	$y = mx + c$ $\qquad y - y_1 = m(x - x_1)$ $0 = \frac{1}{4}(12) + c$ or $y - 0 = \frac{1}{4}(x - 12)$ $c = -3$ $\qquad y = \frac{1}{4}x - 3$ $y = \frac{1}{4}x - 3$ **OR/*OF*** $y = mx + c$ $\qquad y - y_1 = m(x - x_1)$ $-2 = \frac{1}{4}(4) + c$ or $y - (-2) = \frac{1}{4}(x - 4)$ $c = -3$ $\qquad y = \frac{1}{4}x - 3$ $y = \frac{1}{4}x - 3$	✓ substitution of E ✓ answer (2) ✓ substitution of C ✓ answer (2)

3.3.1	$y=\frac{1}{4}x-3$ $k=\frac{1}{4}k-3$ $\frac{3}{4}k=-3$ $k=-4$ $\therefore$ B(–4; –4) **OR/*OF*** $m_{\text{BE}}=\frac{1}{4}$ **OR/*OF*** $m_{\text{BE}}=\frac{1}{4}$ $\frac{0-k}{12-k}=\frac{1}{4}$ $\frac{k}{k-12}=\frac{1}{4}$ $-4k=12-k$ $4k=k-12$ $k=-4$ $k=-4$ $\therefore$ B(–4; –4) **OR/*OF*** $m_{\text{AB}}=\tan 81{,}87°$ $m_{\text{AB}}=7$ $m_{\text{AB}}=\frac{10-k}{-2-k}$ $7(-2-k)=10-k$ $-14-7k=10-k$ $-6k=24$ $k=-4$ $\therefore$ B(–4; –4) **OR/*OF*** EB: $y=\frac{1}{4}x-3$ and AB: $y=7x+24$ $\frac{1}{4}x-3=7x+24$ $\frac{27}{4}x=-27$ $x=k=-4$ $\therefore$ B(–4; –4)	✓ substitution ✓ answer (2) ✓ substitution ✓ answer (2) ✓ substitution ✓ answer (2) ✓ equating EB & AB ✓ answer (2)

3.3.2	In ΔAFG: $m_{AC} = \frac{10-(-2)}{-2-4} = -2$ $\tan\theta = m_{AC} = -2$ $\theta = 180° - 63{,}43...°$ $\therefore \theta = 116{,}57°$ $\therefore \hat{A} = 116{,}57° - 81{,}87°$ [ext $\angle$ of Δ] $\therefore \hat{A} = 34{,}70°$ **OR/*OF*** In ΔABC: $a = BC = 2\sqrt{17}; b = AC = 6\sqrt{5}; c = AB = 10\sqrt{2}$ $a^2 = b^2 + c^2 - 2bc.\cos A$ $\left(2\sqrt{17}\right)^2 = \left(6\sqrt{5}\right)^2 + \left(10\sqrt{2}\right)^2 - 2(6\sqrt{5})(10\sqrt{2}).\cos A$ $\cos A = \frac{\left(6\sqrt{5}\right)^2 + \left(10\sqrt{2}\right)^2 - \left(2\sqrt{17}\right)^2}{2\left(6\sqrt{5}\right)\left(10\sqrt{2}\right)}$ $= 0{,}822...$ $\therefore A = 34{,}7°$	✓ $m_{AC} = -2$ ✓ $\tan\theta = -2$ ✓ $\theta = 116{,}57°$ ✓ answer (4) ✓ all 3 lengths ✓ substitution into the correct cosine rule ✓ cos A subject ✓ answer (4)
3.3.3	$M\left(\frac{12+(-2)}{2} ; \frac{10+(0)}{2}\right)$ Diagonals intersect at the point (5 ; 5)	✓ x-value ✓ y-value (2)
3.4.1	BE = ET $4\sqrt{17} = \sqrt{(12-p)^2 + (0-p)^2}$ $\left(4\sqrt{17}\right)^2 = \left(\sqrt{(12-p)^2 + (0-p)^2}\right)^2$ $272 = 144 - 24p + p^2 + p^2$ $p^2 - 12p - 64 = 0$ $(p-16)(p+4) = 0$ $\therefore p = 16$ or $p = -4$ (n.a.) $\therefore$T(16; 16)	✓ substitution of E & T ✓ equating ✓ standard form ✓ factors ✓ $p = 16$ (5)
3.4.2a	$(x-12)^2 + y^2 = \left(4\sqrt{17}\right)^2 = 272$	✓ LHS ✓ RHS (2)
3.4.2b	$m_{radius} = \frac{1}{4}$ $m_{tangent} = -4$ $y = -4x + c$ $-4 = -4(-4) + c$ $c = -20$ $y = -4x - 20$ **OR/*OF*** $y - y_1 = -4(x - x_1)$ $y - (-4) = -4(x - (-4))$ $y = -4x - 20$	✓ $m_{tangent}$ ✓ substitution of B ✓ equation (3)
		[24]

9. 'n Sirkel binne 'n parallelogram, met CD as sy raaklyn

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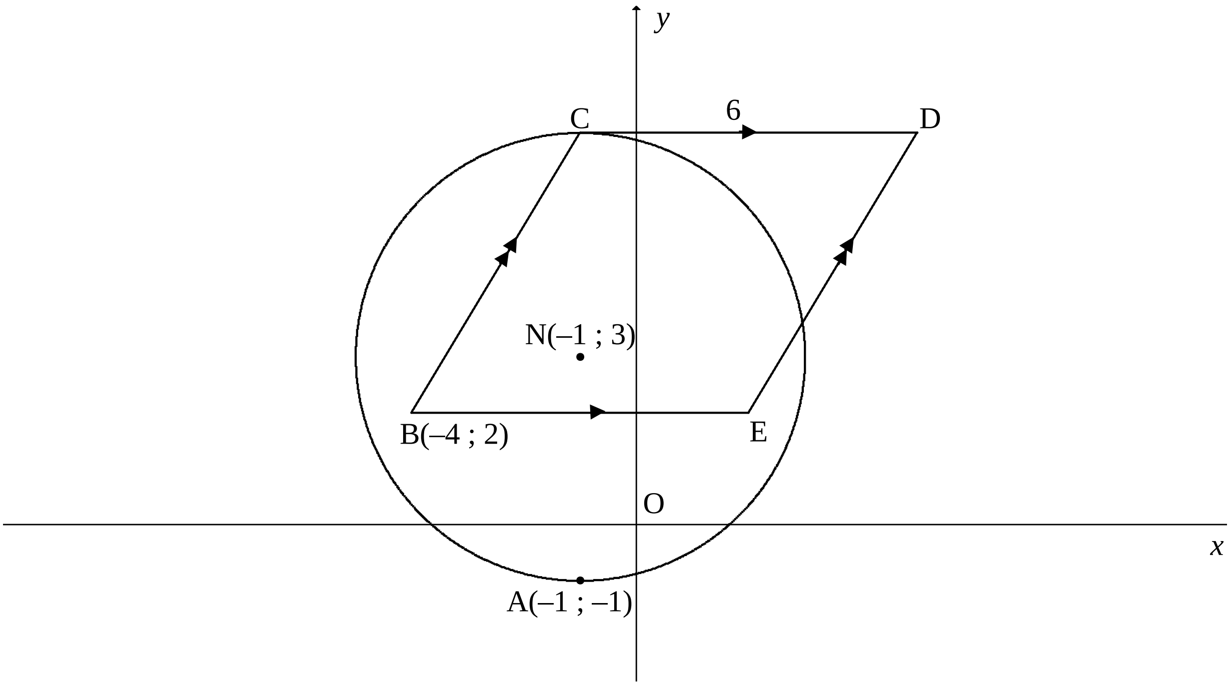
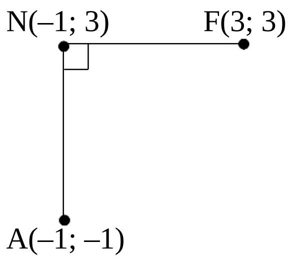
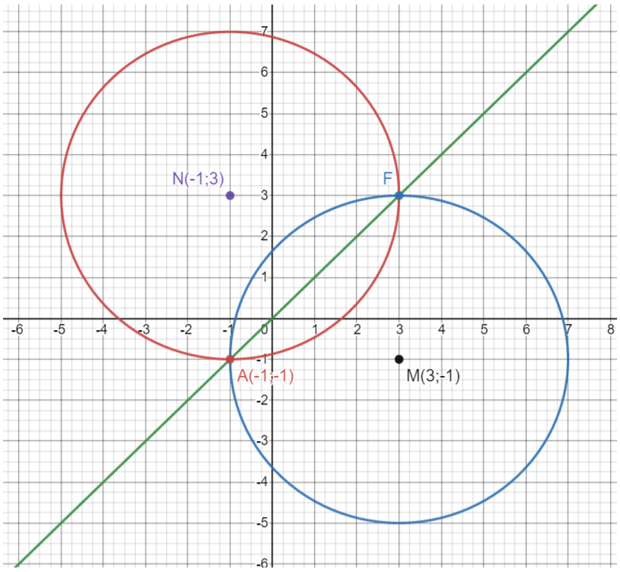
QUESTION/*VRAAG* 4

