Confidential

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/
NATIONAL SENIOR CERTIFICATE EXAMINATIONS

MATHEMATICS P2

MAY/JUNE 2025

MARKS: 150

TIME: 3 hours

This question paper consists of 13 pages and 1 information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. An information sheet with formulae is included at the end of the question paper.
9. Write neatly and legibly.

QUESTION 1

An insurance broker signed contracts with 15 people. The monthly premium (in rands) payable on each contract is given below.

134	215	325	326	362	429	515	531	598	610	624	728	923	1 034	1 200

1.1 Calculate the mean of the data. (2)

1.2 Write down the standard deviation of the data. (1)

1.3 Calculate how many monthly premiums are within ONE standard deviation of the mean. (2)

1.4 The insurance company decided to increase the monthly premiums.

- Monthly premiums that were less than R500 increased by 18%
- Monthly premiums that were equal to or more than R500 increased by k%

After these increases were applied to the above data, the new mean monthly premium was R686,44. Calculate the value of k. (4)

[9]

QUESTION 2

The manager of a supermarket decided to do a survey on the number of items that a customer ordered online and the time (in minutes) that a packer took to have the order ready for delivery. The supermarket received 10 online orders on a certain day. The information for these 10 orders is shown in the table below.

Number of items (x)	10	3	20	14	17	9	12	18	15	19
Time (in minutes) (y)	5	5	9	7	6	6	8	11	10	12

2.1 Draw a scatter plot on the grid provided in the ANSWER BOOK. (3)

2.2 Determine the equation of the least squares regression line. (3)

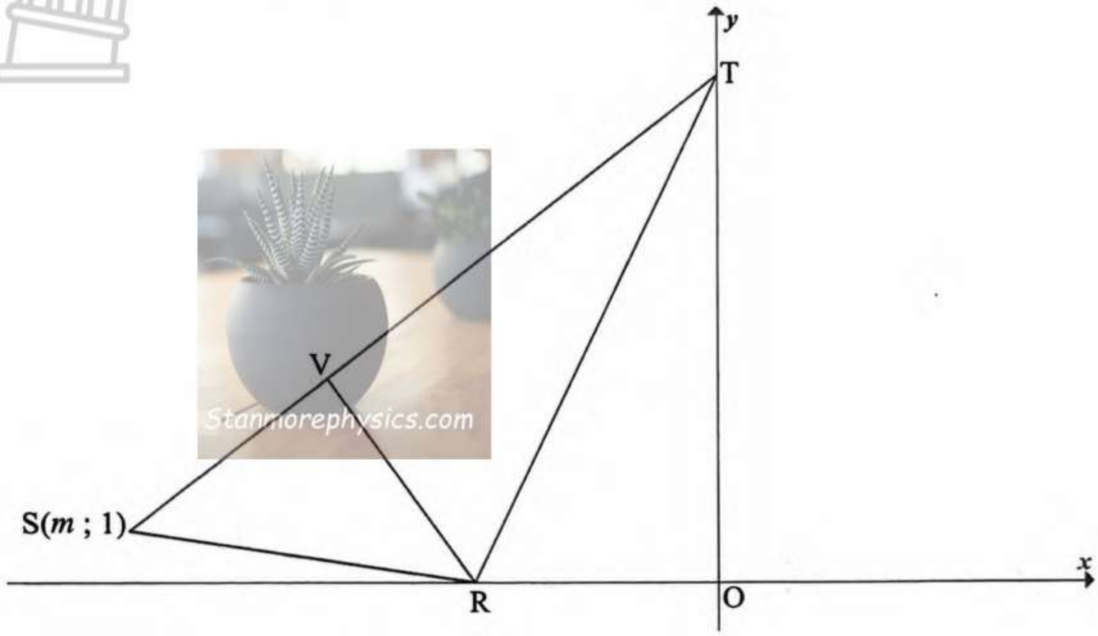
2.3 Write down the correlation coefficient of the data. (1)

2.4 The supermarket received an online order for 13 items. Predict how long (in minutes) it will take a packer to pack the order and have it ready for delivery. (2)

2.5 Explain why the y-intercept of the least squares regression line in QUESTION 2.2 does NOT make sense in this context. (1)
[10]

QUESTION 3

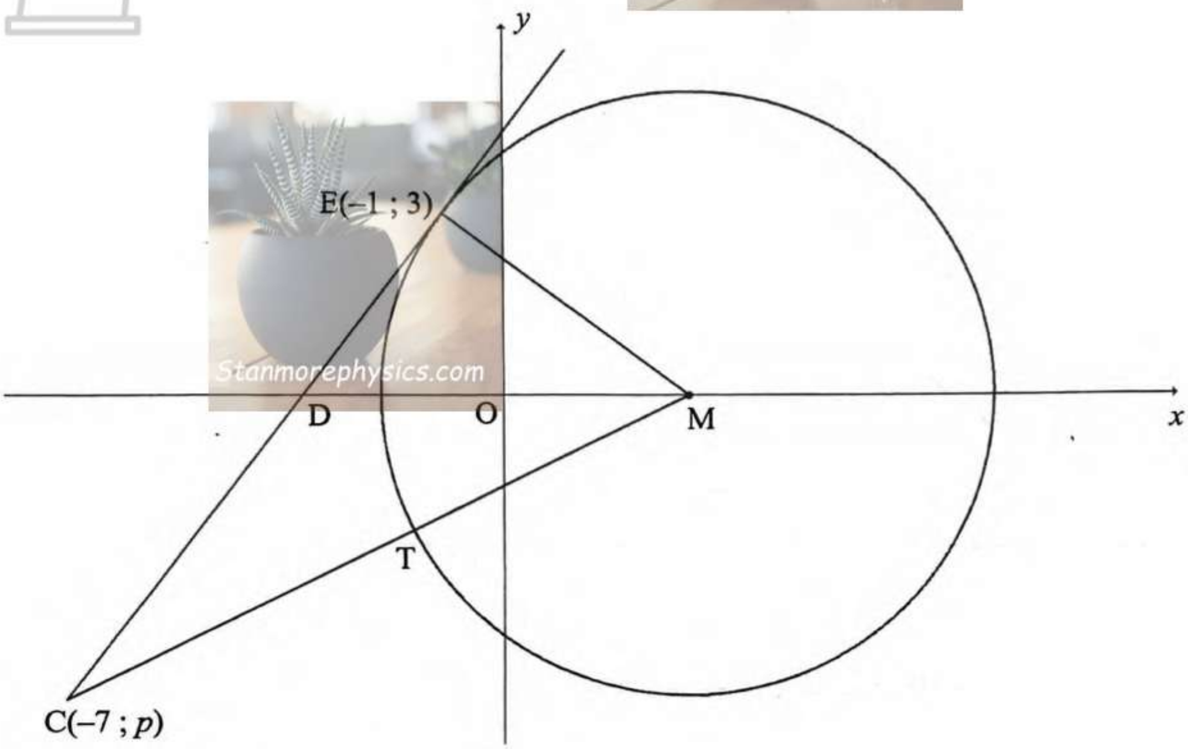
In the diagram below, ΔSRT is drawn where R lies on the x-axis and S lies to the left of R. T lies on the y-axis and the coordinates of S are $(m\ ;\ 1)$. The equation of RT is $2x - y + 10 = 0$.



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 $2\,\text{RT}^2 = 5\,\text{SR}^2$, 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]

QUESTION 5

5.1 If $\cos\theta = -\frac{5}{13}$ where $180° < \theta < 360°$, determine, **without using a calculator**, the value of:

5.1.1 $\sin^2\theta$ (3)

5.1.2 $\tan(360° - \theta)$ (2)

5.1.3 $\cos(\theta - 135°)$ (4)

5.2 Simplify the expression to a single trigonometric term: $\frac{2\cos(180° - x)\sin(-x)}{1 - 2\cos^2(90° - x)}$ (6)

5.3 Calculate the value of the following expression **without using a calculator**: $(\tan 92°)(\tan 94°)(\tan 96°) \ldots (\tan 176°)(\tan 178°)$ (4)

[19]

QUESTION 6

6.1 Prove that $2\cos^2(45° + x) = 1 - \sin 2x$. (4)

6.2 Consider the expression: $\sin(\text{A} - \text{B}) - \sin(\text{A} + \text{B})$

6.2.1 Prove that $\sin(\text{A} - \text{B}) - \sin(\text{A} + \text{B}) = -2\cos\text{A}\sin\text{B}$. (2)

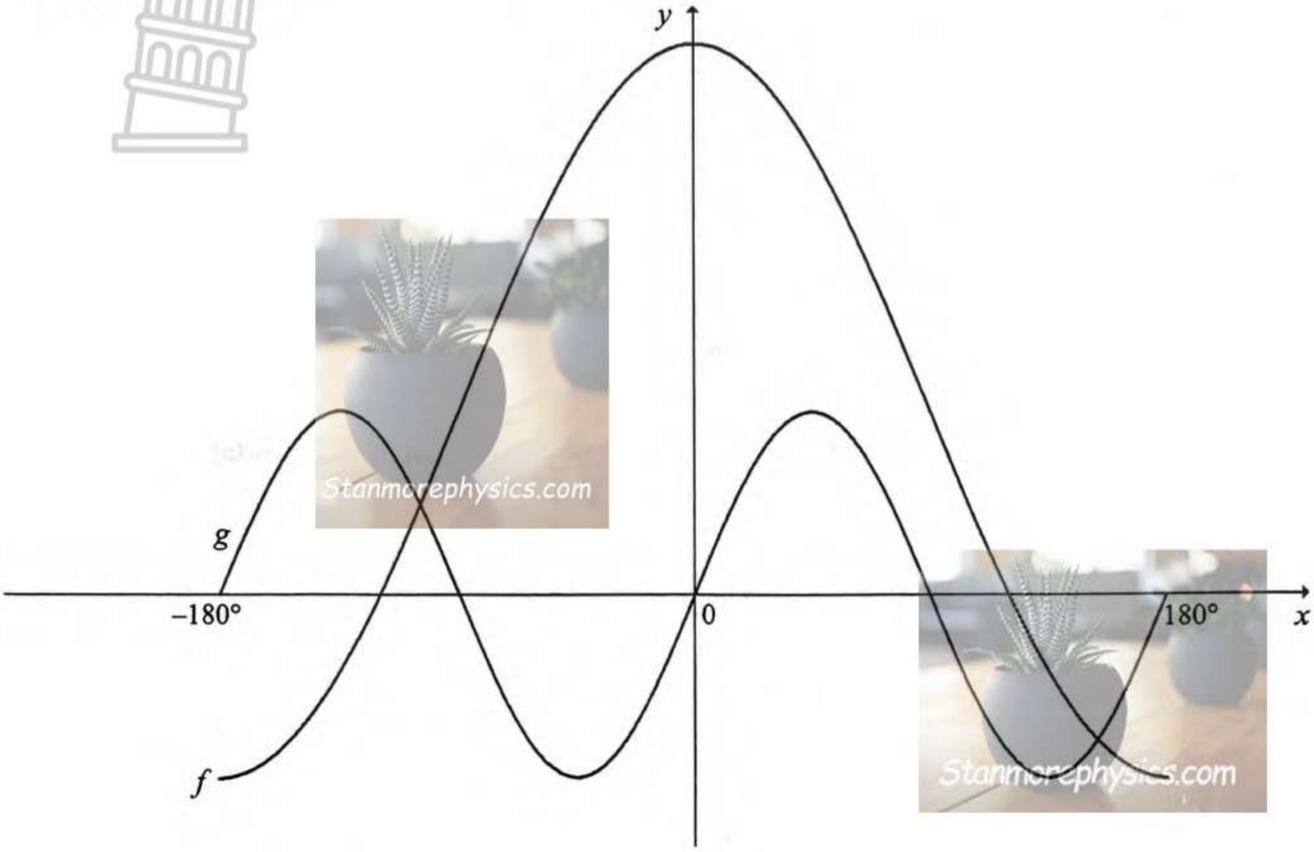
6.2.2 Simplify the following expression to a single term: $\sin 4x - \sin 10x$ (2)

