education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 12

MATHEMATICS P2

JUNE 2026

MARKS: 150

TIME: 3 hours

This question paper consists of 13 pages, 1 information sheet and an answer book of 23 pages.

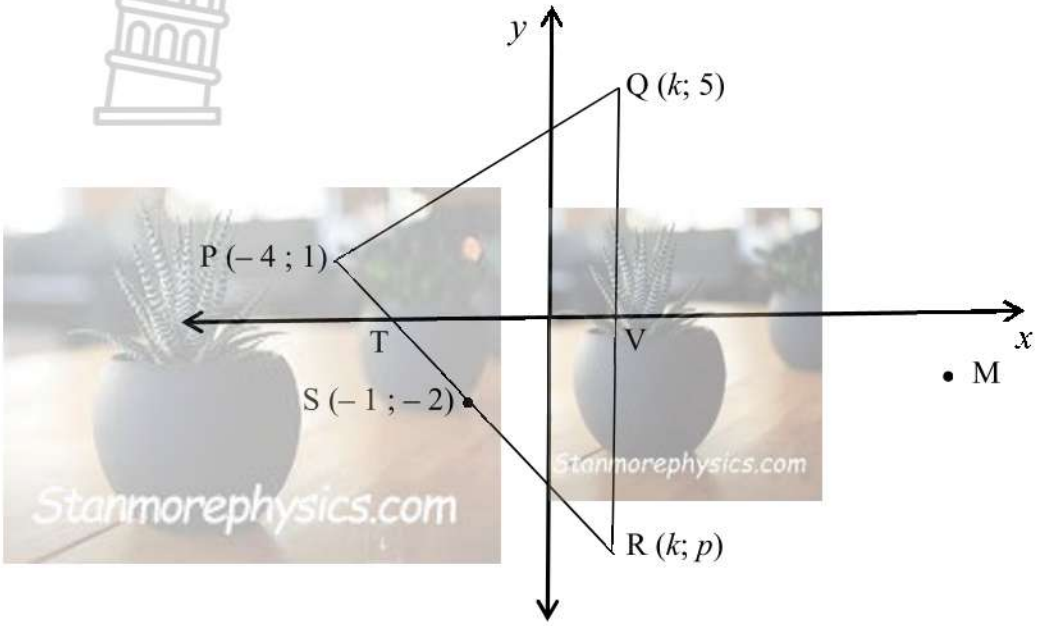
INSTRUCTIONS AND INFORMATION

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 the 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

In the diagram below, P (– 4; 1), Q (*k*; 5) and R(*k*; p) are vertices of ΔPQR.
S (– 1; – 2) is a midpoint of PR. T is the *x*-intercept of PR and V is the *x*-intercept of QR. QR is perpendicular to the *x*-axis.



1.1 Show that $k = 2$ and $p = -5$. (2)

1.2 Calculate the length of PR. (2)

1.3 Determine the gradient of PR. (2)

1.4 Determine the equation of PR, in the form $y = mx + c$. (2)

1.5 Determine whether or not, the point (– 11; 14) lies on the line determined in Question 1.4. (3)

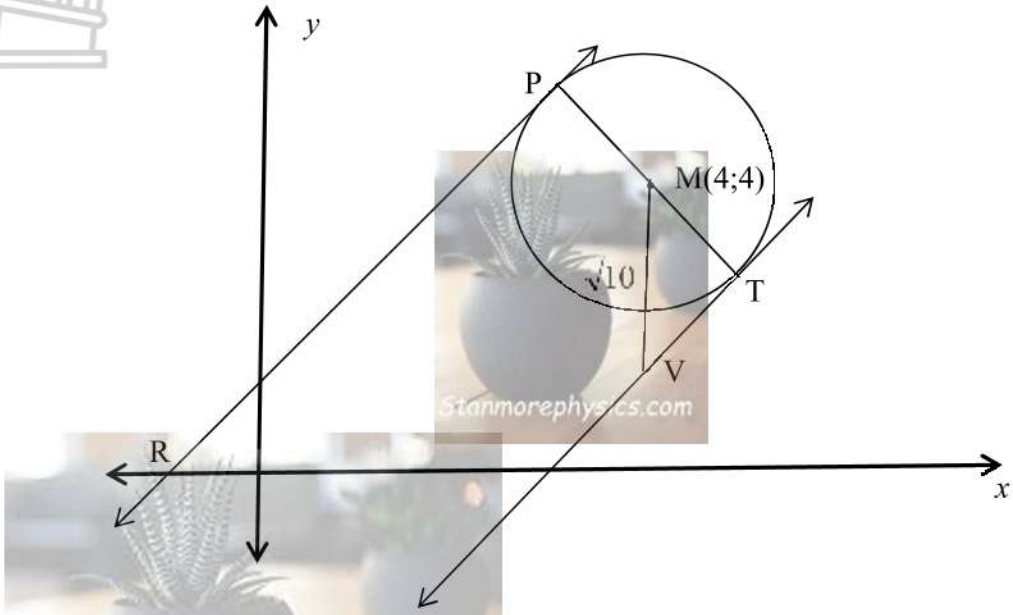
1.6 Determine the equation of the line that passes through point R and is perpendicular to line PR. (3)

1.7 Determine the coordinates of M if PQMR is a parallelogram. (2)

1.8 Calculate the size of $P\hat{R}Q$. (4)
[20]

QUESTION 2

In the diagram below, line PR with equation $y - x - 2 = 0$ is a tangent to the circle with centre M at P. The coordinates of M are (4; 4). PT is the diameter of the circle.
V is a point on the tangent at T such that MV = $\sqrt{10}$ units.



2.1 Calculate the gradient of the diameter. (2)

2.2 Determine the equation of the diameter in the form $y = mx + c$. (2)

2.3 Determine the coordinates of P. (3)

2.4 Determine the equation of the circle in the form $(x-a)^2 + (y-b)^2 = r^2$ (3)

2.5 Determine the coordinates of T. (2)

2.6 Calculate the length of VT. (2)

2.7 If the equation of VT is $y = x - 2$, for which values of k will $y = x + k$ NOT be a secant to circle P? (2)

2.8 A second circle with centre S(1; 3) and radius q touches the circle with centre M. Determine the value(s) of q. (3)
[19]

QUESTION 3

3.1 Simplify the expression below to a single trigonometric ratio, **without using a calculator:**

$$\frac{\cos 200^\circ.\cos(90^\circ - x).\tan(x-180^\circ).\cos(540^\circ + x)}{\sin(360^\circ - x).\sin 110^\circ} \quad (8)$$

3.2 Determine, **without using a calculator**, determine the value of:

$$\frac{-\cos^2 10^\circ + \sin^2 190^\circ}{\cos(-145^\circ).\cos 235^\circ} \quad (9)$$

3.3 If $\cos 40^\circ = \sqrt{1-p^2}$, express the following in terms of p.

3.3.1 $\cos 50^\circ$ (3)

3.3.2 $\cos 70^\circ$ (4)

[24]

QUESTION 4

Given the identity: $\frac{\sin(x+45^\circ)}{\cos(x-45^\circ)} = \frac{\sin 2x + 1}{(\sin x + \cos x)^2}$

4.1 Prove the identity. (7)

4.2 Solve for x, if $x \in [-180^\circ; 180^\circ]$: $\frac{\sin(x+45^\circ)}{\cos(x-45^\circ)} = 1$ (7)

4.3 Given: $\cos 22{,}5^\circ = \frac{a}{c}$ and $a^2 + b^2 = c^2$.

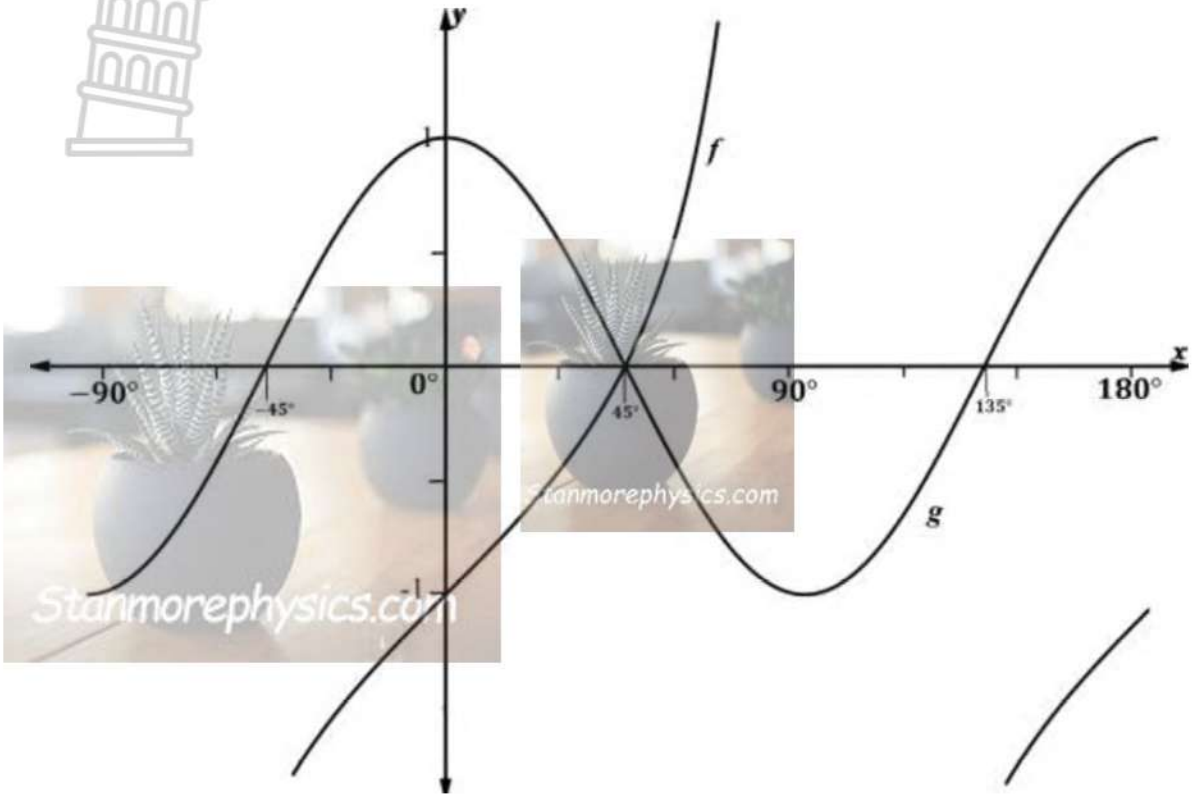
With the aid of a diagram, or otherwise, show that:

$$\frac{2ab}{c^2} = \frac{\sqrt{2}}{2} \quad (5)$$

[19]

QUESTION 5

In the diagram below the graphs of $f(x) = \tan x - 1$ and $g(x) = \cos 2x$ are drawn for the interval $x \in [-90^\circ; 180^\circ]$.



