SA-STUDENT

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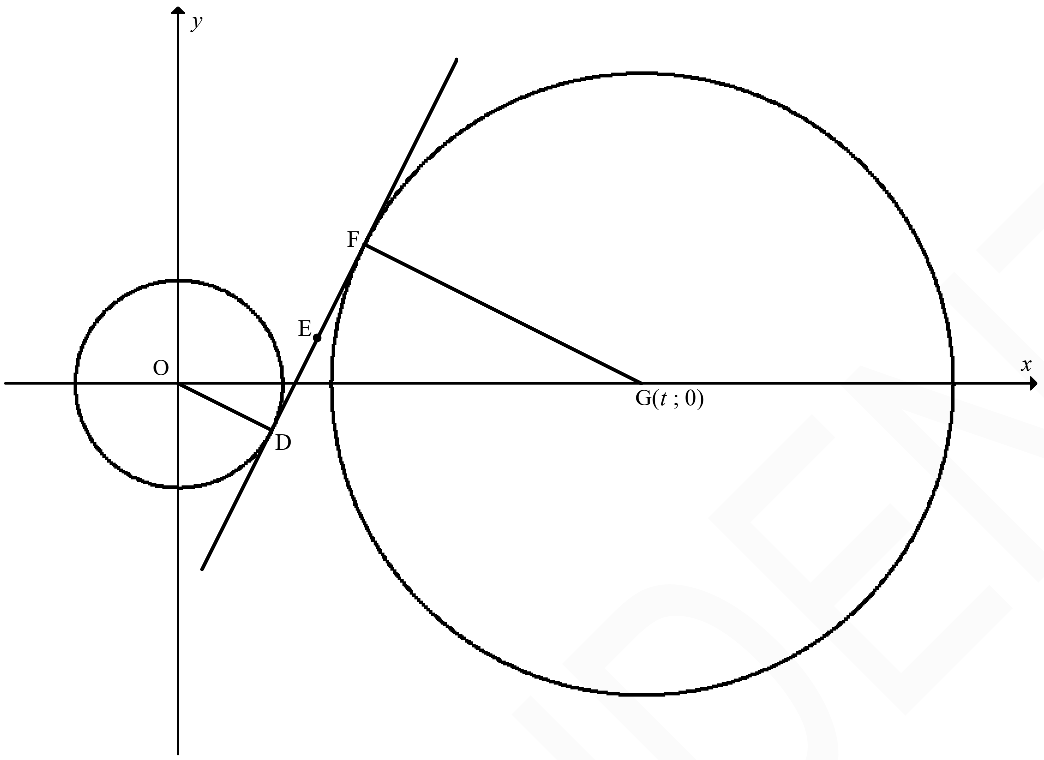
QUESTION/*VRAAG* 4



4.1	D(p ; −2) $x^2 + y^2 = 20$ $p^2 + (-2)^2 = 20$ $p^2 = 16$ $p = \pm 4$ $p = 4$	✓ substitution of point D$(p\ ;-2)$ ✓ $p^2 = 16$ (2)
4.2	$\frac{4 + x_F}{2} = 6$ $\frac{-2 + y_F}{2} = 2$ $x_F = 8$ $y_F = 6$ $F(8;6)$ **OR** $x_E - x_D = 6 - 4$ $y_E - y_D = 2 - (-2)$ $= 2$ $= 4$ $x_F = 6 + 2 = 8$ $y_F = 2 + 4 = 6$ $F(8;6)$	✓ 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** $y-(-2)=2(x-4)$ $c=-10$ $y+2=2x-8$ $y=2x-10$ $y=2x-10$	✓ correct substitution ✓ gradient of DE, DF or EF ✓ substitution of point D(4 ; −2) or E(6 ; 2) or F(8 ; 6) ✓ answer (4)
	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 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] $\frac{0-6}{t-8}=-\frac{1}{2}$ $-(t-8)=2(-6)$ $t=20$	✓ correct gradient of GF ✓ substitution of F ✓ answer (3)
	OR $y=2x-10$ $0=2x-10$ $x=5$ A(5 ; 0) In ΔAFG: FA ⊥ FG $FA^2=(6-0)^2+(8-5)^2=45$ $FG^2=(t-8)^2+(0-6)^2$ $=t^2-16t+100$ $GA^2=(t-5)^2$ $=t^2-10t+25$ $\therefore GA^2=GF^2+FA^2$ $t^2-10t+25=t^2-16t+100+45$ $6t=120$ $t=20$	 ✓ 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 $k=20+(6\sqrt{5}-2\sqrt{5})$ $=20-4\sqrt{5}$ $=20+4\sqrt{5}$ = 11,06 units = 28,94 units **OR** Smaller circle $r=2\sqrt{5}$ $k=2\left(2\sqrt{5}\right)+20-8\sqrt{5}$ or $k=2\left(6\sqrt{5}\right)+20-8\sqrt{5}$ $=20-4\sqrt{5}$ $=20+4\sqrt{5}$ = 11,06 units = 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 $k=20-6\sqrt{5}+\sqrt{20}$ $\therefore k=20+4\sqrt{5}$ $\therefore k=20-4\sqrt{5}$ = 11,06 units = 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)
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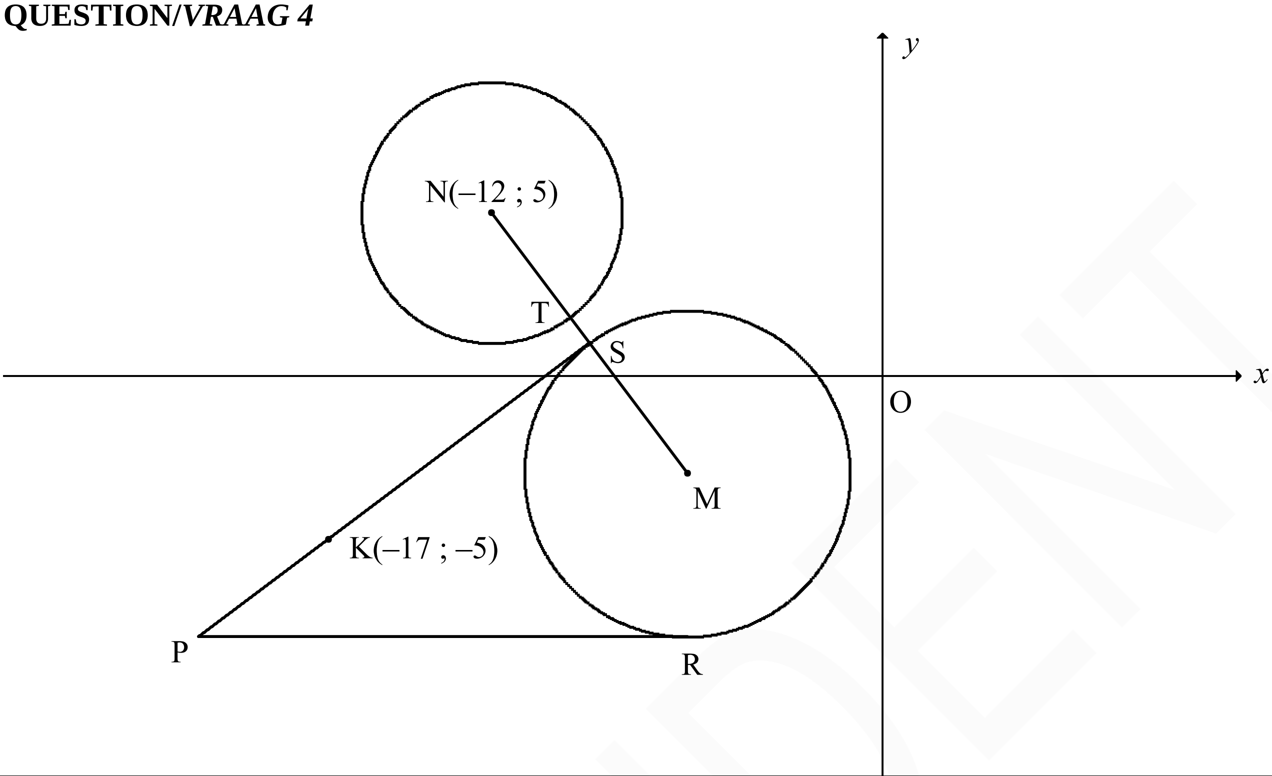

4.1	$M(-6;-3)$	✓ –6 ✓ –3 (2)
4.2.1	$x^2+y^2+24x-10y+153=0$ $(x+12)^2+(y-5)^2=-153+144+25$ $(x+12)^2+(y-5)^2=16$ $r^2=16$ $r=4$ units	✓ $r^2=-153+144+25$ ✓ length of radius (2)
4.2.2	$NM=\sqrt{(-12-(-6))^2+(5-(-3))^2}$ NM = 10 units SM = 5 units $\therefore$ TS = 10 – 5 – 4 = 1 unit	✓ substitution into distance formula ✓ NM = 10 units ✓ SM = 5 units ✓ answer (4)
4.3.1	R(–6 ; –8) $y=-8$	✓ $y_R=-8$ ✓ answer (2)

4.3.2	$m_{NM} = \frac{5-(-3)}{-12-(-6)}$ $m_{NM} = -\frac{4}{3}$ $m_{tangent} = \frac{3}{4}$ $-5 = \frac{3}{4}(-17)+c$ **OR/*OF*** $y - y_1 = \frac{3}{4}(x - x_1)$ $c = \frac{31}{4}$ $y-(-5) = \frac{3}{4}(x-(-17))$ $y = \frac{3}{4}x + \frac{31}{4}$ $y = \frac{3}{4}x + \frac{31}{4}$	✓ substitution ✓ $m_{NM} = -\frac{4}{3}$ ✓ $m_{tangent} = \frac{3}{4}$ ✓ substitution of m and N ✓ equation (5)
	OR/OF NS = SM = 5 $S\left(\frac{-12-6}{2}\ ;\ \frac{5-3}{2}\right)$ S (– 9 ; 1) $m_{SK} = \frac{1-(-5)}{-9+17}$ $= \frac{6}{8} = \frac{3}{4}$ $y+5 = \frac{3}{4}(x+17)$ $y = \frac{3}{4}x + \frac{31}{4}$ *or* $y = \frac{3}{4}x + 7\frac{3}{4}$	✓ S midpoint ✓ coordinates of S ✓ $m_{tangent} = \frac{3}{4}$ ✓ substitution of m and K(–17 ; –5) or S ✓ equation (5)
4.4.1	$-8 = \frac{3}{4}x + \frac{31}{4}$ $-32 = 3x + 31$ $3x = -63$ $x = -21$ P(–21 ; –8) R(–6 ; –8) PR = PS = 15 units [tangents from same point] MS = MR = 5 units Perimeter PSMR = 15 + 15 + 5 + 5 = 40 units	✓ $-8 = \frac{3}{4}x + \frac{31}{4}$ ✓ $x = -21$ ✓ PR = PS = 15 units ✓ MS = MR = 5 units ✓ answer (5)

4.4.2	$\frac{\text{area of } \Delta\text{NPS}}{\text{area of quadrilateral PSMR}}$ $\frac{\frac{1}{2}\text{NS.SP}}{\frac{1}{2}\text{SP.MS}+\frac{1}{2}\text{MR.PR}}$ $=\frac{\frac{1}{2}(5)(15)}{2\left(\frac{1}{2}\right)(5)(15)}$ $=\frac{1}{2}$	 ✓ substitution ✓ answer (2)
	OR $\Delta\text{NPS} \equiv \Delta\text{SPM} \equiv \Delta\text{MPR}$ $\frac{\text{area of } \Delta\text{NPS}}{\text{area of quadrilateral PSMR}}$ $=\frac{1}{2}$	 ✓ congruent ✓ answer (2)
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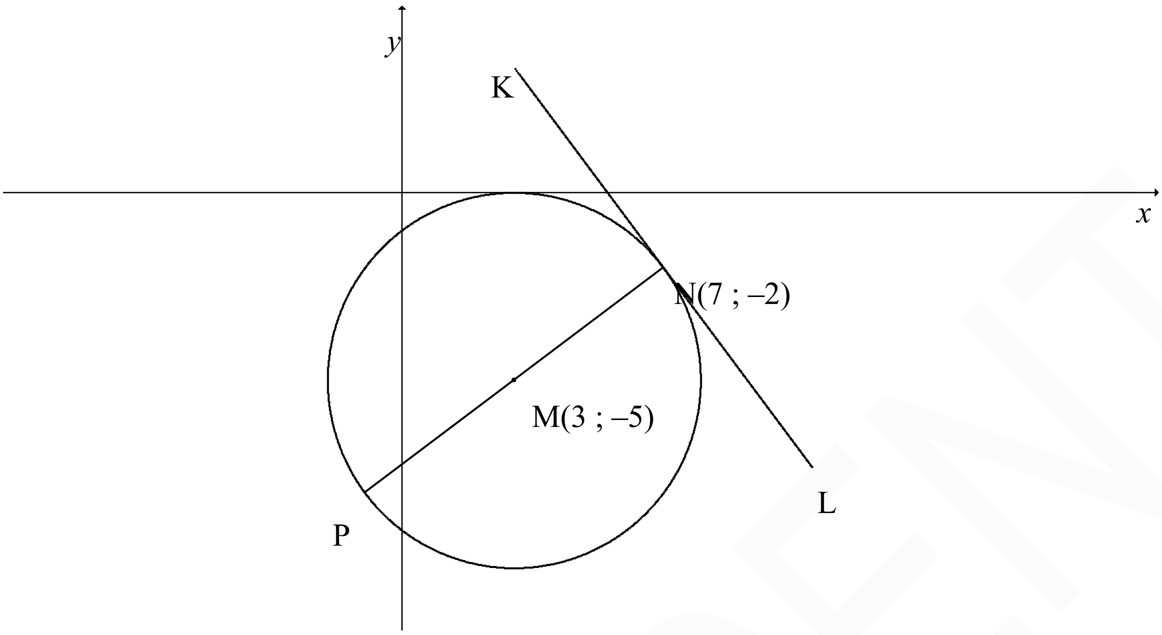

4.1	$P(x;y)$; $N(7;-2)$; $M(3;-5)$ $\frac{x+7}{2}=3$ $\frac{y-2}{2}=-5$ $x=-1$ $y=-8$ $P(-1;-8)$	✓ $x_P=-1$ ✓ $y_P=-8$ (2)
4.2.1	$r^2=(7-3)^2+(-2-(-5))^2$ **OR/*OF*** $r^2=(-1-3)^2+(-8-(-5))^2$ $r^2=25$ $(x-3)^2+(y+5)^2=25$	✓ substitution into distance formula ✓ $(x-3)^2+(y+5)^2$ ✓ $r^2=25$ (3)
4.2.2	$m_{\text{radius}}=\frac{-5-(-2)}{3-7}=\frac{3}{4}$ $m_{\text{tangent}}=-\frac{4}{3}$ [radius ⊥ tangent/*raaklyn* ⊥ *radius*] $-2=-\frac{4}{3}(7)+c$ **OR** $y-(-2)=-\frac{4}{3}(x-7)$ $c=\frac{22}{3}$ $y=-\frac{4}{3}x+\frac{22}{3}$ $y=-\frac{4}{3}x+\frac{22}{3}$	✓ 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	$t = \dfrac{-4}{2(2)}$ $= -1$ Minimum at $t = -1$ $AB = \sqrt{2(-1)^2 + 4(-1) + 9}$ $AB = \sqrt{7}$	✓ substitution into correct formula ✓ $t = -1$ ✓ substitution ✓ answer (4)
	OR/*OF*	
	$4t + 4 = 0$ $t = -1$ Minimum at $t = -1$ $AB = \sqrt{2(-1)^2 + 4(-1) + 9}$ $AB = \sqrt{7}$	✓ derivative = 0 ✓ $t = -1$ ✓ substitution ✓ answer (4)
	OR/*OF*	
	Length of $AB = \sqrt{2t^2 + 4t + 9}$ $= \sqrt{2\left(t^2 + 2t + \dfrac{9}{2}\right)}$ $= \sqrt{2\left[(t+1)^2 + \dfrac{7}{2}\right]}$ $= \sqrt{2(t+1)^2 + 7}$ Minimum at $t = -1$ $AB = \sqrt{2(-1)^2 + 4(-1) + 9}$ $AB = \sqrt{7}$	✓ completing of the square ✓ $t = -1$ ✓ substitution ✓ answer (4)
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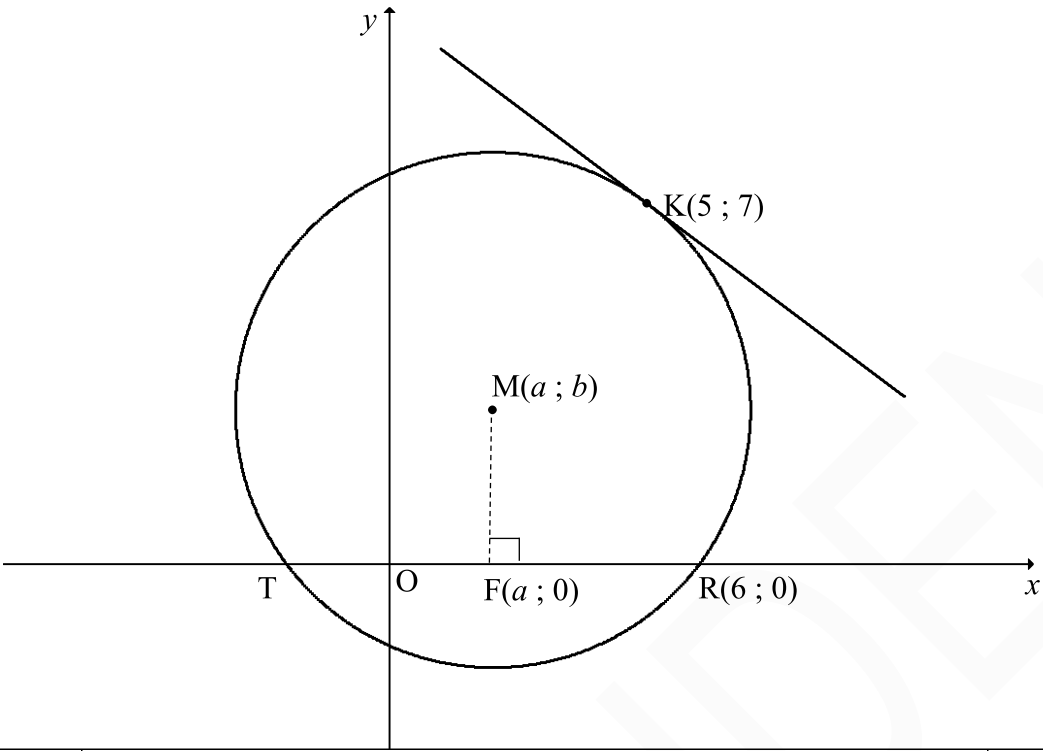