6.2.3 Hence, determine the solution for $\sin 4x - \sin 10x = \sin 3x$ for $x \in [0°; 30°]$. (5)

[13]

QUESTION 7

In the diagram, the graphs of $f(x) = 2\cos x + 1$ and $g(x) = \sin 2x$ are drawn for the interval $x \in [-180°; 180°]$.



7.1 Write down the range of f. (1)

7.2 Write down the period of g. (1)

7.3 For which values of x, in the interval $x \in [-180°; 180°]$, is f increasing? (1)

7.4 Use the graphs to determine the values of x, in the interval $x \in [-180°; 180°]$, for which:

7.4.1 $g(x).\,f'(x) < 0$ (2)

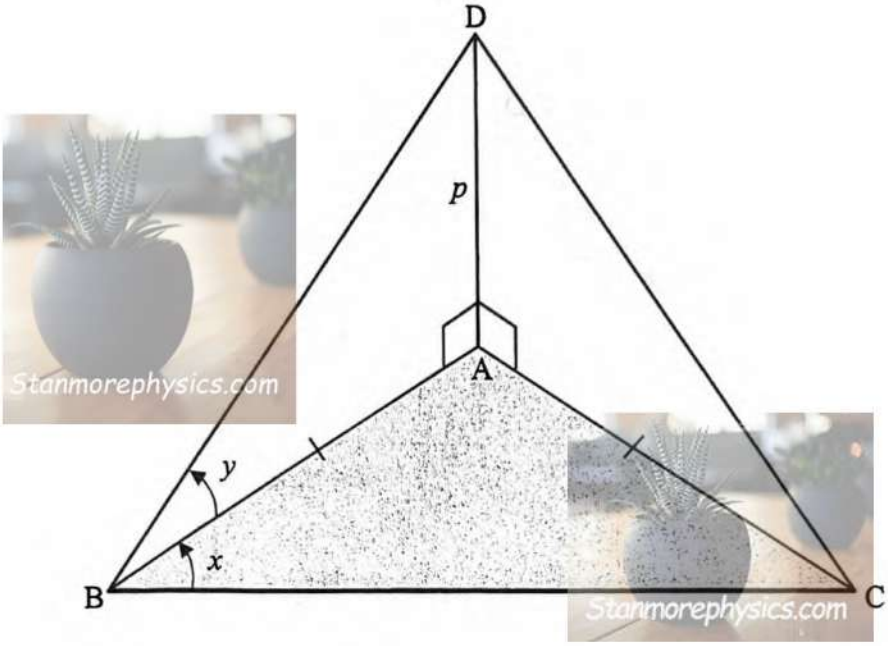
7.4.2 $\cos x \leq -\frac{1}{2}$ (3)

7.5 Graph g is shifted $45°$ to the right to obtain a new graph h. Determine the equation of h in its simplest form. (2)

[10]

QUESTION 8

In the diagram, A, B and C lie in the same horizontal plane with AB = AC. D is directly above A such that 2AD = BC. Also, AD = p, $\mathrm{A\hat{B}C} = x$ and $\mathrm{D\hat{B}A} = y$.



8.1 Determine AB in terms of p and y. (2)

8.2 Show that $\cos x = \tan y$. (4)

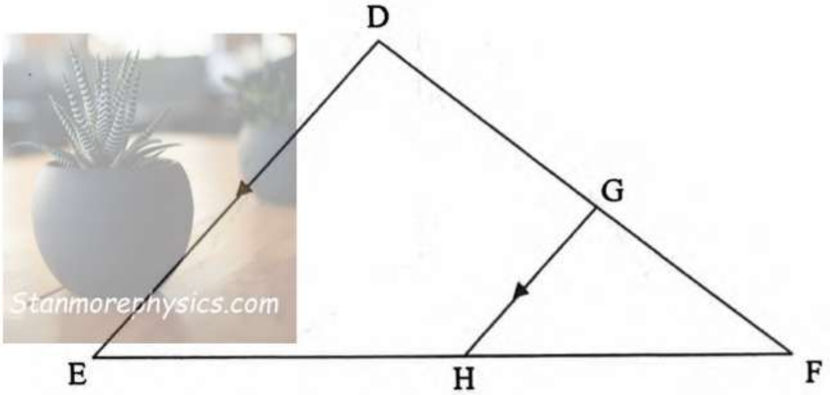
8.3 If $x = 60°$, calculate the size of y. (2)

[8]

Provide reasons for your statements in QUESTIONS 9 and 10.

QUESTION 9

9.1 In the diagram, ΔDEF is drawn. Line GH intersects DF and EF at G and H respectively such that $GH \parallel DE$ and $\frac{GF}{DG} = \frac{2}{5}$.



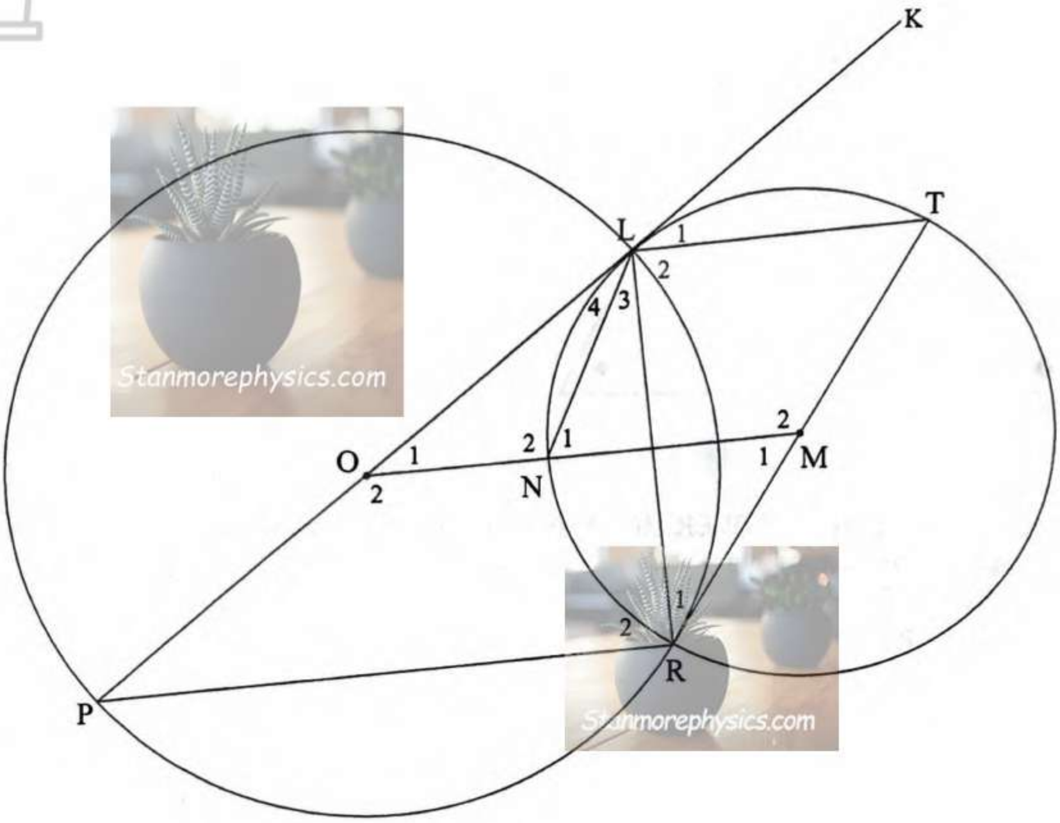
9.1.1 Write down, with a reason, the value of $\frac{HF}{EH}$. (2)

9.1.2 If $EF = 21$ cm, calculate the length of EH. (2)

9.1.3 Write down a triangle which is similar to ΔFGH. (1)

9.1.4 Hence, calculate the value of $\frac{GH}{DE}$. (2)

9.2 In the diagram, POL is a diameter of the larger circle with centre O. TMR is a diameter of the smaller circle with centre M. The two circles intersect at L and R. PLK is a tangent to the smaller circle at L and TR is a tangent to the larger circle at R. OM intersects the smaller circle at N. Straight lines LT, LR, LN and PR are drawn.



