



LIMPOPO

PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA



DEPARTMENT OF
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MATHEMATICS PAPER 2

Stanmorephysics.com

SEPTEMBER 2025

Stanmorephysics.com

MARKS: 150

TIME: 3 HOURS



EMATHP2

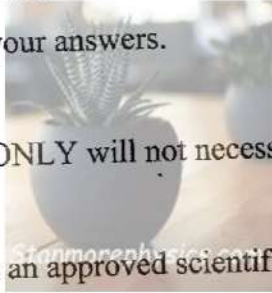
This question paper consists of 14 pages and an information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.



1. This question paper consists of 11 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that 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 answers off to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Write legibly and present your work neatly.



QUESTION 1

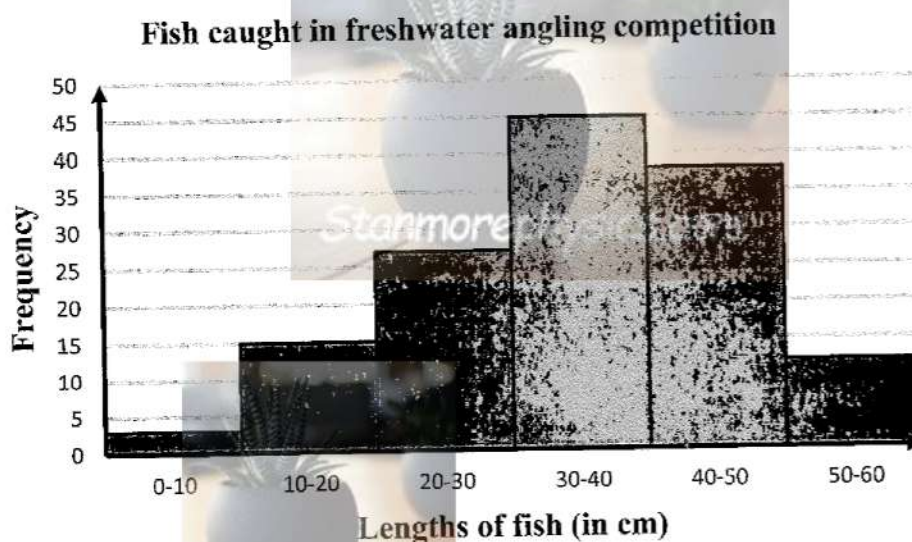


- 1.1 The table below shows the average weight and standard deviation of packets of chips from different distributors. Independent quality controllers investigated the weight of the packets of chips to see if the distributors are complying to the rules. The packets are all marked to have 130g of chips inside.

Distributor	Average (g)	Standard Deviation
A	125	4
B	132	2
C	130	5
D	129	1
E	134	3

- 1.1.1 If 2000 packets of chips were investigated from Distributor C, what was the total weight of chips tested? (1)
- 1.1.2 Which one of the Distributors is the best to buy from? Give a reason for your answer. (2)
- 1.1.3 Which one of the Distributors will you rather not buy from? Give a reason for your answer. (2)

- 1.2 The following histogram represents the lengths and number of fish caught in a freshwater angling competition. The shortest fish was 9cm and the longest one was 58cm.



- 1.2.1 Determine the range of the lengths of the fish.

(1)

- 1.2.2 Complete the cumulative frequency table in the ANSWER BOOK.

Interval	Frequency	Cumulative frequency
$0 < x \leq 10$	3	
$10 < x \leq 20$	15	
$20 < x \leq 30$	27	
$30 < x \leq 40$	45	
$40 < x \leq 50$	38	
$50 < x \leq 60$	12	

(2)

- 1.2.3 Draw an ogive in the ANSWER BOOK to represent the data.

(3)

- 1.2.4 60% of the fish are less than x cm long. Use the ogive to determine the value(s) of x .

(2)

[13]

QUESTION 2

The top 10 athletes in a certain province took part in the Provincial Biathlon championships. They had to participate in 10 km cycling and 3 km swimming.

The following table represents the times for each athlete, for cycling and swimming respectively, recorded in the championship.

Athlete	Cycling (in minutes)	Swimming (in minutes)
1	22	39
2	15	40
3	24	47
4	19	38
5	22	55
6	19	45
7	26	58
8	30	50
9	20	44
10	35	65

- 2.1 Determine the average cycling time for the 10 athletes. (2)
- 2.2 Determine the equation for the least squares regression line of the data. (3)
- 2.3 Calculate the expected time for an athlete to complete the swimming event if he takes 29 minutes to complete the 10km cycling. (2)
- [7]

QUESTION 3



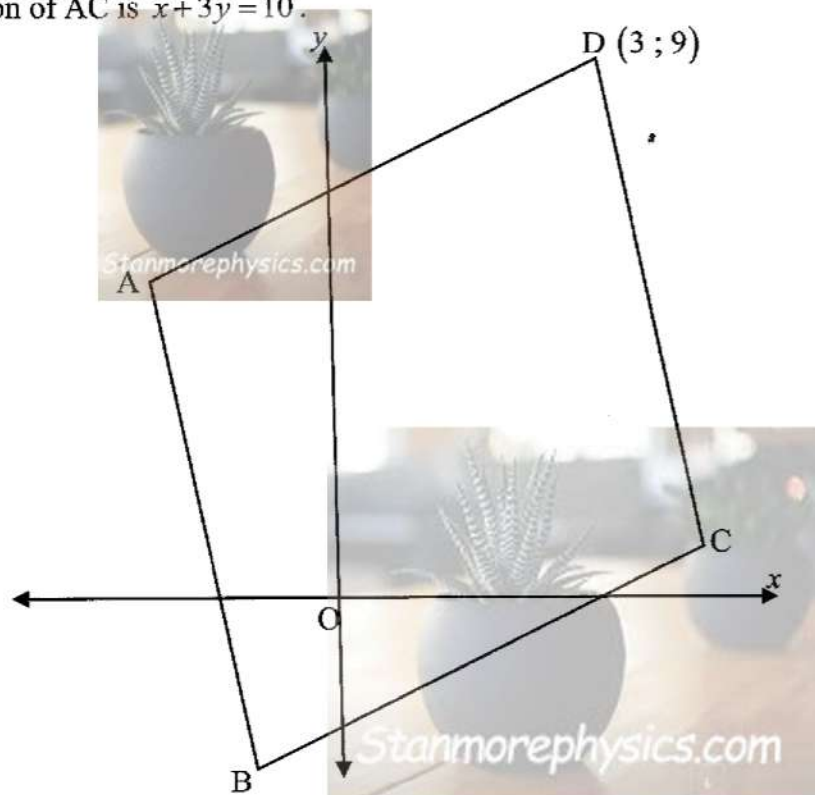
3.1 $P(-3 ; 2)$ and $Q(5 ; 8)$ are two points in a Cartesian plane.

3.1.1 Calculate the length of PQ. (2)

3.1.2 Calculate the angle that PQ forms with the x -axis, rounded of the nearest integer. (3)

3.1.3 Determine the equation of the perpendicular bisector of PQ in the form $y = \dots$. (5)

3.2 In the diagram A, B, C and $D(3 ; 9)$ are the vertices of a rhombus. The equation of AC is $x + 3y = 10$.



3.2.1 Determine the equation of BD. (3)

3.2.2 Calculate the coordinates of K if the diagonals of the rhombus intersect at point K. (4)

3.2.3 Determine the coordinates of B. (2)

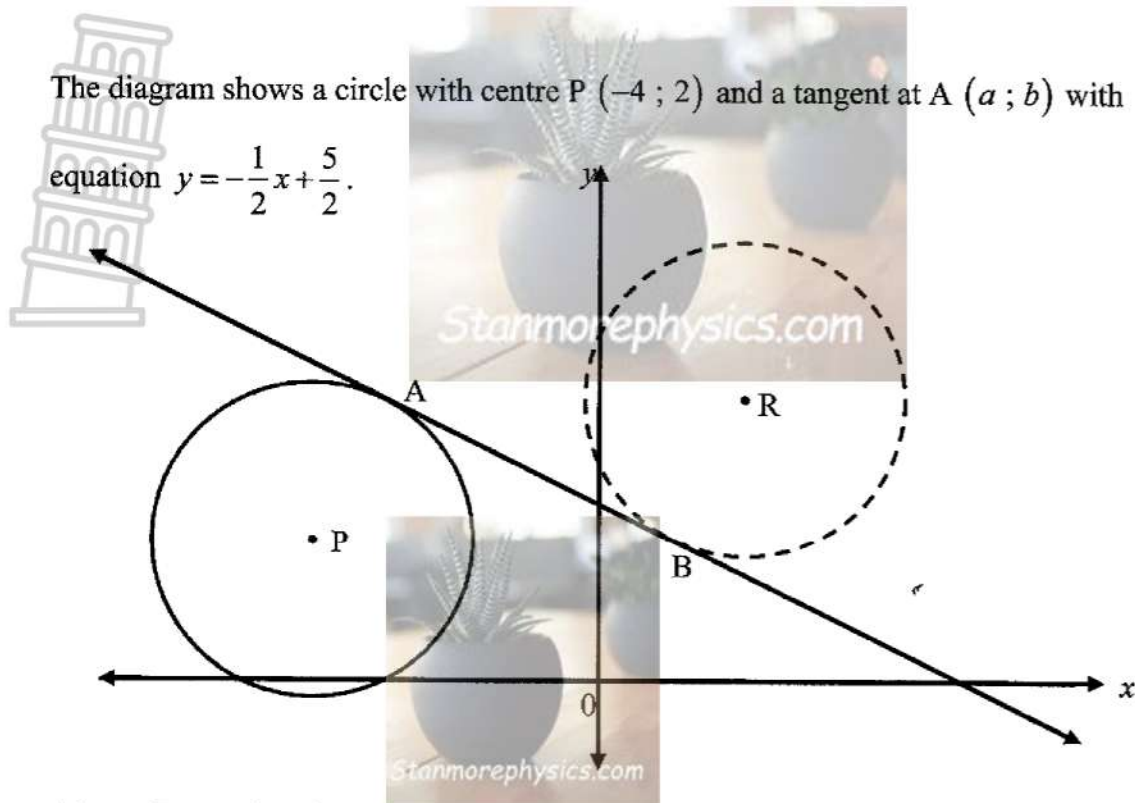
3.2.4 Calculate the coordinates of A and C if $AD = 5\sqrt{2}$ units. (7)