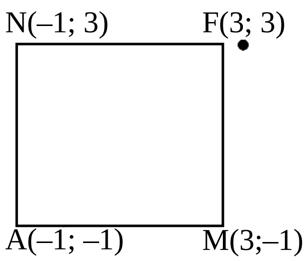


4.1	Radius = 4 units/*eenhede*	✓ answer (1)
4.2.1	$CD \perp CN$ $\therefore C(-1\,;\,7)$	✓x value ✓ y value (2)
4.2.2	CD = 6 units $\therefore D(5\,;\,7)$	✓x value ✓ y value (2)
4.2.3	$\perp h = 5$ units DC = 6 units $\text{Area } \Delta BCD = \frac{1}{2}(6)(5)$ $= 15 \text{ units}^2$ **OR/*OF*** $\perp h = 5$ units DC = 6 units $\text{Area } \Delta BCD = \frac{1}{2}[\text{Area of } \|^m]$ $= \frac{1}{2}[(5)(6)]$ $= 15 \text{ units}^2$	✓ $\perp h = 5$ units ✓ substitution into Area formula ✓ answer (3) ✓ $\perp h = 5$ units ✓ substitution into Area formula ✓ answer (3)

	OR/*OF* Let angle of inclination of BC = α $\tan\alpha = \frac{5}{3}$ $\alpha = 59{,}036...°$ $B\hat{C}D = 180° - \alpha$ $B\hat{C}D = 180° - 59{,}036...°$ $B\hat{C}D = 120{,}96°$ Area $\Delta BCD = \frac{1}{2}\left(\sqrt{34}\right)(6)\sin 120{,}96°$ $= 15$ units^2	✓ $B\hat{C}D = 120{,}96°$ ✓ substitution into Area rule ✓ answer (3)
4.3.1	M(3 ; –1) [reflection of N(–1 ; 3) about the line $y = x$] $\therefore MN = \sqrt{(3-(-1))^2 + (-1-3)^2}$ $MN = \sqrt{32} = 4\sqrt{2} = 5{,}66$ units	✓ coordinates of M (A) ✓ substitution of M&N ✓ answer (3)
4.3.2	M(3 ; –1) $m_{MN} = \frac{3-(-1)}{-1-3} = -1$ MN: $-1 = -(3) + c$ or $y - 3 = -1(x+1)$ $c = 2$ $y - 3 = -x - 1$ $\therefore y = -x + 2$ $y = -x + 2$ $x = -x + 2$ $2x = 2$ $x = 1$ $\therefore y = 1$ midpoint $(1 ; 1)$ **OR/*OF***  N(–1 ; 3) $y_F = y_N = 3$ Reflected about $y = x$ $\therefore$ F(3 ; 3) midpoint $\left(\frac{-1+3}{2} ; \frac{-1+3}{2}\right) = (1 ; 1)$	✓ equation of MN ✓ equating AF & MN ✓x value ✓ y value (4) ✓✓ coordinates of F ✓x value ✓ y value (4)

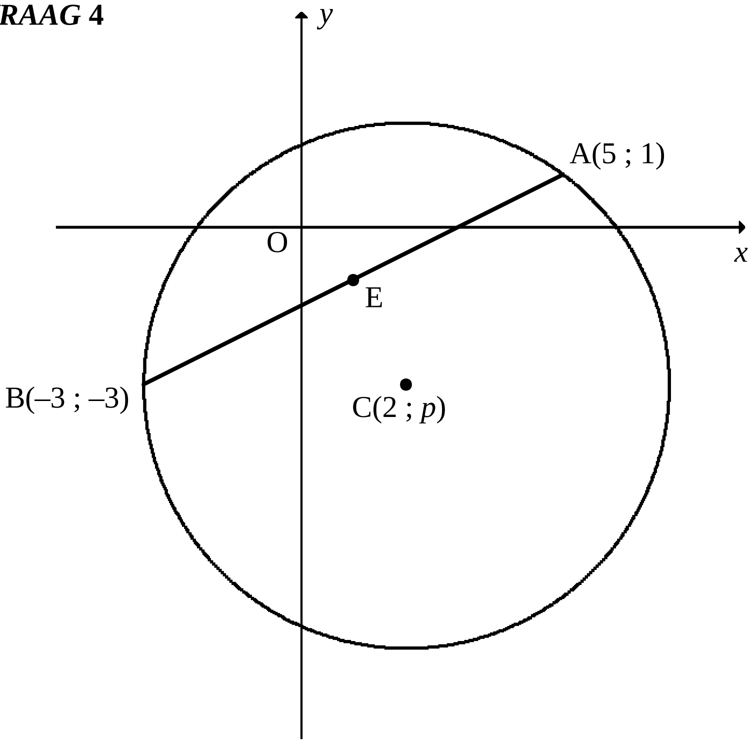
OR/*OF*





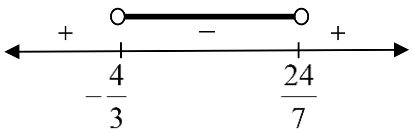
	NAMF is a square (NA=NF=AM=MF and NA $\perp$ AM)	✓ NAMF = square
	Midpoint NM $=(1\ ;\ 1)$ $=$ Midpoint of AF	✓x ✓ y of midpt NM ✓ midpt AF (4)
		[15]

QUESTION/*VRAAG* 4



4.1	$E\left(\frac{5+(-3)}{2};\frac{1+(-3)}{2}\right)$ $\therefore E(1;-1)$	✓ $x=1$ ✓ $y=-1$ (2)
4.2	$AB=\sqrt{(x_A-x_B)^2+(y_A-y_B)^2}$ $AB=\sqrt{(5-(-3))^2+(1-(-3))^2}$ $AB=\sqrt{80}=4\sqrt{5}=8,94$ units	✓ $AB=\sqrt{80}=4\sqrt{5}=8,94$ (1)
4.3	$m_{AB}=\frac{1-(-3)}{5-(-3)}$ $m_{AB}=\frac{1}{2}$ $\therefore m_{CE}=-2$ [$CE\perp AB$] $E(1;-1)$ $y=-2x+c$ **OR** $y-y_1=-2(x-x_1)$ $(-1)=-2(1)+c$ $y-(-1)=-2(x-1)$ $c=1$ $y=-2x+1$ $y=-2x+1$	✓ $m_{AB}=\frac{1}{2}$ ✓ m_{CE} ✓ substitution of E ✓ equation (4)

