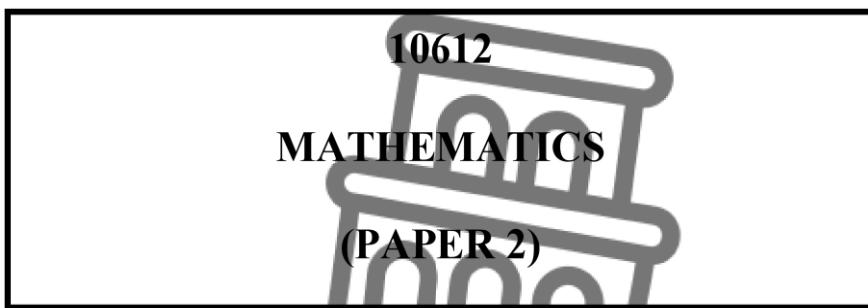




PREPARATORY EXAMINATION

2023



TIME: 3 hours

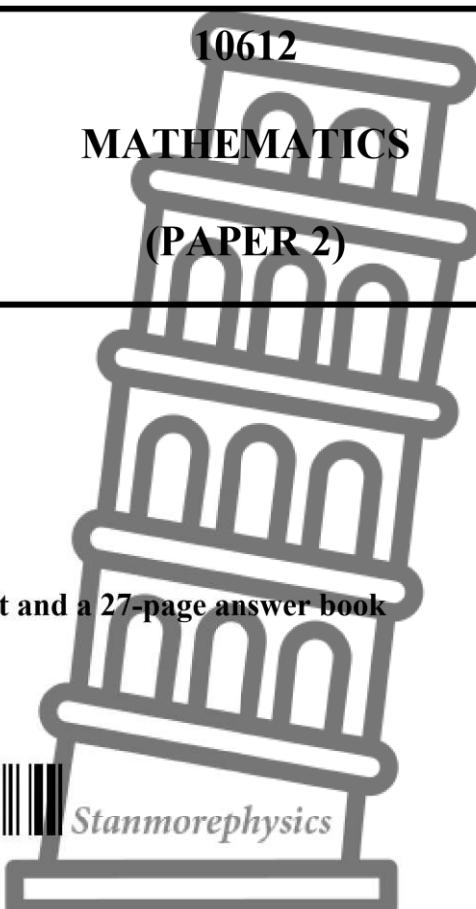
MARKS: 150

14 pages + 1 information sheet and a 27-page answer book

MATHEMATICS: Paper 2



10612E



X05



INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of TEN questions.
2. Answer ALL the questions in the ANSWER BOOK provided.
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-off answers correct 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.

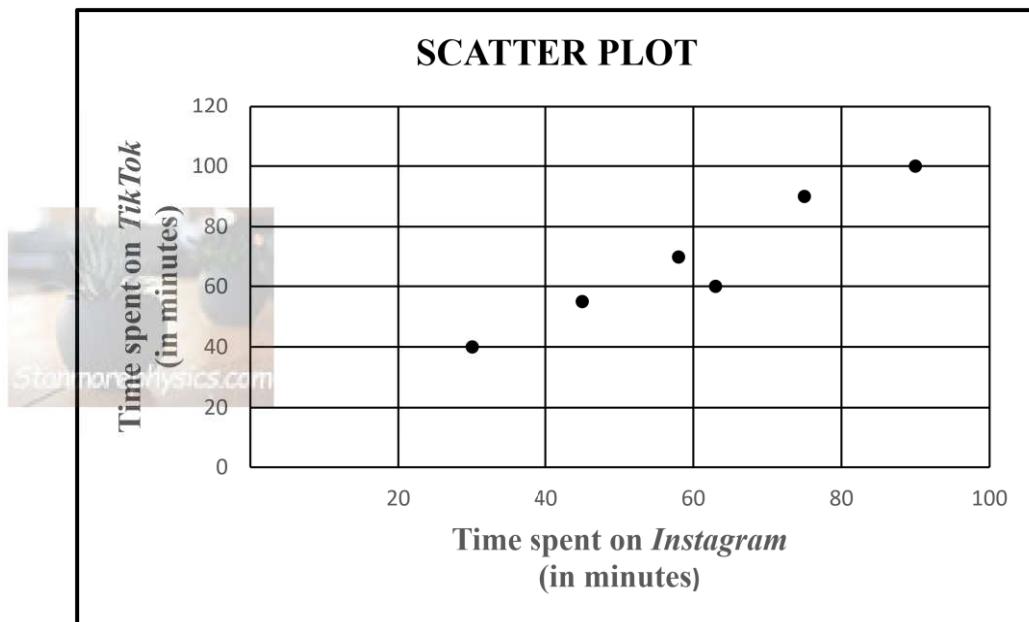


QUESTION 1

A survey was conducted among a group of learners to compare the time spent on *Instagram* to the time spent on *TikTok*.