3.2.5 If the rhombus is reflected about the line $x = 1$, find the coordinates of the image of A. (2)

[28]

QUESTION 4

The diagram shows a circle with centre P $(-4 ; 2)$ and a tangent at A $(a ; b)$ with equation $y = -\frac{1}{2}x + \frac{5}{2}$.



- 4.1 Determine the coordinates of A. (5)
- 4.2 Determine the equation of the circle P in the form $(x-a)^2 + (y-b)^2 = r^2$. (3)
- 4.3 It is further given that the circle P is reflected about the line AB and then translated along the line AB to centre R. Circle R has y -intercepts at 3 and 5. Find the coordinates of R. (4)

[12]

QUESTION 5

5.1 If it is given that $\tan 20^\circ = t$, express the following in terms of t :

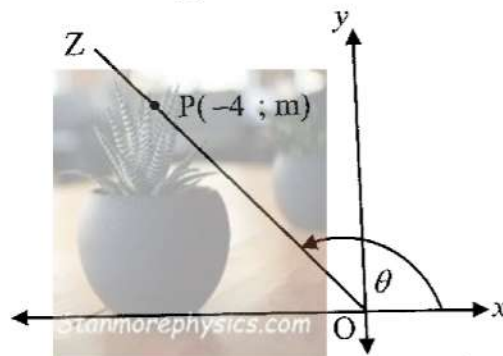
5.1.1 $\tan 70^\circ$ (2)

5.1.2 $\sin 50^\circ$ (4)

5.1.3 $\cos 10^\circ$ (4)

5.2 In the diagram, $P(-4; m)$ is a point in the Cartesian plane. It is also given

that $\angle ZOX = \theta$ and $\sin \theta = \frac{15}{17}$.



Determine the value of m , without using a calculator.

(6)

[16]

QUESTION 6

6.1 Simplify the following without using a calculator:

$$\frac{2 \cos 105^\circ \cos 15^\circ}{\cos(45^\circ - x) \cos x - \sin(45^\circ - x) \sin x}$$
 (5)

6.2 Determine the general solution of $1 - \tan x = \cos 2x$ if $\sin x \neq \cos x$. (6)

6.3 Determine the value of θ if $\cos 90^\circ$, $\sin 30^\circ$, $\tan \theta$ are three consecutive terms of an arithmetic sequence and $0^\circ \leq \theta \leq 90^\circ$ (4)

[15]

QUESTION 7



7.1 7.1.1

Show that $2 \cos x = \sin(x + 30^\circ)$ can be written as

$$\sqrt{3} \sin x = 3 \cos x$$

(3)

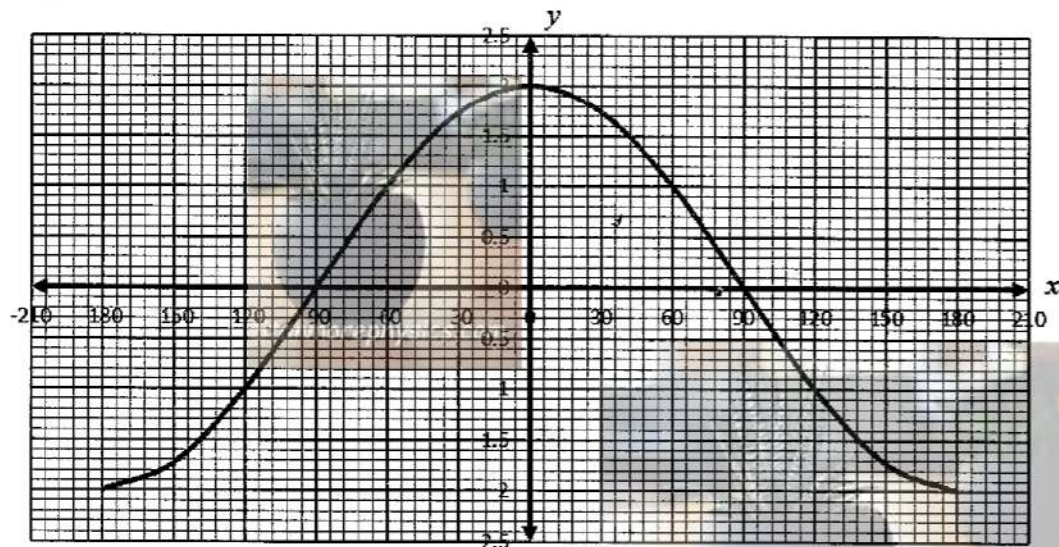
7.1.2

Hence, solve the equation $2 \cos x = \sin(x + 30^\circ)$ for

$$x \in (-180^\circ; 180^\circ]$$

(4)

7.2 The graph of $f(x) = 2 \cos x$ for $x \in (-180^\circ; 180^\circ]$ is drawn in the diagram below.



7.2.1

Draw the graph of $y = \sin(x + 30^\circ)$ for $x \in (-180^\circ; 180^\circ]$ on the same set of axes in the ANSWER BOOK. Clearly indicate the intercepts and turning points.

(3)

7.2.2

Use the graph and the information you have, to solve the following:

(a)

$$2 \cos x > \sin(x + 30^\circ), \quad x \in (-180^\circ; 180^\circ]$$

(2)

(b)

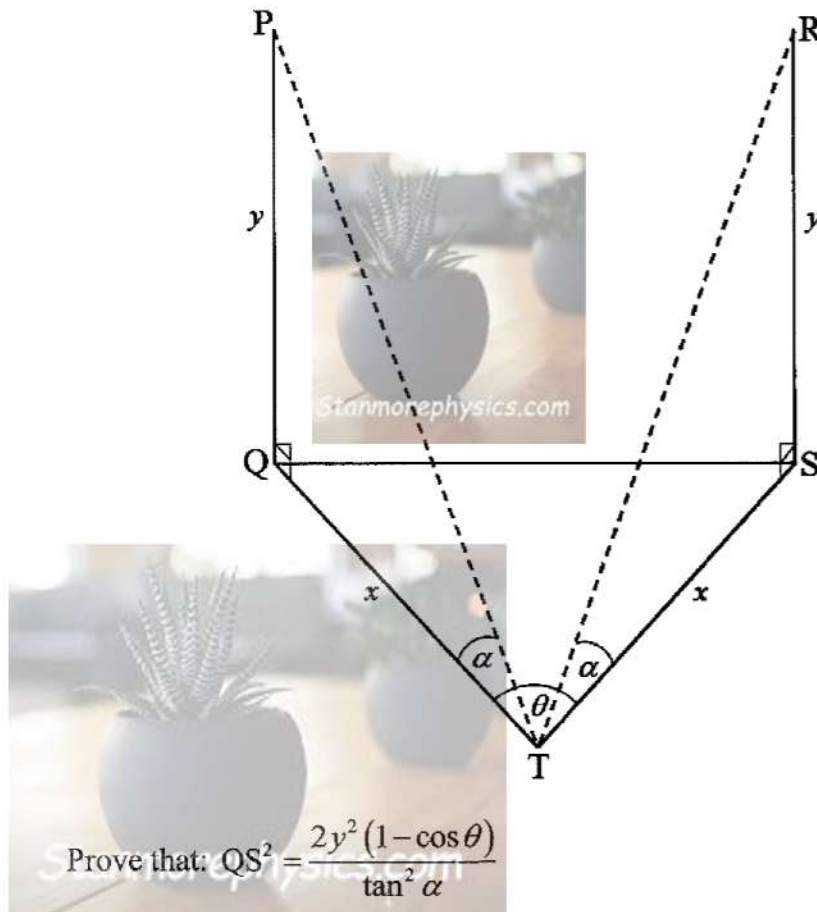
$$\frac{2 \cos x}{\sin(x + 30^\circ)} \geq 0, \quad x \in (-180^\circ; 0^\circ]$$

(3)

[15]

QUESTION 8

Two poles, PQ and RS with equal lengths of y meters, stand with their lower points Q and S in the same horizontal plane as the point T. They are also equidistant from T, distance equal to x . The angles of elevation of the top of the poles are both α . QS subtend an angle θ at T.



