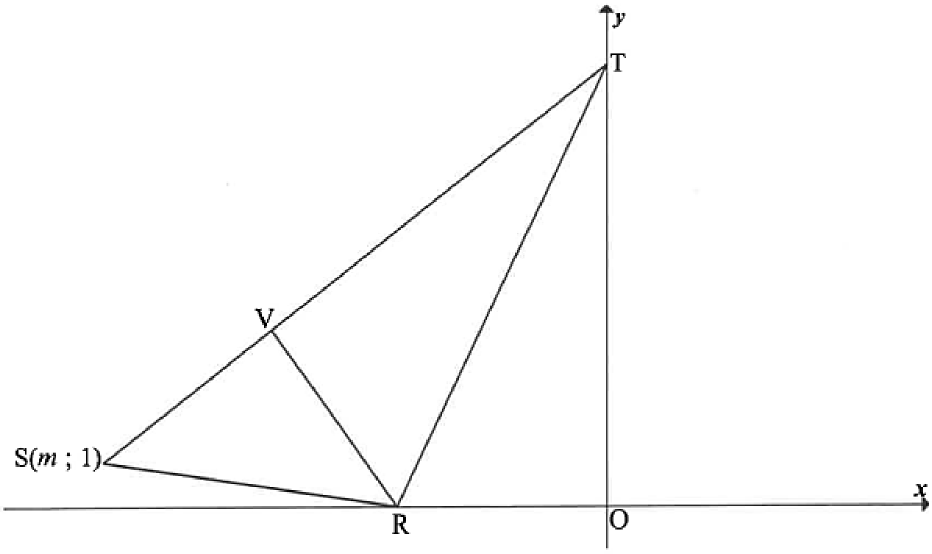
ANALYTICAL GEOMETRY

2026 WORKSHEET

June 2025

QUESTION 3

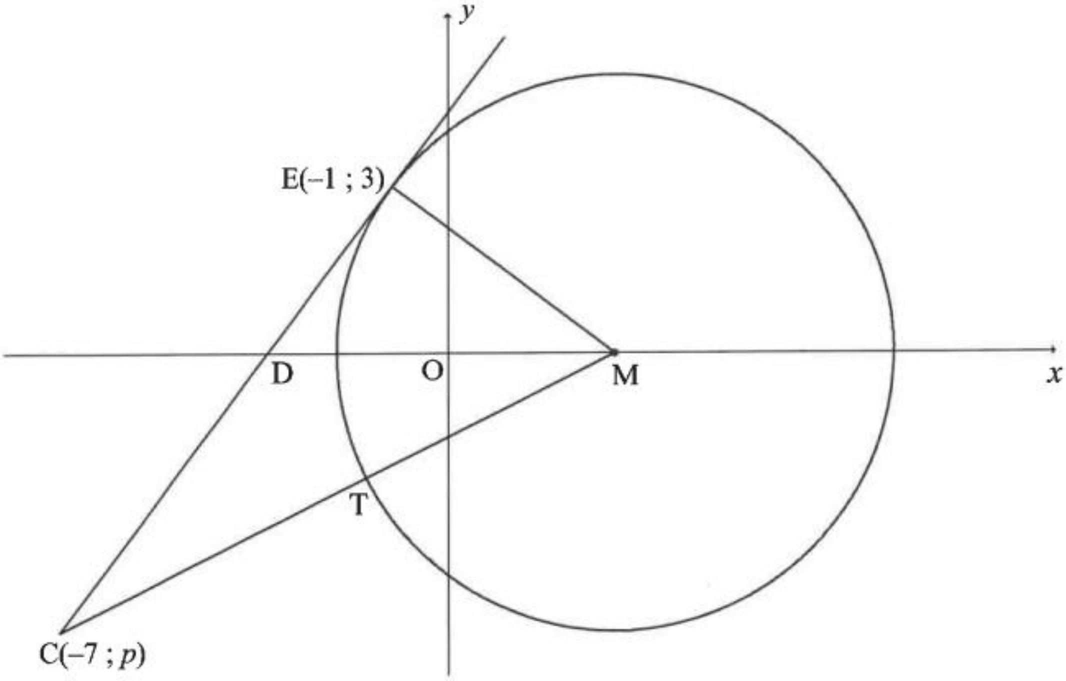
In the diagram below, ΔSRT is drawn where R lies on the x-axis and S lies to the left of R. T lies on the y-axis and the coordinates of S are $(m\ ;\ 1)$. The equation of RT is $2x - y + 10 = 0$.