The results are shown in the table below.

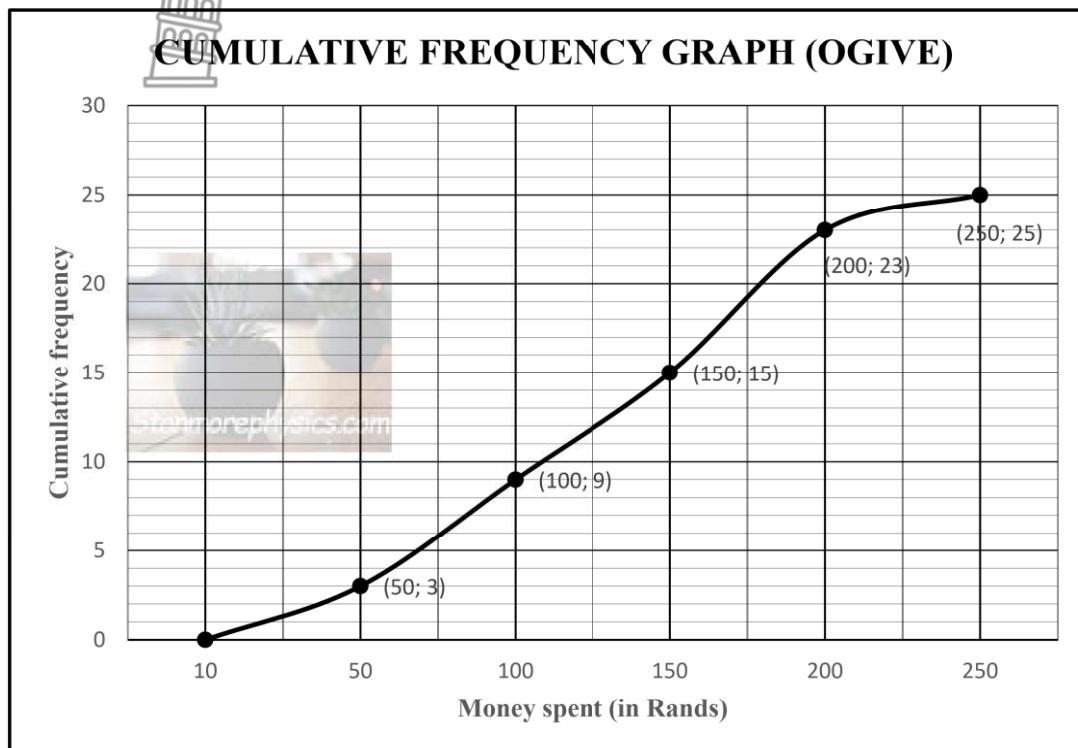
TIME SPENT ON INSTAGRAM (in minutes)	30	45	58	63	75	90
TIME SPENT ON TIKTOK (in minutes)	40	55	70	60	90	100



- 1.1 Calculate the correlation coefficient of the data. (1)
- 1.2 Comment on the strength of the correlation between the time spent on *Instagram* and the time spent on *TikTok*. (1)
- 1.3 Determine the equation of the least squares regression line for the data. (3)
- 1.4 Predict the time that will be spent on *TikTok* if a learner spent 115 minutes on *Instagram*. (2)
- 1.5 It was noticed that 4 learners' data was not recorded. The mean time of the *TikTok* users and *Instagram* users was 73,4 minutes each. The researcher commented that the total amount of time spent on the two social media platforms was more than a full day. Do you agree with the researcher?
Motivate your answer by using necessary calculations. (3)
[10]

QUESTION 2

The amount of money (in rands) that a group of learners spent at a theme park on a specific day was recorded. The data is represented in the cumulative frequency graph (ogive) below.