5.1 What is the amplitude of g? (1)

5.2 Write down the period of g. (1)

5.3 Write down the range of g. (1)

5.4 Determine the value(s) of x, in the interval $x \in [-90^\circ; 180^\circ]$, for which:

5.4.1 $g(x) \times f(x) = -1$ (2)

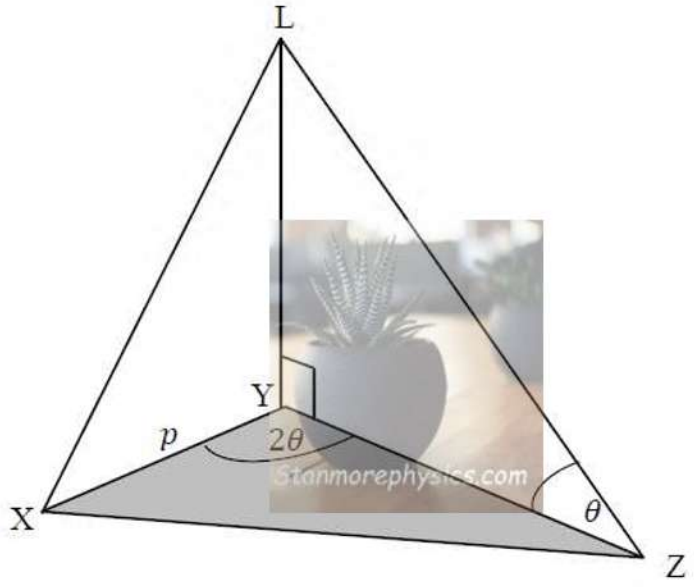
5.4.2 $\tan x = \cos 2x + 1$ (2)

5.4.3 $2 - 2\sin^2 x \leq \tan x$ (4)

[11]

QUESTION 6

In the diagram below, a lamp post LY is placed at the corner of a triangular field XYZ. The area of the field is A m^2 and $X\hat{Y}Z = 2\theta$. $Y\hat{Z}L = \theta$ and XY = p metres.



6.1 Determine, YZ in terms of A, p and 2θ. (2)

6.2 Hence, show that the height of the post is given by:

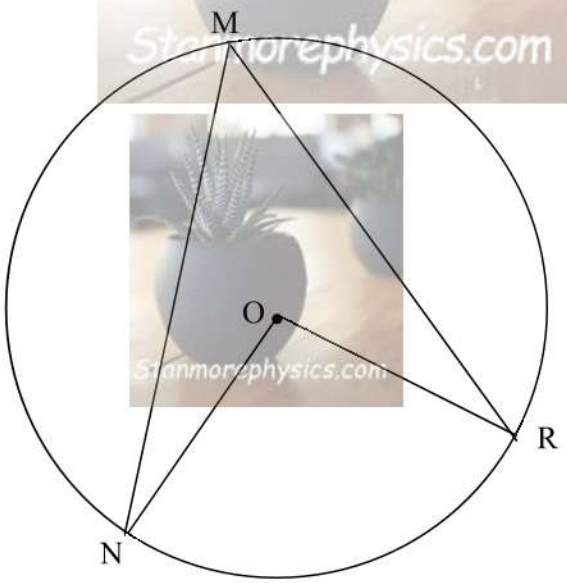
$$LY = \frac{A}{p\cos^2\theta}$$ (4)

6.3 If $p = 15\ m$, YZ = 30 m and $\theta = 60^\circ$, calculate the length of XZ. (2)
[8]

Provide reasons for your statements in Question 7, 8, 9 and 10.

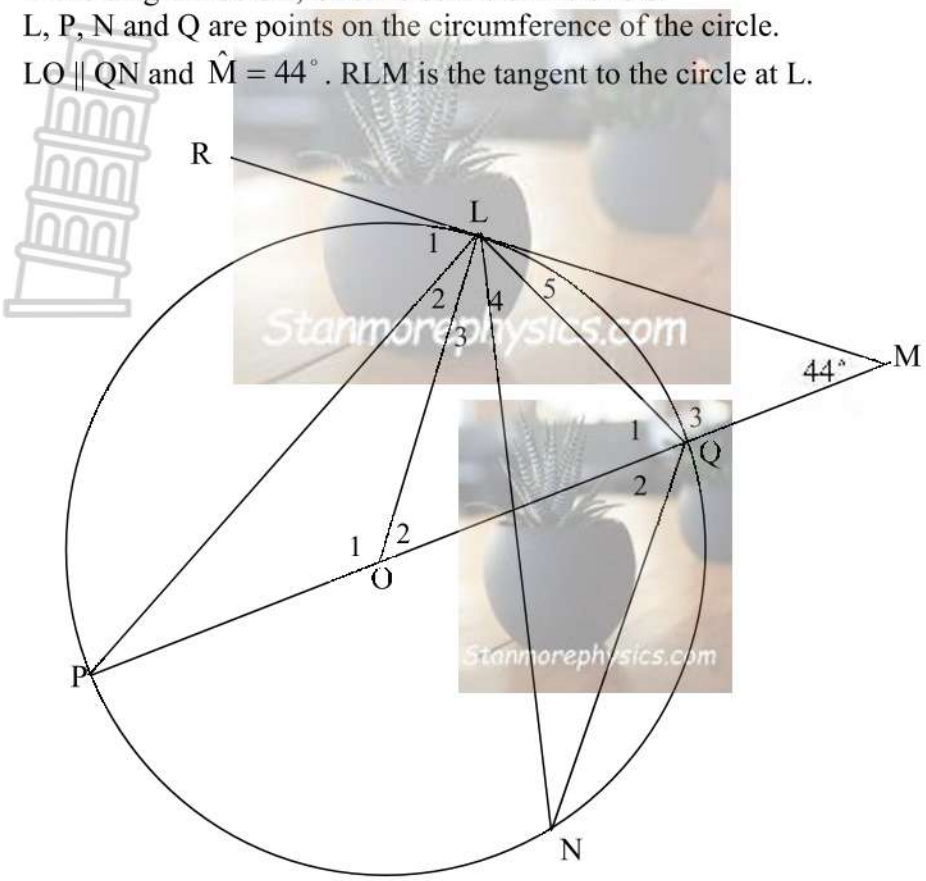
QUESTION 7

7.1 In the diagram below, O is the centre of the circle. M, N and R are points on the circle.



Prove the theorem that states: $N\hat{O}R = 2\hat{M}$ (4)

7.2 In the diagram below, O is the centre of the circle.
L, P, N and Q are points on the circumference of the circle.
LO || QN and $\hat{M} = 44^\circ$. RLM is the tangent to the circle at L.



Determine, giving reasons, the sizes of:

7.2.1 $\hat{O}_2$ (3)

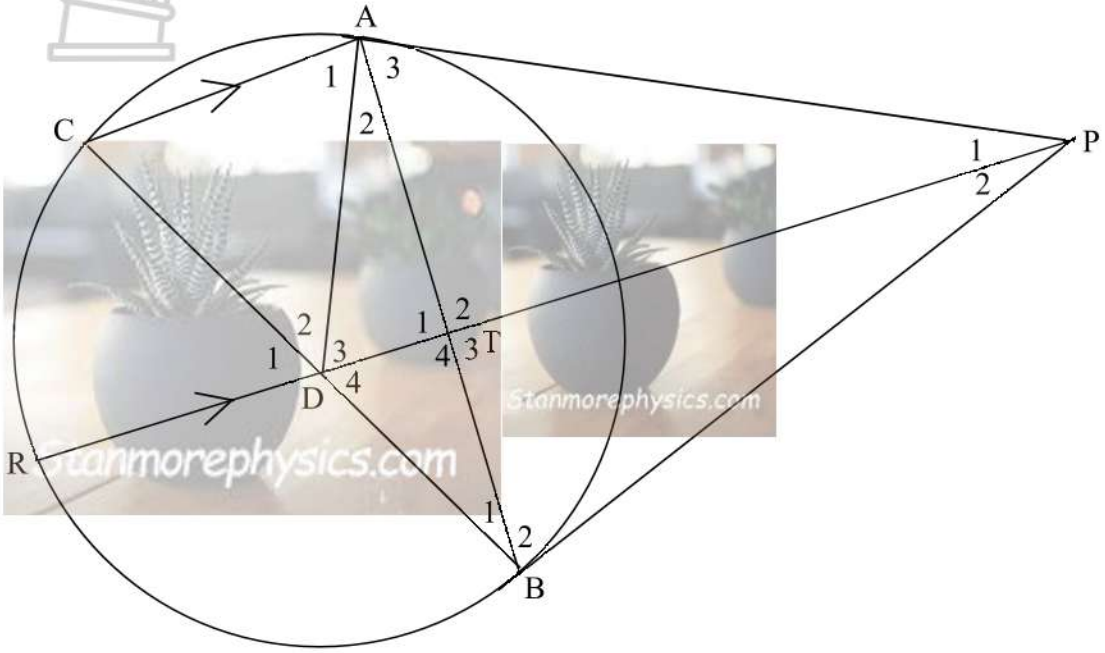
7.2.2 $\hat{L}_2$ (3)

7.2.3 $\hat{Q}_1$ (3)

[13]

QUESTION 8

In the diagram below, PA and PB are tangents to the circle at A and B respectively. PTDR is a straight line. Chord AC is drawn parallel to PR. PR intersects BA and BC at T and D respectively, and AD is drawn. Let $\hat{A}_3 = x$.