3.1	Calculate the coordinates of R.	(2)
3.2	Calculate the length of RT. Leave your answer in surd form.	(3)
3.3	If it is also given that $2RT^2 = 5SR^2$, calculate the value of m.	(4)
3.4	It is further given that V lies on ST such that VR is perpendicular to ST. Determine the equation of VR in the form $y = mx + c$.	(5)
3.5	Hence, show that the coordinates of V are $(-8\ ;\ 4)$.	(2)
3.6	If R' is the reflection of R about the line $x = 0$, calculate the area of $RVTR'$.	(5) **[21]**

QUESTION 4

In the diagram, M is the centre of the circle having equation $(x-3)^2+y^2=25$. E$(-1\,;3)$ and T are points on the circle. EC is a tangent to the circle at E and cuts the x-axis at D. $ED=\frac{15}{4}$ units. MT is produced to meet the tangent at $C(-7\,;p)$.



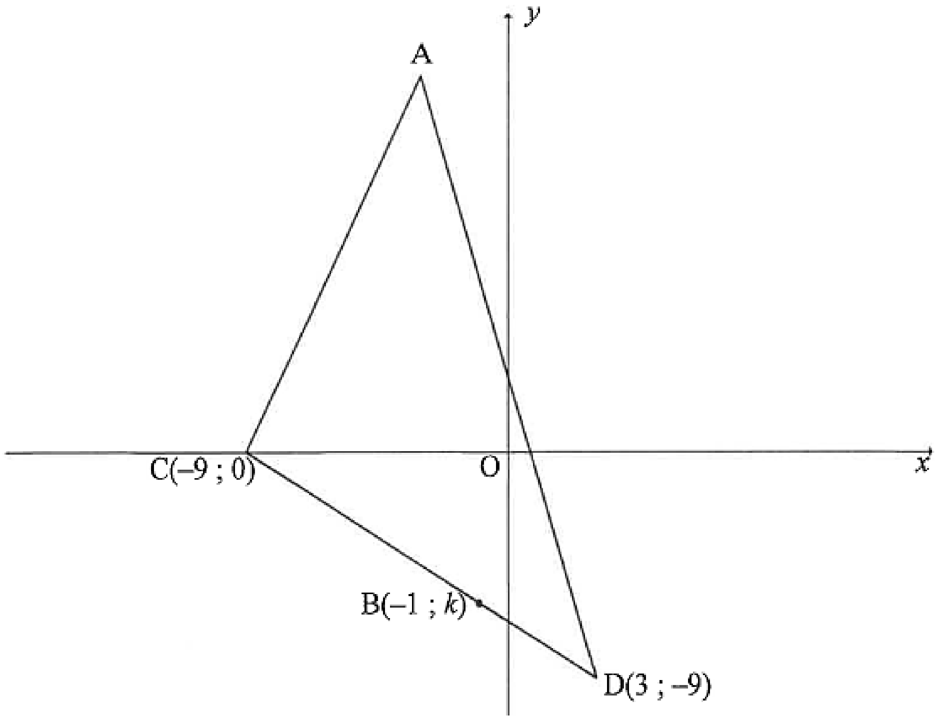
4.1	Write down the size of $C\hat{E}M$.	(1)
4.2	Determine the equation of the tangent EC in the form $y=mx+c$.	(4)
4.3	Calculate the length of DM.	(3)
4.4	Show that $p=-5$	(1)
4.5	Calculate the coordinates of S if SEMC is a parallelogram and $x_s<0$.	(3)
4.6	If the radius of the circle, centred at M, is increased by 7 units, determine whether S lies inside or outside the new circle. Support your answer with the necessary calculations.	(3)
4.7	If ET is drawn, calculate the size of $E\hat{T}M$.	(5)