Prove, giving reasons, that:

9.2.1 LT || PR (4)

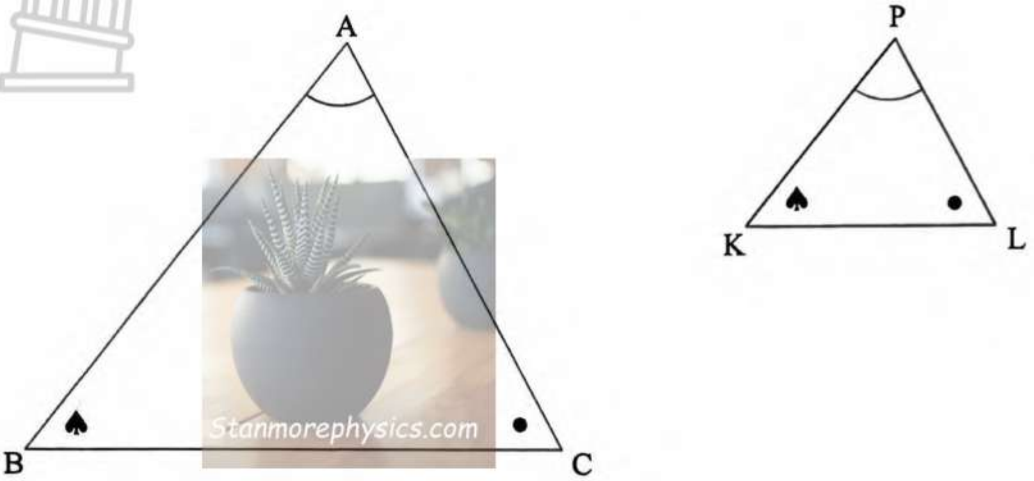
9.2.2 LORM is a cyclic quadrilateral, if it is also given that LT || OM (5)

9.2.3 LN bisects $O\hat{L}R$ (4)

[20]

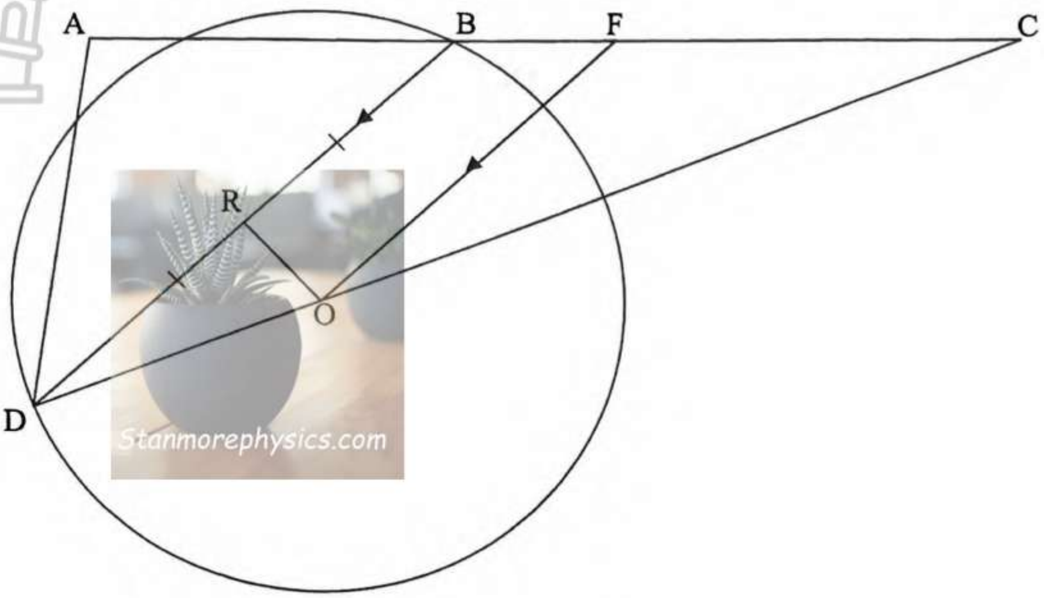
QUESTION 10

10.1 In the diagram, ΔABC and ΔPKL are drawn such that $\hat{A} = \hat{P}$, $\hat{B} = \hat{K}$ and $\hat{C} = \hat{L}$.



Use the diagram in the ANSWER BOOK to prove the theorem which states that if two triangles are equiangular, then the corresponding sides are in proportion, i.e. that $\dfrac{AB}{PK} = \dfrac{AC}{PL}$. (6)

10.2 In the diagram, O is the centre of the circle. Points D and B lie on the circle. Points A and C lie outside the circle such that side AC of ΔADC passes through B. F is a point on BC such that $FO \parallel BD$. $DR = RB$ and RO is drawn.



10.2.1 Prove, with reasons, that $\Delta CFO \parallel\!| \Delta CBD$. (3)

10.2.2 If it is given that $R\hat{D}O = F\hat{C}O$, show, with reasons, that $OF.CD = CO.BC$ (2)

10.2.3 It is further given that $DC = 19{,}2$ units, $BD = 12$ units and $\frac{RO}{RD} = \frac{3}{4}$

Prove, with reasons, that $BF = \frac{75}{16}$ (6)

10.2.4 Calculate the size of $A\hat{B}D$. (3)

[20]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$A = P(1 + ni)$ $\quad A = P(1 - ni)$ $\quad A = P(1 - i)^n$ $\quad A = P(1 + i)^n$

$T_n = a + (n-1)d$ $\quad S_n = \frac{n}{2}[2a + (n-1)d]$

$T_n = ar^{n-1}$ $\quad S_n = \frac{a(r^n - 1)}{r - 1}\ ;\ r \neq 1$ $\quad S_\infty = \frac{a}{1 - r}\ ;\ -1 < r < 1$

$F = \frac{x[(1+i)^n - 1]}{i}$ $\quad P = \frac{x[1 - (1+i)^{-n}]}{i}$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $\quad M\left(\frac{x_1 + x_2}{2}\ ;\frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $\quad y - y_1 = m(x - x_1)$ $\quad m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad m = \tan\theta$

$$(x-a)^2 + (y-b)^2 = r^2$$

In ΔABC: $\quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc\cos A$

area $\Delta ABC = \frac{1}{2}ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$ $\quad \sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$ $\quad \cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$$

$\sin 2\alpha = 2\sin\alpha\cos\alpha$

$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$ $\quad \sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $\quad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$\hat{y} = a + bx$ $\quad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$

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SENIOR CERTIFICATE EXAMINATIONS/
NATIONAL SENIOR CERTIFICATE EXAMINATIONS

MATHEMATICS P2/*WISKUNDE V2*

MAY/JUNE 2025/*MEI/JUNIE 2025*

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 23 pages.
Hierdie nasienriglyne bestaan uit 23 bladsye.

NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.
- Consistent accuracy applies in ALL aspects of the marking guidelines. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

LET WEL:

- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, sien die doodgetrekte poging na.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.*
- *Aanvaar van antwoorde/waardes om 'n probleem op te los, word NIE toegelaat NIE.*

GEOMETRY • MEETKUNDE	
S	**A mark for a correct statement** **(A statement mark is independent of a reason)**
	'n Punt vir 'n korrekte bewering **('n Punt vir 'n bewering is onafhanklik van die rede)**
R	**A mark for the correct reason** **(A reason mark may only be awarded if the statement is correct)**
	'n Punt vir 'n korrekte rede **('n Punt word slegs vir die rede toegeken as die bewering korrek is)**
S/R	**Award a mark if statement AND reason are both correct**
	Ken 'n punt toe as die bewering EN rede beide korrek is

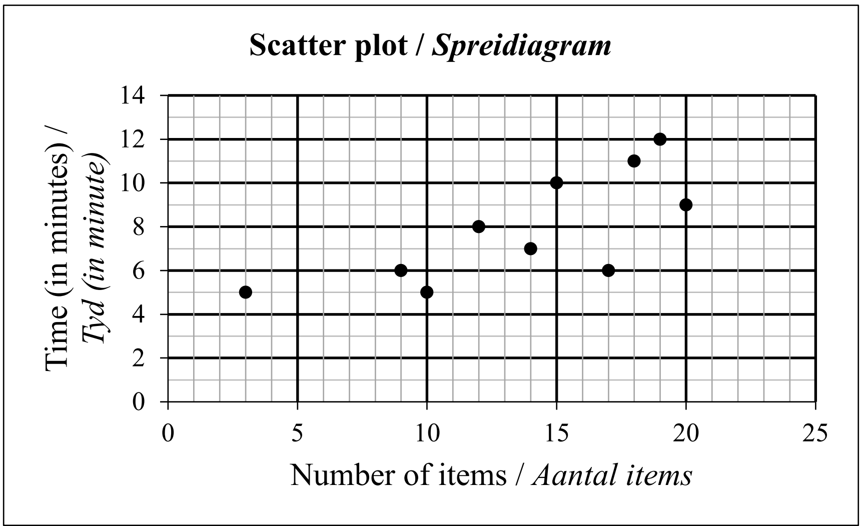
QUESTION/*VRAAG* 1

134	215	325	326	362	429	515	531	598	610	624	728	923	1 034	1 200

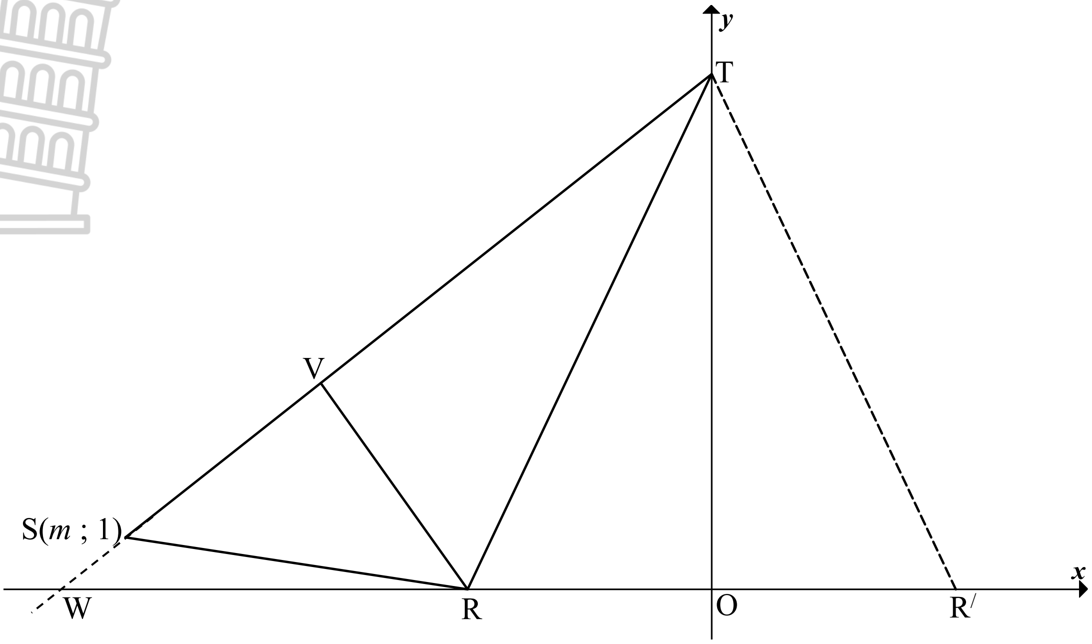
1.1	$\bar{x} = \frac{8554}{15}$ $= 570{,}27$	✓ 8554 ✓ answer (2)
1.2	$\sigma = 291{,}03$	✓ 291,03 (1)
1.3	(279,24 ; 861,3) $\therefore 10$ premiums	✓ $(\bar{x} - \sigma\ ;\ \bar{x} + \sigma)$ ✓ answer (2)
1.4	$\frac{\left(1791 \times \frac{118}{100}\right) + \left(6763 \times \frac{k+100}{100}\right)}{15} = 686{,}44$ $6763 \times \frac{k+100}{100} = 8183{,}22$ $\frac{k+100}{100} = 1{,}209...$ $k + 100 = 120{,}999...$ $k = 21\%$	✓ $1791 \times \frac{118}{100}$ ✓ $6763 \times \frac{k+100}{100}$ ✓ $\frac{\text{sum of new premiums}}{15} = 686{,}44$ ✓ answer (4)
		[9]