8.1 Prove that $\hat{D}_1 = \hat{A}_3$ (2)

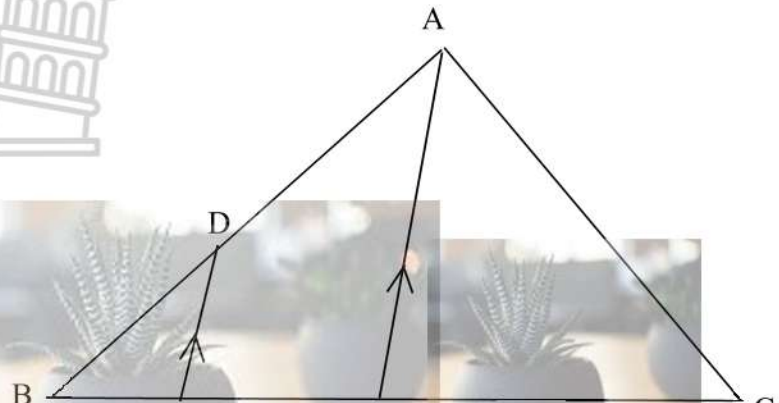
8.2 Hence, prove that PADB is a cyclic quadrilateral. (3)

8.3 Prove that AD = CD. (4)

8.4 Given that AD = DB and $\hat{B}_1 = y$, prove that CB is the diameter of the circle. (5)
[14]

QUESTION 9

The figure below shows Δ ABC with DE || AG and EC : GC = 5 : 3.
BE = 2 cm and GC = 9 cm.



Calculate the value of:

9.1 EG (2)

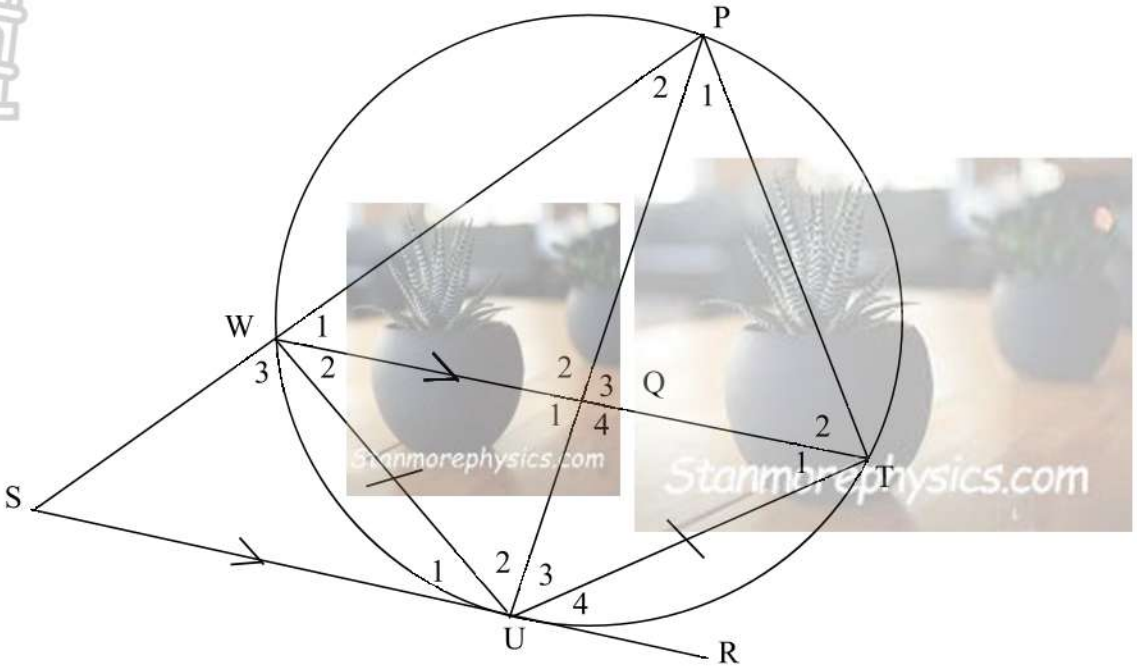
9.2 $\frac{AB}{AD}$ (2)

9.3 The ratio of $\frac{\text{Area of } \Delta ABC}{\text{Area of quadrilateral ADEC}}$, given that AD = 12cm. (6)

[10]

QUESTION 10

10.1 In the figure below, PWUT is a cyclic quadrilateral with WU = TU. Chords WT and PU intersect at Q. PW is extended to S such that WT || SR.

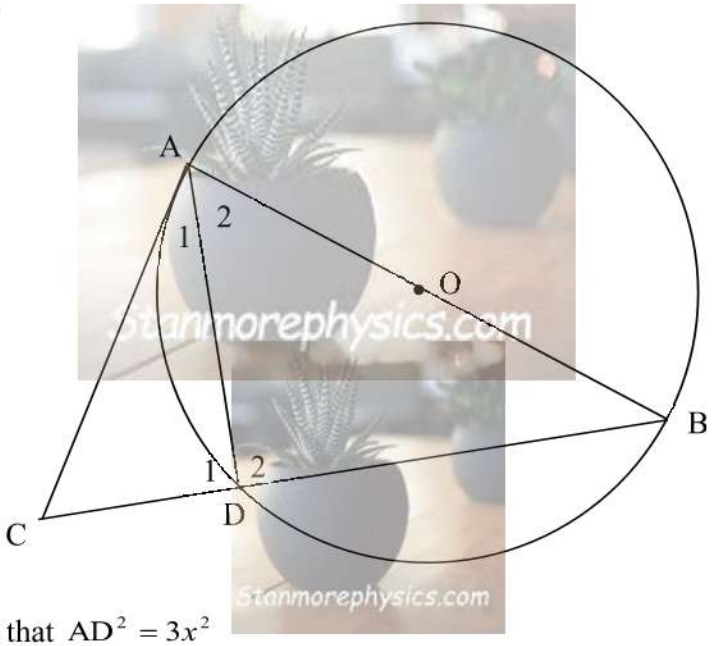


Prove that:

10.1.1 US is a tangent to circle PWUT at U (3)

10.1.2 ΔSPU ||| ΔSUW (3)

10.2 In the figure below, O is the centre of the circle passing through A, B and D.
AC is a tangent and BD produced meets the tangent at C.
CD : CB = 1 : 4.



If CD = x, prove that $AD^2 = 3x^2$ (6)
[12]

TOTAL : 150

INFORMATION SHEET

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

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

$$T_n = a + (n-1)d \qquad S_n = \frac{n}{2}\left(2a + (n-1)d\right)$$

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

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

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

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

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

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

In ΔABC: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C} \qquad a^2 = b^2 + c^2 - 2bc.\cos A$

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

$$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta \qquad \sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$$

$$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta \qquad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$$

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

$$\bar{x} = \frac{\sum fx}{n} \qquad \sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}$$

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

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

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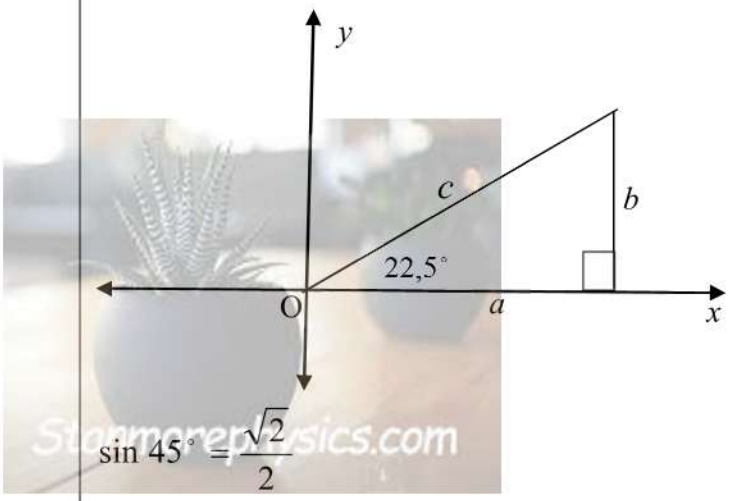
2026 MID-YEAR EXAMINATION ERRATA/ADDITIONS & ADJUSTMENTS TO MARKING GUIDELINES

SUBJECT	MATHEMATICS	**PAPER**	2
DATE	04 JUNE 2026	**TIME OF ERRATA**	16 :30
QUESTION	1.1	**MARKS**	2
QUESTION	1.5	**MARKS**	3
QUESTION	1.8	**MARKS**	4
QUESTION	4.3	**MARKS**	5
QUESTION	5.4.3	**MARKS**	4
QUESTION	6.2	**MARKS**	4
QUESTION	10.2	**MARKS**	6
	TOTAL MARKS AFFECTED		33
	TOTAL MARKS FOR THE PAPER AFTER ADJUSTMENT		150

REPLACE THE ANSWERS OR WRITE ADDITIONS OR ADJUSTMENTS ON THE TABLE BELOW:

1.1	$x = \frac{x_1 + x_2}{2}$ $\quad y = \frac{y_1 + y_2}{2}$ $-1 = \frac{-4+k}{2}$ $\quad -2 = \frac{1+p}{2}$ $k = 2$ $\quad p = -5$ R(2; – 5)	✓ $-1 = \frac{-4+k}{2}$ ✓ $-2 = \frac{1+p}{2}$ (2)
1.5	B(– 11; 14) $m_{BP} = \frac{14-1}{-11+4}$ $m_{BP} = -\frac{13}{7}$ $m_{PR} = m_{PS} = -1$ Gradients are not the same ∴ (– 11; 14) does not lie on $y = -x - 3$	✓ substitution/*vervanging* ✓ $m_{BP} = -\frac{13}{7}$ ✓conclusion/*gevolgtrekking* (3)

1.8	Coordinates of T $-x-3=0$ $x=-3$ T(–3;0) $TR=\sqrt{(0+3)^2+(-3-0)^2}$ $TR=\sqrt{18}$ $TV=5$ $5^2=\left(\sqrt{50}\right)^2+5^2-2\sqrt{50}(5)\cos R$ $25=50+25-10\sqrt{50}\cos R$ $\text{Cos}R=\frac{\sqrt{2}}{2}$ $\hat{R}=45^\circ$	✓ $\tan P\hat{T}V=-1$ ✓ $P\hat{T}V=135^\circ$ ✓ $\hat{R}=135^\circ-90^\circ$ ✓ $\hat{R}=45^\circ$ (4)
2.1	Answer only: Full marks	
2.8	$q+\sqrt{2}=SM$	✓ $q+\sqrt{2}=SM$
3.2		✓ $-\sin 10^\circ/\sin^2 10^\circ$
4.3	$\cos 22{,}5^\circ=\frac{a}{c}$ and $a^2+b^2=c^2$  $\sin 45^\circ=\frac{\sqrt{2}}{2}$ $2\sin 22{,}5^\circ.\cos 22{,}5^\circ=\frac{\sqrt{2}}{2}$ $2\times\frac{b}{c}\times\frac{a}{c}=\frac{\sqrt{2}}{2}$ $\frac{2ab}{c^2}=\frac{\sqrt{2}}{2}$	✓correct sketch ✓ $\sin 45^\circ=\frac{\sqrt{2}}{2}$ ✓ $2\sin 22{,}5^\circ.\cos 22{,}5^\circ$ ✓ $\frac{b}{a}$ ✓ $\frac{a}{c}$ (5)