[20]

November 2024

QUESTION 3

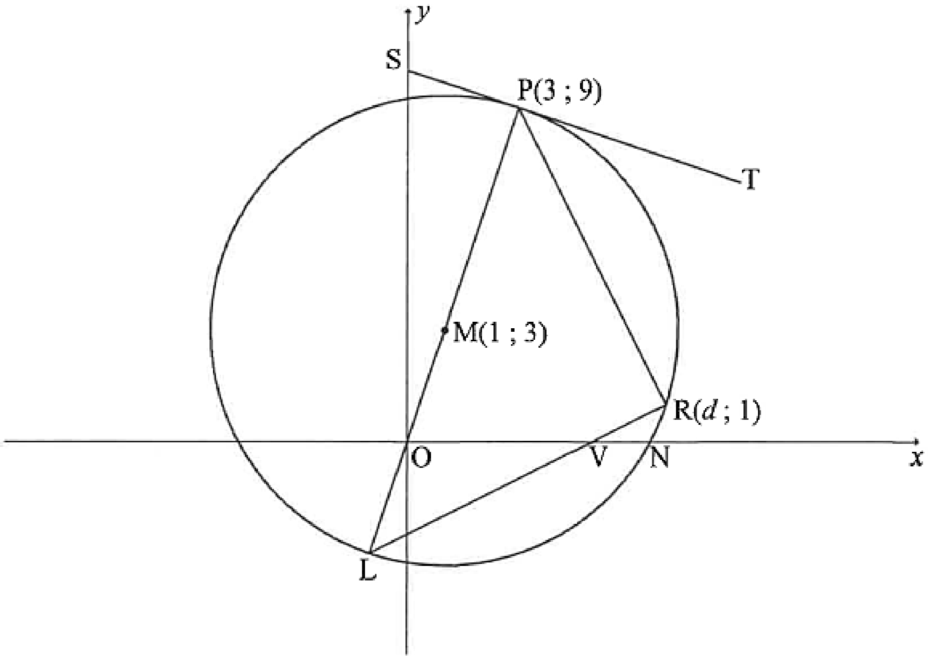
In the diagram below, ΔACD has vertices A, D(3 ; –9) and C(–9 ; 0), where A is a point in the second quadrant. B(–1 ; k) lies on side DC.



3.1	Calculate the gradient of DC.	(2)
3.2	Determine the equation of DC in the form $y = mx + c$.	(2)
3.3	Show that $k = -6$.	(1)
3.4	Calculate the length of DC.	(2)
3.5	Calculate the ratio of $\frac{DB}{DC}$.	(2)
3.6	If M is a point on AD such that AC ∥ MB, calculate the ratio of $\frac{\text{Area } \Delta MBD}{\text{Area } \Delta ACD}$.	(4)
3.7	If it is further given that the gradient of AD is -4 and the length of AD is $\sqrt{612}$ units, calculate the coordinates of A.	(6)
		[19]

QUESTION 4

In the diagram, M(1 ; 3) is the centre of the circle. The circle cuts the x-axis at N. ST is a tangent to the circle at P(3 ; 9). R(d ; 1), with $d > 0$, and L lie on the circle. O and V are the x-intercepts of PL and RL respectively.