4.1.1	$y = x + 1$ $b = a + 1$	✓ $b = a + 1$ (1)
4.1.2	$MR^2 = MK^2$ $(a-6)^2 + (b-0)^2 = (a-5)^2 + (b-7)^2$ $(a-6)^2 + (a+1)^2 = (a-5)^2 + (a+1-7)^2$ $a^2 + 2a + 1 = a^2 - 10a + 25$ $12a = 24$ $a = 2$ $b = 3$ $\therefore M(2 ; 3)$	✓ equating radii / solving simultaneously ✓ substitution $b = a + 1$ ✓ $12a = 24$ ✓ $a = 2$ ✓ $b = 3$ (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)
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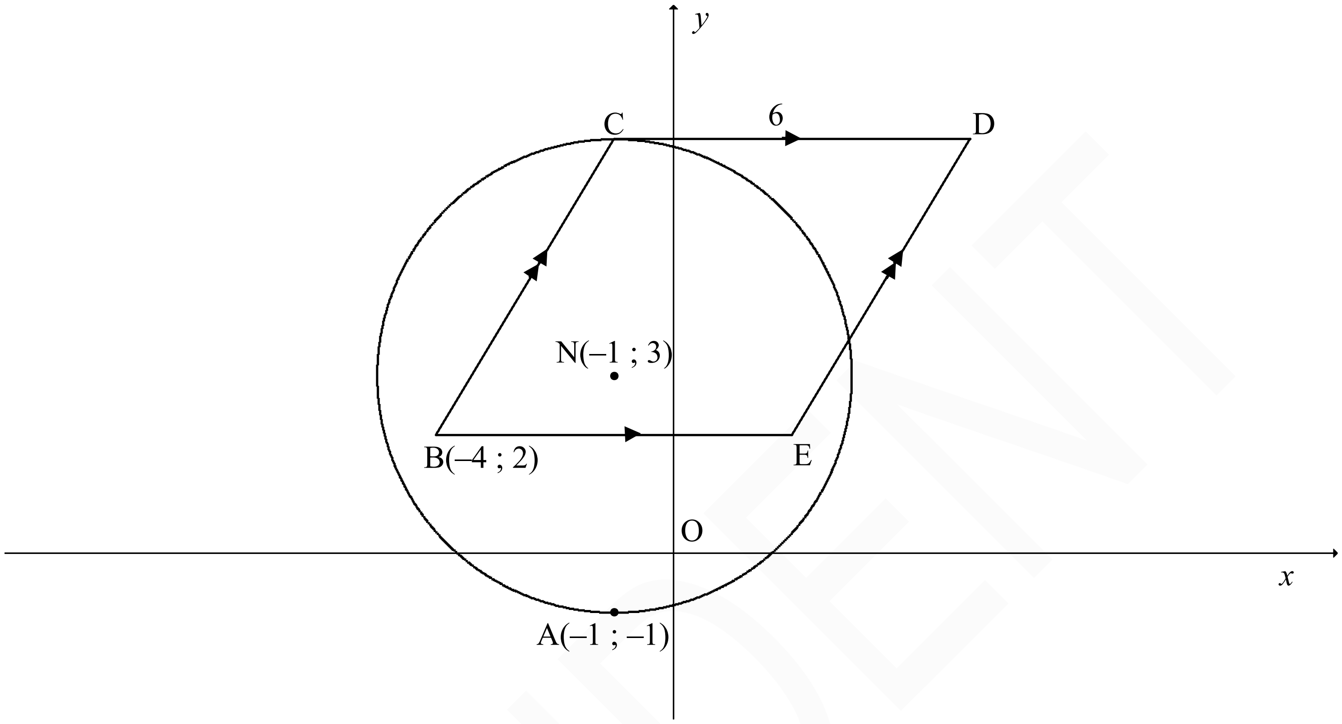
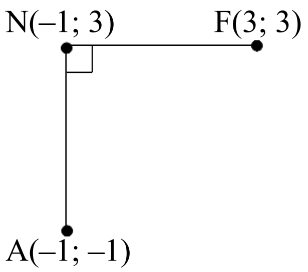
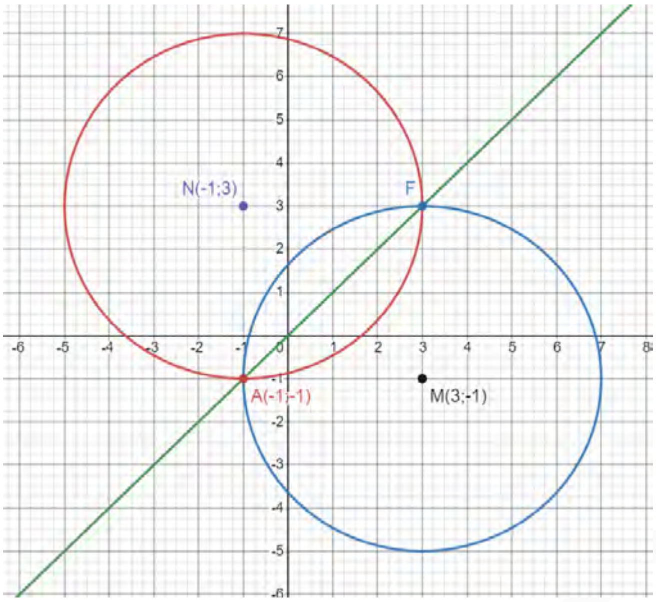
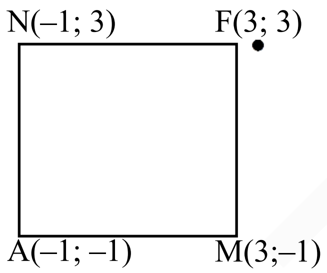


4.1	Radius = 4 units/*eenhede*	✓ answer (1)
4.2.1	$CD \perp CN$ $\therefore C(-1\ ;\ 7)$	✓ x value ✓ y value (2)
4.2.2	CD = 6 units $\therefore D(5\ ;\ 7)$	✓ x value ✓ y value (2)
4.2.3	$\perp h = 5\text{ units}$ DC = 6 units $\text{Area } \Delta BCD = \frac{1}{2}(6)(5)$ $= 15\text{ units}^2$ **OR/*OF***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

	OR/*OF* Let angle of inclination of BC = α $\tan\alpha = \frac{5}{3}$ $\alpha = 59{,}036...^\circ$ $B\hat{C}D = 180^\circ - \alpha$ $B\hat{C}D = 180^\circ - 59{,}036...^\circ$ $B\hat{C}D = 120{,}96^\circ$ Area $\Delta BCD = \frac{1}{2}\left(\sqrt{34}\right)(6)\sin 120{,}96^\circ$ $= 15 \text{ units}^2$	✓ $B\hat{C}D = 120{,}96^\circ$ ✓ substitution into Area rule ✓ answer (3)
4.3.1	M(3 ; –1) [reflection of N(–1 ; 3) about the line $y = x$] $\therefore MN = \sqrt{(3-(-1))^2 + (-1-3)^2}$ $MN = \sqrt{32} = 4\sqrt{2} = 5{,}66 \text{ units}$	✓ 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)

Midpoint NM $= (1\,;1)$

$= \text{Midpoint of AF}$

✓ NAMF = square

✓x ✓ y of midpt NM

✓ midpt AF

(4)

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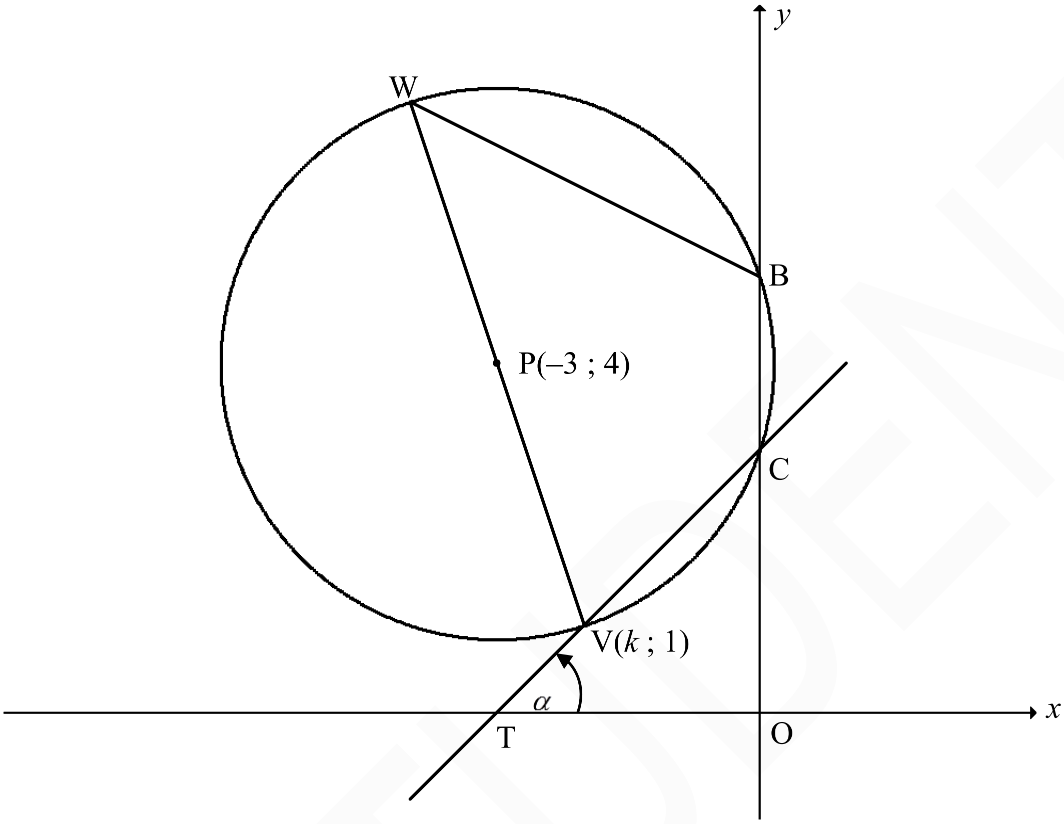
QUESTION 4



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** $(k+3)^2 + 9 = 10$ $k^2 + 6k + 8 = 0$ $\quad (k+3)^2 = 1$ $(k+4)(k+2) = 0$ $\quad k+3 = 1$ 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)
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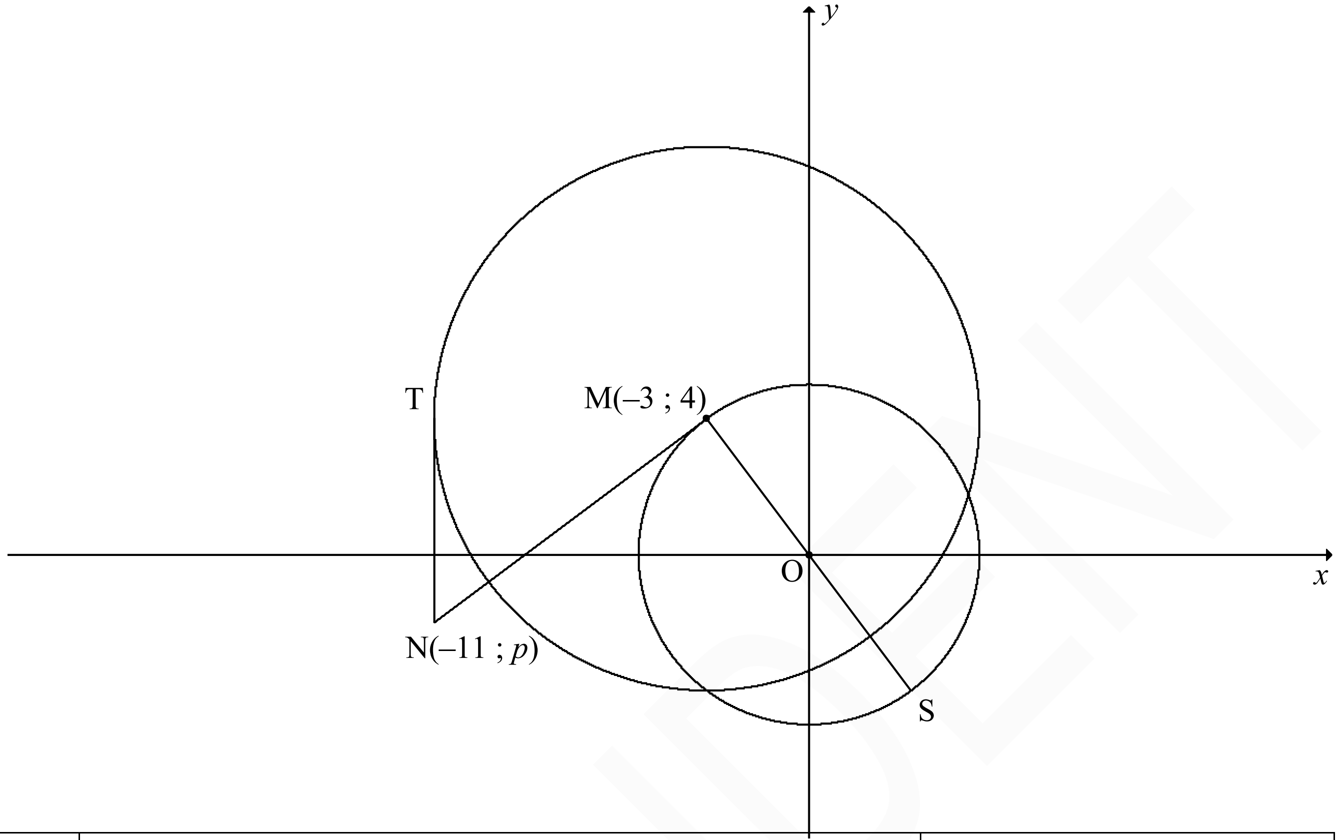

4.1	$x^2 + y^2 = r^2$ $\therefore r^2 = (-3)^2 + (4)^2 = 25$ $x^2 + y^2 = 25$	✓ substitution ✓ answer (2)
4.2	TM ⊥ TN [tangent ⊥ radius] T(–11 ; 4) $r = -3 - (-11) = 8$ $(x+3)^2 + (y-4)^2 = 64$	✓ $x_T = -11$ ✓ LHS ✓ RHS (3)
4.3	O (0 ; 0) and M(–3; 4) $m_{OM} = \frac{4-0}{-3-0} = -\frac{4}{3}$ OR $\frac{0-4}{0-(-3)} = -\frac{4}{3}$ $m_{NM} = \frac{3}{4}$ $y - 4 = \frac{3}{4}(x-(-3))$ **OR** $y = \frac{3}{4}x + c$ $y - 4 = \frac{3}{4}x + \frac{9}{4}$ $4 = \frac{3}{4}(-3) + c$ $\therefore y = \frac{3}{4}x + \frac{25}{4}$ $c = \frac{25}{4}$ $y = \frac{3}{4}x + \frac{25}{4}$	✓ $m_{OM} = -\frac{4}{3}$ ✓ $m_{NM} = \frac{3}{4}$ ✓ substitution of m and M ✓ equation (4)

4.4	N(–11 ; p) $y=\frac{3}{4}x+\frac{25}{4}$ $p=\frac{3}{4}(-11)+\frac{25}{4}$ OR $\frac{4-p}{-3-(-11)}=\frac{3}{4}$ $p=-2$ $\therefore N(-11;-2)$ $\frac{-3+x_S}{2}=0$ and $\frac{4+y_S}{2}=0$ $\therefore S(3;-4)$ $SN=\sqrt{(-11-3)^2+(-2-(-4))^2}$ $=10\sqrt{2}$ units or 14,14 units	✓ subst $x=-11$ into eq or gradient ✓ $p=-2$ ✓ x_S ✓ y_S ✓ answer (CA) (5)
4.5	$B(-2;5)$ $BM=\sqrt{2}$ units Radius of circle centred at M = 8 units $k=8-\sqrt{2}$ or $k=8+\sqrt{2}$ = 6,59 units = 9,41 units = 6,6 units = 9,4 units	✓ $\sqrt{2}$ ✓✓ $k=6,6$ ✓✓ $k=9,4$ (5)
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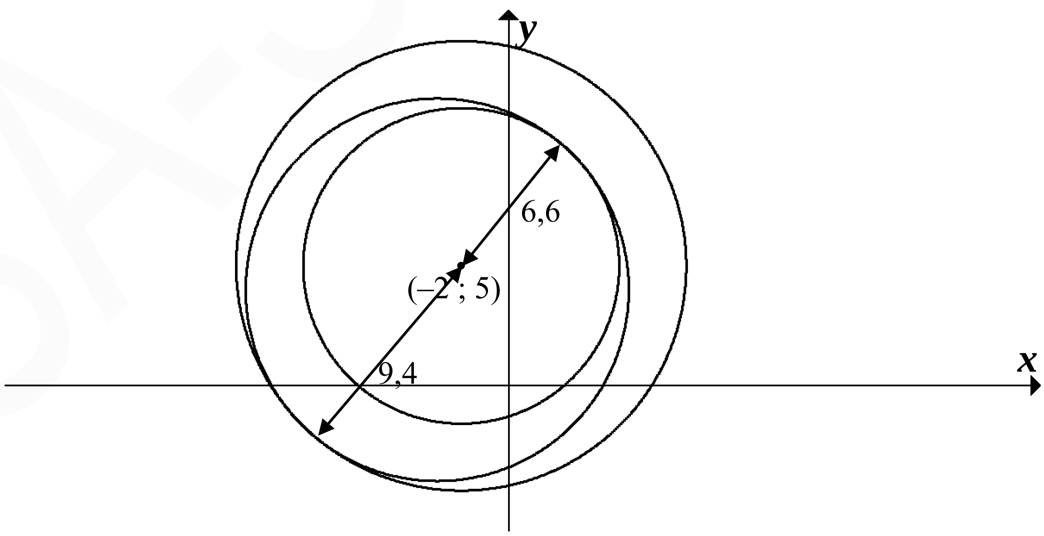