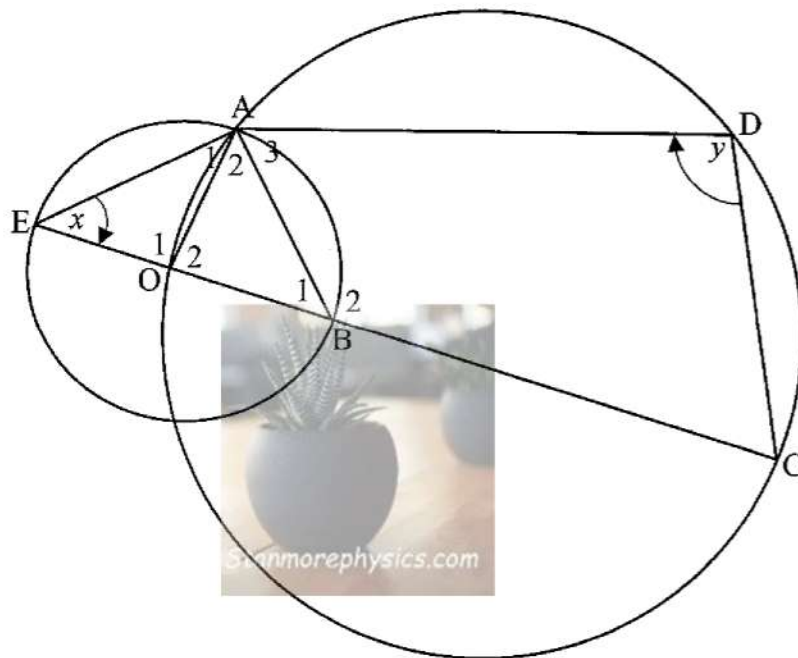
(5)

[5]

QUESTION 9

In the diagram O is the centre of the small circle. AOCD is a cyclic quadrilateral.

EOBC is a straight line and $\hat{B}_1 = 35^\circ$. $\hat{E} = x$ and $\hat{D} = y$.



9.1 Determine the value of x .

(3)

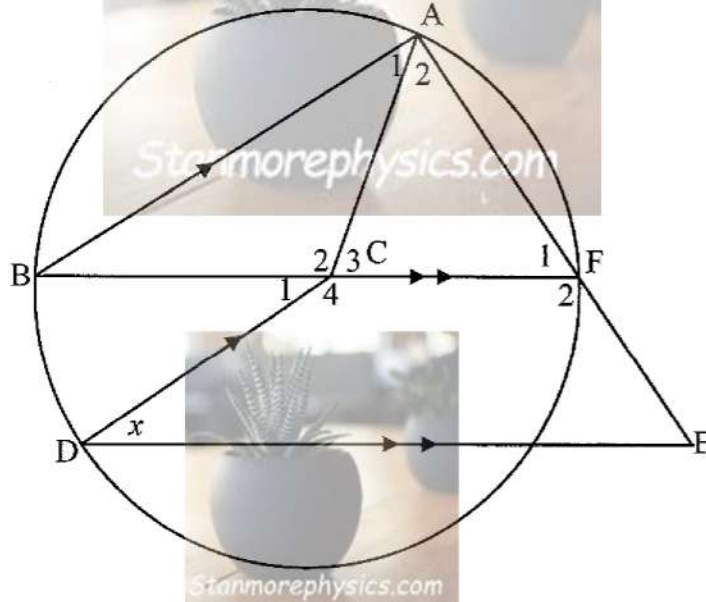
9.2 Determine the value of y .

(4)

[7]

QUESTION 10

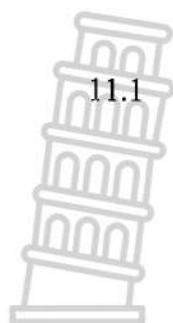
In the diagram BA and DC are parallel. C is the centre of the circle. Diameter BF $\parallel$ DE. E is on AF produced and $\angle CDE = x$.



- 10.1 Name, with reasons, three other angles each equal to x . (5)
- 10.2 Give a reason why $BA \perp AE$. (1)
- 10.3 State, with reasons, whether or not CDEF is a cyclic quadrilateral. (4)

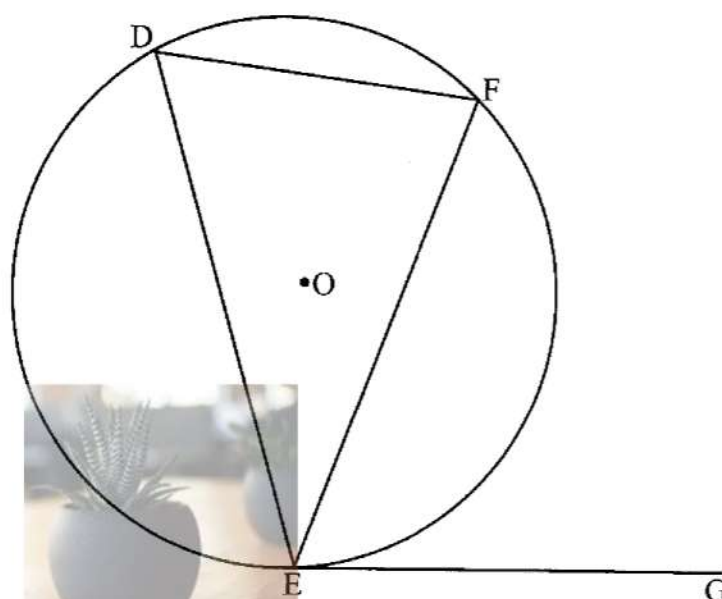
[10]

QUESTION 11



11.1

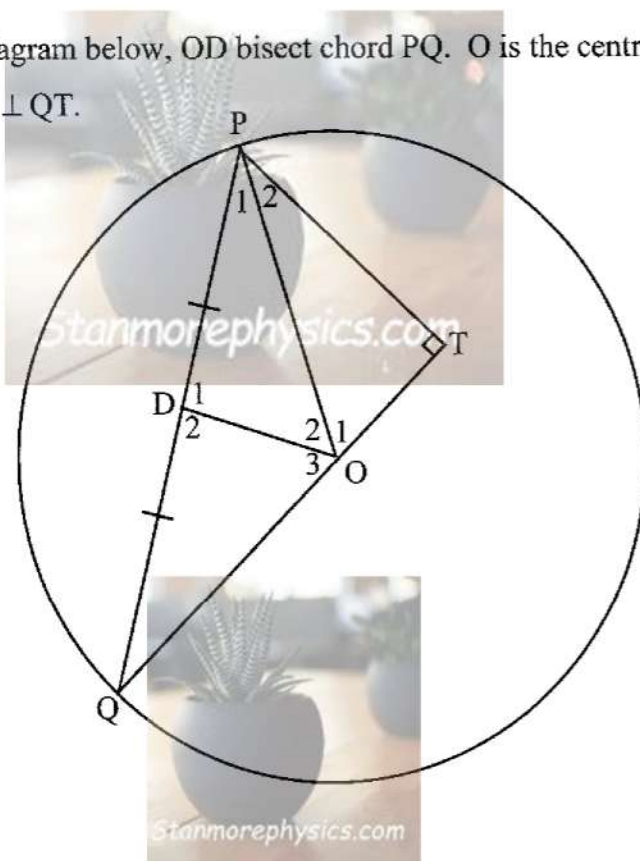
In the diagram EG is a tangent to the circle with centre O.



Prove the theorem stating that $\angle FEG = \hat{D}$.

(5)

- 11.2 In the diagram below, OD bisect chord PQ. O is the centre of the circle and $PT \perp QT$.