5.4.2	Answer only: Full marks	
5.4.3	$2-2\sin^2 x \le \tan x$ $1-2\sin^2 x \le \tan x - 1$ $\cos 2x \le \tan x - 1$ $45^\circ \le x < 90^\circ$	✓ $1-2\sin^2 x \le \tan x - 1$ ✓ $\cos 2x \le \tan x - 1$ ✓ end points/*einde punte* ✓ notation/*notasie* (4)
6.2	$\frac{LY}{\sin\theta} = \frac{YZ}{\sin(90^\circ - \theta)}$ $LY = \frac{2A}{p\sin 2\theta.\cos\theta} \times \sin\theta$ $LY = \frac{2A.\sin\theta}{p \times 2\sin\theta\cos\theta \times \cos\theta}$	✓ $\frac{LY}{\sin\theta} = \frac{YZ}{\sin(90^\circ - \theta)}$ ✓ $\cos\theta$ ✓ $YZ = \frac{2A}{p\sin 2\theta}$ ✓ $2\sin\theta\cos\theta$ (4)
6.3	$XY = 39{,}69\,m$ or $15\sqrt{7}\ m$	✓ answer/*antwoord*
9.1	Answer only: Full marks	
10.2	$\hat{D}_2 = 90^\circ$ [$\angle$ in a semi-circle/$\angle$ *in halwe sirkel*] $\tan \hat{A}_1 = \frac{CD}{AD} = \frac{x}{AD}$ $\tan B = \frac{AD}{BD} = \frac{AD}{3x}$ $\hat{A}_1 = \hat{B}$ [tan chord theorem/*rklyn-koord stelling*] $\therefore \frac{AD}{3x} = \frac{x}{AD}$	✓ S/R ✓ S ✓ S ✓ S ✓ R ✓ S (6)

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PROVINCIAL ASSESSMENT/
PROVINSIALE ASSESSERING

GRADE 12/*GRAAD* 12

MATHEMATICS P2/*WISKUNDE V2*

JUNE/*JUNIE* 2026

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consists of 19 pages.
Hierdie nasienriglyne bestaan uit 19 bladsye.

NOTE

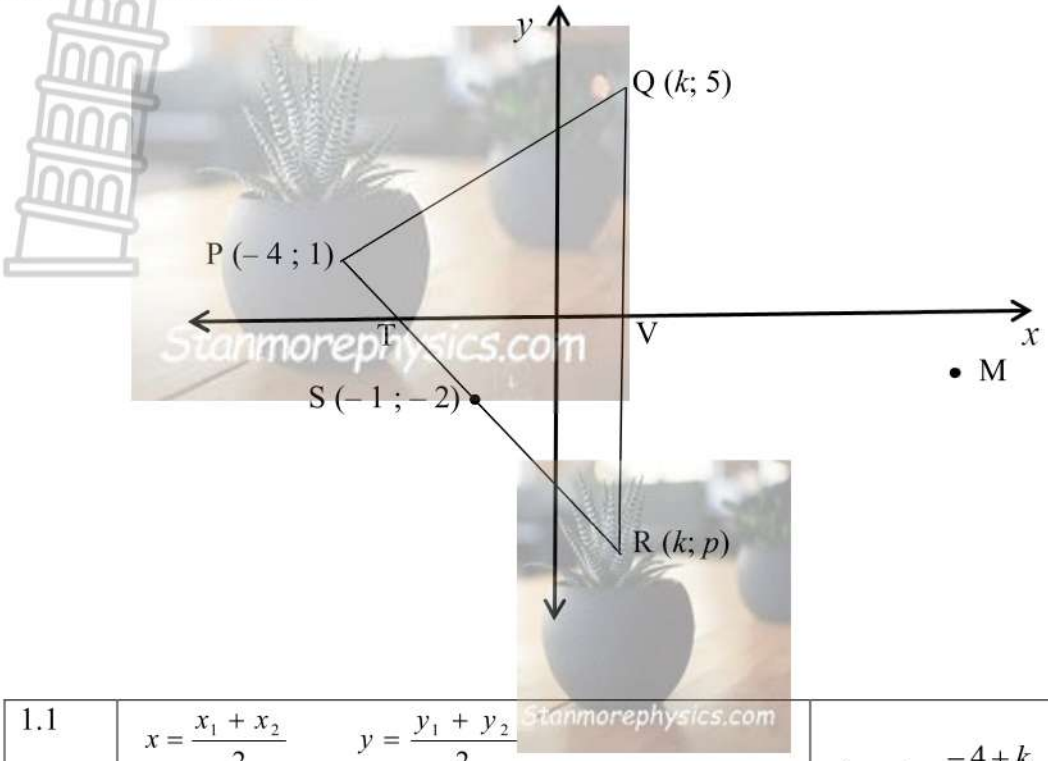
- If a candidate answer a QUESTION twice, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a QUESTION and not redone the QUESTION, mark the crossed out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking at the second calculation error.
- Assuming answer 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, merk die doodgetrekte poging.*
- *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	
S	**A mark for a correct statement/*'n Punt vir die korrekte stelling*** **(**A statement mark is independent of a reason/*'n stelling is onafhanklik van die rede*)
R	**A mark for a correct reason/*'n Punt vir die korrekte rede*** (A reason mark may only be awarded if the statement is correct/*'n rede punt mag skegs toegeken word met korrekte stelling*)
S/R	**Award a mark if statement AND reason are both correct/*ken 'n punt toe as die stelling EN rede beide korrek is***

QUESTION/*VRAAG* 1

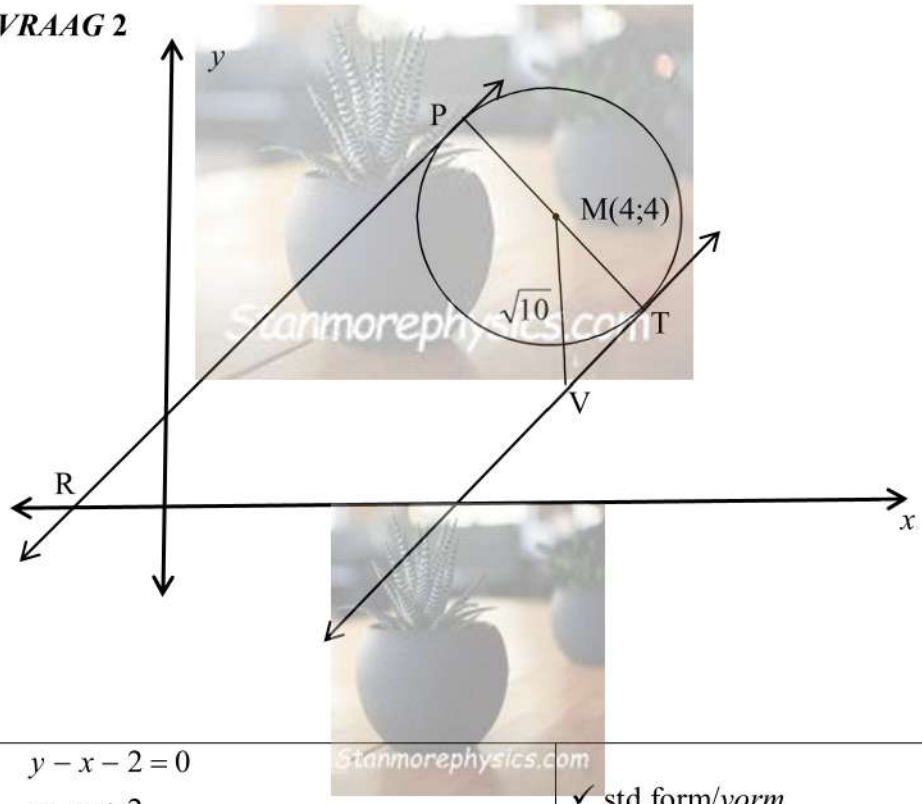


1.1	$x = \frac{x_1 + x_2}{2}$ $\quad y = \frac{y_1 + y_2}{2}$ $-1 = \frac{-4+k}{2}$ $\quad -2 = \frac{1+p}{2}$ $k = 2$ $\quad p = -5$ R(2; – 5)	✓ $-1 = \frac{-4+k}{2}$ ✓ $-2 = \frac{1+p}{2}$ (2)
1.2	PR $= \sqrt{(1+5)^2 + (-4-2)^2}$ PR $= \sqrt{72}$ or $6\sqrt{2}$ or 8,49 units	✓ substitution/*vervanging* ✓ answer/*antwoord* (2)
1.3	$m_{PR} = \frac{-5-1}{2+4}$ **OR** $m_{PS} = \frac{1+2}{-4+1}$ $= -1$ $\quad = -1$	✓ substitution/*vervanging* ✓ answer/*antwoord* (2)
1.4	$y - y_1 = m(x - x_1)$ $y - 1 = -1(x+4)$ $\quad$ $y + 5 = -1(x-2)$ $y - 1 = (x+4)$ **OR** $y + 5 = -x + 2$ $y = -x - 3$ $\quad$ $y = -x - 3$ CA from 1.3	✓ substitution/*vervanging* P,S or R ✓ answer/*antwoord* (2)
1.5	$y = -x - 3$ RHS $= -x - 3$ $= -(-11) - 3$ $= 8$ LHS = 14 LHS $\neq$ RHS $\therefore$ (– 11; 14) does not lie on $y = -x - 3$	✓ substitution/*vervanging* ✓ RHS = 8 ✓conclusion/*gevolgtrekking*