QUESTION/*VRAAG* 2

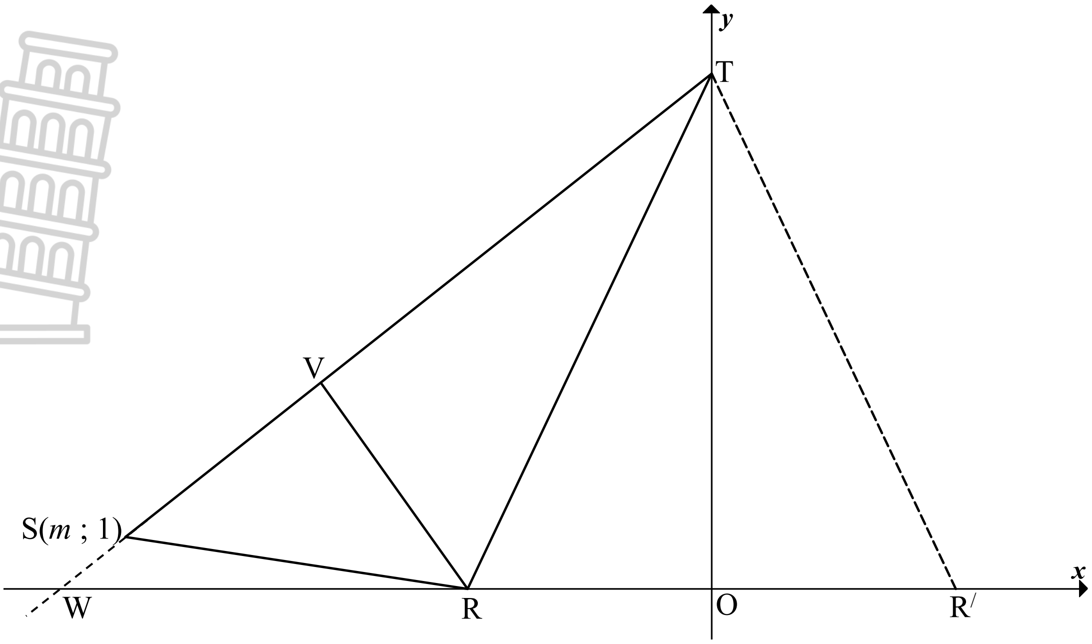
Number of items/*Aantal items* (x)	10	3	20	14	17	9	12	18	15	19
Time (in minutes)/*Tyd in minute)* (y)	5	5	9	7	6	6	8	11	10	12

2.1		✓ 3 points correct ✓ 6 points correct ✓ all points correct (3)
2.2	$a = 3{,}079\ldots$ $b = 0{,}351\ldots$ $\hat{y} = 3{,}08 + 0{,}35x$	✓ $a = 3{,}08$ ✓ $b = 0{,}35$ ✓ equation (3)
2.3	$r = 0{,}74$	✓ 0,74 (1)
2.4	$y = 3{,}08 + 0{,}35(13)$ $y = 7{,}63$ **OR** $y = 7{,}65$ (calculator)	✓ substitute x=13 ✓ answer (2) ✓✓ 7,65 (2)
2.5	It does not make sense to **pack 0** items in **3,08 minutes./** *Dit maak nie sin dat **0 items** in **3,08 minute** gepak kan word nie.*	✓ answer (1)
		[10]

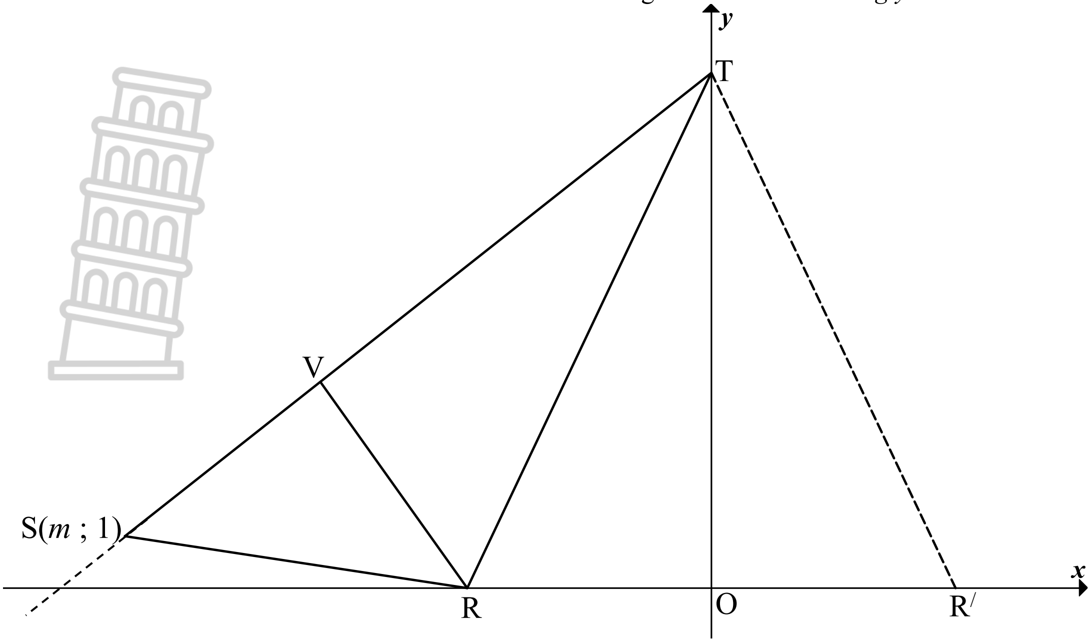
QUESTION/*VRAAG* 3



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) $(\text{RT})^2=(-5-0)^2+(0-10)^2$ **OR** $(\text{RT})^2=5^2+10^2$ (Pythag) $\text{RT}=\sqrt{125}$ units **OR/*OF*** $\text{RT}=5\sqrt{5}$ units	✓ T(0 ; 10) ✓ subst of R & T into distance formula or Pythagoras ✓ answer (3)
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*** $(m+5)^2=49$ $(m-2)(m+12)=0$ $m+5=\pm7$ $m=-5\pm7$ $m=2$ or $m=-12$ $m=2$ or $m=-12$ N/A N/A $\therefore m=-12$ $\therefore m=-12$	✓ length of 2RT^2 ✓ length of 5SR^2 ✓ standard form or isolating square ✓ negative answer (4)