- 2.1 The data from the cumulative frequency graph (ogive) is represented in the incomplete frequency table below.

AMOUNT OF MONEY (IN RANDS)	NUMBER OF LEARNS
$10 \leq x < 50$	a
$50 \leq x < 100$	6
$100 \leq x < 150$	b
$150 \leq x < 200$	8
$200 \leq x < 250$	2

- 2.1.1 How many learners visited the theme park on that specific day? (1)
- 2.1.2 Determine the values of a and b in the frequency table. (2)
- 2.1.3 Use the ogive to determine the percentage of learners that spent more than R175. (2)

- 2.2 It is further given that there are two rides at the theme park, *The Intimidator* and *Terror Thrills*.

The mean amount of money spent on these rides was analysed and is given below.

Rides	<i>The Intimidator</i>	<i>Terror Thrills</i>
Mean amount spent	R13,20	R12,70

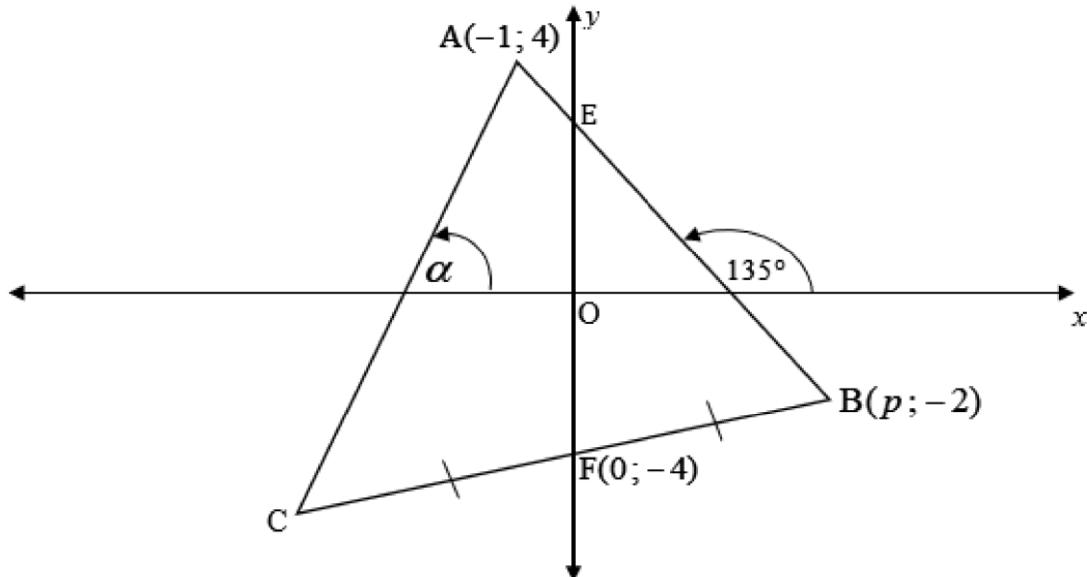
The two standard deviations interval about the mean for *The Intimidator* was calculated as (4,8 ; 9,2). If the standard deviation of *Terror Thrills* is double the standard deviation of *The Intimidator*, calculate the interval for the one standard deviation about the mean for *Terror Thrills*.

(4)
[9]



QUESTION 3

In the diagram below, A($-1; 4$), B($p ; -2$) and C, are vertices of $\triangle ABC$. E is the y -intercept of AB. F(0 ; -4) is the midpoint of BC. The angles of inclination of AB and AC are 135° and α respectively.