	OR B(– 11; 14) $m_{BP} = \frac{14-1}{-11+4}$ $m_{BP} = -\frac{13}{7}$ $m_{PR} = m_{PS} = -1$ Gradients are not the same $\therefore$ (– 11; 14) does not lie on $y = -x - 3$	✓ substitution/*vervanging* ✓ $m_{BP} = -\frac{13}{7}$ ✓conclusion/*gevolgtrekking* (3)
1.6	$m_{\perp} = 1$ R(2; – 5) $y - y_1 = m(x - x)$ $y + 5 = 1(x - 2)$ $y = x - 7$	✓ $m_{\perp} = 1$ ✓ substitution/*vervanging* ✓conclusion/*gevolgtrekking* (3)
1.7	M (8; – 1)	✓ $x = 8$ ✓ $y = -1$ (2)
1.8	$m_{PR} = -1$ $\tan P\hat{T}V = -1$ $P\hat{T}V = 135^\circ$ $\hat{R} = 135^\circ - 90^\circ$ $\hat{R} = 45^\circ$ **OR** Coordinates of T $-x - 3 = 0$ $x = -3$ T(–3;0) $TR = \sqrt{(0+3)^2 + (-3-0)^2}$ $TR = \sqrt{18}$ $TV = 5$ $5^2 = \left(\sqrt{50}\right)^2 + 5^2 - 2\sqrt{50}(5)\cos R$ $25 = 50 + 25 - 10\sqrt{50}\cos R$ $\text{Cos}R = \frac{\sqrt{2}}{2}$ $\hat{R} = 45^\circ$	✓ $\tan P\hat{T}V = -1$ ✓ $P\hat{T}V = 135^\circ$ ✓ $\hat{R} = 135^\circ - 90^\circ$ ✓ $\hat{R} = 45^\circ$ (4) ✓ $\tan P\hat{T}V = -1$ ✓ $P\hat{T}V = 135^\circ$ ✓ $\hat{R} = 135^\circ - 90^\circ$ ✓ $\hat{R} = 45^\circ$ (4)

[20]

QUESTION/*VRAAG* 2



2.1	$y-x-2=0$ $y=x+2$ $m_{dia}=-1$ Answer only: Full marks	✓ std form/*vorm* ✓ answer/*antwoord* (2)
2.2	$y-y_1=m(x-x_1)$ $y-4=-1(x-4)$ $y-4=-x+4$ $y=-x+8$	✓ substitution/*vervanging* ✓ answer/*antwoord* (2)
2.3	$y=-x+8$ and $y=x+2$ $x+2=-x+8$ $2x=6$ $x=3$ $y=5$ P(3;5)	✓ substitution/*vervanging* ✓ $x=3$ ✓ $y=5$ (3)
2.4	PM $=\sqrt{(4-5)^2+(4-3)^2}$ subst (3;5) PM $=\sqrt{2}$ $(x-4)^2+(y-4)^2=2$ OR $(x-4)^2+(y-4)^2=r^2$ $(3-4)^2+(5-4)^2=r^2$ subst (3;5) $r^2=2$ $\therefore (x-4)^2+(y-4)^2=2$	✓ substitution/*vervanging* ✓ PM $=\sqrt{2}$ ✓ answer/*antwoord* ✓ substitution/*vervanging* ✓ $r^2=2$ ✓ answer/*antwoord* (3)

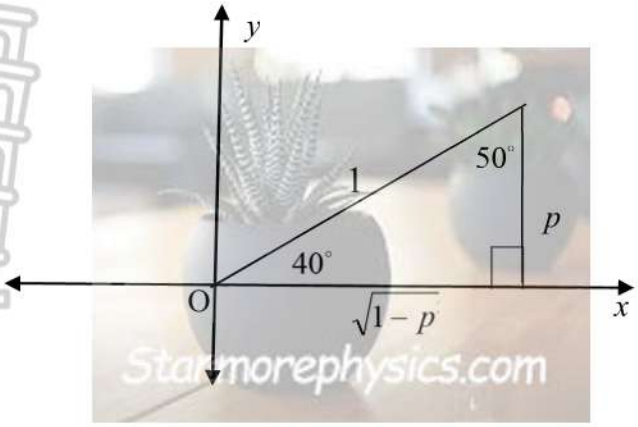
2.5	$x = \frac{x_1 + x_2}{2}$ $\quad y = \frac{y_1 + y_2}{2}$ $4 = \frac{3 + x_2}{2}$ $\quad 4 = \frac{5 + y_2}{2}$ $x_2 = 5$ $\quad y_2 = 3$ T (5;3)	✓ $x_2 = 5$ ✓ $y_2 = 3$ (2)
2.6	PM $= \sqrt{2}$ VT$^2 = (\sqrt{10})^2 - (\sqrt{2})^2$ VT$^2 = 8$ VT $= \sqrt{8}$ or VT $= 2\sqrt{2}$	✓ VT$^2 = (\sqrt{10})^2 - (\sqrt{2})^2$ ✓ answer/*antwoord* (2)
2.7	y-int of PR is 2 y-int of TV is -2 $k \leq -2$ or $k \geq 2$	✓ $k \leq -2$ ✓ $k \geq 2$ (2)
2.8	$q + \sqrt{2} =$ SM $q+\sqrt{2} = \sqrt{(4-3)^2 + (4-1)^2}$ $q+\sqrt{2} = \sqrt{10}$ $q = 1{,}75$	✓ $q + \sqrt{2} =$ SM ✓ substitution/*vervanging* ✓ answer/*antwoord* (3)

[19]

QUESTION/*VRAAG* 3

3.1	$\frac{\cos 200^\circ . \cos(90^\circ - x) . \tan(x - 180^\circ) . \cos(540^\circ + x)}{\sin(360^\circ - x) . \sin 110^\circ}$ $= \frac{\cos(180^\circ + 20^\circ) . \sin x . (\tan x) . \cos(180^\circ + x)}{(-\sin x) . \sin(90^\circ + 20^\circ)}$ or $\sin 70^\circ$ $= \frac{(-\cos 20^\circ) \sin x \left(\frac{\sin x}{\cos x}\right)(-\cos x)}{(-\sin x) . \cos 20^\circ}$ $= -\sin x$	✓ $-\cos 20^\circ$ ✓ $\sin x$ ✓ $\tan x$ ✓ $-\cos x$ ✓ $-\sin x$ ✓ $\cos 20^\circ$ or $\sin 70^\circ$ ✓ $\frac{\sin x}{\cos x}$ ✓ answer/*antwoord* (8)

3.2	$\dfrac{-\cos^2 10^\circ + \sin^2 190^\circ}{\cos(-145^\circ).\cos 235^\circ}$ $= \dfrac{-\cos^2 10^\circ + \sin^2(180^\circ + 10^\circ)}{\cos 145^\circ \cos 235^\circ}$ $= \dfrac{-\cos^2 10^\circ + (-\sin 10^\circ)^2}{\cos(180^\circ - 35^\circ)\cos(180^\circ + 55^\circ)}$ $= \dfrac{-\cos^2 10 + \sin^2 10^\circ}{-\cos 35^\circ(-\cos 55^\circ)}$ $= \dfrac{-(\cos^2 10^\circ - \sin^2 10^\circ)}{\cos 35^\circ(\sin 35^\circ)}$ $= \dfrac{-\cos 20^\circ}{\cos 35^\circ.\sin 35^\circ}$ $= \dfrac{-2\cos 20^\circ}{2\cos 35^\circ.\sin 35^\circ}$ $= \dfrac{-2\cos 20^\circ}{\sin 70^\circ}$ $= \dfrac{-2\cos 20^\circ}{\cos 20^\circ}$ or $= \dfrac{-2\cos 70^\circ}{\cos 70^\circ}$ $= -2$	✓ $-\sin 10^\circ / \sin^2 10^\circ$ ✓ $-\cos 35^\circ$ ✓ $-\cos 55^\circ$ ✓ $-\cos 20^\circ$ ✓ $\sin 35^\circ$ ✓ $2 \div 2$ ✓ $\sin 70^\circ$ ✓ $\cos 20^\circ$ or $\sin 70^\circ$ ✓ answer/*antwoord* (9)

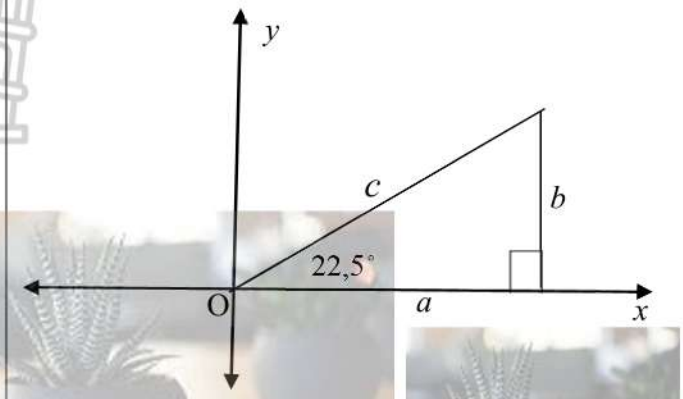
3.3.1	 $opp^2 = 1-(\sqrt{1-p^2})^2$ $opp^2 = 1-(1-p^2)$ $opp^2 = p^2$ $opp = p$ $\cos 50^\circ = p$	✓ correct sketch/*korrekte diagram* ✓ opp = *p*/*teenoorst* = *p* ✓ answer/*antwoord* (3)
3.3.2	$\cos 70^\circ = \cos(40^\circ + 30^\circ)$ $= \cos 40^\circ.\cos 30 - \sin 40^\circ.\sin 30^\circ$ $= \sqrt{1-p^2} \times \frac{\sqrt{3}}{2} - p \times \frac{1}{2}$ $= \frac{\sqrt{3(1-p^2)} - p}{2}$	✓ $\cos(40^\circ + 30^\circ)$ ✓ Expansion ✓ $\sqrt{1-p^2} \times \frac{\sqrt{3}}{2}$ ✓ $p \times \frac{1}{2}$ (4)

[24]