4.4	$y=-2x+1$ $p=-2(2)+1$ $p=-3$ **OR** $m_{CE}=-2$ $\frac{p-(-1)}{2-1}=-2$ $p+1=-2$ $p=-3$	✓ substitution of C(2 ; p) into $\perp$ bisector of AB (1) ✓ substitution of C and E into the gradient formula (1)
4.5	BC = r = 5 units $\therefore (x-2)^2+(y+3)^2=25$ $x^2-4x+4+y^2+6y+9=25$ $x^2+y^2-4x+6y-12=0$	✓ BC = r = 5 units ✓ $(x-2)^2+(y+3)^2$ ✓ r^2 ✓ $x^2-4x+4+y^2+6y+9=25$ (4)

4.6	$(x-2)^2+(y+3)^2=25$ **OR** $x^2+y^2-4x+6y-12=0$ $y=tx+8$ $(x-2)^2+(tx+8+3)^2=25$ **OR** $x^2+(tx+8)^2-4x+6(tx+8)-12=0$ $x^2-4x+4+t^2x^2+22tx+121-25=0$ **OR** $x^2+t^2x^2+16tx+64-4x+6tx+48-12=0$ $x^2(t^2+1)+x(22t-4)+100=0$ $\Delta<0$ $(22t-4)^2-4(t^2+1)(100)<0$ $484t^2-176t+16-400t^2-400<0$ $84t^2-176t-384<0$ $21t^2-44t-96<0$ $(7t-24)(3t+4)<0$ CV: $\frac{24}{7}$; $-\frac{4}{3}$  $\therefore t\in\left(-\frac{4}{3};\frac{24}{7}\right)$ **OR** $-\frac{4}{3}<t<\frac{24}{7}$	✓ substitution of $y=tx+8$ ✓ standard form ✓ $\Delta<0$ ✓standard form of Δ ✓ critical values ✓ answer (6)
		[18]

11. 'n Middellyn, 'n koordevierhoek, en waarheen CV lei

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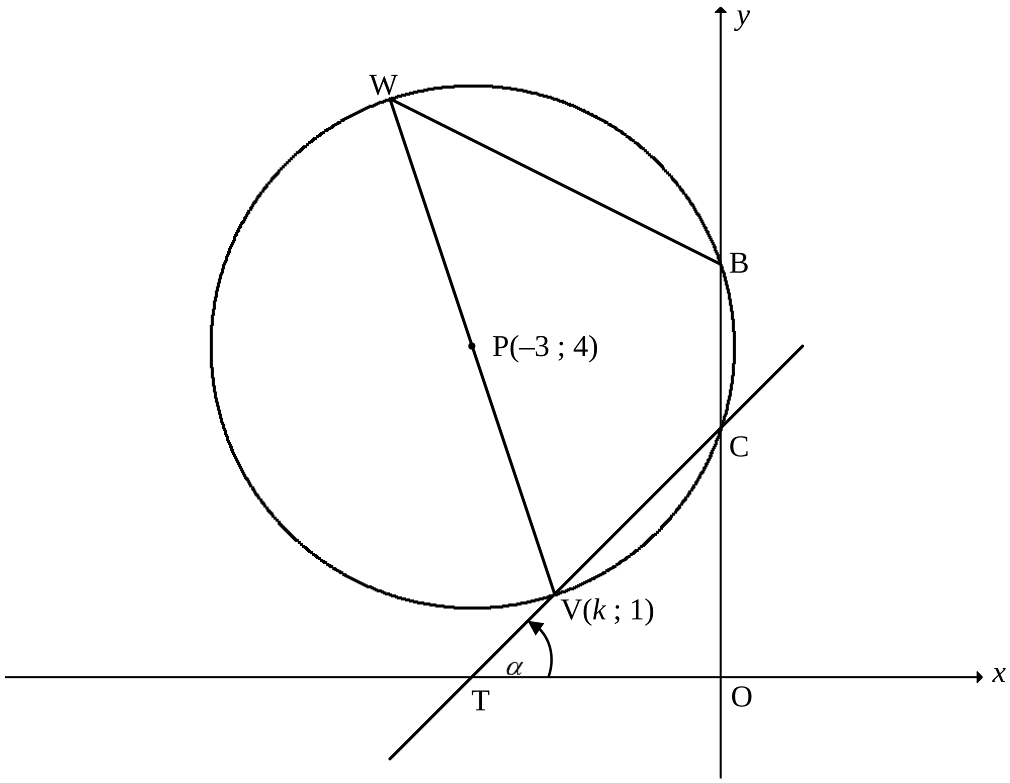
QUESTION 4



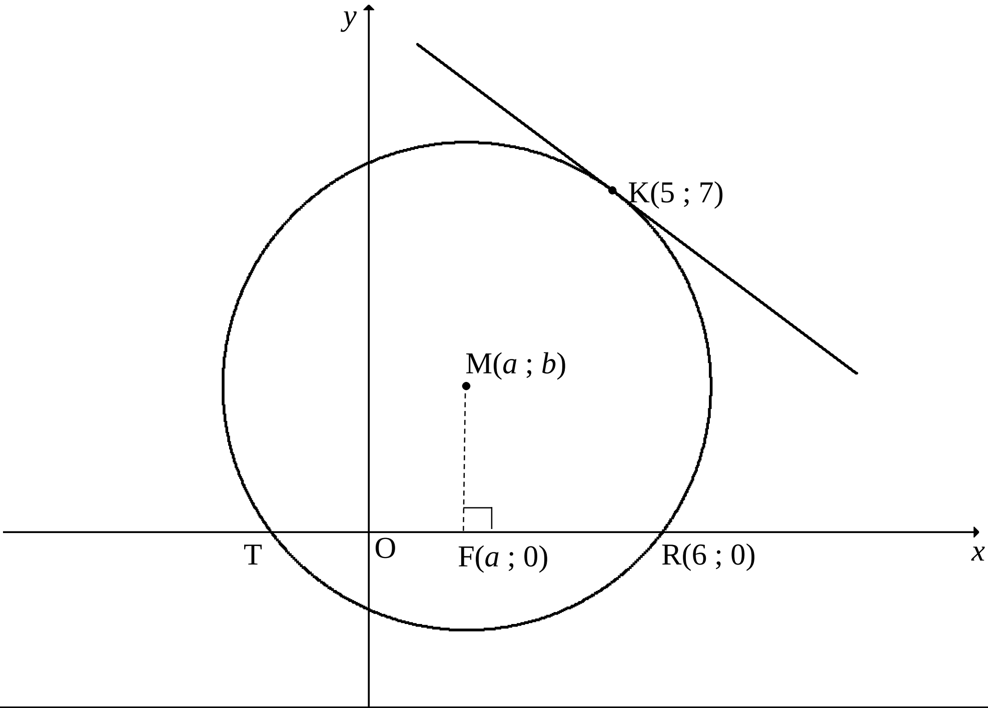
4.1	$PV = r = \sqrt{10}$ $PV = \sqrt{(k-(-3))^2 + (1-4)^2} = \sqrt{10}$ $(PV)^2 = (k-(-3))^2 + (1-4)^2 = 10$ $k^2 + 6k + 9 + 9 = 10$ **OR** $(k+3)^2 + 9 = 10$ $k^2 + 6k + 8 = 0$ $(k+3)^2 = 1$ $(k+4)(k+2) = 0$ $k+3 = 1$ or $k+3 = -1$ $k = -4$ or $k = -2$ $\therefore k = -2$	✓ $PV = r = \sqrt{10}$ ✓ substitution into distance formula ✓ standard form ✓ factors ✓ answer (5)
4.2	$x^2 + 6x + y^2 - 8y + 15 = 0$ y-intercepts: $(0)^2 + 6(0) + y^2 - 8y + 15 = 0$ $(y-3)(y-5) = 0$ $y_C = 3$ or $y_B = 5$ $\therefore BC = 2$ units	✓ $x = 0$ ✓ factors ✓ both values ✓ answer (4)