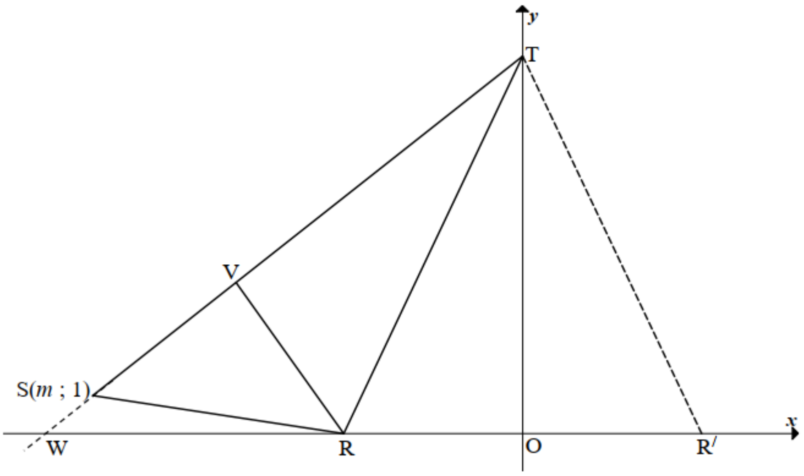


4.1	Write down the coordinates of L.	(2)
4.2	Determine the equation of tangent ST to the circle at P.	(4)
4.3	Show that the equation of the circle with centre M is $x^2 + y^2 - 2x - 6y - 30 = 0$.	(4)
4.4	Show that $d = 7$.	(2)
4.5	Calculate the size of $\hat{L}$	(5)
4.6	TR is a tangent to the circle at R. Prove that PT $\perp$ RT.	(3)
		[20]

WORKSHEET SOLUTIONS

June 2025

QUESTION/*VRAAG* 3

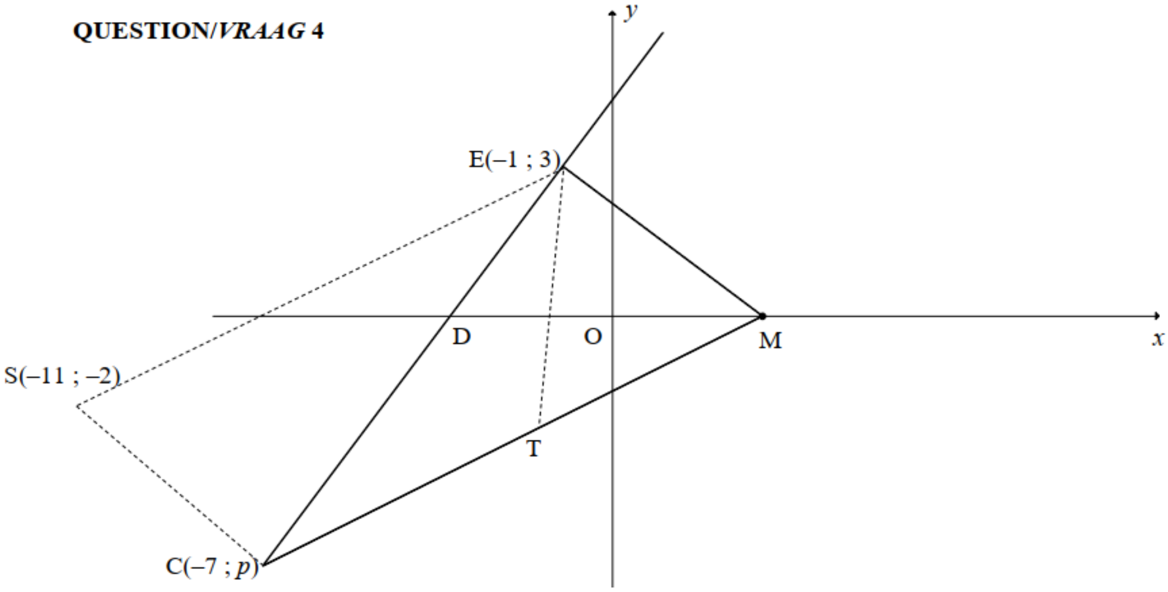


3.1	$2x - y + 10 = 0$ $2x - 0 + 10 = 0$ $x = -5$ R$(-5\ ;\ 0)$
3.2	R$(-5\ ;\ 0)$ T$(0\ ;\ 10)$ $(\text{RT})^2 = (-5-0)^2 + (0-10)^2$ **OR** $(\text{RT})^2 = 5^2 + 10^2$ (Pythag) $\text{RT} = \sqrt{125}$ units **OR/*OF*** $\text{RT} = 5\sqrt{5}$ units
3.3	$2\text{RT}^2 = 5\text{SR}^2$ $2(125) = 5[(m-(-5))^2 + (1-0)^2]$ $5[(m+5)^2 + (1)^2] = 250$ $(m+5)^2 + 1 = 50$ $m^2 + 10m - 24 = 0$ **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 $\therefore m = -12$ $\quad$ $\therefore m = -12$