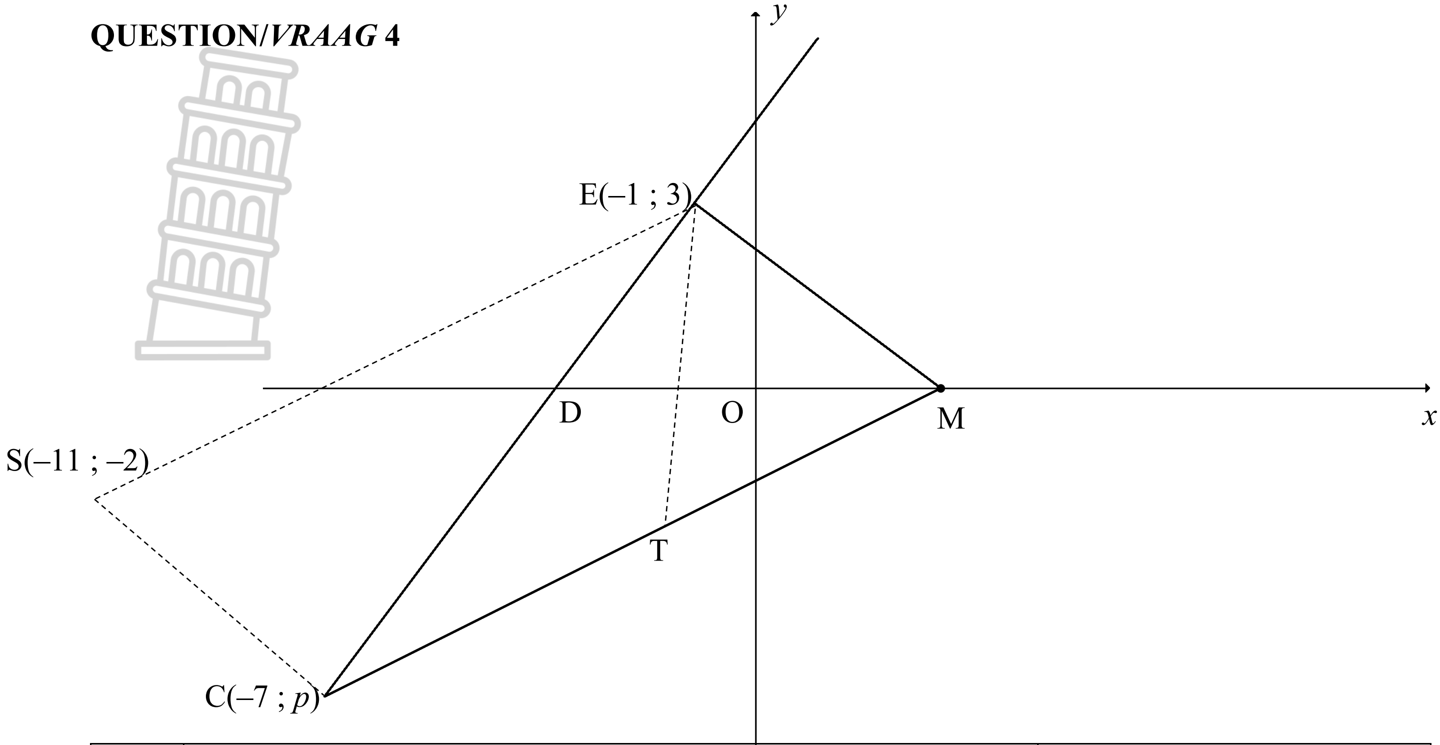


3.4	$m_{ST} = \frac{1-10}{-12-0}$ $m_{ST} = \frac{3}{4}$ $\therefore m_{VR} = -\frac{4}{3}$ $y = -\frac{4}{3}x + c$ **OR/*OF*** $y - y_1 = -\frac{4}{3}(x - x_1)$ $0 = -\frac{4}{3}(-5) + c$ $y - 0 = -\frac{4}{3}(x - (-5))$ $c = -\frac{20}{3}$ $y = -\frac{4}{3}(x+5)$ $y = -\frac{4}{3}x - \frac{20}{3}$ $y = -\frac{4}{3}x - \frac{20}{3}$	✓ 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	$R'(5;0)$	
	$VR=\sqrt{[-8-(-5)]^2+(4-0)^2}=5$	✓ length of VR
	$VT=\sqrt{(-8-0)^2+(4-10)^2}=10$	✓ length of VT
	$\text{Area of RVTR}'=\frac{1}{2}(VR)(VT)+\frac{1}{2}(RR')(OT)$	
	$=\frac{1}{2}(5)(10)+\frac{1}{2}(10)(10)$	✓ area ΔVRT ✓ area $\Delta RTR'$
	$=25+50$	
	$=75\text{ units}^2$	✓ answer
		(5)
	OR/*OF*	
	ST: $y=\frac{3}{4}x+10$	
	$0=\frac{3}{4}x+10$	
	$x=-\frac{40}{3}$ or $-13\frac{1}{3}$	✓ x-intercept of ST
	$W\left(-\frac{40}{3};0\right)$	
	$WR'=5-\left(-\frac{40}{3}\right)=\frac{55}{3}=18\frac{1}{3}$	✓ length of WR'
	$\text{Area of RVTR}'=\text{Area of }\Delta TWR'-\text{Area of }\Delta WVR$	
	$=\frac{1}{2}\left(5+\frac{40}{3}\right)(10)-\frac{1}{2}\left(-5+\frac{40}{3}\right)(4)$	✓ area $\Delta TWR'$ ✓ area ΔWVR
	$=75\text{ units}^2$	✓ answer
		(5)
		[21]

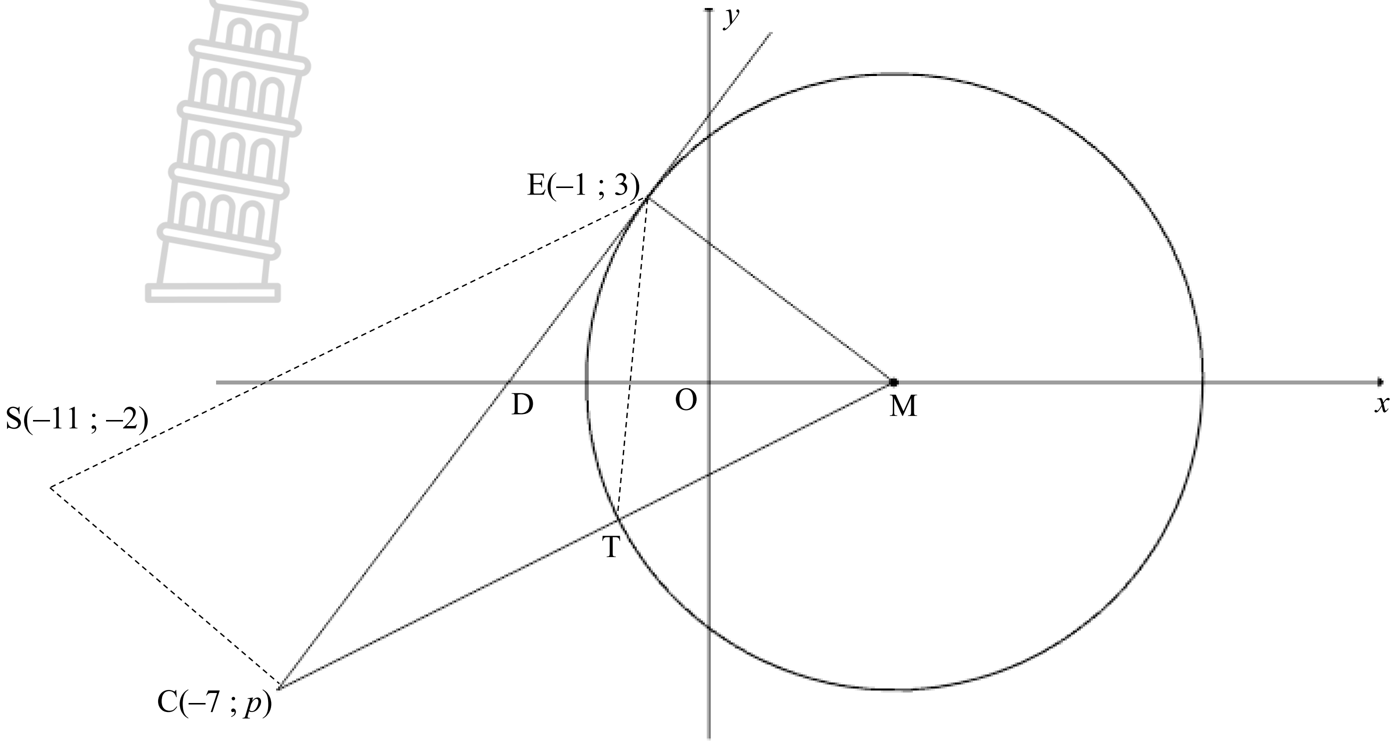
QUESTION/*VRAAG* 4



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*** $y-3 = \frac{4}{3}(x-(-1))$ $y = \frac{4}{3}x + \frac{13}{3}$ $y = \frac{4}{3}x + \frac{13}{3}$	✓ $m_{ME} = -\frac{3}{4}$ ✓ 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*** $y-3 = \frac{4}{3}(x-(-1))$ $y = \frac{4}{3}x + \frac{13}{3}$ $y = \frac{4}{3}x + \frac{13}{3}$	✓ coordinates of D ✓ m_{ED} ✓ substitution of E(–1 ; 3) ✓ equation (4)

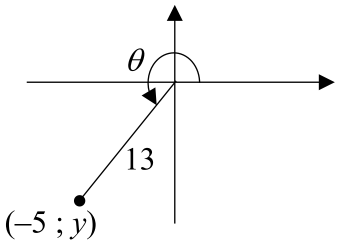
4.3	$y=\frac{4}{3}x+\frac{13}{3}$ $0=\frac{4}{3}x+\frac{13}{3}$ $x_D=-\frac{13}{4}$ $\therefore \text{DM}=3-\left(-\frac{13}{4}\right)$ $\text{DM}=\frac{25}{4}$ or $6{,}25$ units **OR/*OF*** EM = 5 units $\text{ED}=\frac{15}{4}$ units $\text{DM}=\sqrt{(5)^2+\left(\frac{15}{4}\right)^2}$ [Pythagoras] $\text{DM}=\frac{25}{4}$ or $6{,}25$ units	✓ x_D ✓ x_M-x_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*** $m_{EC}=\frac{4}{3}$ $\frac{p-3}{-7-(-1)}=\frac{4}{3}$ $p-3=\frac{4}{3}(-6)$ $p=-5$	✓ 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$(-11\,;-2)$	✓ method: translation ✓ $x_S = -11$ ✓ $y_S = -2$ (3)
	OR/*OF*	
	M → C: $(x\,;y) \rightarrow (x-10\,;y-5)$ [translation] E → S: $(-1\,;3) \rightarrow (-1-10\,;3-5)$ $\therefore$ S$(-11\,;-2)$	✓ method: translation ✓ $x_S = -11$ ✓ $y_S = -2$ (3)
	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: 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]