4.3.1	$m_{TC} = \frac{3-1}{0-(-2)}$ $= 1$ $\tan\alpha = 1$ $\therefore \alpha = 45°$ **OR** $y = mx + 3$ $1 = m(-2) + 3$ $m_{TC} = 1$ $\tan\alpha = 1$ $\therefore \alpha = 45°$	✓ substitution into gradient formula ✓ $\tan\alpha = 1$ ✓ answer (3) ✓ substitution into equation of a line ✓ $\tan\alpha = 1$ ✓ answer (3)
4.3.2	$B\hat{C}V = 135°$ [ext ∠ of Δ/*buite* ∠ v Δ] $\therefore V\hat{W}B = 45°$ [opp ∠s of cyclic quad/*teenoorst. ∠e v kvh*] Answer only: Full marks **OR** $T\hat{C}O = 45°$ [∠s of Δ/∠*e v* Δ] $\therefore V\hat{W}B = 45°$ [ext ∠s of cyclic quad/*buite ∠ v kvh*] Answer only: Full marks	✓ $B\hat{C}V = 135°$ ✓ answer (2) ✓ $T\hat{C}O = 45°$ ✓ answer (2)
4.4.1	$Q(-3;-2)$	✓ x_Q ✓ y_Q (2)
4.4.2	$(x+3)^2 + (y+2)^2 = 10$	✓ LHS ✓ RHS (2)
4.4.3	$x = -2$ or $x = -4$	✓ $x = -2$ ✓ $x = -4$ (2)
		[20]

12. Die middelpunt teruggevind uit 'n raaklyn en 'n afsnit

Amptelike DBE-nasienriglyn · Mei/Junie 2022 · V4 · 20 punte

QUESTION/*VRAAG* 4



4.1.1	$y = x + 1$ $b = a + 1$	✓ $b = a + 1$ (1)
4.1.2	$MR^2 = MK^2$ $(a-6)^2 + (b-0)^2 = (a-5)^2 + (b-7)^2$ $(a-6)^2 + (a+1)^2 = (a-5)^2 + (a+1-7)^2$ $a^2 + 2a + 1 = a^2 - 10a + 25$ $12a = 24$ $a = 2$ $b = 3$ $\therefore M(2 ; 3)$	✓ equating radii / solving simultaneously ✓ substitution $b = a + 1$ ✓ $12a = 24$ ✓ $a = 2$ ✓ $b = 3$ (5)
4.2.1	$(6-2)^2 + (0-3)^2 = r^2$ $r = 5$ **OR/*OF*** $(2-5)^2 + (3-7)^2 = r^2$ $r = 5$ Answer only 2/2	✓ substitution R and M ✓ $r = 5$ (2) ✓ substitution K and M ✓ $r = 5$ (2)

4.2.2	T(–2 ; 0) TR = 8 units [line from centre ⊥ to chord] **OR/*OF*** M(2 ; 3) F(a ; 0) FR = 4 units TR = 8 units [line from centre ⊥ to chord] **OR/*OF*** $(x-2)^2+(0-3)^2=25$ $x^2-4x+4+9=25$ $x^2-4x-12=0$ $(x-6)(x+2)=0$ $x=6$ or $x=-2$ TR = 8 units Answer only 2/2	✓ T(–2 ; 0) ✓ answer (2) ✓ 4 units ✓ answer (2) ✓ x values ✓ answer (2)
4.3	$m_{\text{radius}}=\frac{7-3}{5-2}$ $m_{\text{radius}}=\frac{4}{3}$ $m_{\text{tangent}}=-\frac{3}{4}$ $7=-\frac{3}{4}(5)+c$ **OR/*OF*** $y-7=-\frac{3}{4}(x-5)$ $c=\frac{43}{4}$ $y=-\frac{3}{4}x+\frac{43}{4}$ $y=-\frac{3}{4}x+\frac{43}{4}$	✓ substitution ✓ $m_{\text{radius}}=\frac{4}{3}$ ✓ $m_{\text{tangent}}=-\frac{3}{4}$ ✓ substitution ✓ answer (5)
4.4.1	N(2 ; –2)	✓ $x_N=2$ ✓ $y_N=-2$ (2)
4.4.2	$(-2-2)^2+(0+2)^2=r^2$ $r^2=20$ $(x-2)^2+(y+2)^2=20$	✓ substitution ✓ $r^2=20$ ✓ answer (3)
		[20]

13. PN as middellyn, en die raaklyn by N

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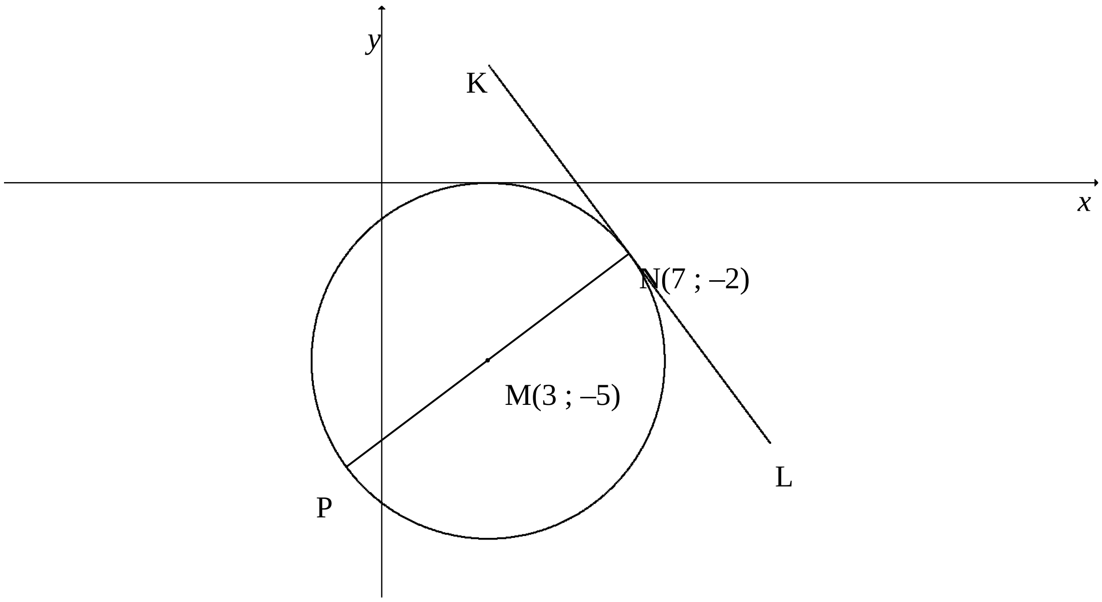

4.1	$P(x;y);\ N(7;-2)\ ;\ M(3;-5)$ $\frac{x+7}{2}=3 \qquad \frac{y-2}{2}=-5$ $x=-1 \qquad y=-8$ $P(-1;-8)$	✓ $x_P=-1$ ✓ $y_P=-8$ (2)
4.2.1	$r^2=(7-3)^2+(-2-(-5))^2$ **OR/*OF*** $r^2=(-1-3)^2+(-8-(-5))^2$ $r^2=25$ $(x-3)^2+(y+5)^2=25$	✓ substitution into distance formula ✓ $(x-3)^2+(y+5)^2$ ✓ $r^2=25$ (3)
4.2.2	$m_{\text{radius}}=\frac{-5-(-2)}{3-7}=\frac{3}{4}$ $m_{\text{tangent}}=-\frac{4}{3}$ [radius ⊥ tangent/*raaklyn* ⊥ *radius*] $-2=-\frac{4}{3}(7)+c$ **OR** $y-(-2)=-\frac{4}{3}(x-7)$ $c=\frac{22}{3}$ $\qquad y=-\frac{4}{3}x+\frac{22}{3}$ $y=-\frac{4}{3}x+\frac{22}{3}$	✓ substitution ✓ $m_{\text{radius}}=\frac{-3}{-4}=\frac{3}{4}$ ✓ $m_{\text{tangent}}=-\frac{4}{3}$ ✓ substitution of *m* and N(7 ; –2) ✓ equation (5)
4.3	$-8=-\frac{4}{3}(-1)+c$ $\therefore\ c=-\frac{28}{3}$ $-\frac{28}{3}<k<\frac{22}{3}$	✓ subst *m* and P ✓ value of *c* ✓✓ answer (4)