QUESTION/*VRAAG* 4

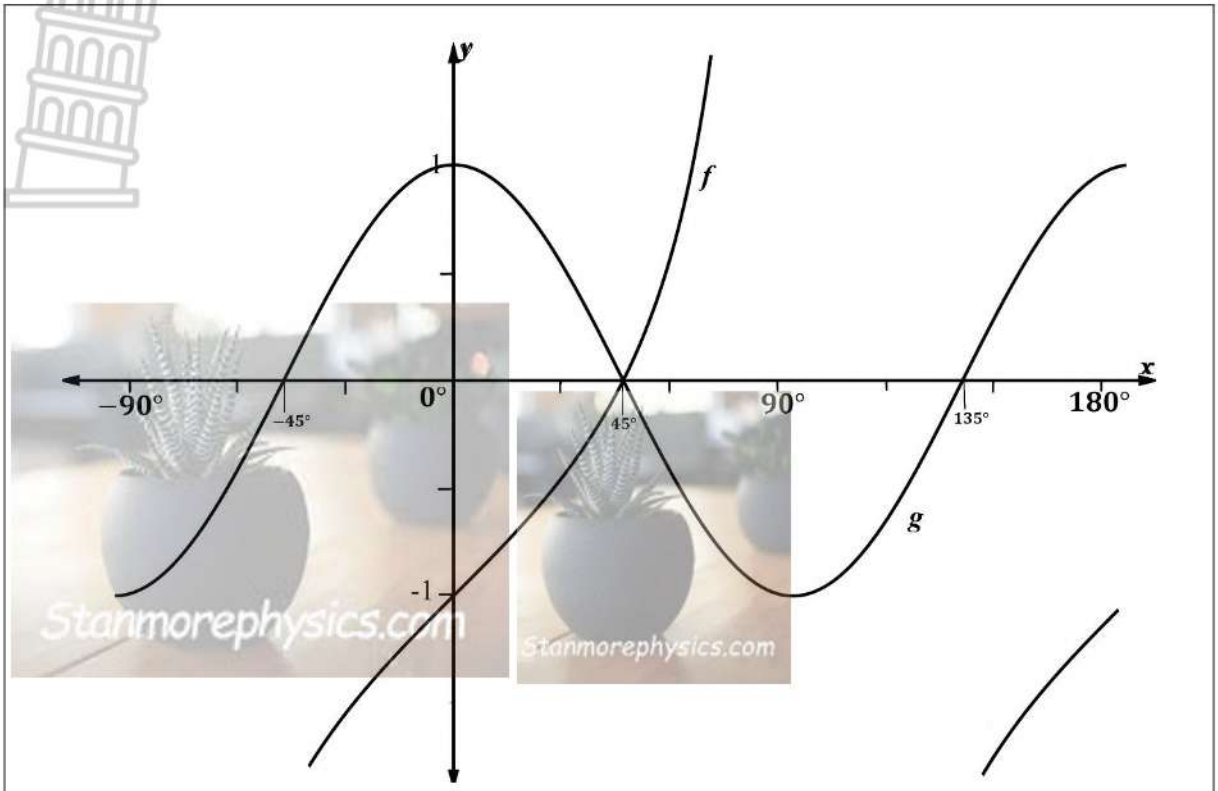
4.1	$\dfrac{\sin(x+45^\circ)}{\cos(x-45^\circ)} = \dfrac{\sin 2x+1}{(\sin x+\cos x)^2}$	
	$\text{LHS} = \dfrac{\sin(x+45^\circ)}{\cos(x-45^\circ)}$	
	$= \dfrac{\sin x\cos 45^\circ + \cos x\sin 45^\circ}{\cos x\cos 45^\circ + \sin x\sin 45^\circ}$	✓ $\sin x\cos 45^\circ + \cos x\sin 45^\circ$ ✓ $\cos x\cos 45^\circ + \sin x\sin 45^\circ$
	$= \dfrac{\frac{\sqrt{2}}{2}\sin x + \frac{\sqrt{2}}{2}\cos x}{\frac{\sqrt{2}}{2}\cos x + \frac{\sqrt{2}}{2}\sin x}$	✓ substitution/*vervanging*
	$= 1$	✓ 1
	$\text{LHS} = \dfrac{\sin 2x+1}{(\sin x+\cos x)^2}$	
	$= \dfrac{2\sin x\cos x + \sin^2 x + \cos^2 x}{(\sin x+\cos x)(\sin x+\cos x)}$	✓ $2\sin x\cos$ ✓ $\sin^2 x + \cos^2 x$
	$= \dfrac{(\sin x+\cos x)(\sin x+\cos)}{(\sin x+\cos x)(\sin x+\cos x)}$	✓factors/*gem faktore* ✓ 1
	$= 1$	
	LHS = RHS	
	OR	
	$\text{LHS} = \dfrac{\sin(x+45^\circ)}{\cos(x-45^\circ)}$	
	$= \dfrac{\sin x\cos 45^\circ + \cos x\sin 45^\circ}{\cos x\cos 45^\circ + \sin x\sin 45^\circ}$	✓ $\sin x\cos 45^\circ + \cos x\sin 45^\circ$ ✓ $\cos x\cos 45^\circ + \sin x\sin 45^\circ$
	$= \dfrac{\frac{\sqrt{2}}{2}\sin x + \frac{\sqrt{2}}{2}\cos x}{\frac{\sqrt{2}}{2}\cos x + \frac{\sqrt{2}}{2}\sin x}$	✓ substitution/*vervanging*
	$= \dfrac{\frac{\sqrt{2}}{2}(\sin x+\cos x)}{\frac{\sqrt{2}}{2}(\sin x+\cos x)} \times \dfrac{(\sin x+\cos x)}{(\sin x+\cos x)}$	✓common factor/*gem faktore* ✓$\times \dfrac{(\sin x+\cos x)}{(\sin x+\cos x)}$
	$= \dfrac{\sin^2 x + 2\sin x\cos x + \cos^2 x}{(\sin x+\cos x)^2}$	✓ $\sin^2 x + \cos^2 x$
	$= \dfrac{1+\sin 2x}{(\sin x+\cos x)^2}$	
	LHS = RHS	✓ $2\sin x\cos x$
		(7)

4.2	$\frac{\sin(x+45^\circ)}{\cos(x-45^\circ)}=1$	
	$\sin(x+45^\circ)=\cos(x-45^\circ)$	✓ $\sin(x+45^\circ)=\cos(x-45^\circ)$
	$\sin(x+45^\circ)=\sin[90^\circ-(x-45^\circ)]$	✓ $\sin(x+45^\circ)=\sin(135^\circ-x)$
	$\sin(x+45^\circ)=\sin(135^\circ-x)$	
	$x+45^\circ=135^\circ-x+k.360^\circ$	✓1st quad/1ste *kwadrant*
	$2x=90^\circ+k.360^\circ$	
	$x=45^\circ+k.180^\circ;k\in Z$	✓ Gen Solution 1/*alg opl 1*
	or	
	$x+45^\circ=180^\circ-(135^\circ-x)+k.360^\circ$	✓2nd quad/2de *kwadrant*
	$x+45^\circ=45+x+k.360^\circ$	✓ Gen Solution 2/*alg opl 2* and/*en* No/*Geen* solution
	No Solution	− 1 if/*as* $k\in Z$ is not included/*nie deel van die antwoord is nie*
	$\therefore x=-135^\circ;\ 45^\circ$	✓answer/*antwoord*
	OR/*OF*	
	$\frac{\sin(x+45^\circ)}{\cos(x-45^\circ)}=1$	
	$\sin(x+45^\circ)=\cos(x-45^\circ)$	✓ $\sin(x+45^\circ)=\cos(x-45^\circ)$
	$\cos[90^\circ-(x+45^\circ)]=\cos(x-45^\circ)$	✓ $\cos(45^\circ-x)=\cos(x-45^\circ)$
	$\cos(45^\circ-x)=\cos(x-45^\circ)$	✓1st quad/1ste *kwadrant*
	$45^\circ-x=\pm(x-45)+k.360^\circ$	✓ Gen Solution 1/*alg opl 1*
	$45^\circ-x=x-45^\circ+k.360^\circ$	
	$-2x=-90^\circ+k.360^\circ$	
	$x=45^\circ-k.180^\circ;k\in Z$	
	or	✓4th quad/4de *kwadrant*
	$45^\circ-x=-(x-45^\circ)+k.360^\circ$	✓ Gen Solution 2/*alg opl 2* and/*en* No/*Geen* solution
	$45^\circ-x=-x-45^\circ+k.360^\circ$	− 1 if/*as* $k\in Z$ is not included/*nie deel van die antwoord is nie*
	No Solution	✓answer/*antwoord*
	$x=-135^\circ;45^\circ$	(7)

4.3	$\cos 22,5^\circ = \frac{a}{c}$ and $a^2 + b^2 = c^2$  $\sin 45^\circ = \frac{\sqrt{2}}{2}$ $2\sin 22,5^\circ.\cos 22,5^\circ = \frac{\sqrt{2}}{2}$ $2 \times \frac{b}{c} \times \frac{a}{c} = \frac{\sqrt{2}}{2}$ $\frac{2ab}{c^2} = \frac{\sqrt{2}}{2}$	✓correct sketch ✓ $\sin 45^\circ = \frac{\sqrt{2}}{2}$ ✓ $2\sin 22,5^\circ.\cos 22,5^\circ$ ✓ $\frac{b}{a}$ ✓ $\frac{a}{c}$ (5)

[19]

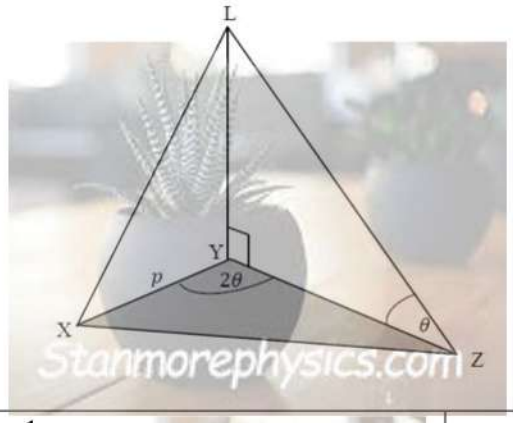
QUESTION/*VRAAG* 5



5.1	Amplitude of $g = 1$	✓ answer/*antwoord* (1)
5.2	Period of g is 180°	✓ answer/*antwoord* (1)
5.3	$y \in [-1;1]$ or $-1 \le y \le 1$	✓ answer/*antwoord* (1)
5.4.1	$x = 0^\circ$ or $x = 180^\circ$	✓ $x = 0^\circ$ ✓ $x = 180^\circ$ (2)
5.4.2	$\tan x = \cos 2x + 1$ $\tan x - 1 = \cos 2x$ $x = 45^\circ$ Answer only: Full marks	✓ $\tan x - 1 = \cos 2x$ ✓ answer/*antwoord* (2)
5.4.3	$2 - 2\sin^2 x \le \tan x$ $1 - 2\sin^2 x \le \tan x - 1$ $\cos 2x \le \tan x - 1$ $45^\circ \le x < 90^\circ$	✓ $1 - 2\sin^2 x \le \tan x - 1$ ✓ $\cos 2x \le \tan x - 1$ ✓ end points/*einde punte* ✓ notation/*notasie* (4)