QUESTION/*VRAAG* 5

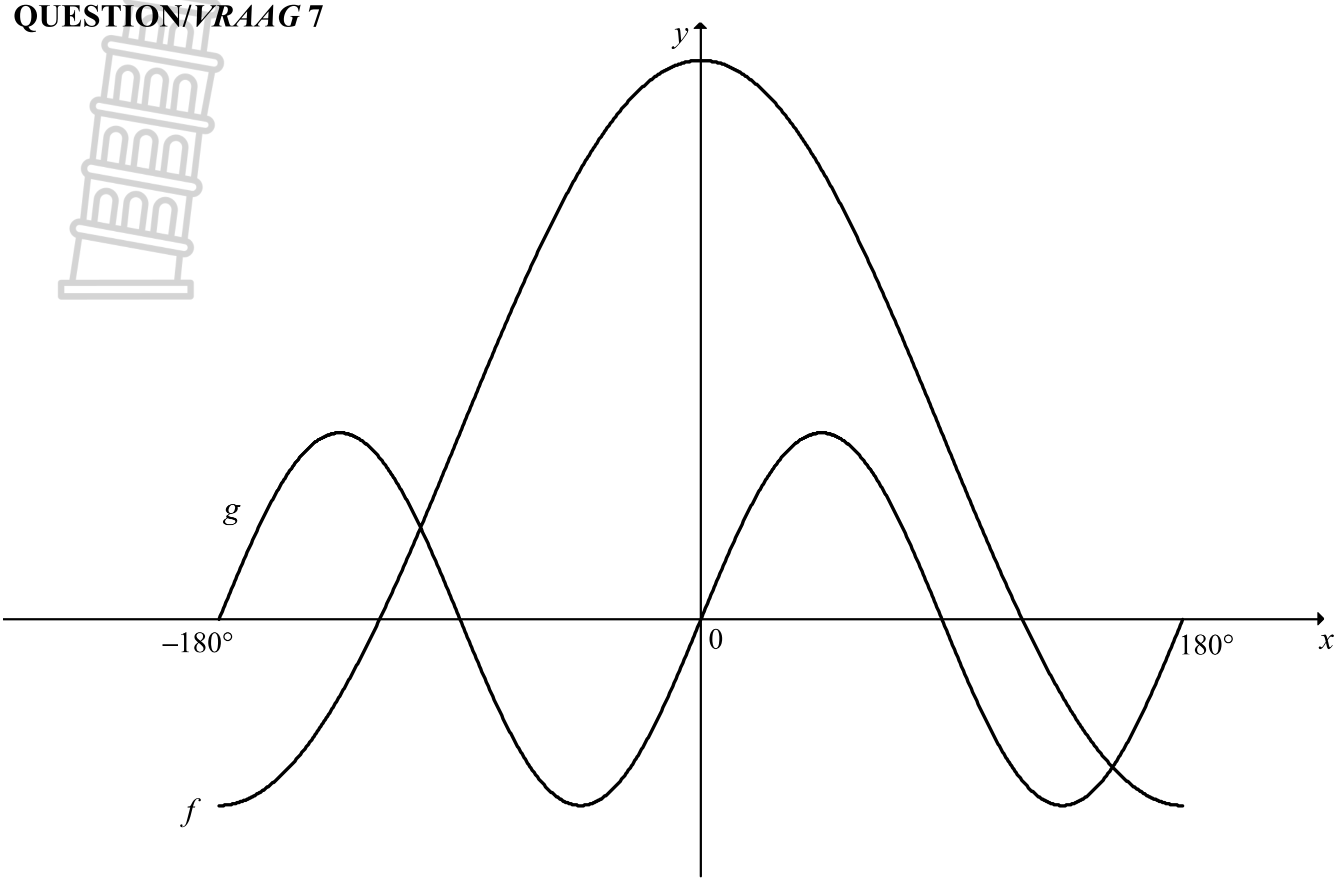
5.1.1	$y^2 = \sqrt{13^2-(-5)^2}$ [Pythagoras] $y = -12$  $\sin^2\theta$ $= \left(-\frac{12}{13}\right)^2$ $= \frac{144}{169}$ **OR/*OF*** $\sin^2\theta = 1-\cos^2\theta$ $\sin^2\theta = 1-\left(-\frac{5}{13}\right)^2$ $\sin^2\theta = \frac{144}{169}$	✓ $y=-12$ ✓ substitution ✓ answer (3) ✓ square identity ✓ substitution ✓ answer (3)
5.1.2	$\tan(360°-\theta)$ $= -\tan\theta$ $= -\left(\frac{-12}{-5}\right)$ $= -\frac{12}{5}$	✓ $-\tan\theta$ ✓ answer (2)
5.1.3	$\cos(\theta-135°)$ $= \cos\theta\cos135° + \sin\theta\sin135°$ $= \cos\theta(-\cos45°) + \sin\theta(\sin45°)$ $= \left(-\frac{5}{13}\right)\left(-\frac{\sqrt{2}}{2}\right) + \left(-\frac{12}{13}\right)\left(\frac{\sqrt{2}}{2}\right)$ OR $\left(-\frac{5}{13}\right)\left(-\frac{1}{\sqrt{2}}\right) + \left(-\frac{12}{13}\right)\left(\frac{1}{\sqrt{2}}\right)$ $= -\frac{7\sqrt{2}}{26}$ $= -\frac{7}{13\sqrt{2}}$	✓ cpd. ∠ expansion ✓ reduction ✓ substitution ✓ answer (4)

5.2	$\dfrac{2\cos(180°-x)\sin(-x)}{1-2\cos^2(90°-x)}$ $=\dfrac{2(-\cos x)(-\sin x)}{1-2\sin^2 x}$ $=\dfrac{2\sin x\cos x}{\cos 2x}$ $=\dfrac{\sin 2x}{\cos 2x}$ $=\tan 2x$	✓ $\cos(180°-x)=-\cos x$ ✓ $\sin(-x)=-\sin x$ ✓ $\cos^2(90°-x)=\sin^2 x$ ✓ $1-2\sin^2 x=\cos 2x$ ✓ $2\sin x\cos x=\sin 2x$ ✓ answer (6)
5.3	$(\tan 92°)(\tan 94°)(\tan 96°)...(\tan 176°)(\tan 178°)$ $=\left(\dfrac{\sin 92°}{\cos 92°}\right)\left(\dfrac{\sin 94°}{\cos 94°}\right)\left(\dfrac{\sin 96°}{\cos 96°}\right)...\left(\dfrac{\sin 176°}{\cos 176°}\right)\left(\dfrac{\sin 178°}{\cos 178°}\right)$ $=\left(\dfrac{\cos 2°}{-\sin 2°}\right)\left(\dfrac{\cos 4°}{-\sin 4°}\right)\left(\dfrac{\cos 6°}{-\sin 6°}\right)...\left(\dfrac{\sin 4°}{-\cos 4°}\right)\left(\dfrac{\sin 2°}{-\cos 2°}\right)$ $=1$ **OR** $(\tan 92°)(\tan 94°)(\tan 96°)...(\tan 176°)(\tan 178°)$ $=(\tan 92°)(\tan 94°)(\tan 96°)....(-\tan 4°)(-\tan 2°)$ $=\left(\dfrac{\sin 92°}{\cos 92°}\right)\left(\dfrac{\sin 94°}{\cos 94°}\right)\left(\dfrac{\sin 96°}{\cos 96°}\right)...\left(-\dfrac{\sin 4°}{\cos 4°}\right)\left(-\dfrac{\sin 2°}{\cos 2°}\right)$ $=\left(\dfrac{\cos 2°}{-\sin 2°}\right)\left(\dfrac{\cos 4°}{-\sin 4°}\right)\left(\dfrac{\cos 6°}{-\sin 6°}\right)...\left(-\dfrac{\sin 4°}{\cos 4°}\right)\left(-\dfrac{\sin 2°}{\cos 2°}\right)$ $=1$	✓ quotient identity ✓ co-ratios ✓ reduction ✓ answer (4) ✓ reduction ✓ quotient identity ✓ co-ratios ✓ answer (4)
		[19]

QUESTION/*VRAAG* 6

6.1	LHS $= 2\cos^2(45° + x)$ $= 2\cos^2(45° + x) + 1 - 1$ $= \cos[2(45° + x)] + 1$ $= \cos(90° + 2x) + 1$ $= (-\sin 2x) + 1$ $= 1 - \sin 2x$ $=$ RHS **OR/*OF*** LHS $= 2\cos^2(45° + x)$ $= 2(\cos(45° + x))^2$ $= 2(\cos 45°\cos x - \sin 45°\sin x)^2$ $= 2\left(\frac{\sqrt{2}}{2}\cos x - \frac{\sqrt{2}}{2}\sin x\right)^2$ $= 2\left(\frac{1}{2}\cos^2 x - \sin x\cos x + \frac{1}{2}\sin^2 x\right)$ $= \cos^2 x - 2\sin x\cos x + \sin^2 x$ $= 1 - \sin 2x$ $=$ RHS	✓ + 1 – 1 ✓ double angle ✓ simplification ✓ reduction (4) ✓ compound ∠ expansion ✓ subst. special ∠ values ✓ simplification ✓ $\sin^2 x + \cos^2 x = 1$ (4)
6.2.1	LHS $= \sin(A - B) - \sin(A + B)$ $= \sin A\cos B - \cos A\sin B - (\sin A\cos B + \cos A\sin B)$ $= \sin A\cos B - \cos A\sin B - \sin A\cos B - \cos A\sin B$ $= -2\cos A\sin B$ $=$ RHS	✓ $\sin A\cos B - \cos A\sin B$ ✓ $-\sin A\cos B - \cos A\sin B$ (2)
6.2.2	$\sin 4x - \sin 10x$ $= \sin(7x - 3x) - \sin(7x + 3x)$ $= -2\cos 7x\sin 3x$	✓ $4x = 7x - 3x$ & $10x = 7x + 3x$ ✓ answer (2)
6.2.3	$\sin 4x - \sin 10x = \sin 3x$ $-2\cos 7x\sin 3x = \sin 3x$ $2\cos 7x\sin 3x + \sin 3x = 0$ $\sin 3x(2\cos 7x + 1) = 0$ $\sin 3x = 0$ or $\cos 7x = -\frac{1}{2}$ $3x = 0°$ $7x = 120°$ or $7x = 240°$ $x = 0°$ $x = 17{,}14°$ $x = 34{,}29°$ N/A	✓ substitution ✓ factorisation ✓ both equations ✓ answer ✓ answer (5)
		[13]