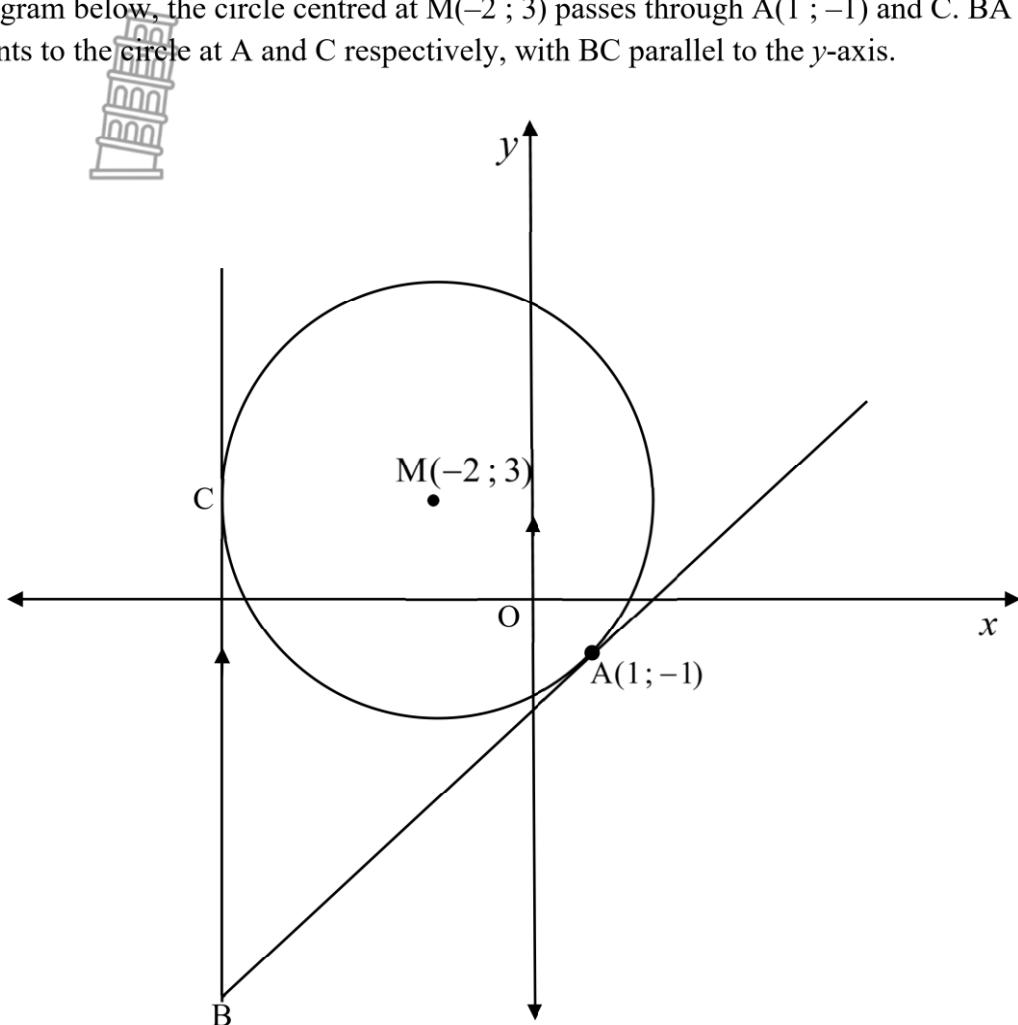


- 3.1 Calculate the gradient of AB. (2)
- 3.2 Show that the value of p is 5. (2)
- 3.3 Calculate the coordinates of C. (2)
- 3.4 Determine the equation of AC in the form $y = mx + c$. (4)
- 3.5 Calculate the size of \hat{CAB} . (3)
- 3.6 Calculate the area of $\triangle BEF$. (3)
- 3.7 Another point K($t ; t$) where $t < 0$, is plotted such that $AK = 5\sqrt{5}$. Calculate the coordinates of K. (5)



QUESTION 4

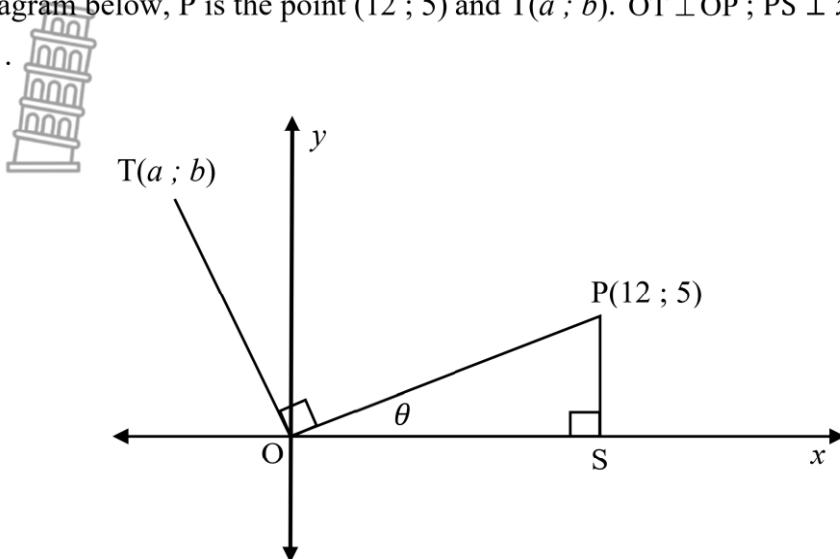
In the diagram below, the circle centred at $M(-2 ; 3)$ passes through $A(1 ; -1)$ and C . BA and BC are tangents to the circle at A and C respectively, with BC parallel to the y -axis.