[11]

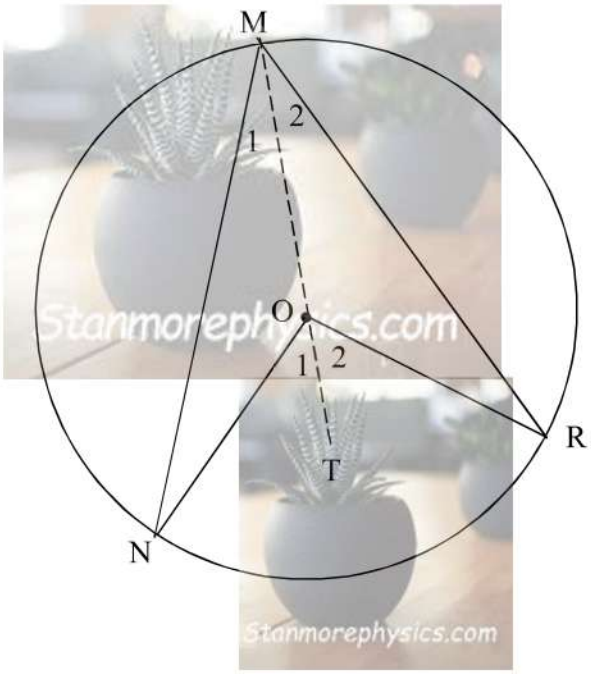
QUESTION/*VRAAG* 6

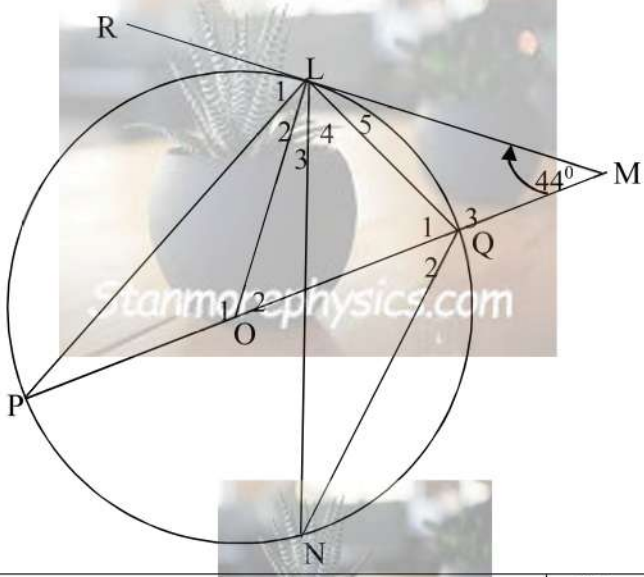


6.1	$\text{Area of } \Delta XYZ = \frac{1}{2}p.YZ.\sin 2\theta$ $A = \frac{1}{2}p.YZ.\sin 2\theta$ $YZ = \frac{2A}{p\sin 2\theta}$ or $\frac{A}{\frac{1}{2}p\sin 2\theta}$	✓ substitution/*vervanging* ✓ answer/*antwoord* (2)
6.2	$\tan\theta = \frac{LY}{YZ}$ $LY = YZ\tan\theta$ $LY = \frac{2A}{p\sin 2\theta}\times\frac{\sin\theta}{\cos\theta}$ $LY = \frac{2A}{p\times 2\sin\theta\cos\theta}\times\frac{\sin\theta}{\cos\theta}$ $LY = \frac{A}{p\cos^2\theta}$ **OR** $\frac{LY}{\sin\theta} = \frac{YZ}{\sin(90^\circ-\theta)}$ $LY = \frac{2A}{p\sin 2\theta.\cos\theta}\times\sin\theta$ $LY = \frac{2A.\sin\theta}{p\times 2\sin\theta\cos\theta\times\cos\theta}$	✓ $\tan\theta = \frac{LY}{YZ}$ ✓ $LY = YZ\tan\theta$ ✓ $LY = \frac{2A}{p\sin 2\theta}\times\frac{\sin\theta}{\cos\theta}$ ✓ $LY = \frac{2A}{p\times 2\sin\theta\cos\theta}\times\frac{\sin\theta}{\cos\theta}$ ✓ $\frac{LY}{\sin\theta} = \frac{YZ}{\sin(90^\circ-\theta)}$ ✓ $\cos\theta$ ✓ $YZ = \frac{2A}{p\sin 2\theta}$ ✓ $2\sin\theta\cos\theta$ (4)
6.3	$XZ^2 = 15^2 + 30^2 - 2(15)(30)\cos 120^\circ$ $XY = 39{,}69\,m$ or $15\sqrt{7}\ m$	✓ substitution/*vervanging* ✓ answer/*antwoord* (2)

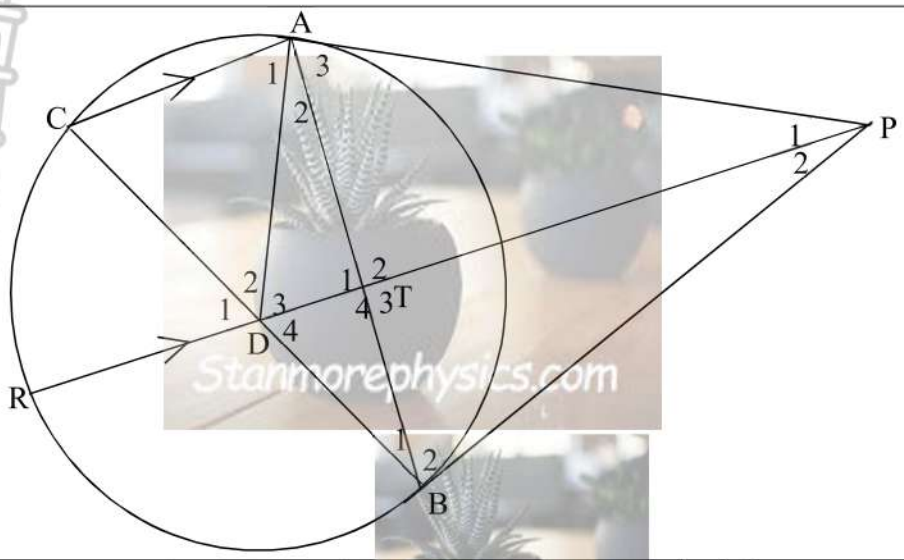
[8]

QUESTION/*VRAAG* 7

7.1		
	Draw MO produced to T/*Trek MO en verbind met T* Proof:/*Bewys* $\hat{M}_1 = \hat{N}$ [$\angle$s opp = sides/ $\angle^e$ *teenoor* = *sye*] $\hat{O}_1 = 2\hat{M}_1$ [ext $\angle$ of a Δ/ *buite* $\angle$ *van* Δ] Similarly: $\hat{O}_2 = 2\hat{M}_2$ $\hat{O}_1 + \hat{O}_2 = 2\hat{M}_1 + 2\hat{M}_2$ $N\hat{O}R = \hat{M}$	✓construction/*konstruksie* ✓S/R ✓S/R ✓S (4)

7.2		
7.2.1	$O\hat{L}M = 90^\circ$ [rad $\perp$ tan/*rklyn*] $\hat{O}_2 = 46^\circ$ [sum of$\angle$s of a Δ/som van $\angle^e$ van Δ]	✓ S ✓ R ✓ S/R (3)
7.2.2	$\hat{P} = \hat{L}_2$ [$\angle$s opp = sides/ $\angle^e$*teenoor = sye*] $2\hat{P} = \hat{O}_2 = 46^\circ$ [$\angle$ at centre = 2× $\angle$ at circumf/ [*midp* $\angle = 2\times$ *omtreks* $\angle$] **OR** [ext $\angle$ of a Δ/ *buite* $\angle$ *van* Δ] $\hat{P} = \hat{L}_2 = 23^\circ$	✓ S/R ✓ S/R ✓answer/*antwoord* (3)
7.2.3	$P\hat{L}Q = 90^\circ$ [$\angle$ subt by dia/ $\angle$ *in halwe sirkel*] $\hat{P} + P\hat{L}Q + \hat{Q}_1 = 180^\circ$ [sum of$\angle$s of a Δ/som van $\angle^e$ van Δ] $23^\circ + 90^\circ + \hat{Q}_1 = 180^\circ$ $\hat{Q}_1 = 67^\circ$ [sum of$\angle$s of a Δ/som van $\angle^e$ van Δ] **OR** $\hat{L}_1 + \hat{L}_2 = 90^\circ$ [rad $\perp$ tan/*rklyn*] $\hat{L}_1 = 67^\circ$ $\hat{Q}_1 = \hat{L}_1 = 67^\circ$ [tan chord theorem/*rklyn-koord stelling*] **OR** $\hat{L}_5 = \hat{P} = 23^\circ$ [tan chord theorem/*rklyn-koord stelling*] $\hat{Q}_1 = 23^\circ + 44^\circ$ $\hat{Q}_1 = 67^\circ$ [ext $\angle$ of a Δ/ *buite* $\angle$ *van* Δ]	✓ S/R ✓ S ✓R ✓ S/R ✓ S ✓R ✓ S ✓R ✓ S/R (3)
		[13]