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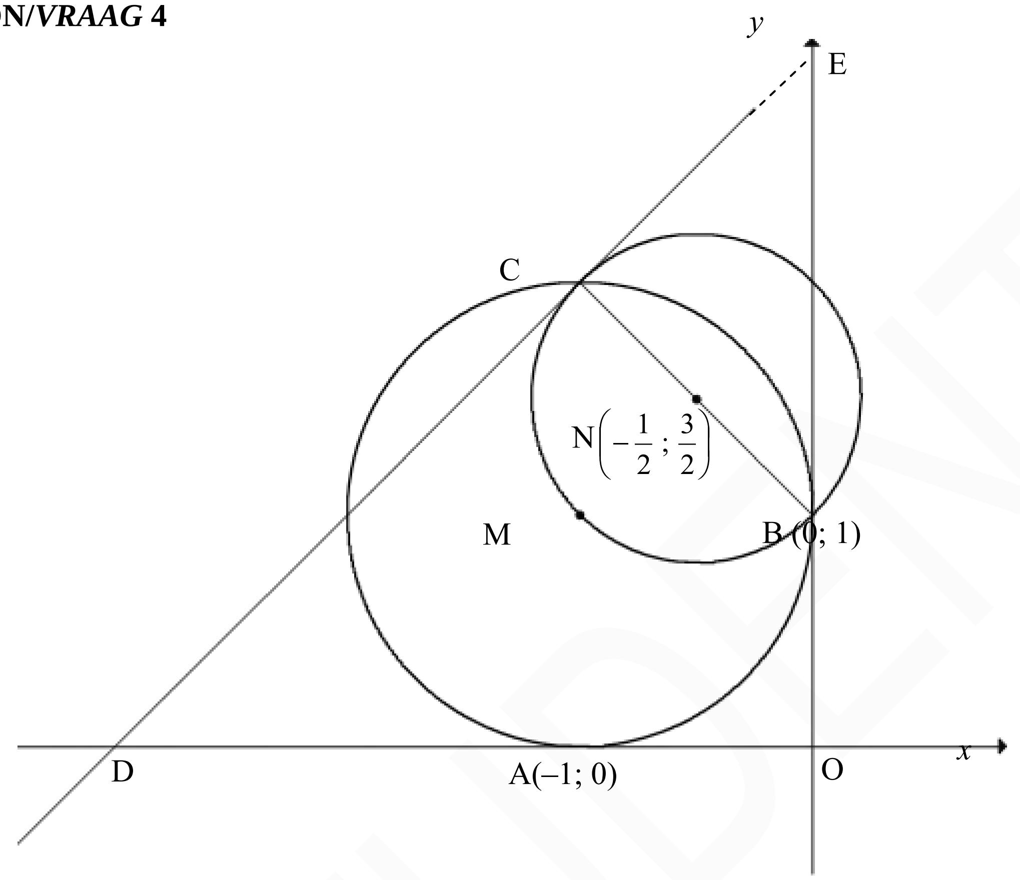
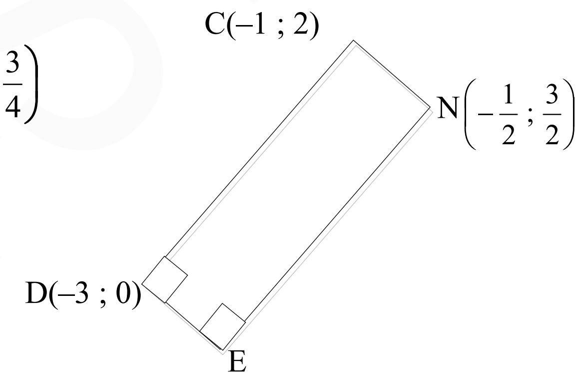
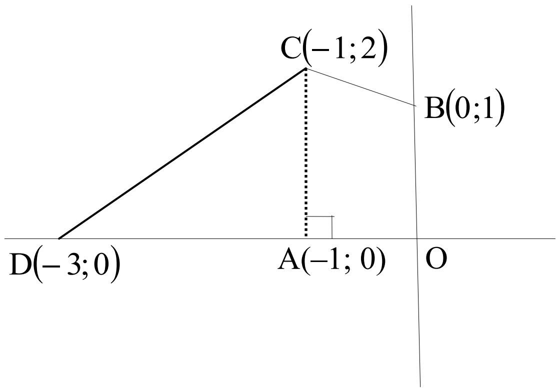


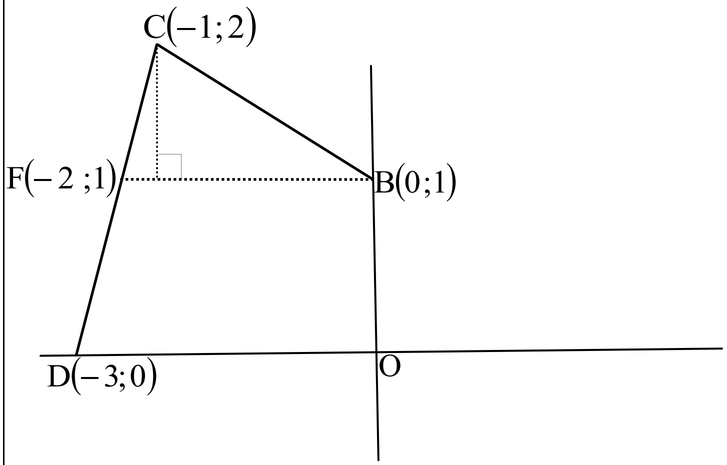
4.1	M(–1;1) $(x+1)^2+(y-1)^2=1$ Answer only: Full marks	✓ M(–1;1) ✓LHS ✓ RHS (3)
4.2	Midpoint of CB, N: (– 0,5 ; 1,5) $\therefore \frac{x_C+0}{2}=-\frac{1}{2}$ and $\frac{y_C+1}{2}=\frac{3}{2}$ Answer only: Full marks $\therefore$ C(– 1 ; 2) **OR** B→N: $(x;y)\to(x-0,5;y+0,5)$ N→C: Answer only: Full marks $(x;y)\to(x-0,5;y+0,5)$ $\therefore$ C(– 0,5 – 0,5 ; 1,5 + 0,5) $\therefore$ C(– 1 ; 2)	✓*x* value ✓ *y* value (2) ✓*x* value ✓ *y* value (2)

4.3	$m_{\text{radius}} = \frac{2-1}{-1-0}$ OR $\frac{2-(-\frac{1}{2})}{-1-\frac{3}{2}}$ OR $\frac{0-(-\frac{1}{2})}{1-\frac{3}{2}}$ $= -1$ $\therefore m_{\text{tangent}} = 1$ $y = mx + c$ $y = x + c$ $2 = 1(-1) + c$ $c = 3$ $\therefore y = x + 3$ $y - x = 3$ **OR** $m_{\text{radius}} = \frac{2-1}{-1-0}$ $= -1$ $\therefore m_{\text{tangent}} = 1$ $y - y_1 = m(x - x_1)$ $y - y_1 = 1(x - x_1)$ $y - 2 = 1(x - (-1))$ $y - 2 = x + 1$ $\therefore y = x + 3$ $y - x = 3$	✓ m_{radius} ✓ m_{tangent} ✓ substitute (– 1 ; 2) and m ✓ simplification (4) ✓ m_{radius} ✓ m_{tangent} ✓ substitute (– 1 ; 2) and m ✓ simplification (4)
4.4	Tangents to circle: $y = x + 3$ and $y = x + 1$ $\therefore t > 3$ or $t < 1$ Answers only: Full marks	✓ $y = x + 1$ ✓ $t > 3$ ✓ $t < 1$ (3)
4.5	Draw rectangle CNED: Midpt of DN $\left(-\frac{7}{4} ; \frac{3}{4}\right)$ $\therefore$ E$\left(-\frac{5}{2} ; -\frac{1}{2}\right)$	✓ midpt of DN ✓x value ✓ y value (3)



	OR/*OF* D(– 3 ; 0) C→N: $(x ; y) \rightarrow (x + 0{,}5 ; y - 0{,}5)$ D→E: D$(x ; y) \rightarrow$ E$(x + 0{,}5 ; y - 0{,}5)$ $\therefore$ E(– 3 + 0,5 ; 0 – 0,5) $\therefore$ E(– 2,5 ; – 0,5) Answer only: Full marks	✓ coordinates of D ✓x value ✓ y value (3)

4.6		
	area of trapezium AOBC $= \frac{1}{2}(1+2)(1)$ $= 1\frac{1}{2}$ square units	✓ substitution into area of trapezium form ✓ area of trapezium
	area of ΔACD $= \frac{1}{2}(2)(2)$ $= 2$ square units	✓ area of triangle
	area of quadrilateral OBCD $= 3\frac{1}{2}$ square units	✓ area of OBCD
	$\therefore 2a^2 = \frac{7}{2}$ $a^2 = \frac{7}{4}$ $a = \frac{\sqrt{7}}{2}$	✓ equating area OBCD to $2a^2$ (5)
	OR	



BM produced cuts the tangent at F.

area of $\Delta CFB = \frac{1}{2}(2)(1)$

$= 1$ square unit

area of trapezium BFDO $= \frac{1}{2}(2+3)(1)$

$= 2\frac{1}{2}$ square units

area of quadrilateral OBCD $= 3\frac{1}{2}$ square units

$\therefore 2a^2 = \frac{7}{2}$

$a^2 = \frac{7}{4}$

$a = \frac{\sqrt{7}}{2}$

✓ area of triangle

✓ substitution into area of trapezium

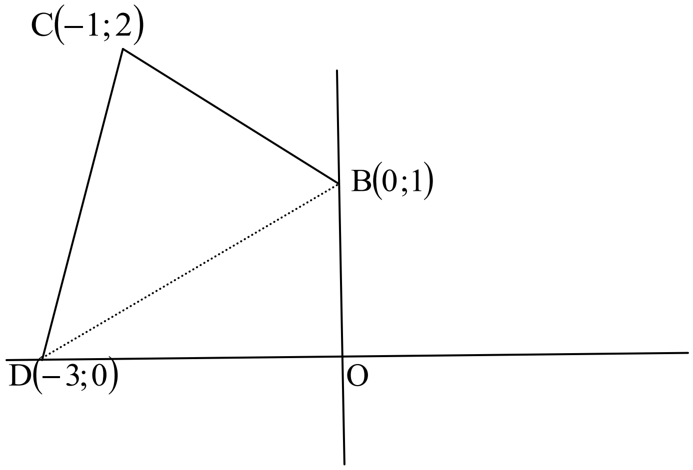
✓ area of trapezium

✓ area of OBCD

✓ equating area OBCD to $2a^2$

(5)

OR



Join DB

area of $\Delta ODB = \frac{1}{2}(3)(1)$

$= \frac{3}{2}$ square unit ✓ area of Δ

area of $\Delta DCB = \frac{1}{2}\left(2\sqrt{2}\right)\left(\sqrt{2}\right)$ ✓ subst into area of Δ

$= 2$ square unit ✓ area of Δ

$\therefore$ area of OBCD $= \frac{3}{2} + 2 =$ square units ✓ area of OBCD

$2a^2 = \frac{7}{2}$ ✓ equating area OBCD to $2a^2$

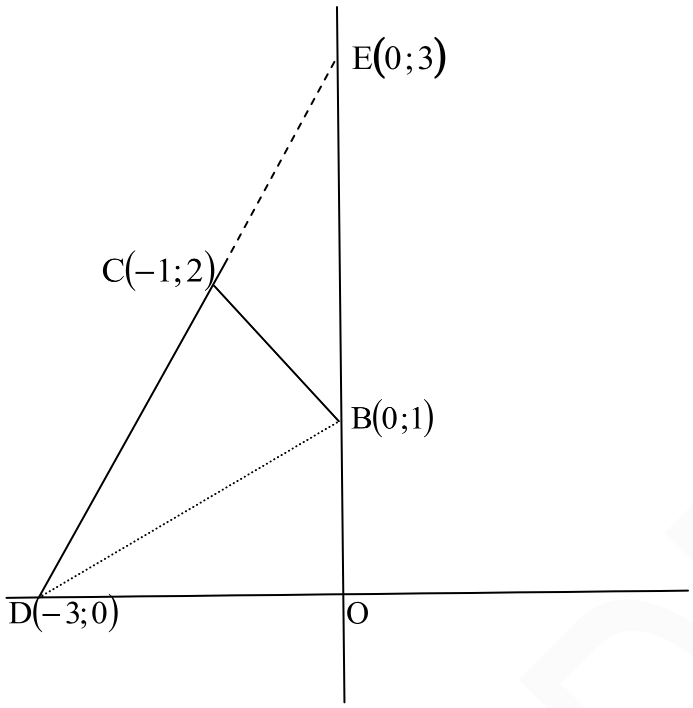
$a^2 = \frac{7}{4}$

$a = \frac{\sqrt{7}}{2}$

(5)

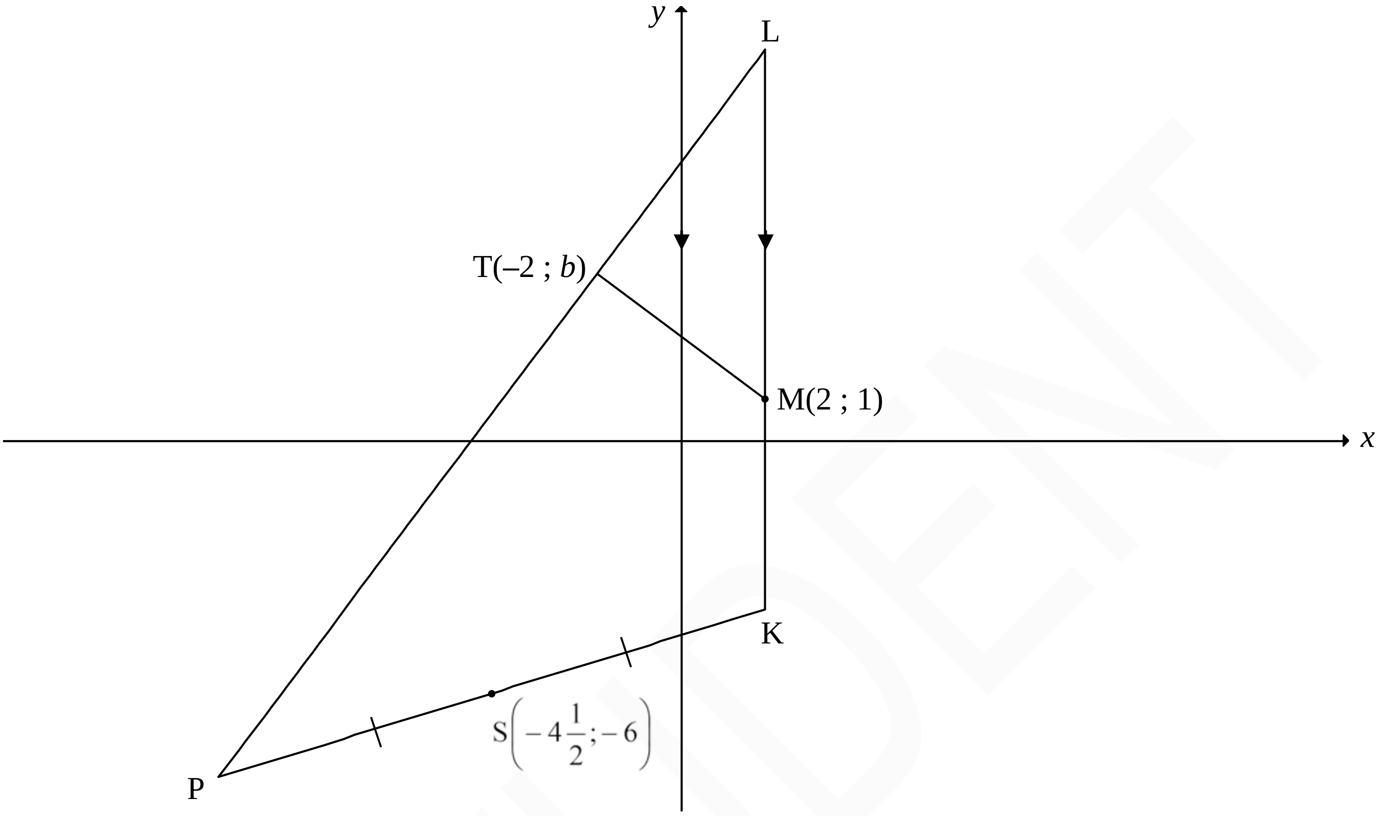
OR

 Please turn over/*Blaai om asseblief*

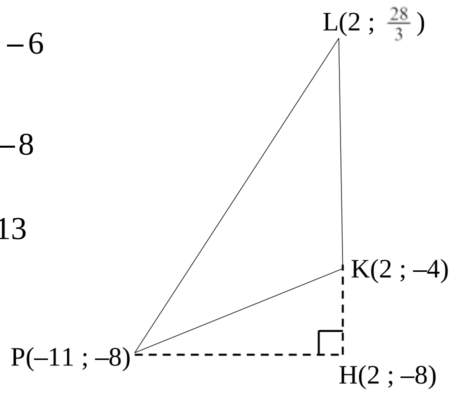


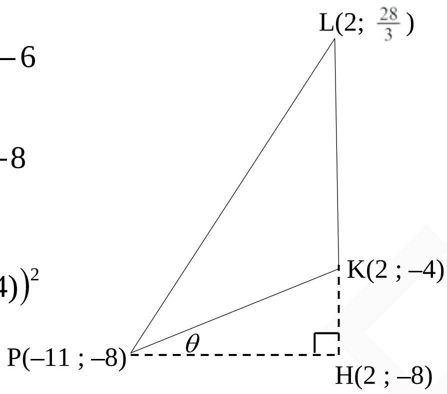
	Let E be the point of intersection of DC with the positive *y*–axis. area of $\Delta DEO = \frac{1}{2}(3)(3)$ $= \frac{9}{2}$ square unit area of $\Delta ECB = \frac{1}{2}(2)(1)$ or $\frac{1}{2}(\sqrt{2})(\sqrt{2})$ $= 1$ square unit area of quadrilateral OBCD $= \frac{9}{2} - 1 = 3\frac{1}{2}$ square units $\therefore 2a^2 = \frac{7}{2}$ $a^2 = \frac{7}{4}$ $a = \frac{\sqrt{7}}{2}$	✓ area of Δ ✓ subst into area of Δ ✓ area of Δ ✓ area of OBCD ✓ equating area OBCD to $2a^2$ (5)
		[20]