3.4	$m_{ST} = \dfrac{1-10}{-12-0}$ $m_{ST} = \dfrac{3}{4}$ $\therefore m_{VR} = -\dfrac{4}{3}$ $y = -\dfrac{4}{3}x + c$ **OR/*OF*** $y - y_1 = -\dfrac{4}{3}(x - x_1)$ $0 = -\dfrac{4}{3}(-5) + c$ $\quad$ $y - 0 = -\dfrac{4}{3}(x-(-5))$ $c = -\dfrac{20}{3}$ $\quad$ $y = -\dfrac{4}{3}(x+5)$ $y = -\dfrac{4}{3}x - \dfrac{20}{3}$ $\quad$ $y = -\dfrac{4}{3}x - \dfrac{20}{3}$
3.5	VR: $y = -\dfrac{4}{3}x - \dfrac{20}{3}$ ST: $y = \dfrac{3}{4}x + 10$ $\dfrac{3}{4}x + 10 = -\dfrac{4}{3}x - \dfrac{20}{3}$ $9x + 120 = -16x - 80$ $25x = -200$ $x = -8$ $y = 4$ $\therefore$ V$(-8\ ;\ 4)$

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

QUESTION/*VRAAG* 4

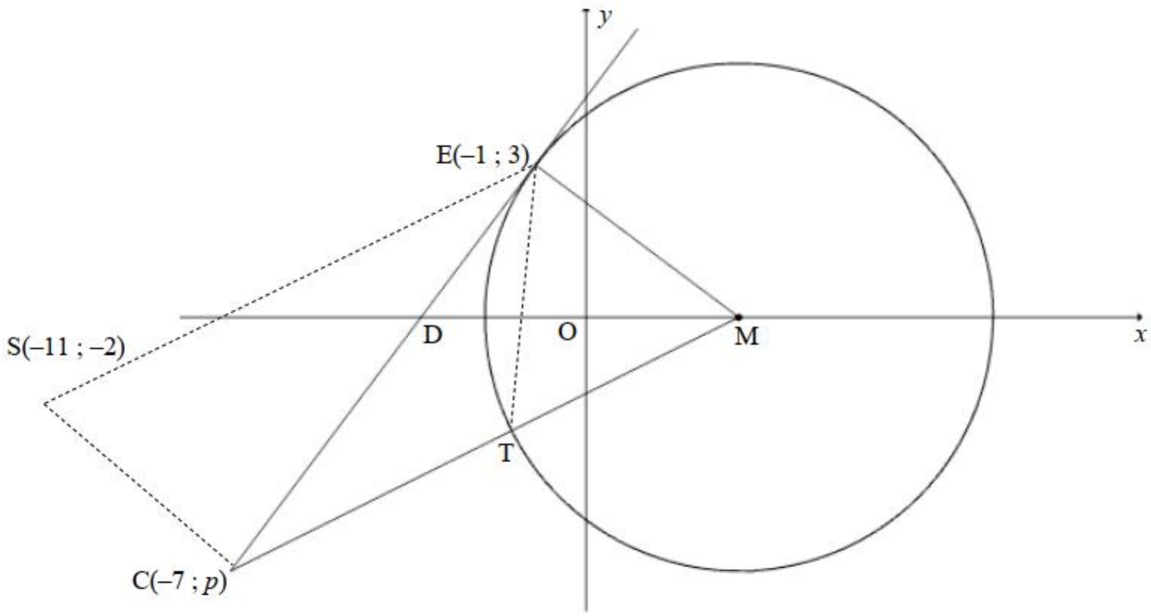


4.1	$\hat{CEM} = 90°$
4.2	$m_{ME} = \frac{0-3}{3-(-1)}$ $m_{ME} = -\frac{3}{4}$ $\therefore m_{ED} = \frac{4}{3}$ $3 = \frac{4}{3}(-1)+c$ **OR/*OF*** $y-3 = \frac{4}{3}(x-(-1))$ $y = \frac{4}{3}x+\frac{13}{3}$ $y = \frac{4}{3}x+\frac{13}{3}$ **OR/*OF*** $DM = \sqrt{(5)^2+\left(\frac{15}{4}\right)^2}$ [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*** $y-3 = \frac{4}{3}(x-(-1))$ $y = \frac{4}{3}x+\frac{13}{3}$ $y = \frac{4}{3}x+\frac{13}{3}$