Proof that:

$$11.2.1 \quad \hat{O}_3 = \hat{QPT} \quad (4)$$

$$11.2.2 \quad \triangle PTQ \parallel \triangle ODQ \quad (3)$$

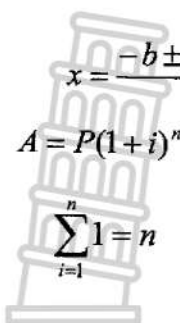
$$11.2.3 \quad OQ \cdot QT = 2PD^2 \quad (5)$$

$$11.2.4 \quad QT = \frac{QT^2 + PT^2}{2OQ} \quad (5)$$

[22]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS



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

$$A = P(1+i)^n$$

$$\sum_{i=1}^n 1 = n$$

$$T_n = ar^{n-1}$$

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$y = mx + c$$

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

In $\triangle ABC$:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{area } \triangle ABC = \frac{1}{2} ab \sin C$$

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

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

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

$$(x; y) \rightarrow (x \cos \theta + y \sin \theta; y \cos \theta - x \sin \theta)$$

$$(x; y) \rightarrow (x \cos \theta - y \sin \theta; y \cos \theta + x \sin \theta)$$

$$\bar{x} = \frac{\sum fx}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$\hat{y} = a + bx$$

$$A = P(1+ni)$$

$$A = P(1-ni)$$

$$A = P(1-i)^n$$

$$\sum_{i=1}^n i = \frac{n(n+1)}{2}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}; \quad r \neq 1$$

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

$$T_n = a + (n-1)d$$

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

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

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

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

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

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

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

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

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$



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**NATIONAL SENIOR
CERTIFICATE/*NASIONALE
SENIOR SERTIFIKAAT***

GRADE/*GRAAD 12*

**MATHEMATICS P2/*WISKUNDE P2*
MARKING GUIDELINES/*NASIENRIGLYNE***

SEPTEMBER 2025

MARKS/*PUNTE*: 150

This marking guidelines consists of 19 pages/*Hierdie nasienriglyne bestaan uit 19 bladsye*

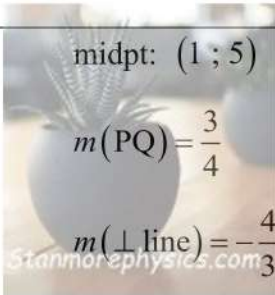
NOTE/NOTA:

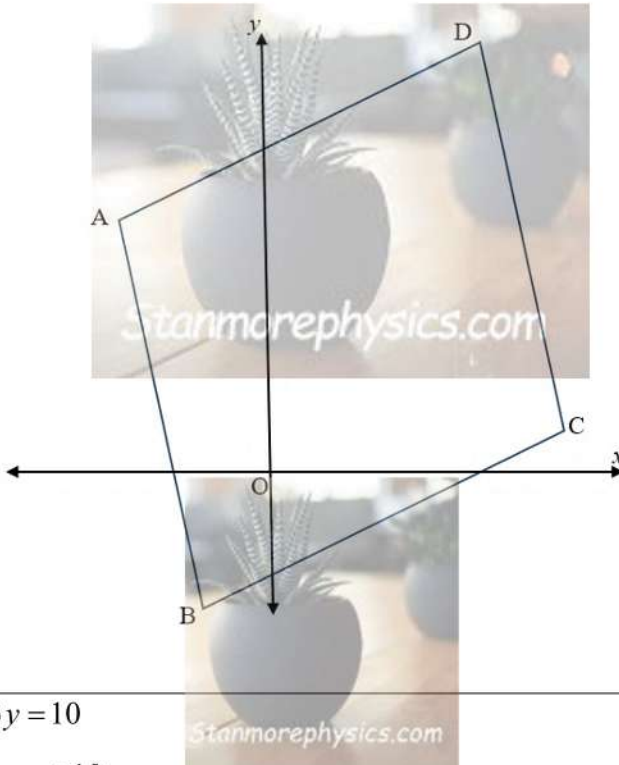
- If a candidate answers a question TWICE, only mark the FIRST attempt/ *As 'n kandidaat 'n vraag twee keer beantwoord, merk slegs die EERSTE poging.*
- Consistent Accuracy applies in all aspects of the marking guidelines/ *Konsekwente akkuraatheid is van toepassing in alle aspekte van die nasienriglyne*

QUESTION 1 / VRAAG 1

1.1.1	$130\text{g} \times 2000 = 260\,000\text{g} = 260\text{kg}$	✓answer / <i>antwoord</i>	(1)																					
1.1.2	Distributor D. The standard deviation is the smallest and the average grams per packet is the closest to 130g / <i>Verspreider D. Die standaardafwyking is die kleinste en die gemiddelde gram per pakkie is die naaste aan 130g</i>	✓D ✓reason / <i>rede</i>	(2)																					
1.1.3	Distributor A. Even when the packets are filled above the standard deviation of the mean, they do not fill it up to the recommended grams / <i>Verspreider A. Selfs wanneer die pakkies bo die standaardafwyking van die gemiddelde gevul word, vul hulle dit nie tot die aanbevole gram nie</i>	✓A ✓reason / <i>rede</i>	(2)																					
1.2.1	Range / <i>Waardeversameling</i> = $58 - 9 = 49$	✓answer / <i>antwoord</i>	(1)																					
1.2.2	<table><tr><th>Interval</th><th>Frequency <i>Frekwensie</i></th><th>Cumulative Frequency <i>Kumulatiewe Frekwensie</i></th></tr><tr><td>$0 < x \leq 10$</td><td>3</td><td>3</td></tr><tr><td>$10 < x \leq 20$</td><td>15</td><td>18</td></tr><tr><td>$20 < x \leq 30$</td><td>27</td><td>45</td></tr><tr><td>$30 < x \leq 40$</td><td>45</td><td>90</td></tr><tr><td>$40 < x \leq 50$</td><td>38</td><td>128</td></tr><tr><td>$50 < x \leq 60$</td><td>12</td><td>140</td></tr></table>	Interval	Frequency <i>Frekwensie</i>	Cumulative Frequency <i>Kumulatiewe Frekwensie</i>	$0 < x \leq 10$	3	3	$10 < x \leq 20$	15	18	$20 < x \leq 30$	27	45	$30 < x \leq 40$	45	90	$40 < x \leq 50$	38	128	$50 < x \leq 60$	12	140	✓45 ✓140	(2)
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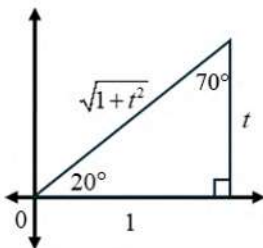
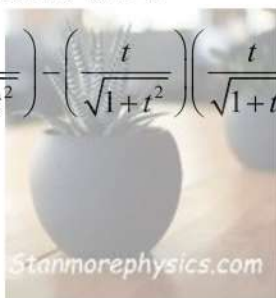
1.2.3	Fish caught in competition SIZE OF FISH (IN CM)	✓grounding / <i>anker</i> ✓use cumulative freq / <i>gebruik kumulatiewe frekwensie</i> ✓shape / <i>vorm</i>	
1.2.4	$60\% \times 140 = 84$ $x < 39$ [accept / <i>aanvaar 37 – 39</i>]	✓84 ✓answer / <i>antwoord</i>	(3)
			[13]
QUESTION 2 / VRAAG 2			
2.1	$\bar{x} = \frac{232}{10} = 23,2$	✓232 ✓answer / <i>antwoord</i>	(2)
2.2	$a = 19,86 \quad b = 1,22$ $y = 19,86 + 1,22x$	✓19,86 ✓1,22 ✓equation / <i>vergelyking</i>	(3)
2.3	$y = 19,86 + 1,22(29) = 55,24 \text{ min}$	✓substitute / <i>vervang</i> ✓answer / <i>antwoord</i>	(2)
			[7]

QUESTION 3 / VRAAG 3			
3.1.1	$PQ = \sqrt{(-3-5)^2 + (2-8)^2}$ $PQ = 10$	✓subst into formula / vervang in formule ✓answer / antwoord	(2)
3.1.2	$m(PQ) = \frac{2-8}{-3-5} = \frac{3}{4}$ $\tan \theta = \frac{3}{4}$ $\theta = 36,87^\circ \approx 37^\circ$	✓gradient ✓trig ratio / trig verh ✓answer / antwoord	(3)
3.1.3	$y - y_1 = m(x - x_1)$  $y - 5 = -\frac{4}{3}(x - 1)$ $y - 5 = -\frac{4}{3}x + \frac{4}{3}$ $y = -\frac{4}{3}x + \frac{19}{3}$	✓midpt ✓gradient of $\perp$ bisector / gradiënt midloodlyn ✓subst into formula / vervang in formule ✓simplify/vereenvoudig ✓answer / antwoord	(5)

3.2			
3.2.1	$x + 3y = 10$ $3y = -x + 10$ $y = -\frac{1}{3}x + \frac{10}{3}$ $m(AC) = -\frac{1}{3}$ $m(BD) = 3$ point / punt (3 ; 9) $y - 9 = 3(x - 3)$ $y = 3x$	$\checkmark m(AC) = -\frac{1}{3}$ $\checkmark m(BD) = 3$ $\checkmark y = 3x$	(3)
3.2.2	$y = 3x$ ① $x + 3y = 10$ ② ① in ②: $x + 3(3x) = 10$ $x + 9x = 10$ $10x = 10$ $x = 1$ Subst / vervang $x = 1$ in ①: $y = 3(1) = 3$ $K(1 ; 3)$	$\checkmark$ subst ① into ② / vervang ① in ② $\checkmark$ simplify / vereenvoudig $\checkmark x = 1$ $\checkmark y = 3$	(4)
3.2.3	$B(-1 ; -3)$	$\checkmark x$ – value / waarde $\checkmark y$ – value / waarde	(2)