- 4.1 Determine the equation of the circle in the form $(x-a)^2 + (y-b)^2 = r^2$. (3)
 - 4.2 Write down the coordinates of C . (2)
 - 4.3 Determine the equation of the tangent AB in the form $y = mx + c$. (5)
 - 4.4 Determine the length of BC . (3)
 - 4.5 Determine the equation of the circle centred at A that has both the x - and y -axis as tangents. (2)
 - 4.6 If another circle with centre $N(p ; 3)$ and a radius of 4 intersects the circle centred at M at two distinct points, determine all the possible values of p . (5)
- [20]

QUESTION 5

- 5.1 In the diagram below, P is the point $(12 ; 5)$ and $T(a ; b)$. $OT \perp OP$; $PS \perp x$ -axis and $P\hat{O}S = \theta$.



Without using a calculator, determine the value of:

5.1.1 $\tan \theta$ (1)

5.1.2 $\sin \theta$ (2)

5.1.3 a , if $TO = 19,5$ units (4)

- 5.2 Determine the value of the following, **without using a calculator**:

$$\frac{\sin(360^\circ - 2x) \cdot \sin(-x)}{\sin(90^\circ + x)} + 2 \cos^2(180^\circ + x) \quad (6)$$

- 5.3 Given: $\cos 42^\circ = \sqrt{k}$

Without using a calculator, determine the value of $\sin^2 69^\circ$ in terms of k . (3)

- 5.4 Given the identity: $\frac{\sin 5x \cdot \cos 3x - \cos 5x \cdot \sin 3x}{\tan 2x} - 1 = -2 \sin^2 x$

- 5.4.1 Prove the identity. (4)

- 5.4.2 Determine the values of x for which the identity will be undefined in the interval $x \in [0^\circ ; 60^\circ]$. (2)