4.3	$y=\frac{4}{3}x+\frac{13}{3}$ $0=\frac{4}{3}x+\frac{13}{3}$ $x_{D}=-\frac{13}{4}$ $\therefore \text{DM}=3-\left(-\frac{13}{4}\right)$ $\text{DM}=\frac{25}{4}$ 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

4.4	EC: $y=\frac{4}{3}x+\frac{13}{3}$ $p=\frac{4}{3}(-7)+\frac{13}{3}$ $p=-5$ **OR/*OF*** $m_{EC}=\frac{4}{3}$ $\frac{p-3}{-7-(-1)}=\frac{4}{3}$ $p-3=\frac{4}{3}(-6)$ $p=-5$

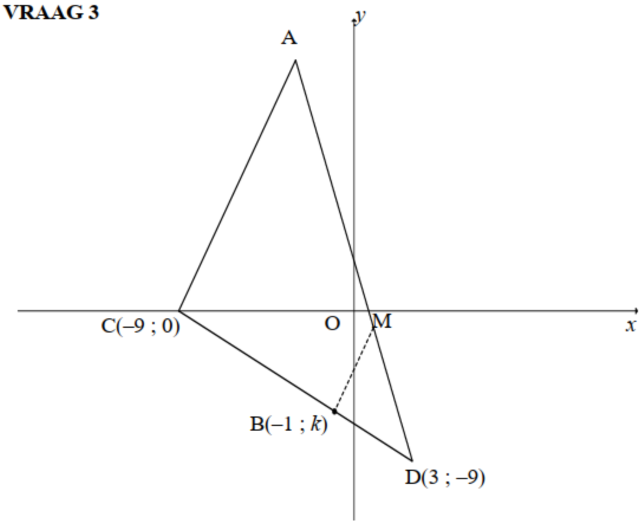
4.5	M → E: $(x\,;y) \rightarrow (x-4\,;y+3)$ [translation] C → S: $(-7\,;-5) \rightarrow (-7-4\,;-5+3)$ $\therefore$ S$(-11\,;-2)$ **OR/*OF*** M → C: $(x\,;y) \rightarrow (x-10\,;y-5)$ [translation] E → S: $(-1\,;3) \rightarrow (-1-10\,;3-5)$ $\therefore$ S$(-11\,;-2)$ **OR/*OF*** E$(-1\,;3)$ and C$(-7\,;-5)$ $\left(\frac{-1+(-7)}{2}\,;\frac{3+(-5)}{2}\right)$ [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$(-11\,;-2)$
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



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] $\therefore E\hat{T}M = \frac{180° - 63{,}44°}{2}$ $\therefore E\hat{T}M = 58{,}28°$