4.4.1	$AB^2 = AM^2 - MB^2$ $AB^2 = \left[(t-3)^2 + (t+5)^2\right] - 5^2$ $= t^2 - 6t + 9 + t^2 + 10t + 25 - 25$ $AB = \sqrt{2t^2 + 4t + 9}$	✓ substitution into Pythagoras ✓ simplification (A) (2)
4.4.2	$t = \frac{-4}{2(2)}$ $= -1$ Minimum at $t = -1$ $AB = \sqrt{2(-1)^2 + 4(-1) + 9}$ $AB = \sqrt{7}$ **OR/*OF*** $4t + 4 = 0$ $t = -1$ Minimum at $t = -1$ $AB = \sqrt{2(-1)^2 + 4(-1) + 9}$ $AB = \sqrt{7}$ **OR/*OF*** Length of $AB = \sqrt{2t^2 + 4t + 9}$ $= \sqrt{2\left(t^2 + 2t + \frac{9}{2}\right)}$ $= \sqrt{2\left[(t+1)^2 + \frac{7}{2}\right]}$ $= \sqrt{2(t+1)^2 + 7}$ Minimum at $t = -1$ $AB = \sqrt{2(-1)^2 + 4(-1) + 9}$ $AB = \sqrt{7}$	✓ substitution into correct formula ✓ $t = -1$ ✓ substitution ✓ answer (4) ✓ derivative = 0 ✓ $t = -1$ ✓ substitution ✓ answer (4) ✓ completing of the square ✓ $t = -1$ ✓substitution ✓answer (4)
		[20]

14. Twee sirkels, en die raaklyn gemeenskaplik aan albei

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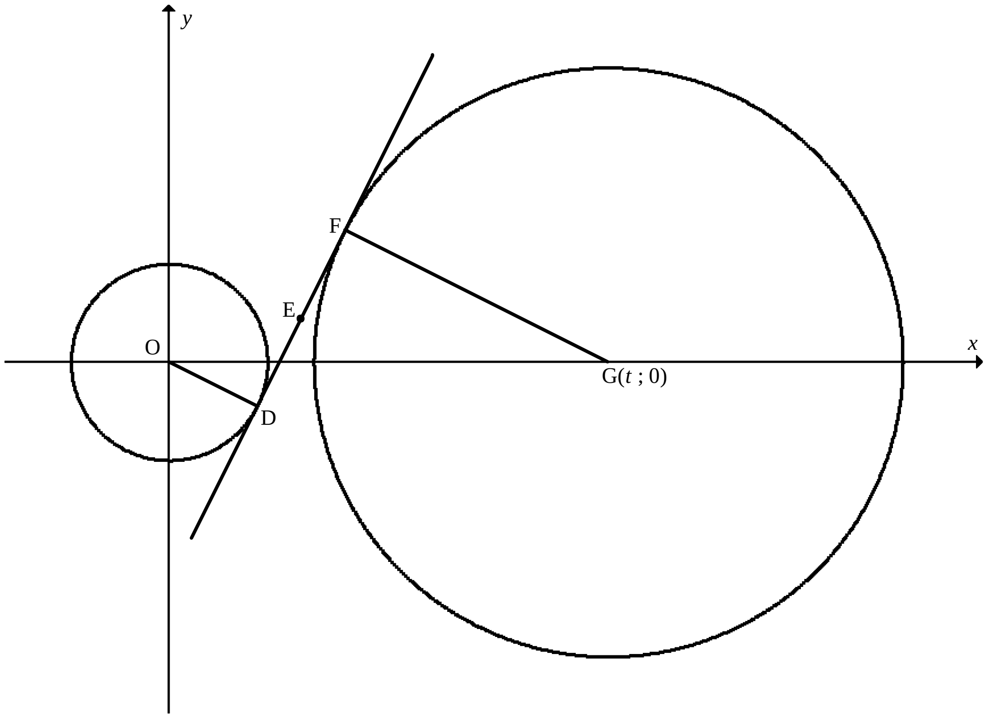

4.1	D$(p\,;\,-2)$ $x^2+y^2=20$ $p^2+(-2)^2=20$ $p^2=16$ $p=\pm4$ $p=4$	✓ substitution of point D$(p\,;-2)$ ✓ $p^2=16$ (2)
4.2	$\frac{4+x_F}{2}=6$ $\quad$ $\frac{-2+y_F}{2}=2$ $x_F=8$ $\quad$ $y_F=6$ F$(8;6)$ **OR** $x_E-x_D=6-4$ $\quad$ $y_E-y_D=2-(-2)$ $=2$ $\quad$ $=4$ $x_F=6+2=8$ $\quad$ $y_F=2+4=6$ F$(8;6)$	✓ method ✓ x-value ✓ y-value (3) ✓ method ✓ x-value ✓ y-value (3)

4.3	$m_{DE} = \frac{-2-2}{4-6}$ $m_{DE} = 2$ $-2 = 2(4) + c$ **OR** $y-(-2) = 2(x-4)$ $c = -10$ $y+2 = 2x-8$ $y = 2x-10$ $y = 2x-10$ **OR** $m_{OD} = -\frac{2}{4} = -\frac{1}{2}$ $\therefore m_{DE} = 2$ [tan ⊥ radius] $-2 = 2(4) + c$ **OR** $y-(-2) = 2(x-4)$ $c = -10$ $y+2 = 2x-8$ $y = 2x-10$ $y = 2x-10$	✓ correct substitution ✓ gradient of DE, DF or EF ✓ substitution of point D(4 ; −2) or E(6 ; 2) or F(8 ; 6) ✓ answer (4) ✓ correct gradient of OD ✓ gradient of DE ✓ substitution of point D(4 ; −2) or E(6 ; 2) or F(8 ; 6) ✓ answer (4)
4.4	$m_{DE} = 2$ $\therefore m_{GF} = -\frac{1}{2}$ [tan ⊥ radius] $\frac{0-6}{t-8} = -\frac{1}{2}$ $-(t-8) = 2(-6)$ $t = 20$ **OR** $y = 2x-10$ $0 = 2x-10$ $x = 5$ A(5 ; 0) In ΔAFG: FA ⊥ FG $FA^2 = (6-0)^2 + (8-5)^2 = 45$ $FG^2 = (t-8)^2 + (0-6)^2$ $= t^2 - 16t + 100$ $GA^2 = (t-5)^2$ $= t^2 - 10t + 25$ $\therefore GA^2 = GF^2 + FA^2$ $t^2 - 10t + 25 = t^2 - 16t + 100 + 45$ $6t = 120$ $t = 20$	✓ correct gradient of GF ✓ substitution of F ✓ answer (3) ✓ x-intercept of DF ✓ substitution into Pythagoras ✓ answer (3)