5.5 Given: $f(x) = 2\cos x - \sin^2 x$

5.5.1 Show that $f(x)$ can be expressed as $f(x) = (\cos x + 1)^2 - 2$. (2)

5.5.2 Hence, or otherwise, find the maximum value of f . (2)
[26]

QUESTION 6

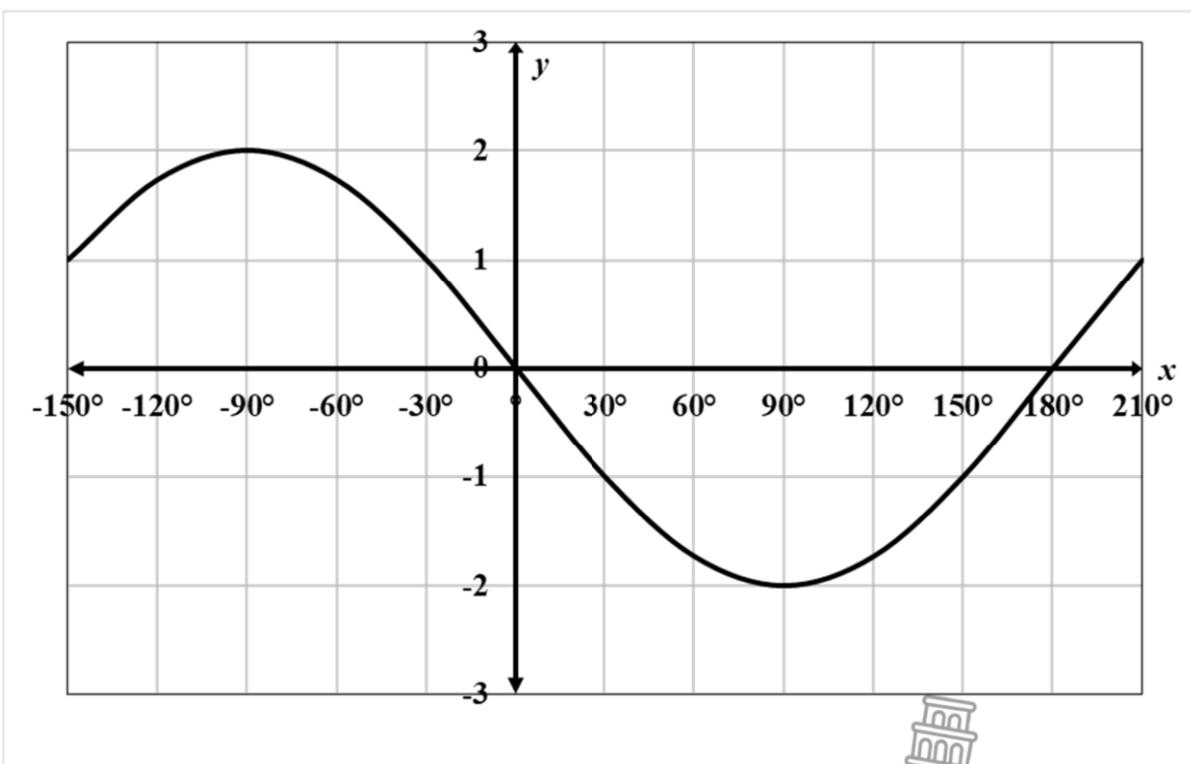
Given the equation: $\cos(x - 30^\circ) + 2\sin x = 0$

6.1 Show that the equation can be written as $\tan x = -\frac{\sqrt{3}}{5}$. (4)

6.2 Determine the solutions of the equation $\cos(x - 30^\circ) + 2\sin x = 0$ in the interval

$-180^\circ \leq x \leq 180^\circ$. (3)

6.3 In the diagram below, the graph of $f(x) = -2\sin x$ is drawn for $x \in [-150^\circ; 210^\circ]$.



6.3.1 Write down the amplitude of f . (1)

6.3.2 Draw the graph of $g(x) = \cos(x - 30^\circ)$ for the interval $x \in [-150^\circ; 210^\circ]$ on the grid provided in the ANSWER BOOK. Clearly show ALL intercepts with the axes and endpoint(s) of the graph. (3)

- 6.3.3 Use the graphs to determine the values of x , in the interval $x \in [-150^\circ; 210^\circ]$, for which:

(a) $g(x) > f(x)$

(b) $f'(\frac{1}{2}x) = 0$

(2)

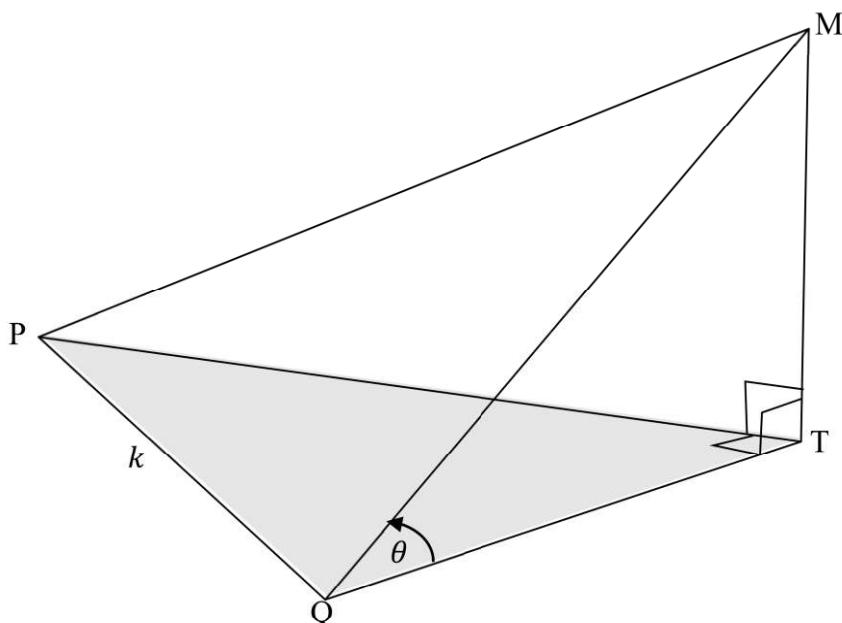
(1)

[14]

QUESTION 7

In the diagram below, P, Q and T are three points in the same horizontal plane and MT is a vertical mast. MP and MQ are two straight stay wires. The angle of elevation of M from Q is θ .