November 2024

QUESTION / VRAAG 3

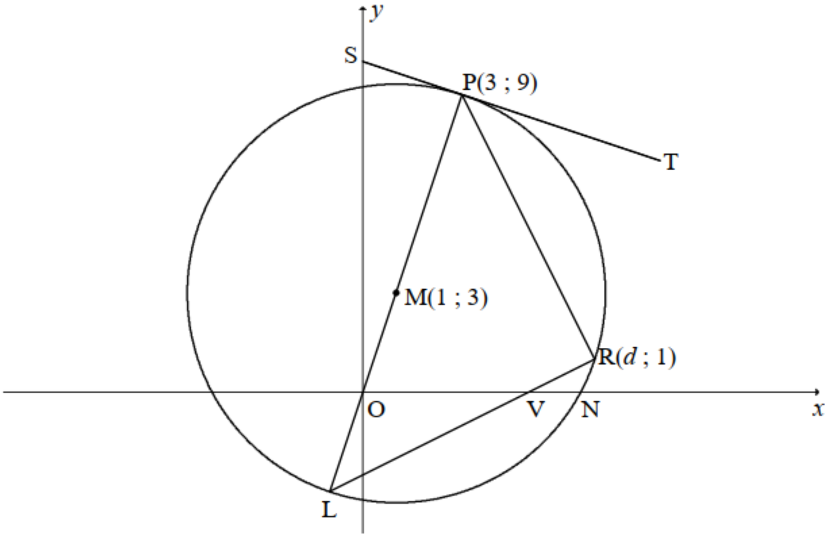


3.1	$m_{DC}=\frac{-9-0}{3-(-9)}$ **OR/*OF*** $m_{DC}=\frac{0-(-9)}{-9-3}$ $m_{DC}=-\frac{3}{4}$ $m_{DC}=-\frac{3}{4}$
3.2	Equation of DC: $0=-\frac{3}{4}(-9)+c$ **OR/*OF*** $y-0=-\frac{3}{4}(x-(-9))$ $c=\frac{-27}{4}$ or $-6\frac{3}{4}$ $y=-\frac{3}{4}(x+9)$ $y=-\frac{3}{4}x-\frac{27}{4}$ $y=-\frac{3}{4}x-\frac{27}{4}$
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*** $k=-\frac{3}{4}(8)$ $k=-6$ $k=-6$ $k=-6$
3.4	$DC=\sqrt{(3+9)^2+(-9-0)^2}$ DC = 15 units

3.5	$DB=\sqrt{(3-(-1))^2+(-9-(-6))^2}$ DB = 5 $\therefore \frac{DB}{DC}=\frac{5}{15}=\frac{1}{3}$

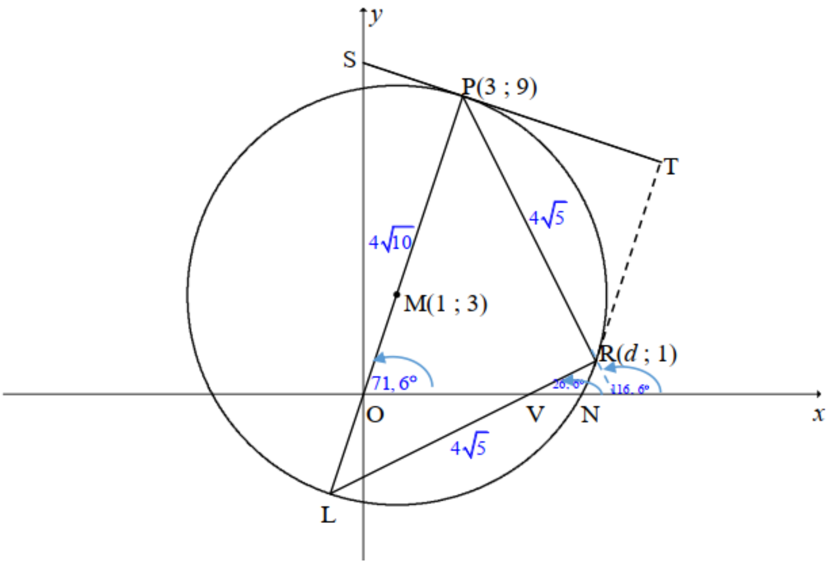
3.6	$\frac{DM}{DA}=\frac{DB}{DC}=\frac{1}{3}$ $\frac{\text{Area }\Delta MBD}{\text{Area }\Delta ACD}=\frac{\frac{1}{2}(DM)(DB)\left(\sin\hat{D}\right)}{\frac{1}{2}(DA)(DC)\left(\sin\hat{D}\right)}$ $=\frac{1}{3}\times\frac{1}{3}$ $=\frac{1}{9}$
3.7	$y=-4x+c$ $m_{AD}=-4$ $-9=-4(3)+c$ **OR/*OF*** $\frac{y+9}{x-3}=-4$ $c=3$ $y+9=-4x+12$ $y=-4x+3$ $y=-4x+3$ $(x-3)^2+(y+9)^2=612$ $(x-3)^2+(-4x+3+9)^2=\left(\sqrt{612}\right)^2$ $(x-3)^2+(-4x+12)^2=612$ $x^2-6x+9+16x^2-96x+144=612$ $17x^2-102x-459=0$ $x^2-6x-27=0$ $(x-9)(x+3)=0$ $x=9$ or $x=-3$ N/A $y=-4(-3)+3$ $y=15$ $A(-3;15)$
	OR/*OF* $-9=-4(3)+c$ $c=3$ $y=-4x+3$ $N(0;3)$ $ND=\sqrt{(3-0)^2+(-9-3)^2}$ $=3\sqrt{17}$ $AD=6\sqrt{17}$ $ND=\frac{1}{2}AD$ N is the midpoint of AD $A(-3;15)$