QUESTION/*VRAAG* 4

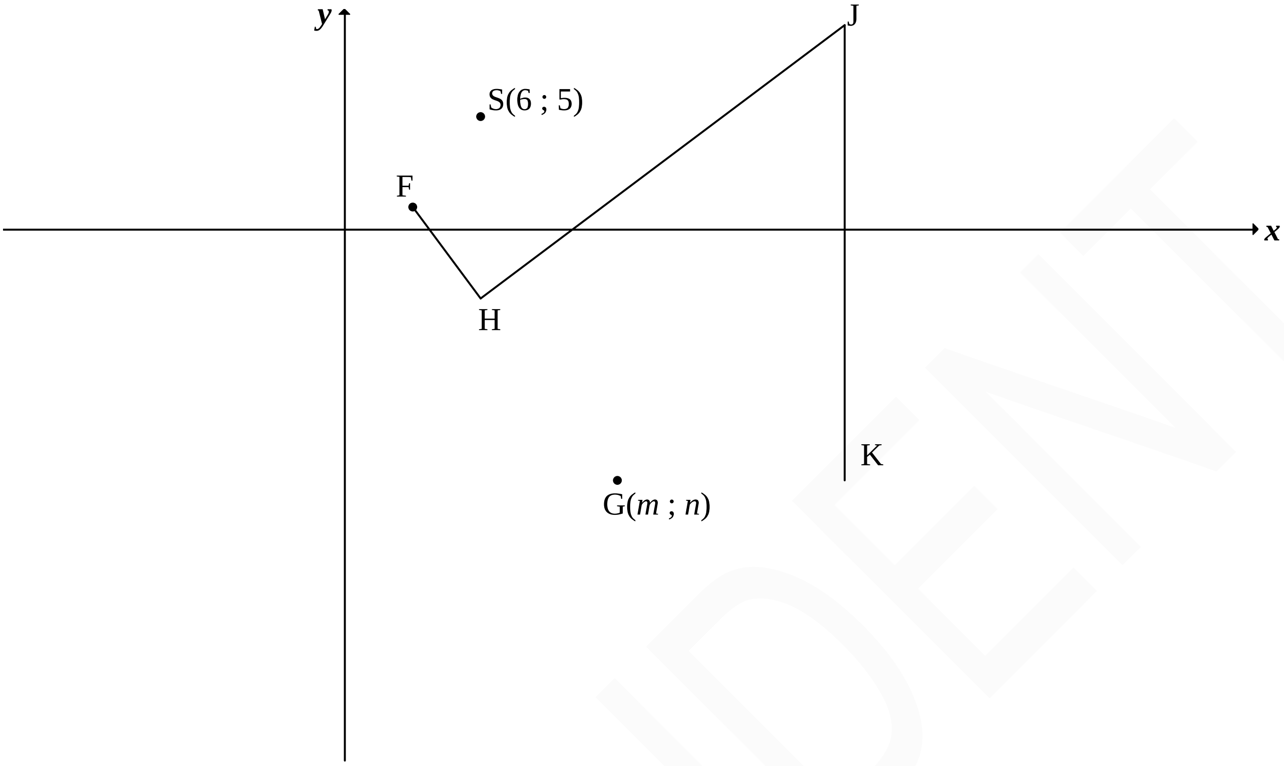


4.1	$(x-2)^2+(y-1)^2=25$ $(-2-2)^2+(b-1)^2=25$ $(b-1)^2=9$ $b-1=\pm3$ $\therefore b=4$ or $b\neq-2$ **OF** $(x-2)^2+(y-1)^2=25$ $(-2-2)^2+(b-1)^2=25$ $16+b^2-2b+1=25$ $b^2-2b-8=0$ $\therefore b=4$ or $b\neq-2$	✓ equation of the circle ✓substitution of point T ✓simplification ✓ answer (4)
4.2.1	K(2 ; 1 – 5) ∴ K(2 ; –4) Answer only: full marks	✓ x value ✓ y value (2)
4.2.2	$m_{MT}=\frac{4-1}{-2-2}=-\frac{3}{4}$ $m_{PL}=\frac{4}{3}$ [radius ⊥ tangent] $y=\frac{4}{3}x+c$ $4=\frac{4}{3}(-2)+c$ $c=\frac{20}{3}$ $y=\frac{4}{3}x+\frac{20}{3}$	✓ m_{MT} ✓ $m_{PL}=\frac{4}{3}$ ✓ substitution of m_{PL} and the point T ✓ equation (4)

	OR $m_{\text{MT}} = \frac{4-1}{-2-2} = -\frac{3}{4}$ $m_{\text{PL}} = \frac{4}{3}$ [radius ⊥ tangent] $y - y_1 = \frac{4}{3}(x - x_1)$ $y - 4 = \frac{4}{3}(x+2)$ $y = \frac{4}{3}x + \frac{20}{3}$	✓ m_{MT} ✓ $m_{\text{PL}} = \frac{4}{3}$ ✓ substitution of m_{PL} and the point T ✓ equation (4)
	OR P(–11 ; –8) $m_{\text{PL}} = \frac{4-(-8)}{-2-(-11)}$ $= \frac{4}{3}$ $y = \frac{4}{3}x + c$ $-8 = \frac{4}{3}(-11) + c$ $c = \frac{20}{3}$ $y = \frac{4}{3}x + \frac{20}{3}$	✓ coordinates of P ✓ $m_{\text{PL}} = \frac{4}{3}$ ✓ substitution of m_{PL} and the point P or T ✓ equation (4)
4.2.3	$y_{\text{L}} = \frac{4}{3}(2) + \frac{20}{3} = \frac{28}{3}$ $\text{L}\left(2\ ;\ \frac{28}{3}\right)$ and $\text{K}(2\ ;-4)$: $\text{LK} = \frac{28}{3} - (-4) = \frac{40}{3}$ Coordinates of P: $\frac{x+2}{2} = -4\frac{1}{2}$ and $\frac{y-4}{2} = -6$ $\therefore\ x = -11$ $y = -8$ $\therefore \text{P}(-11; -8)$ $\perp$height (PH) $= 2-(-11) = 13$ Area ΔPKL $= \frac{1}{2}$(LK)(PH) $= \frac{1}{2}\left(\frac{40}{3}\right)(13)$ $= \frac{260}{3}$ **OR** 86,67 square units 	✓ $y_{\text{L}} = \frac{28}{3}$ ✓ length of LK ✓ x_{P} ✓ y_{P} ✓ length of ⊥ height ✓ substitution into the area formula ✓ answer (7)

4.2.3	**OR** $y_L = \frac{4}{3}(2) + \frac{20}{3} = \frac{28}{3}$ $L\left(2\ ;\ \frac{28}{3}\right)$ and $K(2\ ;-4)$: $LK = \frac{28}{3} - (-4) = \frac{40}{3}$ <u>Coordinates of P:</u> $\frac{x+2}{2} = -4\frac{1}{2}$ and $\frac{y-4}{2} = -6$ $\therefore\ x = -11$ $y = -8$ $\therefore P(-11;-8)$  $PK^2 = (-11-2)^2 + (-8-(-4))^2$ $PK = \sqrt{185}$ units $m_{PK} = \frac{-8-(-4)}{-11-2} = \frac{4}{13}$ $\tan\theta = \frac{4}{13}$ $\therefore \theta = 17{,}1027...°$ $\therefore P\hat{K}L = 90° + 17{,}1027...° = 107{,}1°$ $\text{Area}\ \Delta PKL = \frac{1}{2}(PK)(LK).\sin P\hat{K}L$ $= \frac{1}{2}\left(\sqrt{185}\right)\left(\frac{40}{3}\right)\sin 107{,}10°$ $= 86{,}67$ square units	✓ $y_L = \frac{28}{3}$ ✓ length of LK ✓ x_P ✓ y_P ✓ $P\hat{K}L$ ✓ substitution into the area rule ✓ answer (7)
4.3	The centres of the two circles lie on the same vertical line $x = 2$. and the sum of the radii = 10 $n - 1 = 10$ or $1 - n = 10$ $n = 11$ $n = -9$ Answer only: full marks	✓ correct method ✓ sum of radii = 10 ✓ $n = 11$ ✓ $n = -9$ (4)
		[21]

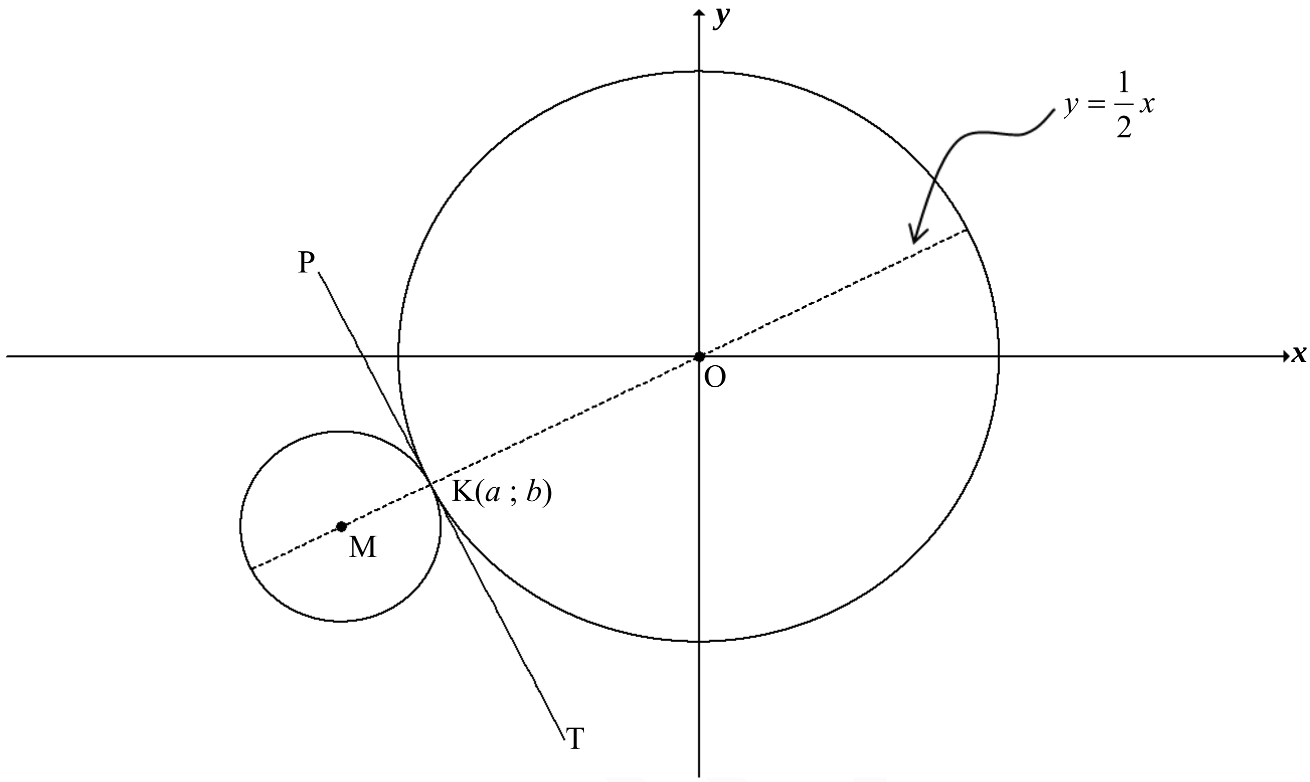
QUESTION/*VRAAG* 4



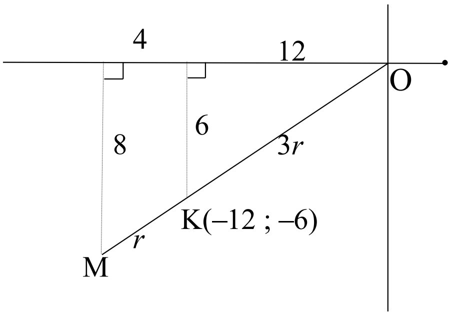
4.1	$F(3;1)$	✓x value ✓ y value (2)
4.2	$FS = \sqrt{(6-3)^2 + (5-1)^2}$ FS = 5	✓ substitution of F & S ✓ answer (2)
4.3	FH(FS) : HG = 1 : 2 $\therefore$ HG = 2 FH = 10	✓ HG = 10 (1)
4.4	Tangents from common/same point / *Raaklyne vanaf gemeenskaplike of dieselfde punt*	✓ answer (1)
4.5.1	$F\hat{H}J = 90°$ [tan ⊥ radius / *rkl ⊥ radius*] $FJ^2 = 20^2 + 5^2$ [Pyth theorem/*stelling*] FJ = $\sqrt{425}$ or $5\sqrt{17}$ or 20,62	✓ S ✓ R ✓ S ✓ answer (4)
4.5.2	$(x-m)^2 + (y-n)^2 = 100$	✓ answer (1)

4.5.3	K(22; n) [radius ⊥ tangent] GK = HG = 10 [radii] FH = FS = 5 [radii] m = 22 – 10 m = 12 F, H and G are collinear [HJ is a common tangent] *F, H en G is saamlynig [HJ is 'n gemeemskaplike raaklyn]* $FG^2 = (12-3)^2 + (n-1)^2$ $15^2 = 81 + (n-1)^2$ $(n-1)^2 = 144$ $n-1 = \pm 12$ **OR/*OF*** $\boxed{\begin{array}{l} n^2 - 2n - 143 = 0 \\ (n+11)(n-13) = 0 \\ n = -11 \text{ or } n \neq 13 \end{array}}$ $n \neq 13$ or $n = -11$ $\therefore$ G(12; –11) **OR/*OF*** K(22; n) [radius ⊥ tangent] GK = HG = 10 [radii] FH = FS = 5 [radii] m = 22 – 10 m = 12 Let J(22 ; y): $FJ^2 = (22-3)^2 + (y-1)^2$ $425 = 361 + y^2 - 2y + 1$ $0 = y^2 - 2y - 63$ $0 = (y-9)(y+7)$ $\therefore$ y = 9 or/of $y \neq -7$ $\therefore$ n = 9 – 20 = –11 $\therefore$ G(12; –11)	✓ K(22; n) ✓ value of m ✓ subst. of F and G in distance formula ✓ FG = 15 ✓ simplification/ standard form ✓ value of n ✓ coordinates of G (7) ✓ K(22; n) ✓ value of m ✓ subst. of F and J in distance formula ✓ FJ = $\sqrt{425}$ ✓ standard form ✓ value of n ✓ coordinates of G (7)
		[18]

QUESTION/*VRAAG* 4

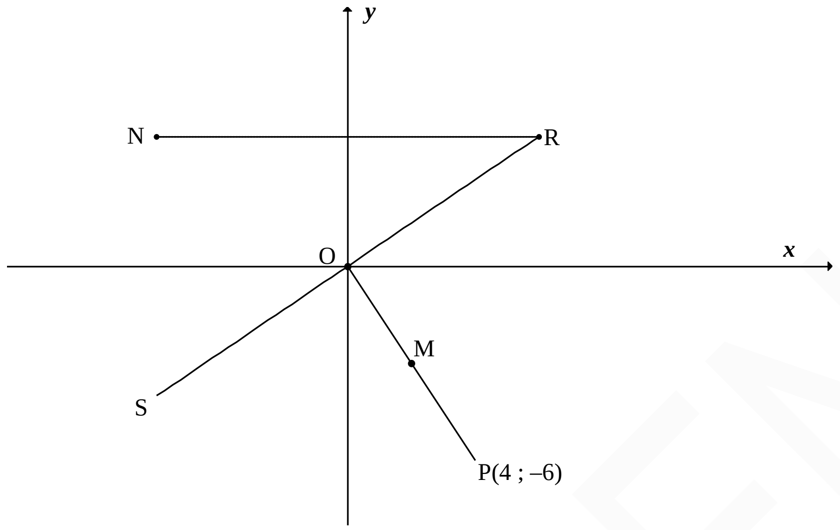


4.1	$\text{OK} = \sqrt{180}$ or $6\sqrt{5}$	✓ answer (1)
4.2	$a^2 + b^2 = 180$ $b = \frac{1}{2}a$ $a^2 + \left(\frac{1}{2}a\right)^2 = 180$ No penalty if x and y are not converted to a and b $a^2 + \frac{1}{4}a^2 = 180$ $a^2 = 144 \quad \therefore a = -12$ $b = \frac{1}{2}(-12)$ Error in simplification: max 2/4 K (–12 ; – 6) (given)	✓ b in terms of a ✓ substitution ✓ $a^2 = 144$ ✓ substitution (4)
	OR/*OF* $a^2 + b^2 = 180$ $a = 2b$ $(2b)^2 + b^2 = 180$ $5b^2 = 180$ $b^2 = 36 \quad \therefore b = -6$ $a = 2(-6)$ K (–12 ; – 6) (given)	✓ a in terms of b ✓ substitution ✓ $b^2 = 36$ ✓ substitution (4)

4.3.1	$m_{\text{OK}} = \frac{1}{2}$ $\quad [\, y = \frac{1}{2}x \,]$ $m_{\text{PT}} = -2$ $\quad$ [radius $\perp$ tangent/*raaklyn*] $y = mx + c$ **OR/*OF*** $y - y_1 = m(x - x_1)$ $-6 = -2(-12) + c$ $\quad$ $y - (-6) = -2(x - (-12))$ $c = -30$ $\quad$ $c = -30$ $y = -2x - 30$ $\boxed{\text{Using } m = \frac{1}{2} : 0/3 \quad \text{Using } m = -\frac{1}{2} \text{ or } 2 : 2/3}$	✓ $m_{\text{PT}} = -2$ ✓ substitution of m & K$(-12\,;-6)$ ✓ equation (3)
4.3.2	3MK = OK $\Rightarrow$OM = $\frac{4}{3}$ OK $\text{M} = \frac{4}{3}(-12\,;-6)$ $\therefore$M(–16 ; –8) $\boxed{\text{Answer only: } 0/6}$	✓ 3MK = OK ✓ OM = $\frac{4}{3}$ OK ✓✓ $\text{M} = \frac{4}{3}(-12\,;-6)$ ✓ x-coordinate ✓ y-coordinate (6)
	OR/*OF* 3MK = OK $9\text{MK}^2 = \text{OK}^2 = 180$ $\therefore \text{MK}^2 = 20$ Let M(x ; y), then : $(x+12)^2 + (y+6)^2 = 20$ $(x+12)^2 + \left(\frac{1}{2}x + 6\right)^2 = 20$ $x^2 + 24x + 144 + \frac{1}{4}x^2 + 6x + 36 = 20$ $\frac{5}{4}x^2 + 30x + 160 = 0$ $x^2 + 24x + 128 = 0$ $(x+16)(x+8) = 0$ $x = -16 \quad x \neq -8$ [since M is outside the large circle] $y = -8$ $\text{M}(-16\,;-8)$	✓ 3MK = OK ✓ $\text{MK}^2 = 20$ ✓ equation ✓ substitution ✓ x-coordinate ✓ y-coordinate (6)
	OR/*OF*  $\therefore$M(–16 ; –8)	✓ 3MK = OK ✓ ✓✓ diagram with values **OR** valid explanation ✓ x-coordinate ✓ y-coordinate (6)
	OR/*OF*	

	$3MK = OK$ $9MK^2 = OK^2 = 180$ $\therefore MK^2 = 20$ Let M(x ; y), then $y = \frac{1}{2}x$: $(x+12)^2 + (y+6)^2 = 20$ $(x+12)^2 + \left(\frac{1}{2}x+6\right)^2 = 20$ $4(x+12)^2 + (x+12)^2 = 80$ $(x+12)^2 = 16$ $x+12 = \pm 4$ $x = -16 \quad x \neq -8$ [since M is outside the large circle] $y = -8$ $M(-16;-8)$	✓ $3MK = OK$ ✓ $MK^2 = 20$ ✓ equation ✓ substitution ✓ x-coordinate ✓ y-coordinate (6)
4.3.3	$(x-(-16))^2 + (y-(-8))^2 = \left(\frac{1}{3}\sqrt{180}\right)^2$ $(x+16)^2 + (y+8)^2 = 20$	✓ LHS (CA from 4.3.2) ✓ RHS (CA from 4.1) (2)
4.4	$OK < r < OK + 2KM$ $\sqrt{180} < r < \sqrt{180} + \frac{2}{3}\sqrt{180}$ $6\sqrt{5} < r < 10\sqrt{5}$ Answer only: full marks (No need to simplify)	✓✓ values ✓ inequality (3)
4.5	$x^2 + 32x + (16)^2 + y^2 + 16y + (8)^2 = 256 + 64 - 240$ $(x+16)^2 + (y+8)^2 = 80$ New circle/*nuwe sirkel*: Centre/*middelpt* $(-16;-8)$ & $r = 4\sqrt{5}$ Original circle/*oorspronklike sirkel*: $M(-16;-8)$ & $r = 2\sqrt{5}$ This circle will never cut the circle with centre M as they have the **same centre (concentric circles) but unequal radii**/*Hierdie sirkel sal nooit die sirkel met middelpt M sny nie, want hulle is* ***konsentries, want het dieselfde middelpunt met verskillende radii***.	✓ equation in centre, radius form ✓ Centre: $(-16;-8)$ ✓ $r = 4\sqrt{5}$ (new) ✓ $r = 2\sqrt{5}$ (original) ✓ conclusion ("concentric" must be stated) (5) **[24]**