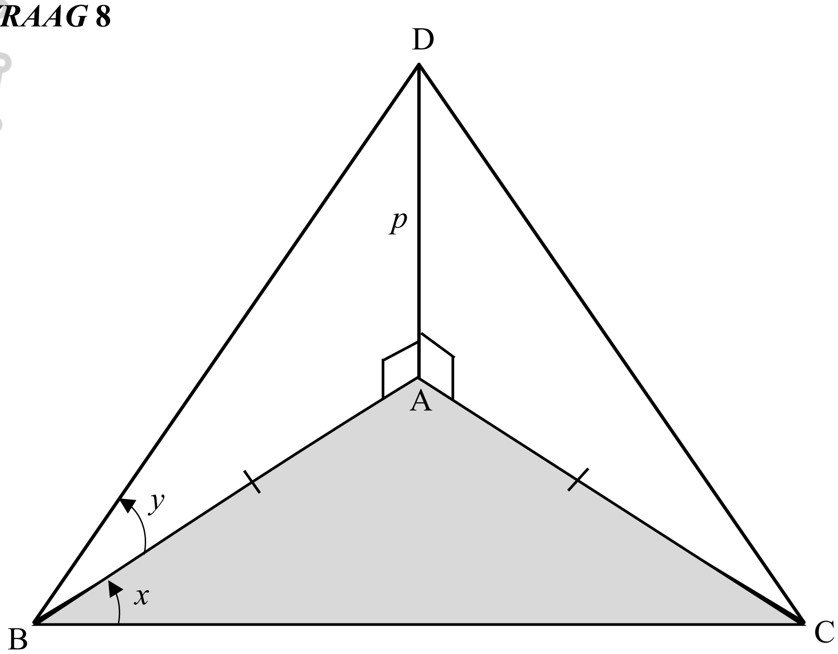
QUESTION/*VRAAG* 7



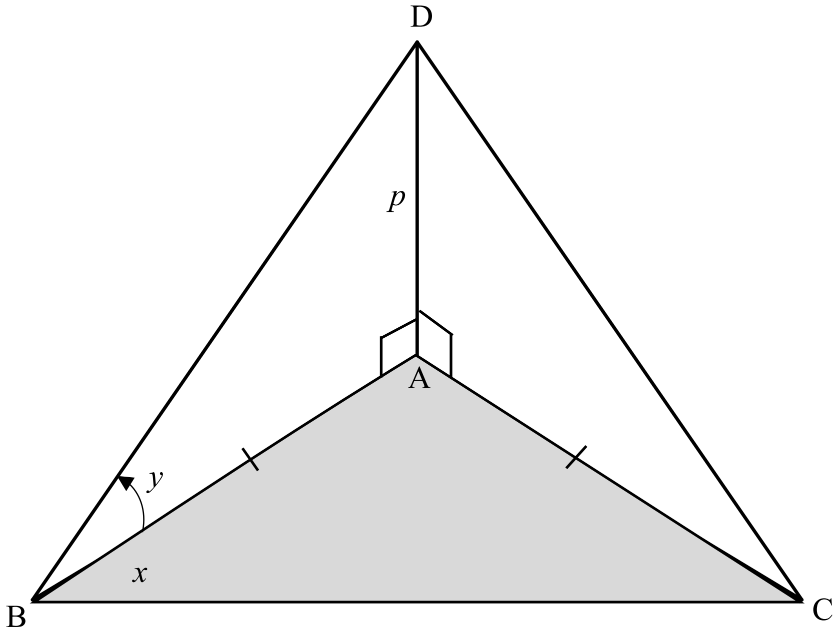
7.1	Range of *f*: $y \in [-1\ ;\ 3]$ **OR/*OF*** $-1 \le y \le 3$	✓ $y \in [-1\ ;\ 3]$ (1) ✓ $-1 \le y \le 3$ (1)
7.2	Period of *g*: $180°$	✓ $180°$ (1)
7.3	f increasing: $x \in (-180°\ ;\ 0°)$ **OR/*OF*** $-180° < x < 0°$	✓ $x \in (-180°\ ;\ 0°)$ (1) ✓ $-180° < x < 0°$ (1)
7.4.1	$g(x).f'(x) < 0$ $x \in (-90°\ ;\ 0°) \cup (0°\ ;\ 90°)$ **OR/*OF*** $-90° < x < 0°$ or $0° < x < 90°$	✓ $x \in (-90°\ ;\ 0°)$ ✓ $x \in (0°\ ;\ 90°)$ (2) ✓ $-90° < x < 0°$ ✓ $0° < x < 90°$ (2)

7.4.2	$\cos x \leq -\frac{1}{2}$ $2\cos x + 1 \leq 0$ $x \in [-180°\ ;\ -120°] \cup [120°\ ;\ 180°]$ **OR/*OF*** $2\cos x + 1 \leq 0$ $-180° \leq x \leq -120°$ or $120° \leq x \leq 180°$	✓ $2\cos x + 1 \leq 0$ ✓ $x \in [-180°\ ;\ -120°]$ ✓ $x \in [120°\ ;\ 180°]$ (3) ✓ $2\cos x + 1 \leq 0$ ✓ $-180° \leq x \leq -120°$ ✓ $120° \leq x \leq 180°$ (3)
7.5	$g(x) = \sin 2x$ $h(x) = \sin 2(x - 45°)$ $= \sin(2x - 90°)$ $= -\sin(90° - 2x)$ $= -\cos 2x$	✓ $\sin(2x - 90°)$ ✓ equation of h (2)
		[10]

QUESTION/*VRAAG* 8



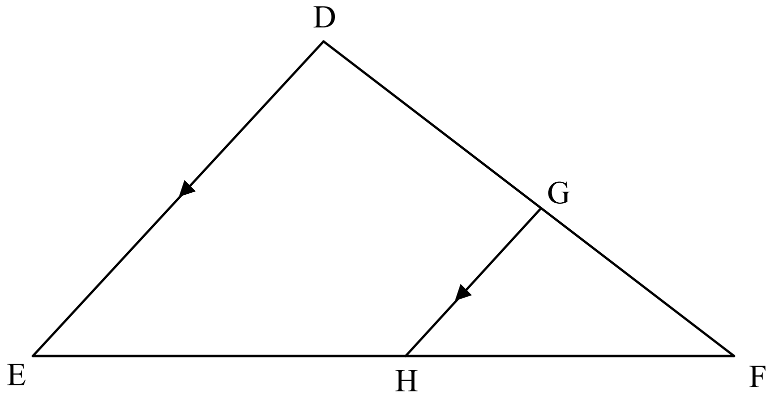
8.1	$\tan y = \dfrac{p}{AB}$ $AB = \dfrac{p}{\tan y}$	✓ correct trig ratio ✓ answer (2)
8.2	In ΔBAC: $\dfrac{\sin B\hat{A}C}{BC} = \dfrac{\sin A\hat{C}B}{AB}$ $\dfrac{\sin(180° - 2x)}{2p} = \dfrac{\sin x}{\left(\dfrac{p}{\tan y}\right)}$ $\dfrac{\sin 2x}{2p} = \sin x \times \left(\dfrac{\tan y}{p}\right)$ $\dfrac{2\sin x \cos x}{2p} = \sin x \times \left(\dfrac{\tan y}{p}\right)$ $2\cos x = \left(\dfrac{\tan y}{p}\right)(2p)$ $\cos x = \tan y$	✓ correct use of sine-rule ✓ substitute BC & AB ✓ $\sin(180° - 2x) = \sin 2x$ ✓ $\sin 2x = 2\sin x \cos x$ (4)



8.2	**OR/*OF*** In ΔBAC: $BC^2 = AB^2 + AC^2 - 2(AB)(AC)\cos B\hat{A}C$ $(2p)^2 = \left(\frac{p}{\tan y}\right)^2 + \left(\frac{p}{\tan y}\right)^2 - 2\left(\frac{p}{\tan y}\right)\left(\frac{p}{\tan y}\right)\cos(180° - 2x)$ $4p^2 = \frac{2p^2}{\tan^2 y} - \frac{2p^2(-\cos 2x)}{\tan^2 y}$ $4p^2\tan^2 y = 2p^2(1 + \cos 2x)$ $\tan^2 y = \frac{1 + 2\cos^2 x - 1}{2}$ $\tan^2 y = \cos^2 x$ $\tan y = \cos x$	✓ correct use of cos-rule ✓ substitute AB & BC ✓ $\cos(180° - 2x) = -\cos 2x$ ✓ $\cos 2x = 2\cos^2 x - 1$ (4)
8.3	$\cos x = \tan y$ $\tan y = \cos 60°$ $\tan y = 0{,}5$ $y = 26{,}57°$	✓ substitution of 60° ✓ answer (2)
		[8]

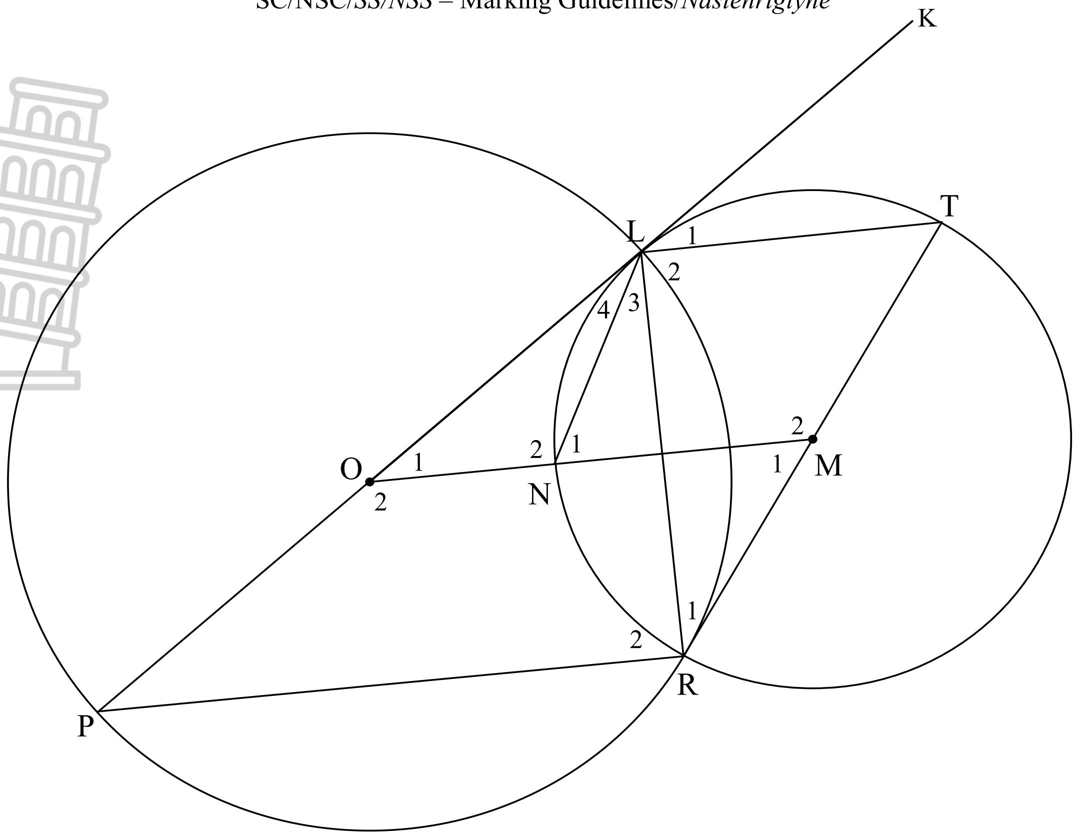
QUESTION/*VRAAG* 9

9.1



9.1.1	$\frac{HF}{EH} = \frac{GF}{GD} = \frac{2}{5}$ [line || to one side of Δ/*lyn* || *een sy van* Δ] **OR** [prop theorem; GH||DE/*eweredigheidst.; GH* || *DE*]	✓ S ✓ R	(2)
9.1.2	$\frac{EH}{EF} = \frac{DG}{DF} = \frac{5}{7}$ [line || to one side of Δ/*lyn* || *een sy van* Δ] **OR** [prop theorem; GH||DE/*eweredigheidst.; GH* || *DE*] $\frac{EH}{21} = \frac{5}{7}$ $EH = 15cm$ **OR/*OF*** $\frac{HF}{EF} = \frac{2}{7}$ [line || to one side of Δ/*lyn* || *een sy van* Δ] **OR** [prop theorem; GH||DE/*eweredigheidst.; GH* || *DE*] $\frac{HF}{21} = \frac{2}{7}$ $HF = 6cm$ $EH = 21 - 6$ $EH = 15cm$	✓ S ✓ answer ✓ S ✓ answer	(2) (2)
9.1.3	ΔFGH ||| **ΔFDE** [∠∠∠]	✓ S	(1)
9.1.4	$\frac{GH}{DE} = \frac{FH}{FE}$ [|||Δ's] **OR/*OF*** $\frac{GH}{DE} = \frac{FG}{FD}$ [|||Δ's] $\frac{GH}{DE} = \frac{2}{7}$	✓ S ✓ S	(2)