3.2.4	$AD = 5\sqrt{2}$ and / en $x + 3y = 10$ $x = 10 - 3y$ $5\sqrt{2} = \sqrt{(x-3)^2 + (y-9)^2}$ $5\sqrt{2} = \sqrt{(10-3y-3)^2 + (y-9)^2}$ $5\sqrt{2} = \sqrt{(7-3y)^2 + (y-9)^2}$ $5\sqrt{2} = \sqrt{49 - 42y + 9y^2 + y^2 - 18y + 81}$ $50 = 10y^2 - 60y + 130$ $0 = 10y^2 - 60y + 80$ $0 = y^2 - 6y + 8$ $0 = (y-4)(y-2)$ $y = 4$ or / of $y = 2$ $x = -2$ or / of $x = 4$ $A(-2 ; 4)$ C(4 ; 2)	$\checkmark$ subst / vervang $5\sqrt{2}$ $\checkmark$ subst / vervang $x = 10 - 3y$ $\checkmark$ simplify / vereenvoudig $\checkmark$ std form / vorm $\checkmark$ factors / faktore $\checkmark$ y – values / waardes $\checkmark$ x – values / waardes	(7)
3.2.5	$A'(4 ; 4)$	$\checkmark$ y – value / waarde $\checkmark$ x – value / waarde	(2)
			[28]

QUESTION 4 / VRAAG 4			
4.1	$y - y_1 = m(x - x_1) \quad m_1 = -\frac{1}{2} \quad m_2 = 2$ Point / punt $(-4 ; 2)$ $y - 2 = 2(x + 4)$ $y = 2x + 10 \quad \dots\dots ①$ $y = -\frac{1}{2}x + \frac{5}{2} \quad \dots\dots ②$ Subst / vervang ① in ②: $2x + 10 = -\frac{1}{2}x + \frac{5}{2}$ $4x + 20 = -x + 5$ $5x = -15$ $x = -3$ $y = 4 \quad \therefore A(-3 ; 4)$	$\checkmark m_2 = 2$ $\checkmark$ equation / vergelyking $\checkmark$ equating / gelykstel $\checkmark x$ - value / waarde $\checkmark y$ - value / waarde	(5)
4.2	$\text{rad} = \sqrt{(-4+3)^2 + (2-4)^2} = \sqrt{5}$ $(x+4)^2 + (y-2)^2 = 5$	$\checkmark \text{rad} = \sqrt{5}$ $\checkmark \text{LHS} / \text{LK} \quad \checkmark \text{RHS} / \text{RK}$	(3)
4.3	y - intercepts at 3 and 5 / y - afsnitte by 3 en 5: $R(a ; 4)$ $(x-a)^2 + (y-4)^2 = 5$ through / deur $(0 ; 3)$ $(0-a)^2 + (3-4)^2 = 5$ $a^2 + 1 = 5$ $a^2 = 4$ $a = \pm 2$ $a = 2 \quad \therefore R(2 ; 4)$	$\checkmark y$ - value / waarde = 4 $\checkmark$ subst point and / vervang punt en $y = 4$ $\checkmark$ simplify / vereenvoudig $\checkmark$ value of / waarde van a	(4)
			[12]

QUESTION 5 / VRAAG 5			
5.1.1	$\text{hyp}^2 = 1^2 + t^2$ $\text{hyp} = \sqrt{1+t^2}$ $\tan 70^\circ = \frac{1}{t}$		$\checkmark \text{ hyp} = \sqrt{1+t^2}$ $\checkmark \text{ answer / antwoord}$ (2)
5.1.2	$\sin 50^\circ$ $= \sin(70^\circ - 20^\circ)$ $= \sin 70^\circ \cos 20^\circ - \cos 70^\circ \sin 20^\circ$ $= \left(\frac{1}{\sqrt{1+t^2}} \right) \left(\frac{1}{\sqrt{1+t^2}} \right) - \left(\frac{t}{\sqrt{1+t^2}} \right) \left(\frac{t}{\sqrt{1+t^2}} \right)$ $= \frac{1-t^2}{1+t^2}$ OR / OF $\sin 50^\circ$ $= \cos 40^\circ$ $= \cos 2 \cdot 20^\circ$ $= 2 \cos^2 20^\circ - 1$ $= 2 \left(\frac{1}{\sqrt{1+t^2}} \right)^2 - 1$ $= \frac{2}{1+t^2} - 1$ $= \frac{2 - (1+t^2)}{1+t^2}$ $= \frac{1-t^2}{1+t^2}$	 $\checkmark 70^\circ - 20^\circ$ $\checkmark \text{ expansion / uitbrei}$ $\checkmark \text{ subst/vervang term 1}$ $\checkmark \text{ subst/vervang term 2}$ $\checkmark \text{ co-function / kofunksie}$ $\checkmark \cos 2 \cdot 20^\circ$ $\checkmark \text{ expansion / uitbrei}$ $\checkmark \text{ subst / vervang } \frac{1}{\sqrt{1+t^2}}$ (4)	

	OR / OF $\sin 50^\circ$ $= \cos 40^\circ$ $= \cos 2 \cdot 20^\circ$ $= 1 - 2 \sin^2 20^\circ$ $= 1 - 2 \left(\frac{t}{\sqrt{1+t^2}} \right)^2$ $= 1 - \frac{2t^2}{1+t^2}$ $= \frac{1+t^2 - 2t^2}{1+t^2}$ $= \frac{1-t^2}{1+t^2}$	✓co-function / <i>kofunksie</i> ✓$\cos 2 \cdot 20^\circ$ ✓expansion / <i>uitbrei</i> ✓subst / <i>vervang</i> $\frac{t}{\sqrt{1+t^2}}$	(4)
5.1.3	$\cos 20^\circ = 2 \cos^2 10^\circ - 1$ $\frac{1}{\sqrt{1+t^2}} = 2 \cos^2 10^\circ - 1$ $\frac{1}{\sqrt{1+t^2}} + 1 = 2 \cos^2 10^\circ$ $\frac{1}{2\sqrt{1+t^2}} + \frac{1}{2} = \cos^2 10^\circ$ $\cos 10^\circ = \sqrt{\frac{1}{2\sqrt{1+t^2}} + \frac{1}{2}}$	✓double angle / <i>dubbelhoek</i> ✓substitution / <i>vervang</i> ✓$\cos^2 10^\circ$ the subject / <i>onderwerp</i> ✓answer / <i>antwoord</i>	(4)