4.5	$F(8;6)$ G(20 ; 0) $(8-20)^2+(6-0)^2=r^2$ $r^2=180$ $(x-20)^2+y^2=180$ $x^2+y^2-40x+220=0$	 ✓ substitution of F and G ✓ value of r^2 ✓ equation of circle ✓ answer (4)
4.6	Smaller circle $r=2\sqrt{5}$ Larger circle $r=6\sqrt{5}$ G(20 ; 0) $k=20-(6\sqrt{5}-2\sqrt{5})$ or $k=20+(6\sqrt{5}-2\sqrt{5})$ $=20-4\sqrt{5}$ $\quad$ $=20+4\sqrt{5}$ = 11,06 units $\quad$ = 28,94 units **OR** Smaller circle $r=2\sqrt{5}$ $k=2\left(2\sqrt{5}\right)+20-8\sqrt{5}$ or $k=2\left(6\sqrt{5}\right)+20-8\sqrt{5}$ $=20-4\sqrt{5}$ $\quad$ $=20+4\sqrt{5}$ = 11,06 units $\quad$ = 28,94 units **OR** $x^2+y^2-40x+220=0$ $y=0$ $\therefore x^2-40x+220=0$ $\therefore x=20+6\sqrt{5}$ or $x=20-6\sqrt{5}$ $\therefore k=20+6\sqrt{5}-\sqrt{20}$ or $k=20-6\sqrt{5}+\sqrt{20}$ $\therefore k=20+4\sqrt{5}$ $\quad$ $\therefore k=20-4\sqrt{5}$ = 11,06 units $\quad$ = 28,94 units	✓ $r=2\sqrt{5}$ ✓ method ✓ answer ✓ answer (4) ✓ $r=2\sqrt{5}$ ✓ method ✓ answer ✓ answer (4) ✓ x-intercepts ✓ method ✓ answer ✓ answer (4)
		[20]

15. 'n Raaklyn by P, dan die ander punte wat op die sirkel lê

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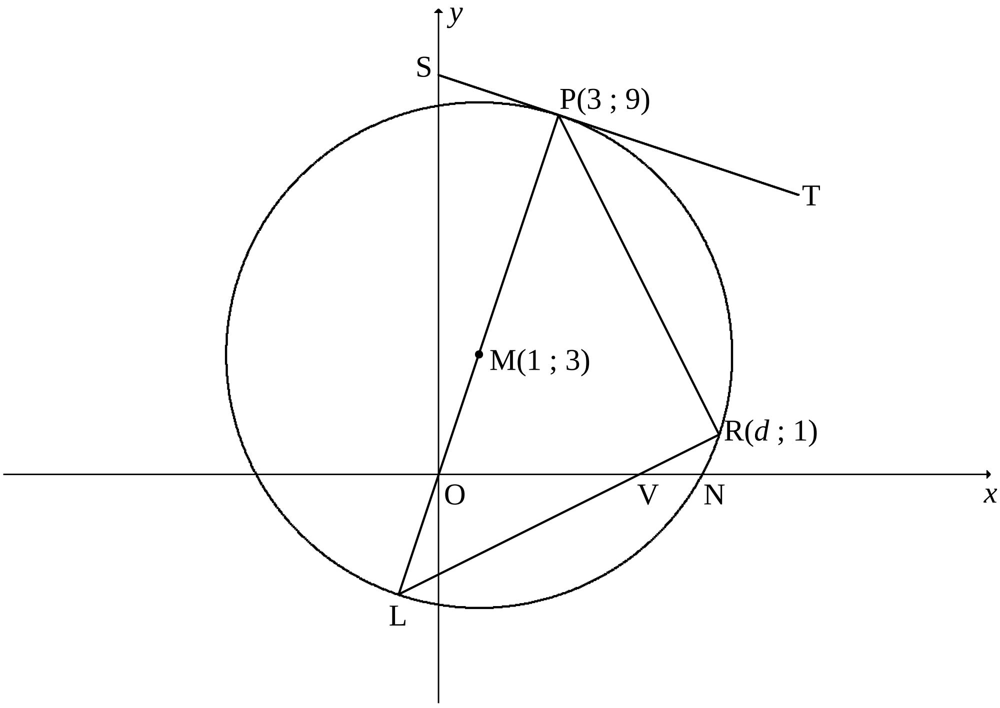
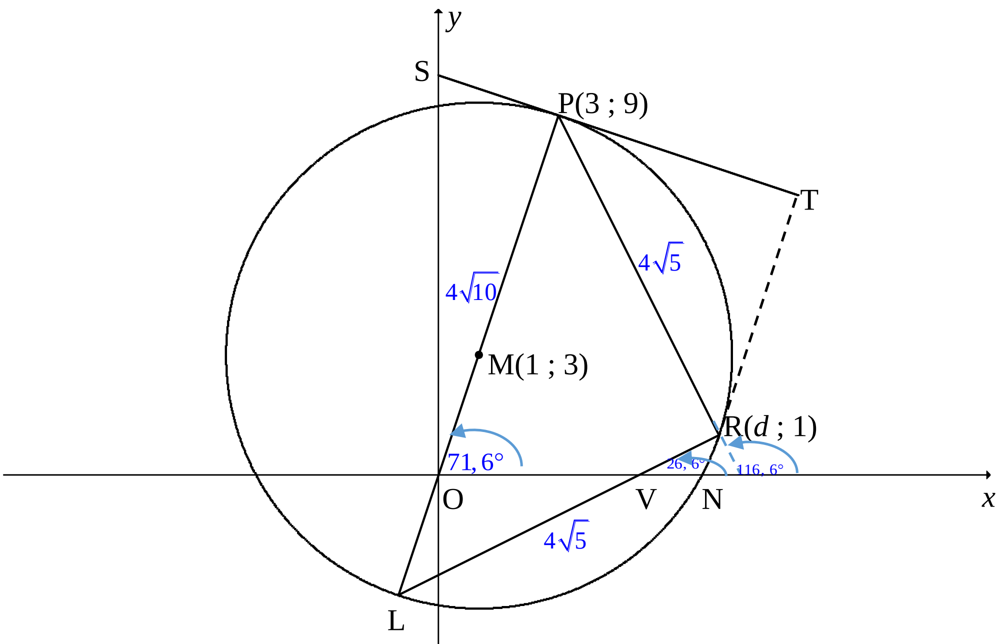


4.1	L(–1 ; –3)	✓ $x = -1$ ✓ $y = -3$ (2)
4.2	$m_{MP} = \frac{9-3}{3-1}$ $m_{MP} = 3$ $m_{ST} = -\frac{1}{3}$ $9 = -\frac{1}{3}(3) + c$ $y - 9 = -\frac{1}{3}(x-3)$ $c = 10$ **OR/*OF*** $y - 9 = -\frac{1}{3}x + 1$ $y = -\frac{1}{3}x + 10$ $y = -\frac{1}{3}x + 10$	✓ $m_{MP} = 3$ ✓ $m_{ST} = -\frac{1}{m_{MP}}$ ✓ substitution of m_{ST} & P(3; 9) into equation of a line ✓ equation of tangent ST (4)
4.3	$(x-1)^2 + (y-3)^2 = r^2$ $(3-1)^2 + (9-3)^2 = r^2$ $r^2 = 40$ $(x-1)^2 + (y-3)^2 = 40$ $x^2 - 2x + 1 + y^2 - 6y + 9 = 40$ $x^2 + y^2 - 2x - 6y - 30 = 0$	✓ $(3-1)^2 + (9-3)^2 = r^2$ ✓ value of r^2 ✓ LHS of equation of circle ✓ expanding LHS (4)

4.4	$d^2+(1)^2-2d-6(1)-30=0$ $d^2-2d-35=0$ $(d-7)(d+5)=0$ $d=7$ or $d=-5$ $\therefore d=7$	✓ $d^2+(1)^2-2d-6(1)-30=0$ ✓ standard form (2)
	OR/*OF*	**OR/*OF***
	$(x-1)^2+(y-3)^2=40$ $(d-1)^2+(1-3)^2=40$ $(d-1)^2=36$ $d-1=6$ or $d-1=-6$ $d=7$ or $d=-5$ $\therefore d=7$	✓ $(d-1)^2+(1-3)^2=40$ ✓ standard form (2)
	OR/*OF*	**OR/*OF***
	$\mathrm{P\hat{R}L}=90°$ (∠ in semi-circle) $\frac{9-1}{3-d}\times\frac{1-(-3)}{d-(-1)}=-1$ $d^2-2d-35=0$ $(d-7)(d+5)=0$ $d=7$ or $d=-5$ $\therefore d=7$	✓ $m_{\mathrm{PR}}\times m_{\mathrm{RL}}=-1$ ✓ standard form (2)