QUESTION/*VRAAG* 4



4.1	L(–1 ; –3)
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*** $y - 9 = -\frac{1}{3}x + 1$ $y = -\frac{1}{3}x + 10$ $y = -\frac{1}{3}x + 10$
4.3	$(x-1)^2 + (y-3)^2 = r^2$ $(3-1)^2 + (9-3)^2 = r^2$ $r^2 = 40$ $(x-1)^2 + (y-3)^2 = 40$ $x^2 - 2x + 1 + y^2 - 6y + 9 = 40$ $x^2 + y^2 - 2x - 6y - 30 = 0$

4.4	$d^2+(1)^2-2d-6(1)-30=0$ $d^2-2d-35=0$ $(d-7)(d+5)=0$ $d=7$ or $d=-5$ $\therefore d=7$ **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 $d=-5$ $\therefore d=7$ **OR/*OF*** $\hat{PRL}=90°$ ($\angle$ 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 $d=-5$ $\therefore d=7$



4.5

$m_{PO} = 3$

$\therefore \tan P\hat{O}V = 3$

$P\hat{O}V = 71{,}565...°$

$$m_{RL} = \frac{1-(-3)}{7-(-1)}$$

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

$$\therefore \tan R\hat{V}N = \frac{1}{2}$$

$R\hat{V}N = 26{,}565...°$

$\hat{L} = 71{,}565...° - 26.565...°$ [ext. $\angle$ of Δ / *buite* $\angle$ *van* Δ]

$\hat{L} = 45°$

OR/*OF*

$\hat{R} = 90°$ [$\angle$ in semi-circle / $\angle$ *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** $\tan \hat{L} = \dfrac{4\sqrt{5}}{4\sqrt{5}}$

$\hat{L} = 45°$

OR/*OF*

$PL = \sqrt{(3+1)^2 + (9+3)^2} = \sqrt{160} = 4\sqrt{10}$

$PR = \sqrt{(7-3)^2 + (1-9)^2} = \sqrt{80} = 4\sqrt{5}$

$LR = \sqrt{(7+1)^2 + (1+3)^2} = \sqrt{80} = 4\sqrt{5}$

$\cos L = \dfrac{80+160-80}{2\sqrt{80}\times\sqrt{160}}$

$\cos L = \dfrac{\sqrt{2}}{2}$

$\hat{L} = 45°$

4.6

$m_{RM} = \dfrac{1-3}{7-1}$

$= -\dfrac{1}{3}$

$m_{RT} = 3$ (tan ⊥ rad)

$m_{PT} = -\dfrac{1}{3}$

$m_{RT} \times m_{PT} = -1$

$PT \perp RT$

OR/*OF*

$m_{MR} = \dfrac{3-1}{1-7}$

$= -\dfrac{1}{3}$

$m_{PT} = -\dfrac{1}{3}$ [proved in Q4.2]

$m_{PT} = m_{MR}$

$\therefore PT \parallel MR$

$M\hat{R}T = 90°$ [radius ⊥ tangent / *raaklyn ⊥ radius*]

$P\hat{T}R = 90°$ [co-int ∠s; PT || MR/*ooreenkomst. ∠e*; PT || MR]

$PT \perp RT$

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]

$PT \perp RT$