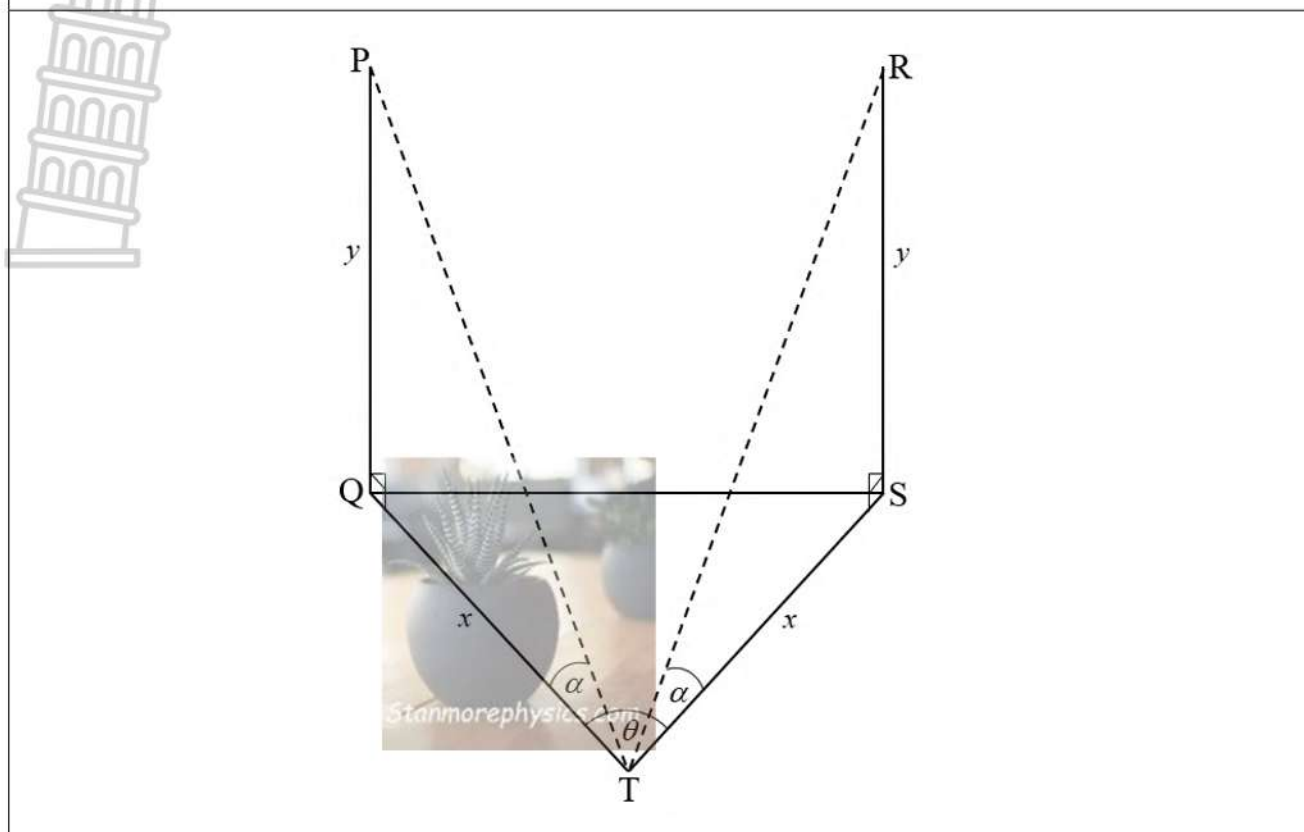
5.2	If: $\sin \theta = \frac{15}{17}$ $r^2 = x^2 + y^2$ $17^2 = x^2 + 15^2$ $x^2 = 64$ $x = -8$ $\therefore \tan \theta = \frac{15}{-8}$ In $\triangle PRO$: $\tan \theta = \frac{m}{-4}$ $\frac{m}{-4} = \frac{15}{-8}$ $-60 = -8m$ $m = \frac{15}{2}$ OR / OF $\sin \theta = \frac{15}{17}$ In $\triangle PRO$: $PO^2 = (-4)^2 + m^2 = 16 + m^2$ $PO = \sqrt{16 + m^2}$ $\sin \theta = \frac{m}{\sqrt{16 + m^2}}$ $\frac{m}{\sqrt{16 + m^2}} = \frac{15}{17}$ $17m = 15\sqrt{16 + m^2}$ $289m^2 = 225(16 + m^2)$ $289m^2 = 3600 + 225m^2$ $64m^2 = 3600$ $m^2 = \frac{225}{4} \quad \therefore m = \frac{15}{2}$	✓subst in / vervang in Pyth ✓ $x = -8$ with selection / met seleksie ✓tan ratio ✓equating / gelykstel ✓simplify / vereenvoudig ✓answer / antwoord ✓subst / vervang in Pyth ✓ $PO = \sqrt{16 + m^2}$ ✓sin ratio ✓equating / gelykstel ✓simplify / vereenvoudig ✓answer with selection / antwoord met seleksie	(6) (6) [16]
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QUESTION 6 / VRAAG 6			
6.1	$\frac{2 \cos 105^\circ \cos 15^\circ}{\cos(45^\circ - x) \cos x - \sin(45^\circ - x) \sin x}$ $= \frac{-2 \cos 75^\circ \cos 15^\circ}{\cos[(45^\circ - x) + x]}$ $= \frac{-2 \sin 15^\circ \cos 15^\circ}{\cos[45^\circ - x + x]}$ $= \frac{-\sin 30^\circ}{\cos 45^\circ}$ $= -\left(\frac{1}{2}\right) \left(\frac{\sqrt{2}}{2}\right)$ $= -\frac{\sqrt{2}}{2}$ 	✓ cos 75° ✓ cos compound angle / saamgestelde hoek ✓ sin double angle / dubbel hoek ✓ special values / spesiale waardes ✓ answer / antwoord	(5)
6.2	$1 - \tan x = \cos 2x$ $1 - \frac{\sin x}{\cos x} = \cos^2 x - \sin^2 x$ $\cos x - \sin x = \cos x (\cos^2 x - \sin^2 x)$ $0 = \cos x (\cos^2 x - \sin^2 x) - (\cos x - \sin x)$ $0 = \cos x (\cos x - \sin x) (\cos x + \sin x) - (\cos x - \sin x)$ But $\sin x \neq \cos x$ $\cos x (\cos x + \sin x) - 1 = 0$ $\cos^2 x + \cos x \sin x - \sin^2 x - \cos^2 x = 0$ $\cos x \sin x - \sin^2 x = 0$ $\sin x (\cos x - \sin x) = 0$ $\sin x = 0 \quad \text{of / or} \quad \cos x = \sin x$ $x = 0^\circ + k.360^\circ; k \in \mathbb{Z} \quad \text{NA}$ or / of $x = 180^\circ + k.360^\circ; k \in \mathbb{Z}$	✓ $\frac{\sin x}{\cos x}$ ✓ cos double angle / dubbel hoek ✓ grouping / groepering ✓ std form / vorm ✓ both equations / beide vergelykings ✓ $x = 0^\circ + k.360^\circ; k \in \mathbb{Z}$ $x = 180^\circ + k.360^\circ; k \in \mathbb{Z}$	(6)

	OR /OF $1 - \tan x = \cos 2x$ $1 - \frac{\sin x}{\cos x} = \cos^2 x - \sin^2 x$ $\frac{\cos x - \sin x}{\cos x} = (\cos x - \sin x)(\cos x + \sin x)$ But $\sin x \neq \cos x$ $\frac{1}{\cos x} = (\cos x + \sin x)$ $1 = \cos x(\cos x + \sin x)$ $\cos^2 x + \cos x \sin x - \sin^2 x - \cos^2 x = 0$ $\cos x \sin x - \sin^2 x = 0$ $\sin x(\cos x - \sin x) = 0$ $\sin x = 0$ of / or $\cos x = \sin x$ $x = 0^\circ + k.360^\circ; k \in \mathbb{Z}$ NA or /of $x = 180^\circ + k.360^\circ; k \in \mathbb{Z}$	$\checkmark \frac{\sin x}{\cos x}$ $\checkmark \cos$ double angle / <i>dubbel hoek</i> $\checkmark$ factors / <i>faktore</i> $\checkmark$ std form / <i>vorm</i> $\checkmark$ both equations / <i>beide vergelykings</i> $\checkmark x = 0^\circ + k.360^\circ; k \in \mathbb{Z}$ $x = 180^\circ + k.360^\circ; k \in \mathbb{Z}$	(6)
6.3	$\cos 90^\circ, \sin 30^\circ, \tan \theta$ $= 0; \frac{1}{2}; \tan \theta$ AS / RR: $T_2 - T_1 = T_3 - T_2$ $\frac{1}{2} - 0 = \tan \theta - \frac{1}{2}$ $\tan \theta = 1$ $\theta = 45^\circ$	$\checkmark$ special angles / <i>spesiale hoeke</i> $\checkmark$ common diff / <i>konstante verskil</i> $\checkmark$ trig equation / <i>vergelyking</i> $\checkmark$ answer / <i>antwoord</i>	(4)
			[15]