QUESTION/*VRAAG* 8

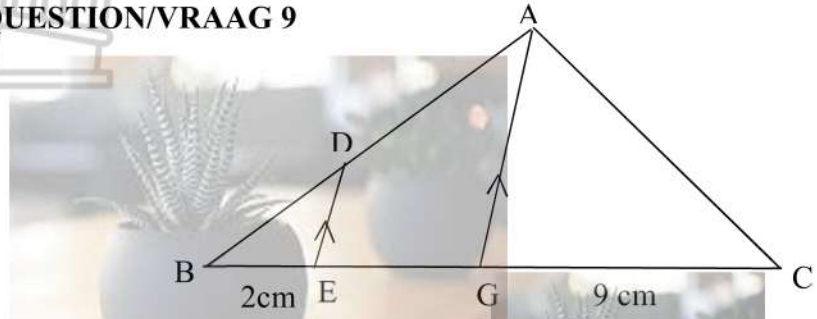


8.1	$C = A_3$ [tan chord theorem/*rklyn-koord stelling*] $\hat{D}_1 = C$ [alt ∠s /*verw* $\angle^e$; CA//RP] $\therefore \hat{D}_1 = \hat{A}_3$	✓ S/R ✓ S/R (2)
8.2	$\hat{D}_4 = \hat{D}_1$ vert opp ∠s/*regoorst* $\angle^e$] $\hat{D}_4 = \hat{A}_3$ [both = $\hat{C}$ /beide = $\hat{C}$] $\therefore \hat{D}_4 = \hat{A}_3$ PADB is a cyclic quad / *is 'n kvh* [converse of ∠s in same seg/*omgekeerde* $\angle^e$ *in dies seg*]	✓ S/R ✓ S ✓ R (3)
8.3	$\hat{B}_2 = \hat{D}_3$ [∠s in same seg/ $\angle^e$ *in dies seg*] $\hat{A}_1 = \hat{D}_3$ [alt ∠s /*verw* $\angle^e$; CA//RP] $\therefore \hat{A}_1 = \hat{B}_2$ But $\hat{B}_2 = \hat{C}$ [tan chord theorem/*rklyn/koor st*] $\therefore \hat{A}_1 = C$ AD = CD[sides opp = ∠s /*sye t.o* = $\angle^e$]	✓ S/R ✓ S/R ✓S/R ✓R (4)
8.4	Let $\hat{C} = x$ $\hat{A}_1 = \hat{C} = x$ [proven in 8.3] $\hat{B}_1 = \hat{A}_2 = y$ [both = $\hat{C}$] $\hat{C} + \hat{A}_1 + \hat{A}_2 + \hat{B}_1 = 180^\circ$ [sum of ∠s of a Δ/*som* $\angle^e$ *v* Δ] $x + x + y + y = 180^\circ$ $2x + 2y = 180^\circ$ $x + y = 90^\circ$ BC is a diameter [converse: ∠ in a semi-cirle /*omgekeerde* ∠ *in halwe sirkel*] **OR**	✓S/R ✓S/R ✓S ✓S ✓R (5)

	AD = DB [given/*gegee*] But/*Maar* AD = CD [proved in 8.3] D is the centre/*middelpunt* [CD = AD = BD] CB is a diameter/*middellyn* [CD = DB]	✓S/R ✓S/R ✓S ✓R ✓R (5)

[14]

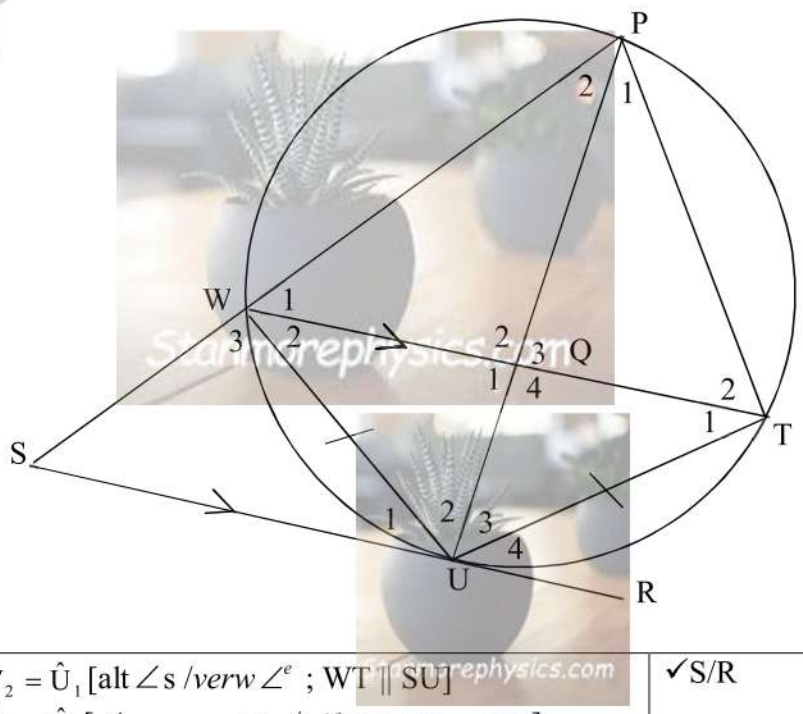
QUESTION/VRAAG 9



9.1	$\frac{EG}{GC}=\frac{2k}{3k}$ $\frac{EG}{9}=\frac{2}{3}$ EG = 6 cm Answer only: Full marks	✓S ✓ answer/*antwoord* (2)
9.2	$\frac{AB}{AD}=\frac{8}{6}$ [Prop theorem/*eweredigheidstelling* DE||AG] $\frac{AB}{AD}=\frac{4}{3}$	✓ S ✓R (2)
9.3	$\frac{BD}{12}=\frac{2}{6}$ [line || to one side of Δ/*lyn* ||*een sy v* Δ OR Prop theorem/*eweredigheidstelling* DE||AG] BD = 4 *cm* $\frac{\text{Area of } \Delta ABC}{\text{Area of quadrilateral } ADEC}$ $=\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta ABC - \text{Area of } \Delta DBE}$ $=\frac{\frac{1}{2}(16)(17)\sin\hat{B}}{\frac{1}{2}(16)(17)\sin\hat{B}-\frac{1}{2}(4)(2)\sin\hat{B}}$ $=\frac{136\sin\hat{B}}{132\sin\hat{B}}$ $=\frac{34}{33}$	✓ S/R ✓ BD = 4 *cm* ✓ method/*metode* ✓ $\frac{1}{2}(16)(17)\sin\hat{B}$ ✓ $\frac{1}{2}(4)(2)\sin\hat{B}$ ✓ answer/*antwoord* (6)

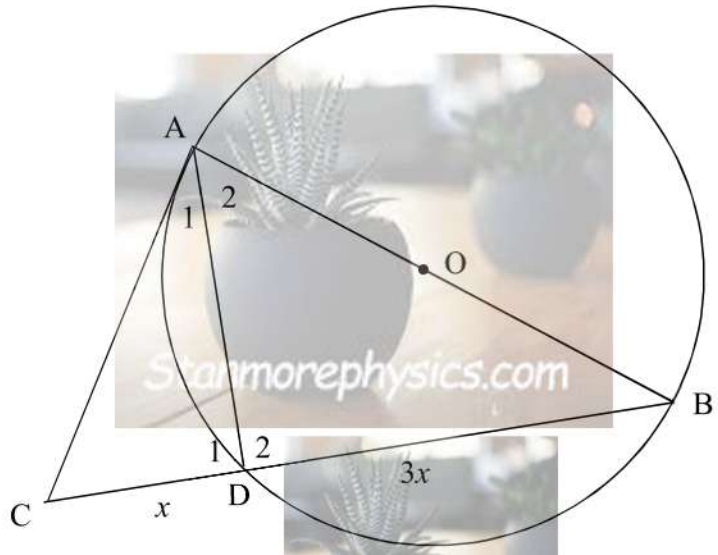
[10]

QUESTION/VRAAG 10



10.1.1	$\hat{W}_2 = \hat{U}_1$ [alt ∠s /*verw* $\angle^e$; WT ‖ SU] $\hat{W}_2 = \hat{T}_1$ [∠s opp = sides/ $\angle^e$ *teenoor = sye*] $\therefore \hat{U}_1 = \hat{T}_1$ US is a tangent to circle PWUT. [converse tan/chord theorem/ *omgekeerde rklyn-koord stelling*] **OR** $\hat{P}_1 = \hat{P}_2$ [= chords = ∠s/=*koorde* = $\angle^e$] $\hat{P}_1 = \hat{W}_2$ [∠s in same seg/ $\angle^e$ *in dies seg*] $\hat{W}_2 = \hat{U}_1$ [alt ∠s /*verw* $\angle^e$; WT ‖ SU] $\therefore \hat{U}_1 = \hat{P}_2$ US is a tangent to circle PWUT. [converse tan/chord theorem/ *omgekeerde rklyn-koord stelling*]	✓S/R ✓S/R ✓R ✓S/R ✓S/R ✓R (3)
10.1.2	In ΔSPU and ΔSUW 1) $\hat{S} = \hat{S}$ [common/*gemeenskaplik*] 2) $\hat{P}_2 = \hat{U}_1$ [tan chord theorem/*rklyn-koord stelling*] 3) $S\hat{U}P = \hat{W}_3$ [sum of ∠s of a Δ/*som* $\angle^e$ *v Δ*] ∴ ΔSPU ||| ΔSUP [AAA/ ∠ ∠ ∠]	✓ S/R ✓ S /R ✓ R or/ 3rd angle/ *of* 3^{de} $\angle$ *v* Δ (3)

10.2



$\hat{D}_2 = 90^\circ$ [$\angle$ in a semi-circle/$\angle$ *in halwe sirkel*]	✓ S/R
In ΔADC and ΔBDA	
1) $\hat{A}_1 = \hat{B}$ [tan chord theorem/*rklyn-koord stelling*]	✓ S/R
2) $\hat{D}_1 = \hat{D}_2 = 90^\circ$ [$\angle$s on a str line/ $\angle^e$ *op RL*]	✓ S/R
3) $\hat{C} = \hat{A}_2$ [sum of $\angle$s of a Δ/*som* $\angle^e$ *v* Δ]	
$\therefore \Delta ADC \text{ ||| } \Delta BDA$ [$\angle\angle\angle$]	✓ S/R or 3rd $\angle$ /of 3de $\angle^e$
$\frac{AD}{BD} = \frac{DC}{DA}$ [Δs |||]	✓ S
$AD^2 = CD.BD$	
$AD^2 = x \times 3x$	✓ S
$AD^2 = 3x^2$	
OR	
$\hat{D}_2 = 90^\circ$ [$\angle$ in a semi-circle/$\angle$ *in halwe sirkel*]	✓ S/R
$\tan \hat{A}_1 = \frac{CD}{AD} = \frac{x}{AD}$	✓ S
$\tan B = \frac{AD}{BD} = \frac{AD}{3x}$	✓ S
$\hat{A}_1 = \hat{B}$ [tan chord theorem/*rklyn-koord stelling*]	✓ S ✓ R
$\therefore \frac{AD}{3x} = \frac{x}{AD}$	✓ S
$AD^2 = 3x^2$	(6)

[12]

TOTAL: 150