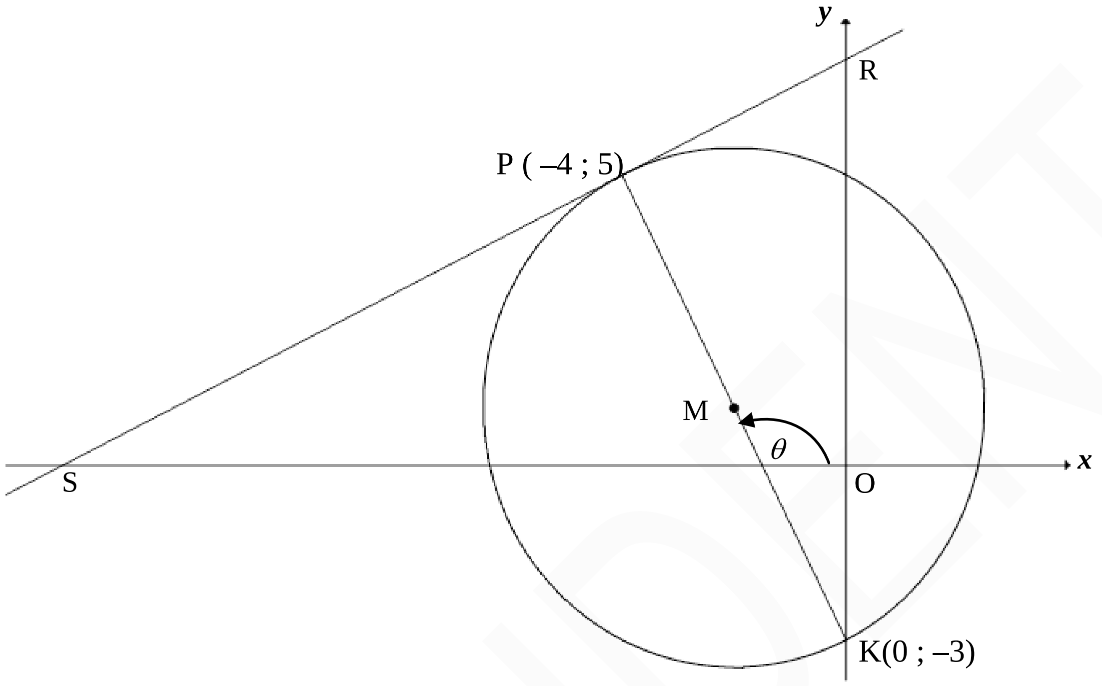
QUESTION/*VRAAG* 4



4.1	$M\left(\frac{0+4}{2}\ ;\ \frac{0+(-6)}{2}\right)$ $\therefore M(2\ ;-3)$	✓ 2 ✓ – 3 (2)
4.2.1	$x^2+y^2=4^2+(-6)^2$ $=52$ $\therefore x^2+y^2=52$	✓ substitution ✓ equation (2)
4.2.2	$(x-2)^2+(y+3)^2=\left(\frac{\sqrt{52}}{2}\right)^2=13$ $x^2-4x+4+y^2+6y+9-13=0$ $x^2+y^2-4x+6y=0$	✓ substitution of M ✓ substitution of radius = $\frac{\sqrt{52}}{2}$ ✓ answer (3)
4.2.3	$m_{OP}=\frac{-6}{4}=-\frac{3}{2}$ $m_{RS}\times m_{OP}=-1$ [radius ⊥ tangent / *raaklyn*] $\therefore\ m_{RS}=\frac{2}{3}$ $\therefore y=\frac{2}{3}x$	✓ m_{OP} ✓ m_{RS} ✓ equation (3)

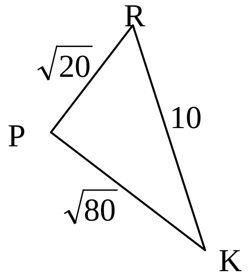
4.3	$x^2 + y^2 = 52$ *and* $y = \frac{2}{3}x$ $x^2 + \left(\frac{2}{3}x\right)^2 = 52$ $x^2 + \frac{4}{9}x^2 = 52$ $1\frac{4}{9}x^2 = 52$ $x^2 = 36$ $x = 6$ ∴ R(6 ; 4) and N(–6 ; 4) ∴ NR = 12 units	✓ substitution ✓ simplification ✓ value of *x* ✓ length of NR (4)
4.4	Let T(*x* ; 0) be the other *x* intercept of the small circle Then OT is the common chord $\therefore (x-2)^2 + (0+3)^2 = 13$ $(x-2)^2 = 13 - 9 = 4$ $x - 2 = \pm 2$ $x = 2 \pm 2$ $x = 4$ *or* 0 OR $x^2 - 4x + 4 + 9 = 13$ $x^2 - 4x = 0$ $x(x-4) = 0$ $x = 0$ or $x = 4$ ∴ length of common chord = OT = 4 units	✓ *y* = 0 ✓ *x*-values ✓ answer (3) **[17]**

QUESTION/*VRAAG* 4



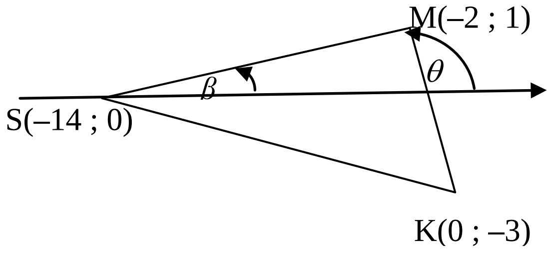
4.1.1	$m_{PK} = \frac{5-(-3)}{-4-0}$ $= -2$ PK ⊥ SR [radius ⊥ tangent/*raaklyn*] $\therefore\ m_{PK} \times m_{RS} = -1$ $\therefore m_{RS} = \frac{1}{2}$	✓ substitution P & K into gradient formula ✓ gradient of PK ✓ PK ⊥ SR **OR** r ⊥ tangent ✓ answer (4)
4.1.2	$y = \frac{1}{2}x + c$ $5 = \frac{1}{2}(-4) + c$ **OR/*OF*** $(y-5) = \frac{1}{2}(x-(-4))$ $c = 7$ $(y-5) = \frac{1}{2}x + 2$ $y = \frac{1}{2}x + 7$ $y = \frac{1}{2}x + 7$	✓ substitution of *m* and P ✓ equation (2)

4.1.3	$M\left(\frac{-4+0}{2}\ ;\ \frac{5+(-3)}{2}\right)$ $\therefore$ M(–2 ; 1) $r^2=(x_2-x_1)^2+(y_2-y_1)^2$ $r^2=(-2+4)^2+(1-5)^2$ $\therefore r^2=20$ $\therefore (x+2)^2+(y-1)^2=20\ \ or\ (\sqrt{20})^2$ **OR/*OF*** $M\left(\frac{-4+0}{2}\ ;\ \frac{5+(-3)}{2}\right)\quad \therefore M(-2\ ;\ 1)$ $(x+2)^2+(y-1)^2=r^2$ $(-4+2)^2+(5-1)^2=r^2$ $\therefore r^2=20$ $\therefore (x+2)^2+(y-1)^2=20\ \ or\ (\sqrt{20})^2$ **OR/*OF*** $M\left(\frac{-4+0}{2}\ ;\ \frac{5+(-3)}{2}\right)\quad \therefore M(-2\ ;\ 1)$ $PK=\sqrt{(-4-0)^2+(5-(-3))^2}=\sqrt{80}$ $r=\frac{\sqrt{80}}{2}=\sqrt{20}$ $\therefore (x+2)^2+(y-1)^2=20\ \ or\ (\sqrt{20})^2$	✓ x value of M ✓ y value of M ✓ $r^2=20$ ✓ equation (4) ✓✓ M (– 2 ; 1) $r^2=20$ ✓ equation (4) ✓✓ M (– 2 ; 1) $r^2=20$ ✓ equation (4)

4.1.4	$\tan\theta = m_{PK} = -2$ $\therefore\ \theta = 180° - 63{,}43°$ $= 116{,}57°$ $P\hat{K}R = 116{,}57° - 90°$ [ext $\angle$ of ΔMOK] $= 26{,}57°$	✓ $\tan\theta = -2$ ✓ size of θ ✓ answer (3)
	OR/*OF*  <u>In ΔRPK:</u> $PK = \sqrt{(0-(-4))^2 + (-3-5)^2} = \sqrt{80}$ $PR = \sqrt{(-4-0)^2 + (5-7)^2} = \sqrt{20}$ $RK = 10$ $\cos P\hat{K}R = \frac{PK^2 + KR^2 - PR^2}{2.PK.KR} = \frac{(\sqrt{80})^2 + (10)^2 - (\sqrt{20})^2}{2(\sqrt{80})(10)}$ $= \frac{2\sqrt{5}}{5}$ $P\hat{K}R = 26{,}57°$	✓ lengths of PK, PR & RK ✓ correct values into cos rule ✓ answer (3)
	OR/*OF* $\sin P\hat{K}R = \frac{\sqrt{20}}{10}$ **OR/*OF*** $\cos P\hat{K}R = \frac{\sqrt{80}}{10}$ $P\hat{K}R = 26{,}57°$ $P\hat{K}R = 26{,}57°$	✓ lengths of sides ✓ ratio ✓ answer (3)
	OR/*OF* $\tan P\hat{K}R = \frac{\sqrt{20}}{\sqrt{80}}$ $P\hat{K}R = 26{,}57°$	✓ lengths of sides ✓ ratio ✓ answer (3)

4.1.5	RS ∥ tangent at K(0 ; −3) $\therefore m_{\text{PS}} = m_{\text{tang}} = \frac{1}{2}$ $\therefore y = \frac{1}{2}x - 3$ **OR/*OF*** $m_{PK} = \frac{1-5}{-2+4} = -2$ $m_{PK} \times m_{\tan g} = -1$ [radius ⊥ tangent/*raaklyn*] $\therefore m_{\tan g} = \frac{1}{2}$ $\therefore y = \frac{1}{2}x - 3$	✓ gradient ✓ equation (2) ✓ gradient ✓ equation (2)
4.2	$t \in (-3\ ;\ 7)$ **OR/*OF*** $-3 < t < 7$	✓ −3 (A) ✓ 7 (CA from 4.1.2) ✓ correct inequality (3) ✓ −3 (A) ✓ 7 (CA from 4.1.2) ✓ correct inequality (3)
4.3	RS: $y = \frac{1}{2}x + 7$ $\therefore$ S(–14 ; 0) $\text{SP} = \sqrt{(-14-(-4))^2 + (0-5)^2} = \sqrt{100+25} = \sqrt{125}$ Area ΔSMK = $\frac{1}{2}$. MK . SP $= \frac{1}{2}(\sqrt{20})(\sqrt{125})$ = 25 square units	✓ coordinates of S ✓ length of SP ✓ correct base & height into Area rule ✓ correct substitution ✓ answer (5)

OR/OF



Let β = inclination of SM/ *inklinasie van SM*

RS: $y = \frac{1}{2}x + 7 \quad \therefore$ S(–14 ; 0) ✓ coordinates of S

$SM = \sqrt{(-14-(-2))^2 + (0-1)^2} = \sqrt{145}$ ✓ length of SM

$\tan\beta = \frac{1-0}{-2-(-14)} = \frac{1}{12} \quad \therefore \ \beta = 4{,}76°$

$\therefore S\hat{M}K = 116{,}57° - 4{,}76°$ [ext $\angle$ of Δ]
$= 111{,}81°$ ✓ size of/*grootte v* $S\hat{M}K$

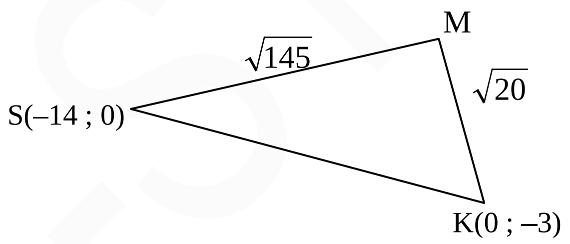
$\text{Area } \Delta SMK = \frac{1}{2}(SM)(MK).\sin S\hat{M}K$

$= \frac{1}{2}(\sqrt{145})(\sqrt{20}).\sin 111{,}81°$ ✓ correct substitution into area rule

$= 24{,}9985 = 25$ square units ✓ answer

(5)

OR/*OF*



RS: $y = \frac{1}{2}x + 7 \quad \therefore$ S(–14 ; 0) ✓ coordinates of S

$SK = \sqrt{(-14-0)^2 + (0+3)^2} = \sqrt{205}$ ✓ length of SK

$\cos S\hat{M}K = \frac{(\sqrt{145})^2 + (\sqrt{20})^2 - (\sqrt{205})^2}{2(\sqrt{145})(\sqrt{20})} = -\frac{2\sqrt{29}}{29}$

$S\hat{M}K = 111{,}80°$ ✓ size of /*grootte v* $S\hat{M}K$

$\text{Area } \Delta SMK = \frac{1}{2}(SM)(MK).\sin S\hat{M}K$

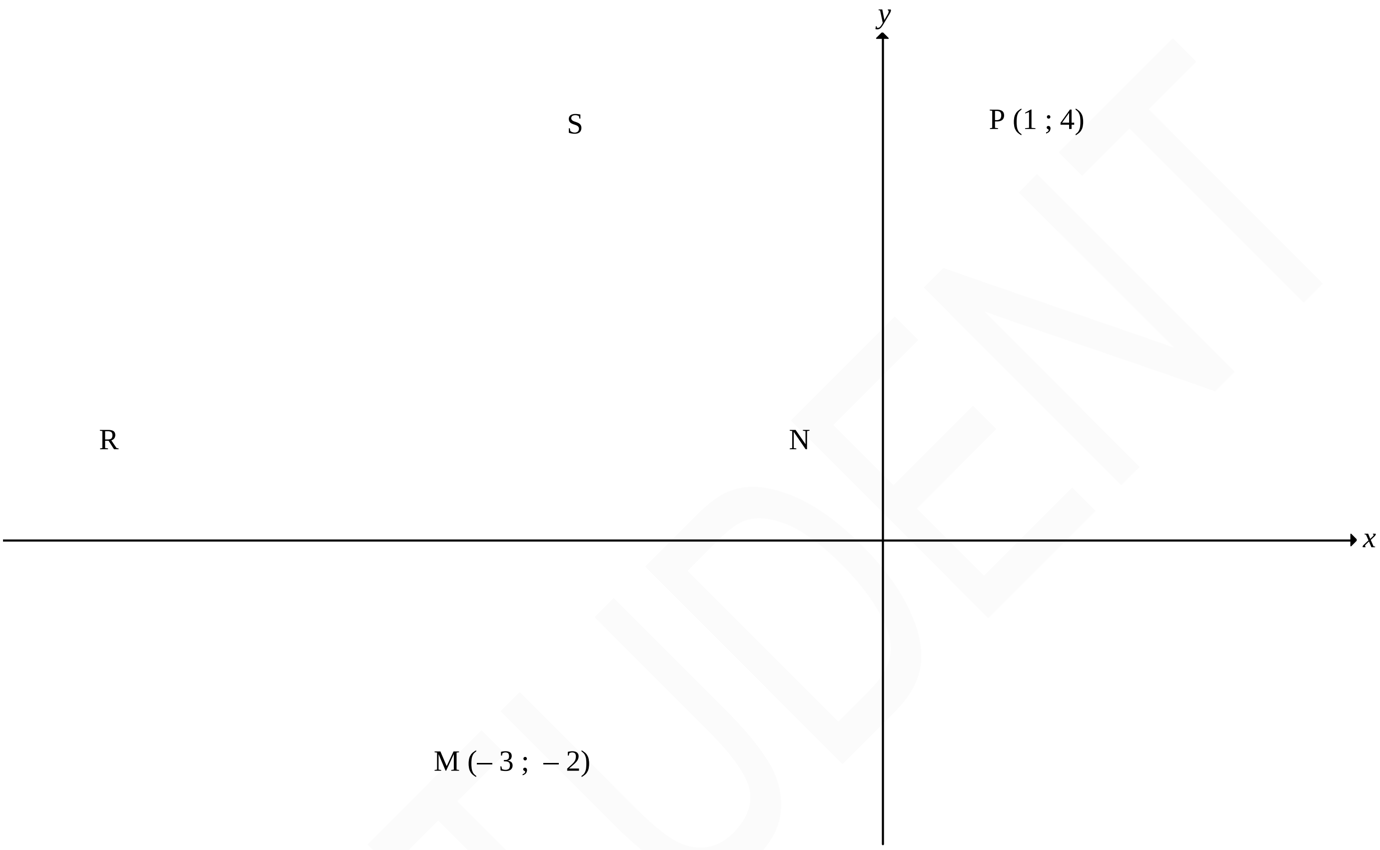
$= \frac{1}{2}(\sqrt{145})(\sqrt{20}).\sin 111{,}81°$ ✓ correct substitution into area rule

$= 24{,}9985 = 25$ square units ✓ answer

(5)

	OR/*OF*	
	Produce KS to T	
	RS: $y=\frac{1}{2}x+7 \quad \therefore$ S(–14 ; 0)	✓ coordinates of S
	$SK=\sqrt{(-14-0)^2+(0+3)^2}=\sqrt{205}$ $SM=\sqrt{(-14-(-2))^2+(0-1)^2}=\sqrt{145}$	✓ length of SK & SM
	$m_{SK}=-\frac{3}{14} \Rightarrow T\hat{S}O=167{,}91°$ $m_{SM}=\frac{1}{12} \Rightarrow M\hat{S}O=4{,}76°$ $M\hat{S}K=180°-167{,}91°+4{,}76°=16{,}85°$	✓ size of /*grootte v* $M\hat{S}K$
	Area $\Delta SMK=\frac{1}{2}(SM)(SK).\sin M\hat{S}K$ $=\frac{1}{2}(\sqrt{145})(\sqrt{205}).\sin 16{,}85°$ $=24{,}9985=25$ square units	✓ correct substitution into area rule ✓ answer (5)