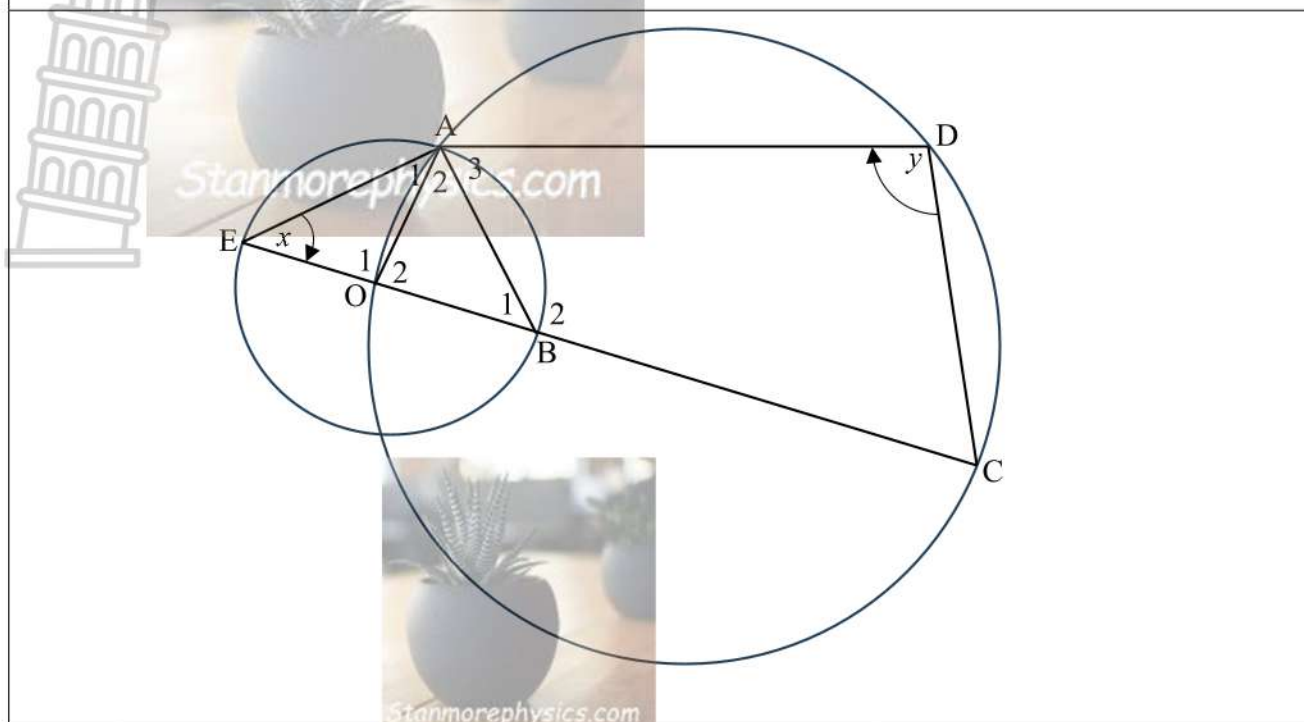
QUESTION 7 / VRAAG 7			
7.1.1	$2 \cos x = \sin(x + 30^\circ)$ $2 \cos x = \sin x \cos 30^\circ + \cos x \sin 30^\circ$ $2 \cos x = \sin x \left(\frac{\sqrt{3}}{2} \right) + \cos x \left(\frac{1}{2} \right)$ $4 \cos x = \sqrt{3} \sin x + \cos x$ $3 \cos x = \sqrt{3} \sin x$	✓expansion / uitbrei ✓special values / spesiale waardes ✓simplify / vereenvoudig	(3)
7.1.2	$2 \cos x = \sin(x + 30^\circ)$ $3 \cos x = \sqrt{3} \sin x$ $\tan x = \frac{3}{\sqrt{3}} = \sqrt{3}$ $x = 60^\circ + k \cdot 180^\circ ; k \in \mathbb{Z}$ $x = \{-120^\circ ; 60^\circ\}$	✓change to $\tan x$ / verander na $\tan x$ ✓general sol / algemene opl ✓ -120° ✓ 60°	(4)
7.2.1		✓x – intercept / afsnit ✓y – intercept / afsnit ✓shape / vorm	(3)
7.2.2 (a)	$x \in (-120^\circ ; 60^\circ)$	✓interval ✓notation / notasie	(2)
7.2.2 (b)	$x \in (-180^\circ ; -90^\circ]$ and / en $x = 0^\circ$	✓interval ✓notation / notasie ✓ $x = 0^\circ$	(3)
			[15]

QUESTION 8 / VRAAG 8



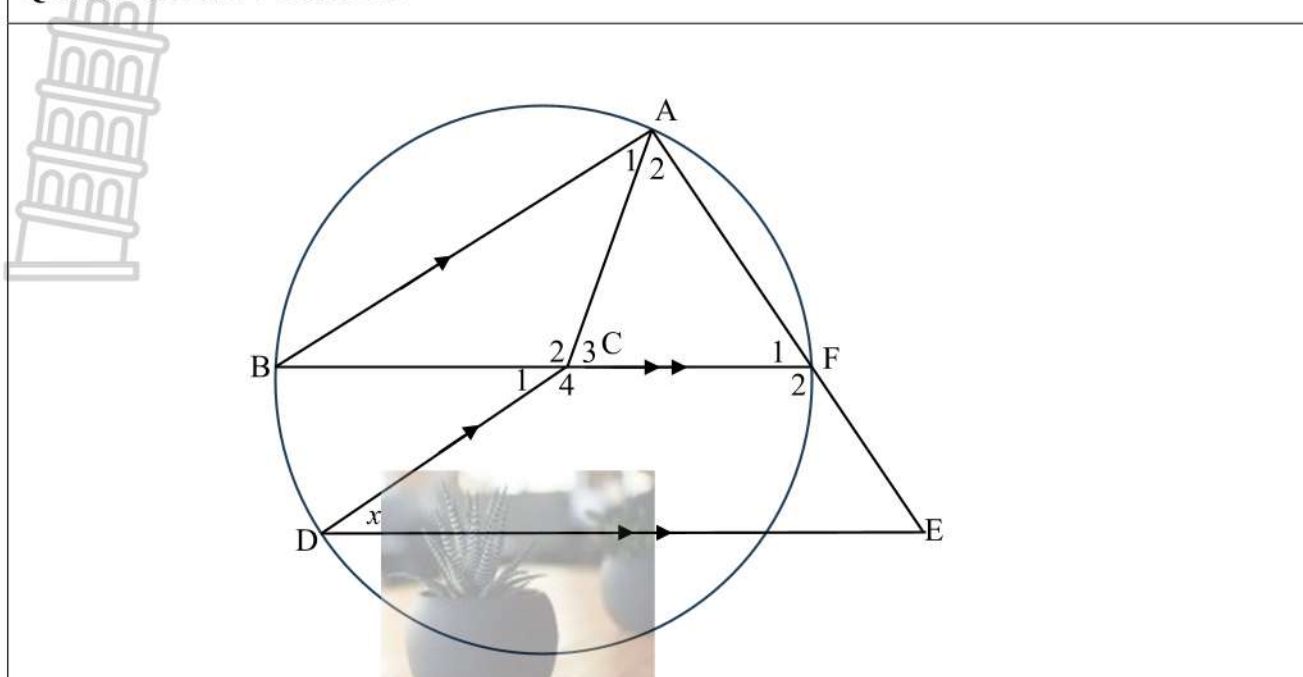
	In ΔPQT: $\tan \alpha = \frac{y}{x}$ $x = \frac{y}{\tan \alpha}$ In ΔQST: $QS^2 = x^2 + x^2 - 2(x)(x)\cos \theta$ $QS^2 = 2x^2 - 2x^2 \cos \theta$ $QS^2 = 2x^2(1 - \cos \theta)$ $QS^2 = 2\left(\frac{y}{\tan \alpha}\right)^2(1 - \cos \theta)$ $QS^2 = \frac{2y^2(1 - \cos \theta)}{\tan^2 \alpha}$	✓tan ratio ✓answer / antwoord ✓subst in cos rule / vervang in cosreël ✓common factor / gemeenskaplike faktor ✓substitute / vervang x	(5)
			[5]

QUESTION 9 / VRAAG 9



9.1	$\hat{E} + \hat{A}_1 + \hat{A}_2 + \hat{B}_1 = 180^\circ$ int $\angle$'s of Δ / binne $\angle$ e Δ $\hat{A}_1 + \hat{A}_2 = 90^\circ$ $\angle$ in semi $\odot$ $x + 90^\circ + 35^\circ = 180^\circ$ $x = 55^\circ$	$\checkmark$ S $\checkmark$ S/R $\checkmark$ answer / antwoord	(3)
9.2	$\hat{O}_2 = 2\hat{E} = 110^\circ$ $\angle$ at centre = $2 \times$ circumf $\angle$ / midpt $\angle = 2 \times$ omtr $\angle$ $\hat{O}_2 + \hat{D} = 180^\circ$ opp $\angle$'s cyclic quad / teenoorst $\angle$ e kvh $\hat{D} = 180^\circ - 110^\circ = 70^\circ$	$\checkmark$ S $\checkmark$ R $\checkmark$ S/R $\checkmark$ answer / antwoord	(4)
			[7]

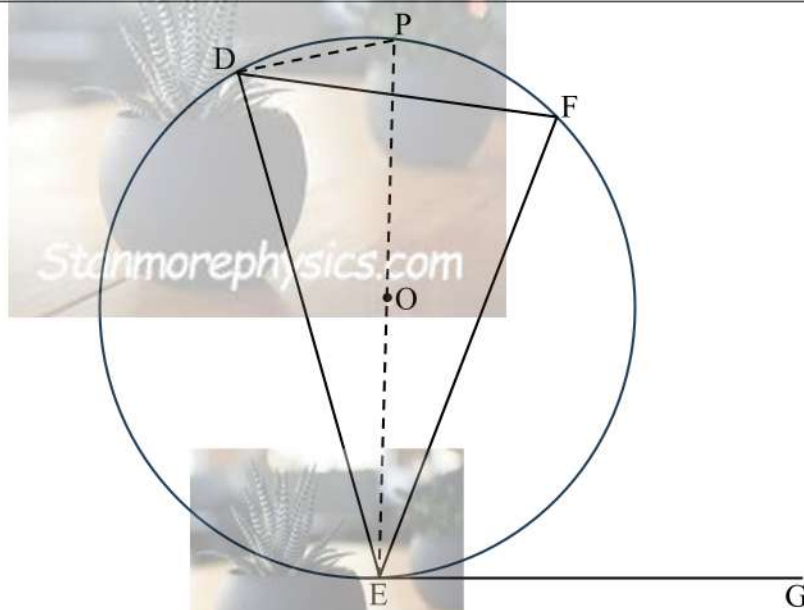
QUESTION 10 / VRAAG 10



10.1	$\hat{D} = \hat{C}_1 = x$ $\hat{C}_1 = \hat{B} = x$ $\hat{B} = \hat{A}_1 = x$	alt $\angle$'s / verw $\angle$ e $BF \parallel DE$ alt $\angle$'s / verw $\angle$ e $DC \parallel BA$ $\angle$'s opp equal sides / $\angle$ e teenoor gelyke sye	$\checkmark$ S $\checkmark$ R $\checkmark$ S/R $\checkmark$ S $\checkmark$ R	(5)
10.2	$\hat{A}_1 + \hat{A}_2 = 90^\circ$ $AB \perp AE$	$\angle$ in semi $\odot$	$\checkmark$ R	(1)
10.3	$\hat{F}_1 = 90^\circ - x$ $\hat{D} = x$ $\hat{F}_1 \neq D$ CDEF is not a cyclic quad	int $\angle$'s Δ / binne $\angle$ e Δ ext $\angle$ not equal opp int $\angle$ / buite $\angle$ nie gelyk aan teenoorst binne $\angle$ nie	$\checkmark$ S $\checkmark$ R $\checkmark$ concl / gevolgtr $\checkmark$ R	(4)
				[10]