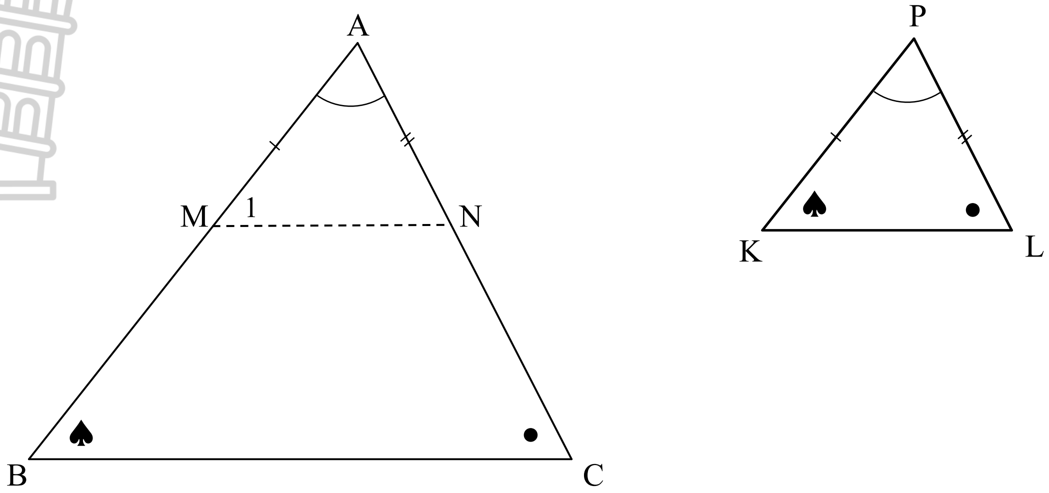
9.2



9.2.1	$\hat{L}_2 = 90°$ [$\angle$ in semi-circle/ *$\angle$ in halwe sirkel*] **OR** $\hat{L}_1 = \hat{R}_1$ [tan chord theorem/ *raaklyn-koordst.*] $\hat{R}_2 = 90°$ [$\angle$ in semi-circle] *$\angle$ in halwe sirkel*] $\hat{R}_1 = \hat{P}$ [tan chord theorem] *raaklyn-koordst.*] $\therefore\ \hat{L}_2 = \hat{R}_2$ $\therefore \hat{L}_1 = \hat{P}$ $\therefore$ LT || PR [alt $\angle$s =/*verw.* $\angle e$ =] $\therefore$ LT || PR [corresp. $\angle$s =/ *ooreenk.* $\angle e$ =]	✓ S ✓ R ✓ S/R ✓ R (4)
9.2.2	$\hat{L}_1 = \hat{R}_1$ [tan chord theorem/*raaklyn-koordst.*] $\hat{L}_1 = \hat{O}_1$ [corresp. $\angle$s; LT || OM/*ooreenk.* $\angle e$; *LT ||OM*] $\therefore \hat{R}_1 = \hat{O}_1$ $\therefore$ L, O, R and M are concyclic. $\therefore$ LORM is a cyclic quadrilateral [converse $\angle$s in the same seg/ *omgekeerde $\angle e$ in dies. sirkel segm*]	✓ S ✓ R ✓ S/R ✓ S ✓ R (5)
9.2.3	$O\hat{L}R = \hat{M}_1$ [$\angle$s in the same seg/*$\angle e$ in dieselfde segment*] $2\hat{L}_3 = \hat{M}_1$ [$\angle$ at centre = 2 × $\angle$ at circumference/ *midpt. $\angle$ = 2× omtreks $\angle$*] $\therefore O\hat{L}R = 2\hat{L}_3$ $\therefore \hat{L}_4 = \hat{L}_3$ $\therefore$ LN bisects $O\hat{L}R$	✓ S/R ✓ S ✓ R ✓ S (4)
		[20]

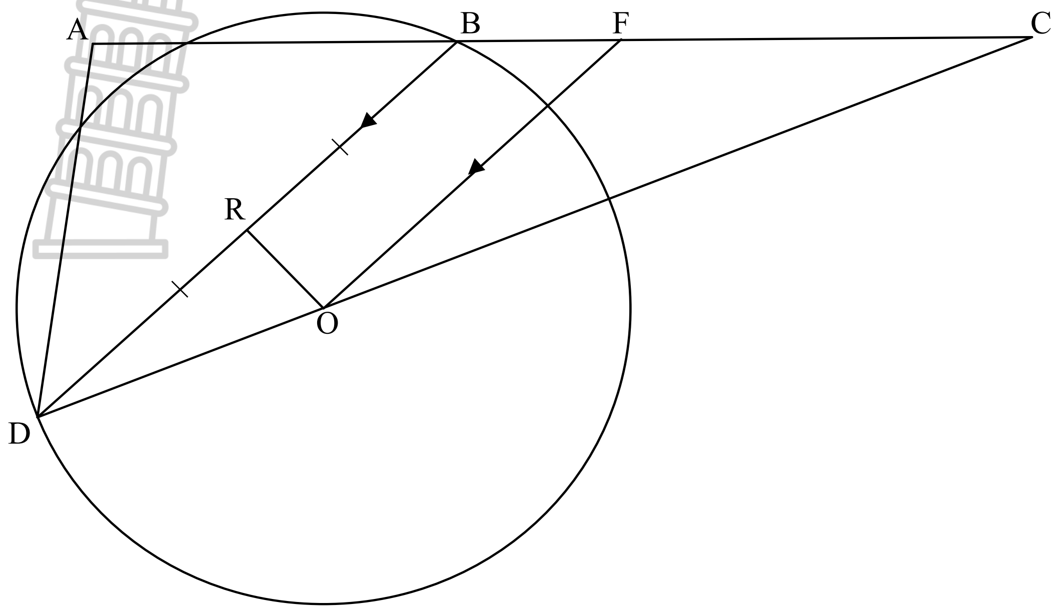
QUESTION/*VRAAG* 10

10.1



10.1	Construction: Draw line MN, where M and N are points on AB and AC respectively such that AM = PK and AN = PL. In Δ AMN and ΔPKL $\hat{A} = \hat{P}$ [given] AM = PK [construction] AN = PL [construction] $\Delta AMN \equiv \Delta PKL$ [s∠s] $\therefore \hat{M}_1 = \hat{K}$ But $\hat{B} = \hat{K}$ [given] $\therefore \hat{M}_1 = \hat{B}$ $\therefore$ MN || BC [corresp ∠s =/*ooreenk. ∠e* =] $\therefore \dfrac{AB}{AM} = \dfrac{AC}{AN}$ [line || one side of Δ/*lyn* || *een sy v* Δ] But AM = PK and AN = PL $\therefore \dfrac{AB}{PK} = \dfrac{AC}{PL}$	✓ construction ✓ S/R ✓ S ✓ S / R ✓ S ✓ R (6)

10.2



10.2.1	In ΔCFO and ΔCBD $\hat{C}=\hat{C}$ [common] $C\hat{F}O = C\hat{B}D$ [corresp ∠s; BD||FO/*ooreenk. ∠e; BD||FO*] $C\hat{O}F = C\hat{D}B$ [sum of ∠s in Δ/*binne ∠e v Δ*] **OR** [corresp ∠s; BD||FO/ *ooreenk. ∠e; BD||FO*] $\Delta CFO \,\|\|\, \Delta CBD$ [∠∠∠]	✓ S ✓ S/R ✓ S/R **OR** R (3)
10.2.2	$\frac{FO}{BD}=\frac{CO}{CD}$ [||| Δs] FO.CD = CO.BD But $R\hat{D}O = F\hat{C}O$ [given] ∴ BD = BC [sides opp equal ∠s/*sye teenoor gelyke ∠e*] ∴ FO.CD = CO.BC	✓ S/R ✓ S/R (2)

10.2.3	RD = 6 units [DR = RB] $\frac{RO}{RD}=\frac{3}{4}$ $\therefore RO=\frac{3}{4}(6)$ RO = 4,5 units OR ⊥ BD [line from centre to midpt of chord/ *midpt. sirkel; midpt koord*] $\therefore DO=\sqrt{6^2+4,5^2}$ [Pythagoras] DO = 7,5 units $\frac{BF}{BC}=\frac{DO}{DC}$ [line || to one side of Δ/*lyn || een sy v* Δ] **OR/*OF*** [prop theorem; BD||FO/*eweredigheidst.;*BD||FO] BC = BD = 12 units [sides opp equal ∠s/*sye teenoor gelyke ∠e*] $\therefore \frac{BF}{12}=\frac{7,5}{19,2}$ $BF=\frac{7,5\times 12}{19,2}$ $BF=\frac{75}{16}$ units	✓ S ✓ S/R ✓ S ✓ S/R ✓ S ✓ S (6)
10.2.4	$\tan R\hat{D}O=\frac{RO}{RD}=\frac{4,5}{6}=\frac{3}{4}$ $R\hat{D}O=36,87°$ $F\hat{C}O=R\hat{D}O=36,87°$ [given] $\therefore A\hat{B}D=73,74°$ [ext ∠ of Δ/*buite ∠ v.* Δ] **OR/*OF*** $CD^2=BC^2+BD^2-2(BC)(BD)\cos D\hat{B}C$ $\cos D\hat{B}C=\frac{12^2+12^2-19,2^2}{2(12)(12)}$ $\cos D\hat{B}C=-\frac{7}{25}$ $D\hat{B}C=106,26°$ $\therefore A\hat{B}D=73,74°$ [∠s on a straight line/*∠e op 'n reguitlyn*]	✓ ratio ✓ $R\hat{D}O$ ✓ answer (3) ✓ substitution into cosine-rule ✓ $D\hat{B}C$ ✓ answer (3)
		[20]

TOTAL/*TOTAAL*: 150