4.5	$m_{PO} = 3$ $\therefore \tan P\hat{O}V = 3$ $P\hat{O}V = 71{,}565...°$ $m_{RL} = \dfrac{1-(-3)}{7-(-1)}$ $= \dfrac{1}{2}$ $\therefore \tan R\hat{V}N = \dfrac{1}{2}$ $R\hat{V}N = 26{,}565...°$ $\hat{L} = 71{,}565...° - 26.565...°$ [ext. ∠ of Δ / *buite* ∠ *van* Δ] $\hat{L} = 45°$	✓ $\tan P\hat{O}V = m_{PO}$ ✓ $P\hat{O}V$ ✓ m_{RL} using R(7 ; 1) & L ✓ $R\hat{V}N$ ✓ answer (5)
	OR/*OF*	**OR/*OF***
	$\hat{R} = 90°$ [∠ in semi-circle /∠ *in 'n halwe sirkel*] $PR^2 = (3-7)^2 + (9-1)^2$ $PR = \sqrt{80} = 4\sqrt{5}$ units $PL^2 = (3-(-1))^2 + (9-(-3))^2$ **OR** $RL^2 = (7+1)^2 + (1+3)^2$ $PL = \sqrt{160} = 4\sqrt{10}$ $RL = \sqrt{80} = 4\sqrt{5}$ $\sin \hat{L} = \dfrac{4\sqrt{5}}{4\sqrt{10}}$ **OR** $\cos \hat{L} = \dfrac{4\sqrt{5}}{4\sqrt{10}}$ **OR** $\tan \hat{L} = \dfrac{4\sqrt{5}}{4\sqrt{5}}$ $\hat{L} = 45°$	✓ $\hat{R} = 90°$ ✓ $PR = \sqrt{80} = 4\sqrt{5}$ ✓ length of PL **OR** RL ✓ trig ratio of $\hat{L}$ ✓ answer (5)

	OR/*OF* $PL = \sqrt{(3+1)^2+(9+3)^2} = \sqrt{160} = 4\sqrt{10}$ $PR = \sqrt{(7-3)^2+(1-9)^2} = \sqrt{80} = 4\sqrt{5}$ $LR = \sqrt{(7+1)^2+(1+3)^2} = \sqrt{80} = 4\sqrt{5}$ $\cos L = \dfrac{80+160-80}{2\sqrt{80}\times\sqrt{160}}$ $\cos L = \dfrac{\sqrt{2}}{2}$ $\hat{L} = 45°$	**OR/*OF*** ✓ length of PL ✓ $PR = \sqrt{80} = 4\sqrt{5}$ ✓ length of LR ✓ substitution into the cos rule ✓ answer (5)
4.6	$m_{RM} = \dfrac{1-3}{7-1}$ $= -\dfrac{1}{3}$ $m_{RT} = 3$ (tan ⊥ rad) $m_{PT} = -\dfrac{1}{3}$ $m_{RT} \times m_{PT} = -1$ PT ⊥ RT **OR/*OF*** $m_{MR} = \dfrac{3-1}{1-7}$ $= -\dfrac{1}{3}$ $m_{PT} = -\dfrac{1}{3}$ [proved in Q4.2] $m_{PT} = m_{MR}$ $\therefore$ PT ∥ MR $M\hat{R}T = 90°$ [radius ⊥ tangent / *raaklyn* ⊥ *radius*] $P\hat{T}R = 90°$ [co-int ∠s; PT ∥ MR/*ooreenkomst.* ∠*e*; PT ∥ MR] PT ⊥ RT **OR/*OF*** $T\hat{P}R = \hat{L} = 45°$ [tan-chord theorem/ ∠ *tussen raaklyn en koord*] $TP = TR$ [tans from common pt] $\therefore T\hat{P}R = T\hat{R}P = 45°$ [∠s opp equal sides/ ∠*e teenoor gelyke sye*] $\therefore P\hat{T}R = 90°$ [sum of ∠s in Δ / *binne* ∠*e van* Δ] PT ⊥ RT	✓ m_{RM} ✓ m_{RT} ✓ $m_{RT} \times m_{PT} = -1$ (3) **OR/*OF*** ✓ PT ∥ MR ✓ $M\hat{R}T = 90°$ ✓ $P\hat{T}R = 90°$ (3) **OR/*OF*** ✓ $T\hat{P}R = \hat{L}$ ✓ $T\hat{P}R = T\hat{R}P$ ✓ $P\hat{T}R = 90°$ (3)

[20]

16. 'n Raaklyn by E, en vyftien eenhede langs MT

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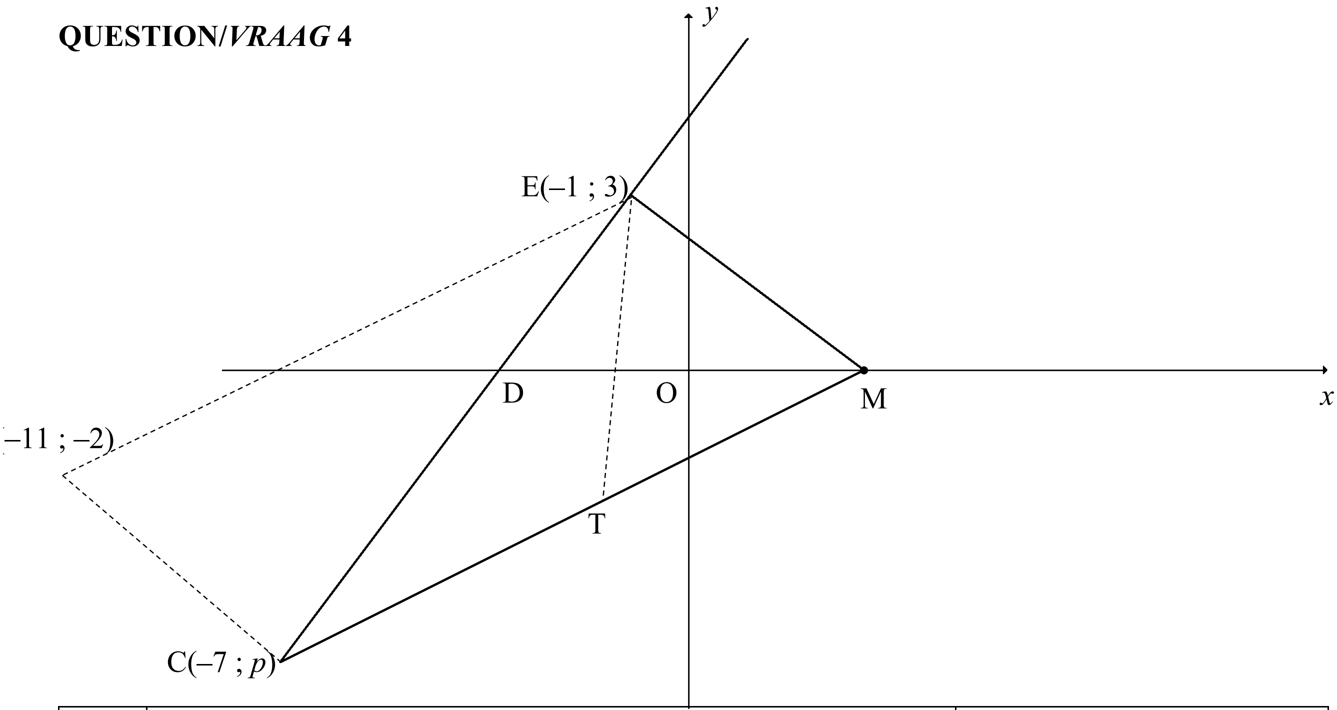
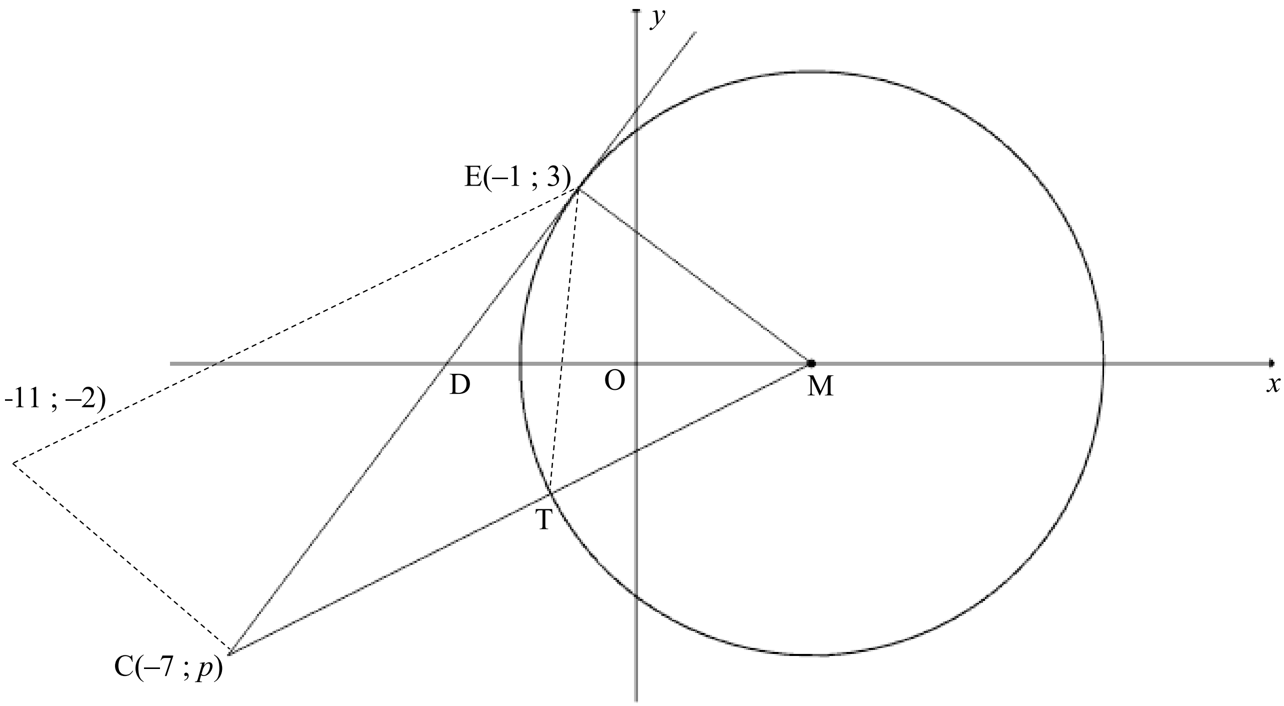