QUESTION/VRAAG 4



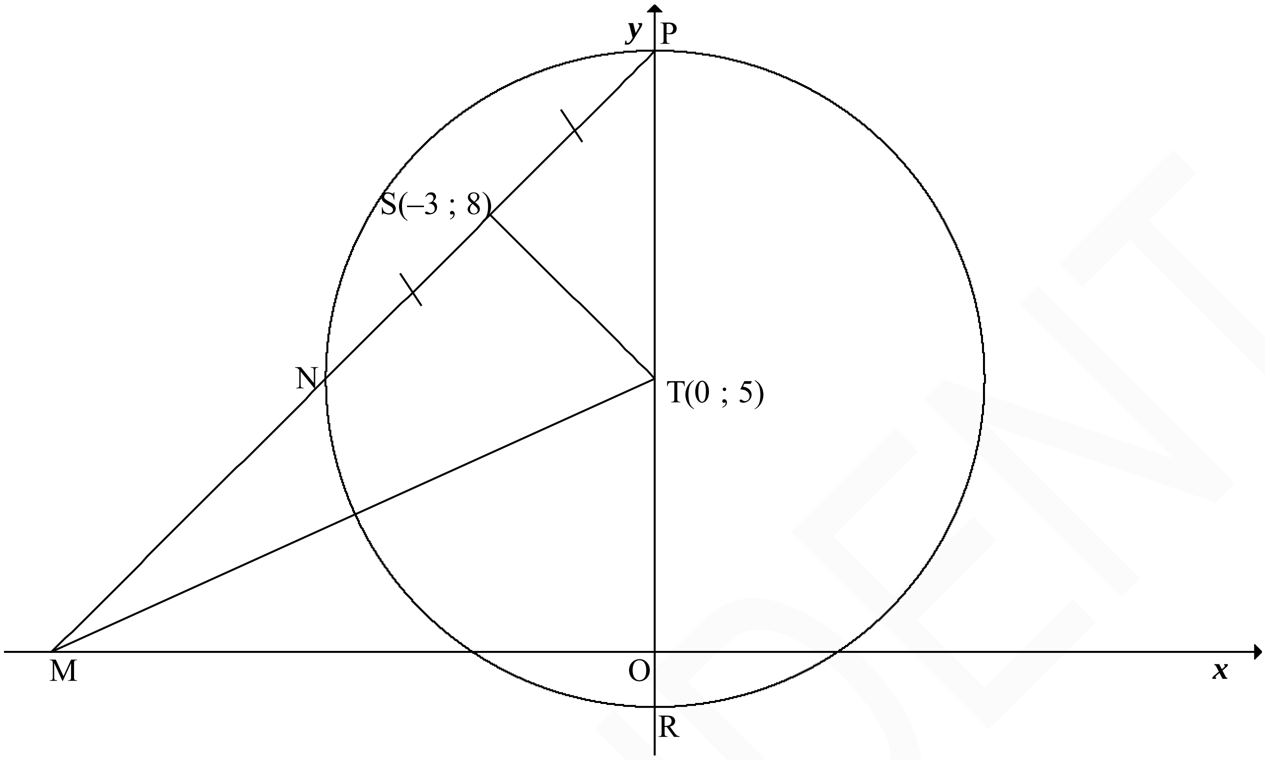
4.1	$N\left(\frac{1+(-3)}{2}\,;\,\frac{4+(-2)}{2}\right)$ $N(-1\,;\,1)$ is the centre of the circle	✓ substitution M & P ✓ x-value of N ✓ y-value of N (3)
4.2	$r=\sqrt{(1-(-1))^2+(4-1)^2}$ $r=\sqrt{13}$ = radius $(x+1)^2+(y-1)^2=13$ **OR/*OR*** $r=\sqrt{(-3-(-1))^2+(-2-1)^2}$ $r=\sqrt{13}$ = radius $(x+1)^2+(y-1)^2=13$	✓ substitution N & P ✓ $r=\sqrt{13}$ ✓ LHS of eq ✓ RHS of eq (4) ✓ substitution N & M ✓ $r=\sqrt{13}$ ✓ LHS of eq ✓ RHS of eq (4)

4.3	$m_{NM} \times m_{MR} = -1$ [radius ⊥ tangent/*raakklyn*] $m_{NM} = \frac{1-(-2)}{-1-(-3)}$ *OR* $m_{PM} = \frac{4-(-2)}{1-(-3)}$ $= \frac{3}{2}$ $= \frac{3}{2}$ $m_{MR} = -\frac{2}{3}$ $y - y_1 = -\frac{2}{3}(x - x_1)$ **OR/*OF*** $y = -\frac{2}{3}x + c$ $y + 2 = -\frac{2}{3}(x+3)$ **OR/*OF*** $-2 = -\frac{2}{3}(-3) + c$ $y = -\frac{2}{3}x - 4$	✓ correct substitution ✓ m_{NM} ✓ m_{MR} ✓substitution of m_{MR} &(–3 ;–2) ✓ equation (5)
4.4	Symmetry of a kite: S(–3 ; 4) **OR/*OF*** $P\hat{S}M = 90°$ [∠ in semi circle] PS ⊥ SM ∴ S(–3 ; 4) **OR/*OF*** $(NS)^2 = (\text{radius})^2$ $(-3+1)^2 + (y-1)^2 = 13$ $(y-1)^2 = 9$ $y - 1 = \pm 3$ $y = 4$ *OR* $y \neq -2$ ∴ S(–3 ; 4)	✓ *x*-value of S ✓ *y*-value of S (2) ✓ *x*-value of S ✓ *y*-value of S (2) ✓ *x*-value of S ✓ *y*-value of S (2)
4.5	$(SR)^2 = (RM)^2$...Tangents from common pt/*rklyne v dies punt* $(x+3)^2 + (y-4)^2 = (x+3)^2 + (y+2)^2$ $y^2 - 8y + 16 = y^2 + 4y + 4$ $-12y = -12$ $y = 1$ $\frac{2}{3}x = -4 - 1$ or $1 = -\frac{2}{3}x - 4$ $x = -\frac{15}{2}$ $x = -7\frac{1}{2}$ ∴ $R\left(-7\frac{1}{2};1\right)$ **OR/*OF***	✓ equating lengths ✓ simplification ✓ *y*-value of R ✓ *x*-value of R (4)

	R$(x;1)$ [RN is a horizontal line] $\therefore 1=-\frac{2}{3}x-4$ $5=-\frac{2}{3}x$ $x=-\frac{15}{2}$ $\therefore \text{R}\left(-\frac{15}{2};1\right)$	✓ $y_{\text{R}}=1$ ✓ horizontal line OR R lies on $y=1$ ✓ equating ✓ x-value of R ($x<-4{,}6$) (4)
	OR/*OF*	
	$m_{\text{NS}}=\frac{1-4}{-1+3}=-\frac{3}{2}$ $\therefore\ m_{\text{RS}}=\frac{2}{3}$ $y-4=\frac{2}{3}(x+3)$ $y=\frac{2}{3}x+6$ $-\frac{2}{3}x-4=\frac{2}{3}x+6$ $x=-7\frac{1}{2}$ $y=\frac{2}{3}(-\frac{15}{2})+6=1$ $\therefore \text{R}\left(-\frac{15}{2};1\right)$	✓ $y=\frac{2}{3}x+6$ ✓ equating ✓ x-value of R ($x<-4{,}6$) ✓ y-value of R (4)
4.6	$\text{RS}=\sqrt{(-3+7{,}5)^2+(4-1)^2}$ OR/OF $\text{RM}=\sqrt{(-3+7{,}5)^2+(-2-1)^2}$ $\text{RS}=\frac{3\sqrt{13}}{2}=5{,}41$ area of RSNM = 2area of ΔRSN $=2\left(\frac{1}{2}\right)(\sqrt{13})\left(\frac{3\sqrt{13}}{2}\right)$ $=\frac{39}{2}$ **OR/*OF*** 19,5 square units	✓ RS **OR** RM ✓ method ✓ $\sqrt{13}$ and $\left(\frac{3\sqrt{13}}{2}\right)$ ✓ answer (4)
	OR/*OF*	✓ method ✓ MS = 6 ✓ RN = 6,5 ✓ answer

	area RSNM $= \frac{1}{2}(\text{MS} \times \text{RN})$ (area of a kite/*opp v vlieër*) $= \frac{1}{2}(6)(6,5)$ $= \frac{39}{2}$ OR 19,5 square units **OR/*OF*** $\text{RS} = \sqrt{(-3+7,5)^2 + (4-1)^2}$ OR/OF $\text{RM} = \sqrt{(-3+7,5)^2 + (-2-1)^2}$ $\text{RS} = \frac{3\sqrt{13}}{2}$ *or* 5,41 area of ΔRSN $= \left(\frac{1}{2}\right)(\sqrt{13})\left(\frac{3\sqrt{13}}{2}\right)$ $= \frac{39}{4}$ **OR/*OF*** 9,75 square units area of RSNM = 2area of ΔRSN $= \frac{39}{2}$ **OR/*OF*** 19,5 square units **OR/*OF*** SM = 6 area of RSNM = Area of ΔSMN + Area of ΔRSM $= \frac{1}{2}(6)(1) + \frac{1}{2}(6)(5\frac{1}{2})$ $= 3 + 16\frac{1}{2}$ $= 19\frac{1}{2}$	(4) ✓ RS **OR** RM ✓ $\left(\frac{1}{2}\right)\sqrt{13}\left(\frac{3\sqrt{13}}{2}\right)$ ✓ method ✓ answer (4) ✓ method ✓ MS = 6 ✓ $h = 1$ & $5\frac{1}{2}$ ✓ answer (4)
		[22]

QUESTION/*VRAAG* 4



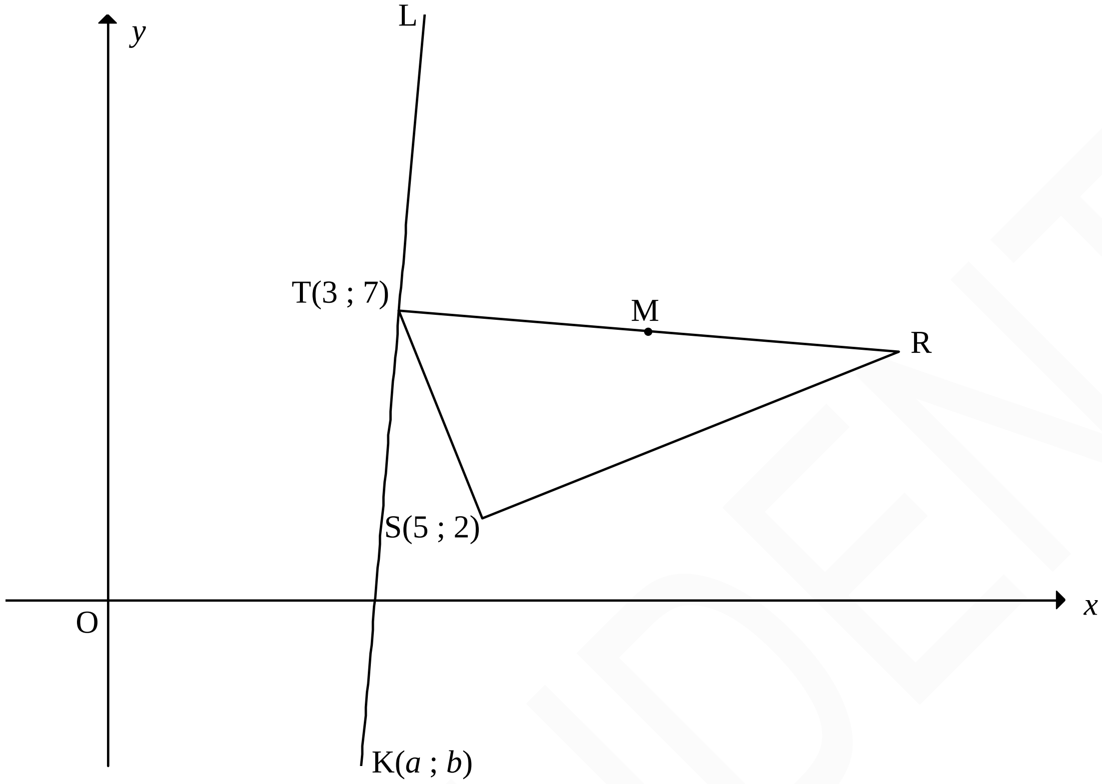
4.1	line from centre to **midpt of chord** / *lyn vanaf midpt na midpt van koord*	✓ answer (1)
4.2	$m_{ST} = \frac{8-5}{-3-0}$ $= -1$ $m_{ST} \times m_{NP} = -1$ [TS ⊥ NP] $\therefore\ m_{NP} = 1$ $\therefore y = x + c$ $8 = -3 + c$ $c = 11$ $\therefore y = x + 11$ **OR/*OF*** $y - y_1 = 1(x - x_1)$ $y - 8 = 1(x + 3)$ $y = x + 11$	✓ subst (–3 ; 8) and (0 ; 5) into gradient formula ✓ m_{ST} ✓ m_{NP} ✓ subst (–3 ; 8) into equation of a line ✓ equation (5)
4.3	P(0 ; 11) [y-intercept of chord NP] $\therefore$ radius is 6 units R(0 ; –1) Equations of the tangents to the circle parallel to the x-axis/ *Vgls van die raaklyne aan die sirkel* || *aan die x-as*: $y = 11$ and $y = -1$	✓ coordinates of P/ koördinate v P ✓ coordinates of R koördinate van R ✓✓ answers (4)
4.4	M(–11 ; 0) [x–intercept of/*x-afsnit van* NP] $MT = \sqrt{(0-11)^2 + (5-0)^2}$ $MT = \sqrt{146} = 12{,}08$	✓✓ coordinates of M ✓ substitution ✓ answer (4)

4.5	MT = diameter/*middellyn* [conv$\angle$ in $\frac{1}{2}$ circle/*omgek* $\angle$ *in* $\frac{1}{2}$ *sirkel*] radius $= \dfrac{\sqrt{146}}{2}$ units Centre of circle/*Middelpunt v sirkel* = Midpoint MT /*Middelpunt MT* $= \left(\dfrac{-11}{2};\dfrac{5}{2}\right)$ Equation of circle through S, T and M: $\left(x+\dfrac{11}{2}\right)^2+\left(y-\dfrac{5}{2}\right)^2=\dfrac{146}{4}$ **OR/*OF*** $\left(x+5\dfrac{1}{2}\right)^2+\left(y-2\dfrac{1}{2}\right)^2=\dfrac{73}{2}=6{,}04$	✓ radius of circle ✓ x value of M ✓ y value of M ✓ LHS of equation ✓ RHS of equation (5) **[19]**

QUESTION/*VRAAG* 5

5.1	$a=-1$ $b=2$	✓ answer ✓ answer (2)
5.2	$f(3x) = -\sin 3x$ Period of $f(3x) = \dfrac{360°}{3}$ $= 120°$ Answer only: Full marks	✓ $\dfrac{360°}{3}$ ✓ answer (2)
5.3	$x \in [90°\ ;\ 135°) \cup \{180°\}$ **OR/*OF*** $90° \leq x < 135°$ or $x = 180°$	✓ 90° and 135° in interval form ✓ 180° as single value ✓ correct brackets (3) ✓ 90° and 135° in interval form ✓ 180° as single value ✓ correct inequalities (3) **[7]**

QUESTION/*VRAAG* 4



4.1	∠ in semi circle/ ∠ at centre = 2∠ on circle ∠ *in halfsirkel* /∠ by middelpt = 2∠ op sirkel	✓ R (1)
4.2	$m_{TS} = \frac{7-2}{3-5}$ $= -\frac{5}{2}$	✓ substitution ✓ m_{TS} (2)
4.3	$m_{TS} \times m_{RS} = -1$ [TS ⊥ SR] $\therefore m_{RS} = \frac{2}{5}$ $y = \frac{2}{5}x + c$ $2 = \frac{2}{5}(5) + c$ $c = 0$ $y = \frac{2}{5}x$ **OR/*OF***	✓ m_{RS} ✓substitution m and (5 ; 2) ✓ equation (3)

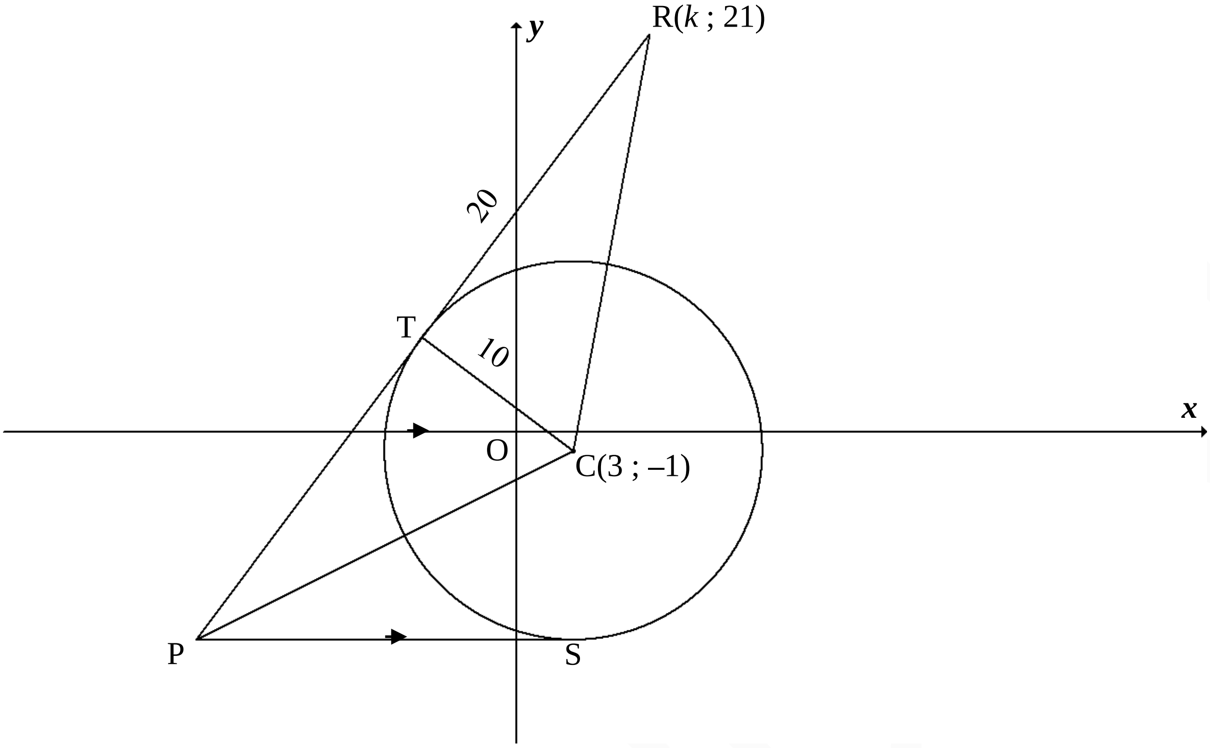
	$m_{TS} \times m_{RS} = -1$ [TS ⊥ SR] $\therefore m_{RS} = \frac{2}{5}$ $y - y_1 = \frac{2}{5}(x - x_1)$ $y - 2 = \frac{2}{5}(x - 5)$ $y = \frac{2}{5}x$	✓ m_{RS} ✓substitution *m* and (5 ; 2) ✓ equation (3)
4.4.1	$r = \sqrt{36\frac{1}{4}}$ $TR = 2.r = 2\left(\sqrt{36\frac{1}{4}}\right) = \sqrt{145}$	✓ *r* ✓ answer (2)
	OR/OF $TM = \sqrt{(3-9)^2 + \left(7 - 6\frac{1}{2}\right)^2} = \frac{\sqrt{145}}{2}$ $TR = 2.r = 2\left(\sqrt{36\frac{1}{4}}\right) = \sqrt{145}$	✓ substitution ✓ answer (2)
4.4.2	$M\left(9\ ;\ 6\frac{1}{2}\right)$ $\therefore \frac{x_R + 3}{2} = 9$ and $\frac{y_R + 7}{2} = 6\frac{1}{2}$ $\therefore R(15\ ;\ 6)$ Answer only: full marks Answer only: only 1 coordinate correct (1 mark)	✓ M ✓ *x* coordinate ✓ *y* coordinate (3)
	OR/*OF* $M\left(9\ ;\ 6\frac{1}{2}\right)$ $\therefore R\left(9 + 6\ ;\ 6\frac{1}{2} - \frac{1}{2}\right) = R(15\ ;\ 6)$	✓ M ✓ *x* coordinate ✓ *y* coordinate (3)
	OR/OF	