QUESTION 11 / VRAAG 11

11.1



Draw EO produced to P on the circumference. Join PD
/ Trek EO verleng na P op die omtrek. Verbind PD

✓construction /
konstruksie

$$\hat{P}EG = 90^\circ$$

rad $\perp$ tan / rad $\perp$ rklyn

✓S ✓R

$$\hat{E}DP = 90^\circ$$

$\angle$ in semi $\odot$

✓S/R

$$\hat{P}EG = \hat{E}DP$$

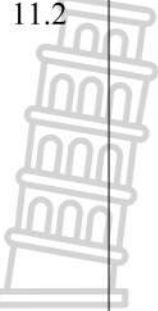
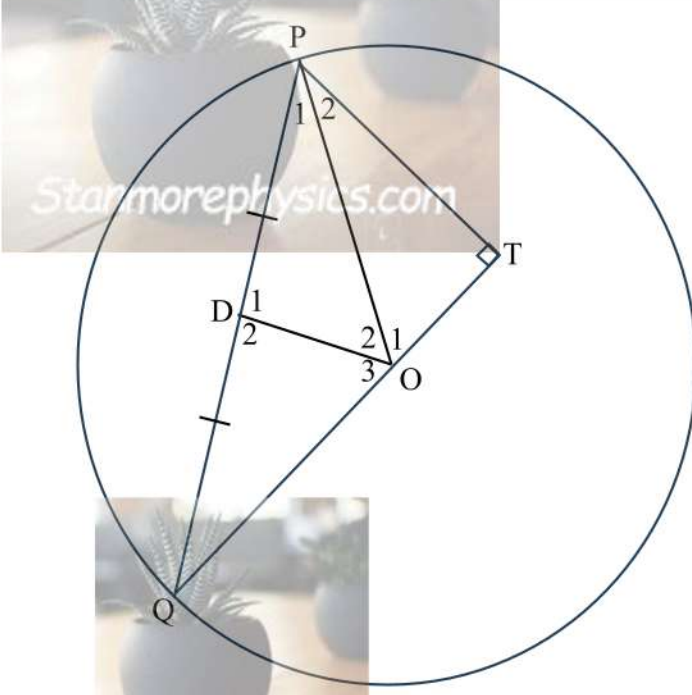
$\angle$'s in same segment / $\angle$ e
in dies segment

✓S/R

$$\text{But } \hat{P}EF = \hat{P}DF$$

$$\therefore \hat{F}EG = \hat{D}$$

(5)

11.2 																	
11.2.1	<table border="0"> <tr> <td>$\hat{D}_1 = \hat{D}_2 = 90^\circ$</td> <td>line from centre to midpt chord / lyn van midpt na midpt v krd</td> <td>✓S ✓R</td> </tr> <tr> <td>$\hat{O}_3 = 90^\circ - \hat{Q}$</td> <td>int $\angle$'s of Δ / binne $\angle$ e Δ</td> <td>✓S</td> </tr> <tr> <td>$\hat{P}_1 + \hat{P}_2 = 90^\circ - \hat{Q}$</td> <td>int $\angle$'s of Δ / binne $\angle$ e Δ</td> <td>✓S</td> </tr> <tr> <td>$\hat{O}_3 = \hat{P}_1 + \hat{P}_2$</td> <td></td> <td></td> </tr> </table>	$\hat{D}_1 = \hat{D}_2 = 90^\circ$	line from centre to midpt chord / lyn van midpt na midpt v krd	✓S ✓R	$\hat{O}_3 = 90^\circ - \hat{Q}$	int $\angle$'s of Δ / binne $\angle$ e Δ	✓S	$\hat{P}_1 + \hat{P}_2 = 90^\circ - \hat{Q}$	int $\angle$'s of Δ / binne $\angle$ e Δ	✓S	$\hat{O}_3 = \hat{P}_1 + \hat{P}_2$			(4)			
$\hat{D}_1 = \hat{D}_2 = 90^\circ$	line from centre to midpt chord / lyn van midpt na midpt v krd	✓S ✓R															
$\hat{O}_3 = 90^\circ - \hat{Q}$	int $\angle$'s of Δ / binne $\angle$ e Δ	✓S															
$\hat{P}_1 + \hat{P}_2 = 90^\circ - \hat{Q}$	int $\angle$'s of Δ / binne $\angle$ e Δ	✓S															
$\hat{O}_3 = \hat{P}_1 + \hat{P}_2$																	
11.2.2	In ΔPTQ and / en ΔODQ: <table border="0"> <tr> <td>(i) $\hat{O}_3 = \hat{P}_1 + \hat{P}_2$</td> <td>Proven / bewys</td> <td>✓S</td> </tr> <tr> <td>(ii) $\hat{Q} = \hat{Q}$</td> <td>Common / gemeensk</td> <td>✓S</td> </tr> <tr> <td>(iii) $\hat{D}_2 = \hat{T}$</td> <td>3rd $\angle$ of Δ / 3de hoek v Δ</td> <td>✓S</td> </tr> </table> $\therefore \Delta PTQ \parallel \Delta ODQ$ OR / OF In ΔPTQ and / en ΔODQ: <table border="0"> <tr> <td>(i) $\hat{O}_3 = \hat{P}_1 + \hat{P}_2$</td> <td>Proven / bewys</td> <td>✓S</td> </tr> <tr> <td>(ii) $\hat{Q} = \hat{Q}$</td> <td>Common / gemeensk</td> <td>✓S</td> </tr> </table> $\therefore \Delta PTQ \parallel \Delta ODQ$ AAA / HHH	(i) $\hat{O}_3 = \hat{P}_1 + \hat{P}_2$	Proven / bewys	✓S	(ii) $\hat{Q} = \hat{Q}$	Common / gemeensk	✓S	(iii) $\hat{D}_2 = \hat{T}$	3 rd $\angle$ of Δ / 3de hoek v Δ	✓S	(i) $\hat{O}_3 = \hat{P}_1 + \hat{P}_2$	Proven / bewys	✓S	(ii) $\hat{Q} = \hat{Q}$	Common / gemeensk	✓S	(3)
(i) $\hat{O}_3 = \hat{P}_1 + \hat{P}_2$	Proven / bewys	✓S															
(ii) $\hat{Q} = \hat{Q}$	Common / gemeensk	✓S															
(iii) $\hat{D}_2 = \hat{T}$	3 rd $\angle$ of Δ / 3de hoek v Δ	✓S															
(i) $\hat{O}_3 = \hat{P}_1 + \hat{P}_2$	Proven / bewys	✓S															
(ii) $\hat{Q} = \hat{Q}$	Common / gemeensk	✓S															

11.2.3	$\frac{TQ}{DQ} = \frac{PQ}{OQ}$ $TQ.OQ = PQ.DQ$ $PQ = 2PD$ $DQ = PD$ radii $TQ.OQ = 2PD.PD = 2PD^2$	$\Delta PTQ \parallel \Delta ODQ$ 	$\checkmark S \checkmark R$ $\checkmark S$ $\checkmark S$ $\checkmark$ substitute / vervang	(5)
11.2.4	$TQ.OQ = 2PD^2$ From / van 10.2.3 $TQ = \frac{2PD^2}{OQ}$ $PQ^2 = QT^2 + PT^2$ Pyth And $PQ = 2PD$ $\therefore (2PD)^2 = QT^2 + PT^2$ $4PD^2 = QT^2 + PT^2$ $TQ = \frac{2PD^2}{OQ} = \frac{4PD^2}{2OQ}$ Equivalent fraction / ekwivalente breuke $TQ = \frac{QT^2 + PT^2}{2OQ}$	 	$\checkmark S$ $\checkmark S/R$ $\checkmark S$ $\checkmark$ simplify / vereenvoudig $\checkmark S$	(5)
				[22]