4.1	$\hat{CEM} = 90°$	✓ answer (1)
4.2	$m_{ME} = \frac{0-3}{3-(-1)}$ $m_{ME} = -\frac{3}{4}$ $\therefore m_{ED} = \frac{4}{3}$ $3 = \frac{4}{3}(-1)+c$ **OR/*OF*** $y-3 = \frac{4}{3}(x-(-1))$ $y = \frac{4}{3}x+\frac{13}{3}$ $\quad y = \frac{4}{3}x+\frac{13}{3}$	✓ $m_{ME} = -\frac{3}{4}$ ✓ m_{ED} ✓ substitution of E(–1 ; 3) ✓ equation (4)
	OR/*OF* $DM = \sqrt{(5)^2+\left(\frac{15}{4}\right)^2}$ [Pythagoras] $DM = \frac{25}{4}$ or 6,25 units $\therefore D\left(-\frac{13}{4};0\right)$ $m_{ED} = \frac{3-0}{-1-\left(-\frac{13}{4}\right)}$ $\therefore m_{ED} = \frac{4}{3}$ $3 = \frac{4}{3}(-1)+c$ **OR/*OF*** $y-3 = \frac{4}{3}(x-(-1))$ $y = \frac{4}{3}x+\frac{13}{3}$ $\quad y = \frac{4}{3}x+\frac{13}{3}$	✓ coordinates of D ✓ m_{ED} ✓ substitution of E(–1 ; 3) ✓ equation

4.3	$y=\frac{4}{3}x+\frac{13}{3}$ $0=\frac{4}{3}x+\frac{13}{3}$ $x_{\text{D}}=-\frac{13}{4}$ $\therefore \text{DM}=3-\left(-\frac{13}{4}\right)$ $\text{DM}=\frac{25}{4}$ or 6,25 units **OR/*OF*** EM = 5 units $\text{ED}=\frac{15}{4}$ units $\text{DM}=\sqrt{(5)^2+\left(\frac{15}{4}\right)^2}$ [Pythagoras] $\text{DM}=\frac{25}{4}$ or 6,25 units	 ✓ x_{D} ✓ $x_{\text{M}}-x_{\text{D}}$ ✓ answer (3) ✓ EM = 5 units ✓ substitution of EM & ED ✓ answer (3)
4.4	EC: $y=\frac{4}{3}x+\frac{13}{3}$ $p=\frac{4}{3}(-7)+\frac{13}{3}$ $p=-5$ **OR/*OF*** $m_{\text{EC}}=\frac{4}{3}$ $\frac{p-3}{-7-(-1)}=\frac{4}{3}$ $p-3=\frac{4}{3}(-6)$ $p=-5$	 ✓ substitution of C(–7 ; p) into equation of EC (1) ✓ substitution of C(–7 ; p) into gradient of EC (1)

4.5	M → E: $(x\,;y) \rightarrow (x-4\,;y+3)$ [translation] C → S: $(-7\,;-5) \rightarrow (-7-4\,;-5+3)$ $\therefore$ S(–11 ; –2) **OR/*OF*** M → C: $(x\,;y) \rightarrow (x-10\,;y-5)$ [translation] E → S: $(-1\,;3) \rightarrow (-1-10\,;3-5)$ $\therefore$ S(–11 ; –2) **OR/*OF*** E(–1 ; 3) and C(–7 ; –5) $\left(\frac{-1+(-7)}{2}\,;\,\frac{3+(-5)}{2}\right)$ [Midpoint of EC] $=(-4;-1)$ S(x ; y) and M(3 ; 0) $\frac{x_S+3}{2}=-4$ $\frac{y_S+0}{2}=-1$ $x_S=-11$ $y_S=-2$ $\therefore$ S(–11 ; –2)	✓ method: translation ✓ $x_S=-11$ ✓ $y_S=-2$ (3) ✓ method: translation ✓ $x_S=-11$ ✓ $y_S=-2$ (3) ✓ method: midpoint ✓ $x_S=-11$ ✓ $y_S=-2$ (3)
4.6	$r_{NEW}=5+7$ $r_{NEW}=12$ $MS=\sqrt{(3-(-11))^2+(0-(-2))^2}$ MS = $\sqrt{200}$ or $10\sqrt{2}$ or 14,14 units 14,14 > 12 $\therefore$ S$(-11;-2)$ lies outside the circle	✓ $r_{NEW}=12$ ✓ MS ✓ conclusion (3)



4.7	Inclination of EM: $\tan \hat{M} = m_{ME} = -\frac{3}{4}$ ref.$\angle = 36{,}87°$ Inclination of EM = 143,13° $\therefore E\hat{M}D = 36{,}87°$ Inclination of CM: $\tan \hat{M} = m_{CM} = \frac{5}{10}$ or $\frac{1}{2}$ $\therefore \hat{M} = 26{,}57°$ $\therefore E\hat{M}T = 26{,}57° + 36{,}87°$ $= 63{,}44°$ But EM = MT [radii] $\therefore E\hat{T}M = \frac{180° - 63{,}44°}{2}$ $\therefore E\hat{T}M = 58{,}28°$	✓ inclination of EM ✓ $E\hat{M}D$ ✓ inclination of CM ✓ $E\hat{M}T$ ✓ answer (5)
		[20]