	$m_{TM} = \dfrac{9-3}{6\frac{1}{2}-7} = -\dfrac{1}{12}$ $TM: \quad 7 = -\dfrac{1}{12}(3)+c \quad y = -\dfrac{1}{12}x+\dfrac{29}{4}$ ....(1) $SR: \quad y = \dfrac{2}{5}x$ ....(2) $\dfrac{2}{5}x = -\dfrac{1}{12}x+\dfrac{29}{4}$ $\dfrac{29}{60}x = \dfrac{29}{4}$ $\therefore x = 15$ $\therefore y = \dfrac{2}{5}(15) = 6$	✓ equating ✓ x coordinate ✓ y coordinate (3)
4.4.3	$\text{ST} = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ $\text{ST} = \sqrt{(5-3)^2+(2-7)^2}$ $\text{ST} = \sqrt{4+25} = \sqrt{29}$ $\sin \text{R} = \dfrac{\text{TS}}{\text{TR}} = \dfrac{\sqrt{29}}{\sqrt{145}}$ *or* $\dfrac{\sqrt{5}}{5}$ *or* $\dfrac{1}{\sqrt{5}}$ *or* 0,45 **OR/OF** $TS = \sqrt{29}$ $SR = 2\sqrt{29}$ area of $\Delta\text{TSR} = \dfrac{1}{2}(\sqrt{29})(2\sqrt{29}) = 29$ $29 = \dfrac{1}{2}(\sqrt{145})(2\sqrt{29})\sin R$ $\sin R = \dfrac{\sqrt{5}}{5}$ *or* $\dfrac{1}{\sqrt{5}}$	✓substitution ✓ answer ✓ ratio (3) ✓area ✓ rule ✓ ratio (3)
4.4.4	$m_{\text{TR}} = \dfrac{7-6\frac{1}{2}}{3-9} = -\dfrac{1}{12}$ **OR/*OF*** $m_{\text{TR}} = \dfrac{7-6}{3-15} = -\dfrac{1}{12}$ $m_{\text{TR}} \times m_{\text{KTL}} = -1$ [$r \perp$ tangent] $m_{\text{KTL}} = 12$ $y - y_1 = 12(x - x_1)$ $y - 7 = 12(x-3)$ $y = 12x - 29$ substitute $\text{K}(a;b)$: $b = 12a - 29$ **OR/*OF***	✓ $m_{\text{TR}} = -\dfrac{1}{12}$ ✓ $m_{\text{KTL}} = 12$ ✓ $y = 12x - 29$ (3)

	$m_{TR} = \dfrac{7-6\frac{1}{2}}{3-9} = -\dfrac{1}{12}$ $m_{TR} \times m_{KTL} = -1$ [$r \perp$ tangent] $\dfrac{b-7}{a-3} = 12$ $b-7 = 12(a-3)$ $b = 12a-29$ **OR/*OF*** $KR^2 = TR^2 + TK^2$ $(a-15)^2+(b-6)^2 = (15-3)^2+(6-7)^2+(a-3)^2+(b-7)^2$ $-30a+225-12b+36 = 144+1-6a+9-14b+49$ $2b = 24a-58$ $b = 12a-29$	✓ $m_{TR} = -\dfrac{1}{12}$ ✓ $m_{KTL} = 12$ ✓substitution (3 ; 7) & (a ; b) (3) ✓subst into Pyth ✓multiplication ✓simplification (3)
4.4.5	$TK = TR$ $\sqrt{(a-3)^2+(b-7)^2} = \sqrt{145}$ $(a-3)^2+(b-7)^2 = 145$ Substitute $b = 12a - 29$ [from 4.4.4] $(a-3)^2+(12a-29-7)^2 = 145$ $(a-3)^2+(12a-36)^2 = 145$ $a^2-6a+9+144a^2-864a+1296-145=0$ $145a^2-870a+1160=0$ $a = \dfrac{870 \pm \sqrt{(870)^2-4(145)(1160)}}{290}$ $a = 2$ or $a = 4$ $\therefore$ $b = 12(2) - 29$ or $b = 12(4) - 29$ $= -5$ $= 19$ $\therefore$ K(2 ; –5) **OR/*OF***	✓ substitution into distance formula ✓ substitution of $b = 12a - 29$ ✓standard form ✓ subst into formula or factorise ✓ values of a ✓ value of b (6)

	$\text{TK} = \text{TR}$ $\sqrt{(a-3)^2+(b-7)^2} = \sqrt{145}$ $(a-3)^2+(b-7)^2 = 145$ Substitute $b = 12a - 29$ [from 4.4.4] $(a-3)^2+(12a-29-7)^2 = 145$ $(a-3)^2+(12a-36)^2 = 145$ $(a-3)^2+144(a-3)^2 = 145$ $(a-3)^2 = 1$ $a-3 = \pm 1$ $a = 2$ or 4 $\therefore b = 12(2) - 29$ or $b = 12(4) - 29$ $= -5$ $= 19$ $\therefore$ K(2 ; –5) **OR/*OF*** $KR^2 = TR^2 + TK^2$ $(a-15)^2+(b-6)^2 = 145+145$ $(a-15)^2+(12a-29-6)^2 = 290$ $(a-15)^2+(12a-35)^2 = 290$ $a^2-30a+225+144a^2-840a+1225 = 290$ $145a^2-870a+1160=0$ $a^2-6a+8=0$ $\therefore (a-2)(a-4)=0$ $a=2$ or $a=4$ $\therefore b = 12(2) - 29$ or $b = 12(4) - 29$ $= -5$ $= 19$ $\text{K}(2\,;-5)$	✓ substitution into distance formula ✓ substitution of $b = 12a - 29$ ✓ $(a-3)^2 = 1$ ✓ ± 1 ✓ values of a ✓ value of b (6) ✓ substitution ✓ substitution of $b = 12a - 29$ ✓standard form ✓ factors ✓ values of a ✓ value of b (6)
		[23]

QUESTION/*VRAAG* 4

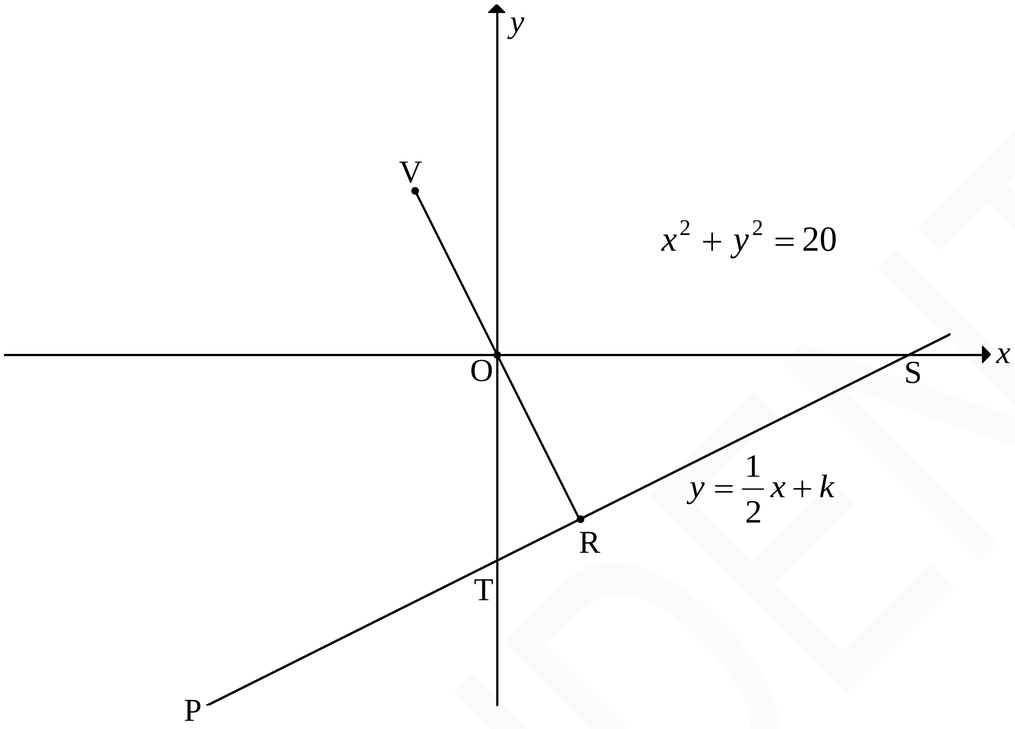


4.1	radius $\perp$ tangent /*raaklyn*	✓ R (1)
4.2	$CR^2 = TR^2 + CT^2$ (Pyth) $CR^2 = 20^2 + 10^2 = 500$ $CR = \sqrt{500}$ or $10\sqrt{5}$	✓ substitution ✓ answer (2)
4.3	$CR^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$ $500 = (k-3)^2 + (21+1)^2$ $k^2 - 6k + 9 + 484 = 500$ $k^2 - 6k - 7 = 0$ $(k-7)(k+1) = 0$ $k = 7$ or $k \neq -1$ **OR/*OF*** $CR^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$ $500 = (k-3)^2 + (21+1)^2$ $(k-3)^2 = 16$ $k - 3 = 4$ or $k - 3 = -4$ $k = 7$ or $k \neq -1$	✓ substitution ✓ standard form ✓ factors ✓ $k = 7$ (4) ✓ substitution ✓ square form ✓ square root ✓ $k = 7$ (4)

4.4	$(x-3)^2+(y+1)^2=100$	✓✓ answer (2)
4.5	CS = 10 and CS $\perp$ PS $\therefore S(3;-11)$ $\therefore y=-11$	✓ $S(3;-11)$ ✓ answer (2)
4.6.1	$S(3;-11)$ $\therefore 3(-11)-4x=35$ $x=-17$ $\therefore P(-17;-11)$ **OR/*OF*** $\frac{4}{3}x+\frac{35}{3}=-11$ $\frac{4}{3}x=\frac{-68}{3}$ $x=-17$ $P(-17;-11)$	✓ substituting ✓ answer (2) ✓ equating ✓ answer (2)
4.6.2	PT = PS [tangents from common point/*rklyne vanaf dies pt*] = 17 + 3 = 20 units **OR** $PC=\sqrt{(-17-3)^2+(-11+1)^2}$ $=\sqrt{500}$ *or* $10\sqrt{5}$ $PT^2=PC^2-TC^2$ [Pyth th] = 500 – 100 = 400 $\therefore$ PT = 20 **OR** $PC=\sqrt{(-17-3)^2+(-11+1)^2}$ $=\sqrt{500}$ *or* $10\sqrt{5}$ Δ PTC $\equiv$ ΔRTC [90°HS] $\therefore$ PT = TR $\therefore$ PT = 20	✓ S ✓R ✓ answer (3) ✓ value of PC ✓ using Pyth ✓ answer (3) ✓ value of PC ✓ S/R or proved ✓ answer (3)
4.7.1	$M(3;-16)$	✓answer (1)

4.7.2	Radius = 4	✓ answer (1)
4.7.3	$r_1 + r_2 = 10 + 4 = 14$ $\text{distance CM} = \sqrt{(3-3)^2 + (-1+16)^2}$ $= \sqrt{225}$ $= 15$ CM > $r_1 + r_2$ Therefore the two circles do not intersect or touch./*Daarom sny of raak die twee sirkels nie.*	✓ $r_1 + r_2$ ✓ 15 ✓explanation (3) **[21]**

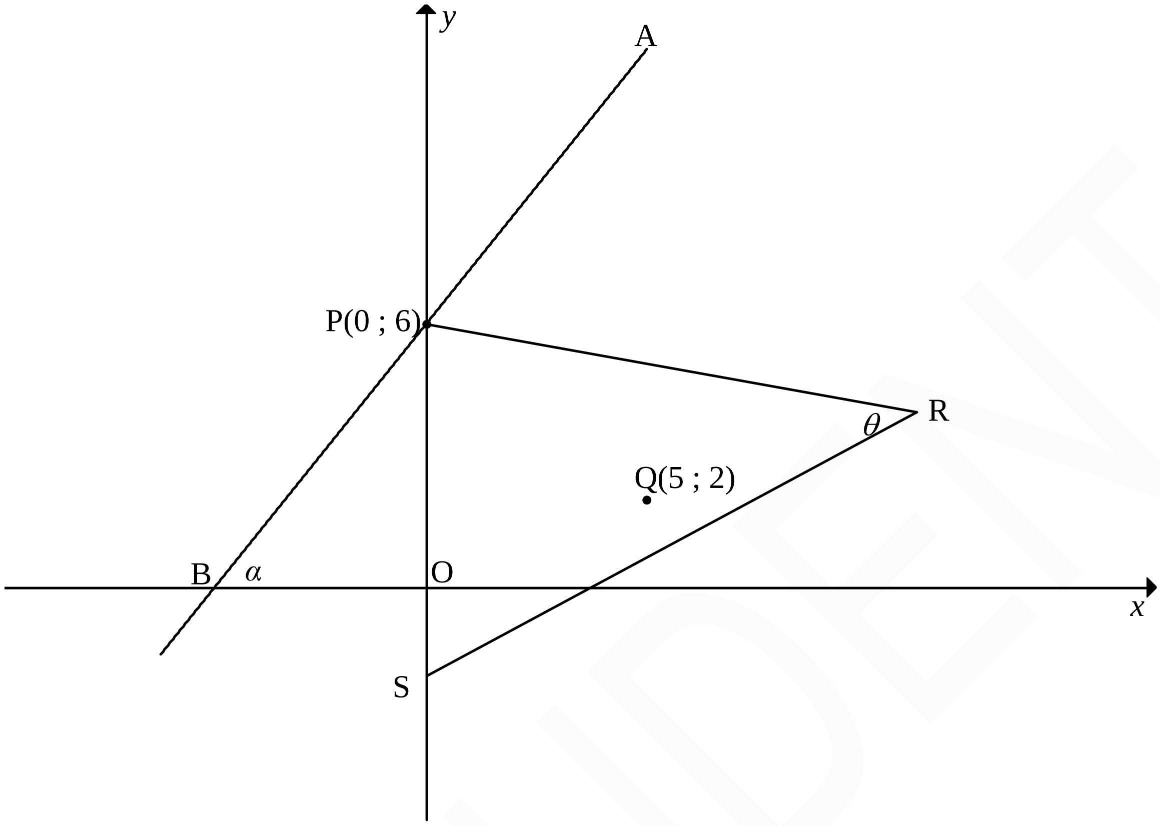
QUESTION/*VRAAG* 4



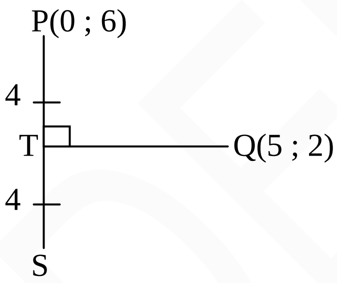
4.1	OR ⊥ TR [radius ⊥ tangent/*raakl*] $\therefore\ m_{TR} \times m_{OR} = -1$ $\therefore\ m_{OR} = -2$ $\therefore\ y = -2x$	✓S/R ✓*m* of/*van* OR ✓equation/*vgl* (3)
4.2	$x^2 + (-2x)^2 = 20$ $x^2 + 4x^2 = 20$ $5x^2 - 20 = 0$ $x^2 - 4 = 0$ $(x+2)(x-2) = 0$ $\therefore\ x = 2$ $y = -2(2) = -4$ $\therefore$ R(2 ; –4)	✓subst eq of OR into circle eq/ *subst vgl OR in sirkelvgl* ✓st. form/*st. vorm* ✓*x*-value/*waarde* ✓*y*-value/*waarde* (4)

4.3	Subst R(2 ; –4) into the equation of/*in vgl van* PRS: $-4=\frac{1}{2}(2)+k$ $k=-5$ $\therefore$ OT = 5 $0=\frac{1}{2}x-5$ $x=10$ $\therefore$ OS = 10 Area/*Oppervlakte* = $\frac{1}{2}$ OS . OT $=\frac{1}{2}(10)(5)$ = 25 sq units/*vk eenh*	✓correct subst/ *korrekte subst* ✓value of *k* ✓$y = 0$ ✓*x*-intercept/*afsnit* ✓correct subst into area form/ *subst korrek in opp-formule* ✓answ/*antw* (6)
4.4	$0=\frac{x_V+2}{2}$ and/*en* $0=\frac{y_V-4}{2}$ $\therefore$ V(–2 ; 4) T(0 ; –5) .... from/*van* 4.3 $VT=\sqrt{(-2-0)^2+(4-(-5))^2}$ $=\sqrt{4+81}$ $=\sqrt{85}$	✓*x*-value/*waarde*V ✓*y*-value/*waarde*V ✓subst of points V and T into distance formula/ *subst punte V en T in afst-form* ✓answ/*antw* (4) **[17]**

QUESTION/*VRAAG* 4

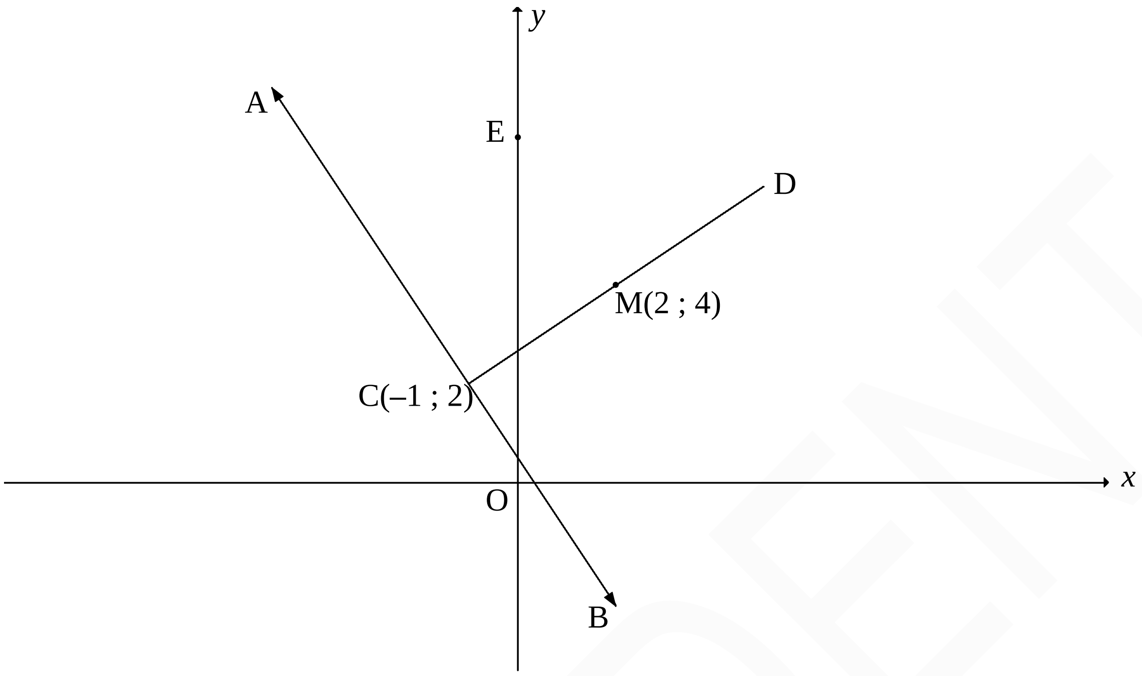


4.1	$(x-5)^2+(y-2)^2=r^2$ $(0-5)^2+(6-2)^2=r^2$ $25+16=r^2$ $41=r^2$ $\therefore\ (x-5)^2+(y-2)^2=41$ **OR/*OF*** $PQ=\sqrt{(0-5)^2+(6-2)^2}$ $=\sqrt{25+16}$ $r=\sqrt{41}$ $\therefore\ (x-5)^2+(y-2)^2=41$	✓ subst (5 ; 2) into circle eq/*in sirkelvgl* ✓ value of/*waarde van* r^2 ✓ equation/*vgl* (3) ✓ subst (5 ; 2) & (0 ; 6) into dist. form/*in afst. form* ✓ value of/*waarde van r* ✓ equation/*vgl* (3)
4.2	$(0-5)^2+(y-2)^2=41$ $25+(y-2)^2=41$ $25+y^2-4y+4=41$ $y^2-4y-12=0$ $(y-6)(y+2)=0$ $y\neq 6\quad or/of\quad y=-2$ $\therefore$ S(0 ; –2) or $y=-2$	✓ $x=0$ ✓ st form/*st. vorm* ✓ answ/*antw* (neg value) (3)

	OR/*OF* $(0-5)^2+(y-2)^2 = 41$ $25+(y-2)^2 = 41$ $(y-2)^2 = 16$ $y-2 = \pm 4$ $y = 2 \pm 4$ $y \neq 6 \quad \text{or / } of \quad y = -2$ $\therefore$ S(0 ; –2)	✓ $x = 0$ ✓ square form/ *kwadraatvorm* ✓ answ/*antw* (neg value) (3)
	OR/*OF* Draw/*Trek* QT ⊥ PS PT = TS [line from centre ⊥ to chord/ *lyn van midpt ⊥ koord*] PT = $y_P - y_Q = 6-2 = 4$ $y_Q - y_S = 4$ $y_S = 2-4 = -2$ $\therefore$ S(0 ; –2) 	✓ $x = 0$ ✓✓ $y = -2$ (3)
4.3	$m_{PQ} = \frac{6-2}{0-5}$ $= -\frac{4}{5}$ $m_{PQ} \times m_{APB} = -1$ [tan/*raakl* ⊥ radius] $\therefore\ m_{APB} = \frac{5}{4}$ $\therefore y = \frac{5}{4}x + 6$	✓ subst (0 ; 6) & (5 ; 2) into grad form/*in grad. formule* ✓ m_{PQ} ✓ m_{APB} ✓ equation/*vgl* (4)
4.4	$\tan\alpha = \frac{5}{4}$ $\therefore\ \alpha = 51{,}34°$ **OR/*OF*** B(4,8 ; 0) $\therefore\ \tan\alpha = \frac{6}{4{,}8}$ $\therefore\ \alpha = 51{,}34°$	✓ $\tan\alpha = m_{APB}$ ✓ answ/*antw* (2) ✓ $\tan\alpha = \frac{6}{4{,}8}$ ✓ answ/*antw* (2)

4.5	$\theta = B\hat{P}S$ [tan-chord th/*raakl-koordst.*] $= 90° - \alpha$ [∠ sum in Δ/∠ *som van* Δ] $= 90° - 51{,}34°$ $= 38{,}66°$ **OR/*OF*** PS = 8 $PQ = SQ = \sqrt{41}$ $PS^2 = PQ^2 + SQ^2 - 2.PQ.SQ.\cos P\hat{Q}S$ $64 = 41 + 41 - 2.41.\cos P\hat{Q}S$ $\cos P\hat{Q}S = \frac{18}{82}$ $P\hat{Q}S = 77{,}32°$ $\theta = \frac{1}{2} P\hat{Q}S$ [∠ at centre = 2 × ∠ circumf] $= 38{,}66°$	✓ S ✓ R ✓ $90° - \alpha$ ✓ answ/*antw* (4) ✓ correct subst into cosine rule ✓ $P\hat{Q}S = 77{,}32°$ ✓ R ✓ answ/*antw* (4)
4.6	Area $\Delta PQS = \frac{1}{2}$ PS ×height/*hoogte* $= \frac{1}{2}(8)(5)$ = 20 sq units/*vk eenh* **OR/*OF*** $P\hat{Q}S = 2 \times 38{,}66°$ [∠at centre = 2×∠ at circum/ *midpts∠=2omtreks∠*] $= 77{,}32°$ Area $\Delta PQS = \frac{1}{2} PQ.QS.\sin P\hat{Q}S$ $= \frac{1}{2}.\sqrt{41}.\sqrt{41}.\sin 77{,}32°$ = 20 sq units/*vk eenh*	✓ area formula/*e*: ΔPQS ✓ PS = 8 ✓ $\perp h = 5$ ✓ answ/*antw* (4) ✓ size of/*grootte v* $P\hat{Q}S$ ✓ area rule/*reël*: ΔPQS ✓ subst correctly/ *subst korrek* ✓ answ/*antw* (4) **[20]**

QUESTION/VRAAG 4

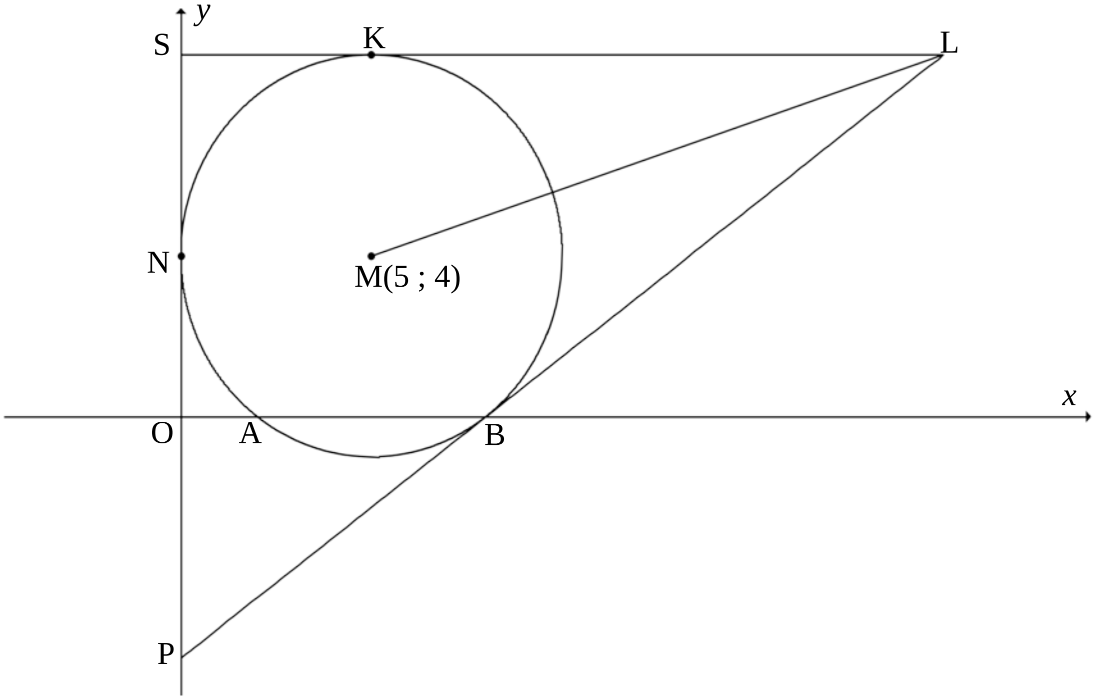


4.1.1	Radius = $\sqrt{(2+1)^2+(4-2)^2}$ $r = \sqrt{13}$ Equation of circle/*vgl van sirkel*: $(x-2)^2+(y-4)^2=13$	✓ $\sqrt{(2+1)^2+(4-2)^2}$ or/*of* $\sqrt{13}$ ✓ $(x-2)^2+(y-4)^2$ ✓ 13 (3)
	OR/*OF*	
	$(x-2)^2+(y-4)^2=r^2$ $(-1-2)^2+(2-4)^2=r^2$ $r^2=13$ $\therefore\ (x-2)^2+(y-4)^2=13$	✓ $(x-2)^2+(y-4)^2$ ✓ $(-1-2)^2+(2-4)^2$ ✓ 13 (3)
4.1.2	At/*by* D: $\frac{-1+x_D}{2}=2$ $\frac{2+y_D}{2}=4$ $-1+x_D=4$ and/*en* $2+y_D=8$ $x_D=5$ $y_D=6$ D(5 ; 6)	✓ x – value/*waarde* ✓ y - value/*waarde* (2)
	OR/*OF* By inspection/*deur inspeksie*: D(5 ; 6)	✓ x - value/*waarde* ✓ y - value/*waarde* (2)

4.1.3	$m_{MC} = \frac{4-2}{2+1} = \frac{2}{3}$ $m_{AB} \times m_{MC} = -1$ (Tangent ⊥ radius/*raaklyn ⊥ radius*) $m_{AB} = -\frac{3}{2}$ $y - y_1 = m(x - x_1)$ ***OR/OF*** $y = mx + c$ $y - 2 = -\frac{3}{2}(x+1)$ $2 = -\frac{3}{2}(-1) + c$ $y = -\frac{3}{2}x + \frac{1}{2}$ $y = -\frac{3}{2}x + \frac{1}{2}$	✓ $m_{MC} = \frac{4-2}{2+1} = \frac{2}{3}$ ✓ $m_{AB} \times m_{MC} = -1$ ✓ $m_{AB} = -\frac{3}{2}$ ✓subst *m* and (–1 ; 2) into eq /*subst m en (–1 ; 2) in vgl* ✓ eq in standard form/ *vgl in st vorm* (5)
4.1.4	At/*by* E: $(0-2)^2 + (y-4)^2 = 13$ $(y-4)^2 = 9$ $y - 4 = \pm 3$ $y = 7$ or $y = 1$ E(0 ; 7) **OR/*OF*** At/*by* E: $(0-2)^2 + (y-4)^2 = 13$ $4 + y^2 - 8y + 16 = 13$ $y^2 - 8y + 7 = 0$ $(y-7)(y-1) = 0$ $y = 7$ or $y = 1$ E(0 ; 7)	✓ $x = 0$ ✓ simplification/ *vereenvoudiging* ✓ *y* - values/*waardes* ✓ E(0 ; 7) (4) ✓ $x = 0$ ✓ simplification/ *vereenvoudiging* ✓ *y* - values/*waardes* ✓ E(0 ; 7) (4)
4.1.5	$m_{EM} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{4-7}{2-0}$ $= -\frac{3}{2}$ $m_{AB} = -\frac{3}{2}$ $\therefore$ EM | | AB ($m_{EM} = m_{AB}$)	✓ $m_{EM} = -\frac{3}{2}$ ✓ reason/*rede* (2)

4.2	The centres of the circles are / *Die middelpunte van die sirkels is* P(–2 ; 4) and / *en* Q(5 ; –1) $QP^2 = (-2-5)^2 + (4-(-1))^2$ $QP = \sqrt{74} \approx 8{,}60$ units $r_M + r_P = 5+3$ $= 8$ $\therefore\ r_M + r_P < QP$ $\therefore$ The two circles do not intersect/*Die twee sirkels sny nie*	✓ both centres/*albei Midpte* ✓ QP ✓ correct subst into form/*korrekte subst in formule* ✓ distance between 2 centres/*afstand tussen 2 midpte* ✓✓ $r_M + r_P < QP$ (6) **[22]**

QUESTION/*VRAAG* 3



3.1	r = MN = 5	✓ answer/*antw* (1)
3.2	$(x-5)^2+(y-4)^2=25$	✓equation/*vgl* (1)
3.3	A(x ; 0) $(x-5)^2+(0-4)^2=25$ $x^2-10x+25+16=25$ $x^2-10x+16=0$ $(x-8)(x-2)=0$ $\therefore x=8$ or/*of* $x=2$ $\therefore$ A(2 ; 0) **OR/*OF*** $(x-5)^2+(0-4)^2=25$ $(x-5)^2+16=25$ $(x-5)^2=9$ $(x-5)=\pm 3$ $\therefore x=8$ or/*of* $x=2$ $\therefore$ A(2 ; 0)	✓ substitute into eq/ *vervang in vgl* $y=0$ ✓ standard form/ *standaardvorm* or perfect square form/*kwadr vorm* ✓ answer/*antw* (3)
3.4.1	$m_{\text{MB}}=\frac{4-0}{5-8}$ $=-\frac{4}{3}$	✓ subst M and B into form/*vervang M and B in form* ✓ $m_{\text{MB}}=-\frac{4}{3}$ (2)

3.4.2	$m_{MB} \times m_{PB} = -1$ (tangent ⊥ radius/ *rkl ⊥ radius*) $m_{PB} = \frac{3}{4}$ $y = \frac{3}{4}x + c$ **OR/*OF*** $y - y_1 = \frac{3}{4}(x - x_1)$ $0 = \frac{3}{4}(8) + c$ $y - 0 = \frac{3}{4}(x - 8)$ $y = \frac{3}{4}x - 6$ $y = \frac{3}{4}x - 6$	✓ $m_{MB} \times m_{PB} = -1$ ✓ $m_{PB} = \frac{3}{4}$ ✓ equation/*vgl* (3)
3.5	$y_K = y_M + r = 4 + 5$ $y = 9$	✓ 9 ✓ equation/*vgl* (2)
3.6	At/*By* L: $\frac{3}{4}x - 6 = 9$ $3x - 24 = 36$ $3x = 60$ $x = 20$ $\therefore$ L(20 ; 9)	✓ equating simultaneously ✓ simplification (2)
3.7	L(20 ; 9) $\text{ML} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ **OR/OF** $\text{ML} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(20-5)^2 + (9-4)^2}$ $= \sqrt{(15)^2 + (5)^2}$ $= \sqrt{225 + 25}$ $= \sqrt{(5)^2(9+1)}$ $= \sqrt{250}$ *or / of* $5\sqrt{10}$ $= \sqrt{250}$ *or / of* $5\sqrt{10}$	✓ correct subst into distance formula/ *korrekte subst in afstand-formule* ✓ answer in surd form/*antw in wortelvorm* (2)
3.8	**MK ⊥ KL OR/OF** $\mathbf{M\hat{K}L} = 90°$ (radius ⊥ tangent/*radius ⊥ rkl*) $\therefore$ML is a diameter as it subtends a right angle/*ML is middellyn* $r = \frac{\text{ML}}{2} = \frac{\sqrt{250}}{2} = \sqrt{\frac{125}{2}}$ or 7,91 Centre of circle = midpoint of ML/*Midpt van sirkel = midpt v ML* $x = \frac{5+20}{2} = \frac{25}{2} = 12{,}5$ $y = \frac{4+9}{2} = \frac{13}{2} = 6{,}5$ Centre/*midpt*: (12,5 ; 6,5) Equation of the circle KLM /*Vgl van sirkel KLM*: $\therefore \quad (x - 12{,}5)^2 + (y - 6{,}5)^2 = \frac{250}{4} = \frac{125}{2} = 62{,}5$ **OR/*OF***	✓ S ✓ value of/*waarde van r* ✓ $x = 12{,}5$ ✓ $y = 6{,}5$ ✓ answer in correct form/ *antw in korrekte vorm* (5)

	MK $\perp$ KL OR/OF M$\hat{\text{K}}$L $= 90°$ (radius $\perp$ tangent/*radius $\perp$ rkl*) $\therefore$ ML is a diameter as it subtends a right angle/*ML is middellyn* Centre of circle = midpoint of ML/*Midpt van sirkel = midpt v ML* $x = \frac{5+20}{2} = \frac{25}{2} = 12{,}5$ $y = \frac{4+9}{2} = \frac{13}{2} = 6{,}5$ Centre/*midpt*: (12,5 ; 6,5) Equation of the circle KLM /*Vgl van sirkel KLM*: $(x-12{,}5)^2 + (y-6{,}5)^2 = r^2$ subst (5 ; 4): $(5-12{,}5)^2 + (4-6{,}5)^2 = r^2$ $62{,}5 = r^2$ $\therefore \quad (x-12{,}5)^2 + (y-6{,}5)^2 = \frac{250}{4} = \frac{125}{2} = 62{,}5$ **OR/*OF*** By symmetry about LM/*deur simmetrie om LM*: **MK $\perp$ KL OR/OF M$\hat{\text{K}}$L** $= 90°$ (radius $\perp$ tangent/*radius $\perp$ rkl*) $\therefore$ ML is a diameter as it subtends a right angle/*ML is middellyn* ML is a diameter /*ML is 'n middellyn* $r = \frac{\text{ML}}{2} = \frac{\sqrt{250}}{2} = \sqrt{\frac{125}{2}}$ or /of 7,91 Centre of circle = midpoint of ML/*Midpt van sirkel = midpt v ML* $x = \frac{5+20}{2} = \frac{25}{2} = 12{,}5$ $y = \frac{4+9}{2} = \frac{13}{2} = 6{,}5$ Centre/*midpt*: (12,5 ; 6,5) Equation of the circle KLM /*Vgl van sirkel KLM*: $\therefore \quad (x-12{,}5)^2 + (y-6{,}5)^2 = \frac{250}{4} = \frac{125}{2} = 62{,}5$	✓ S ✓ $x = 12{,}5$ ✓ $y = 6{,}5$ ✓ value of/*waarde van* r^2 ✓ answer in correct form/*antw in korrekte vorm* (5) ✓ S ✓ value of/*waarde van r* ✓ $x = 12{,}5$ ✓ $y = 6{,}5$ ✓ answer in correct form/*antw in korrekte vorm* (5) **[21]**

APPARENTLY, THERE ISN'T A MEMO FOR THE 2014 EXEMPLAR, DON'T ASK WHY, I'M CERTAIN IT EXISTS SOMEWHERE JUST CAN'T FIND IT. BUT IF YOU'VE DONE ALL THE PAPERS THUS FAR YOU SHOULD BE GOOD WITHOUT THIS MEMO. (TRUST ME BRO) :)