$PQ = k$ metres, $PM = 2PQ$. The area of $\Delta MPQ = 2k^2 \sin \theta \cos \theta$.



- 7.1 Show that $\hat{MPQ} = 2\theta$.

(3)

- 7.2 Hence, show that $MQ = k\sqrt{1 + 8 \sin^2 \theta}$.

(4)

- 7.3 If $k = 139.5$ m and $\theta = 42^\circ$, determine the length of MT correct to the nearest metre.

(3)

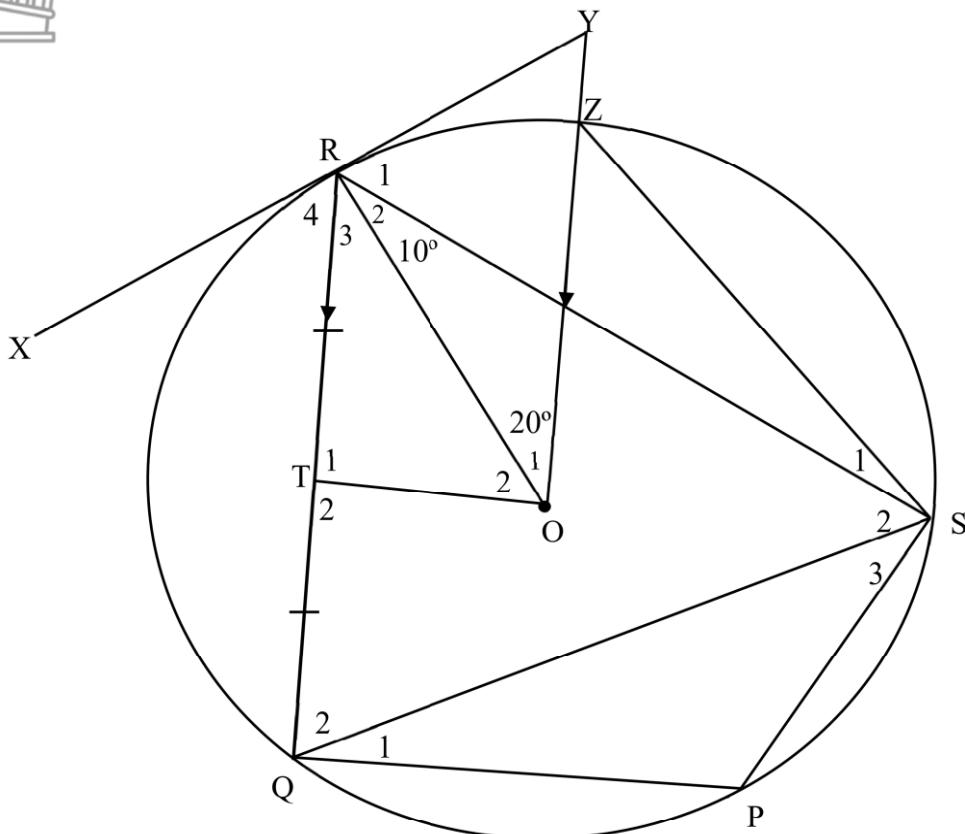
[10]



QUESTION 8

In the diagram below, points P, Q, R and S are points on a circle with centre O. OT bisects chord QR at T. XRY is a tangent to the circle at point R. OZ is produced to meet at Y where $OY \parallel QR$.

$\hat{R}OY = 20^\circ$ and $\hat{SRO} = 10^\circ$. Chord SZ is drawn.



8.1 Calculate, with reasons, the size of the following angles:

8.1.1 \hat{S}_1 (2)

8.1.2 \hat{R}_3 (1)

8.1.3 \hat{P} (2)

8.1.4 \hat{S}_2 (4)

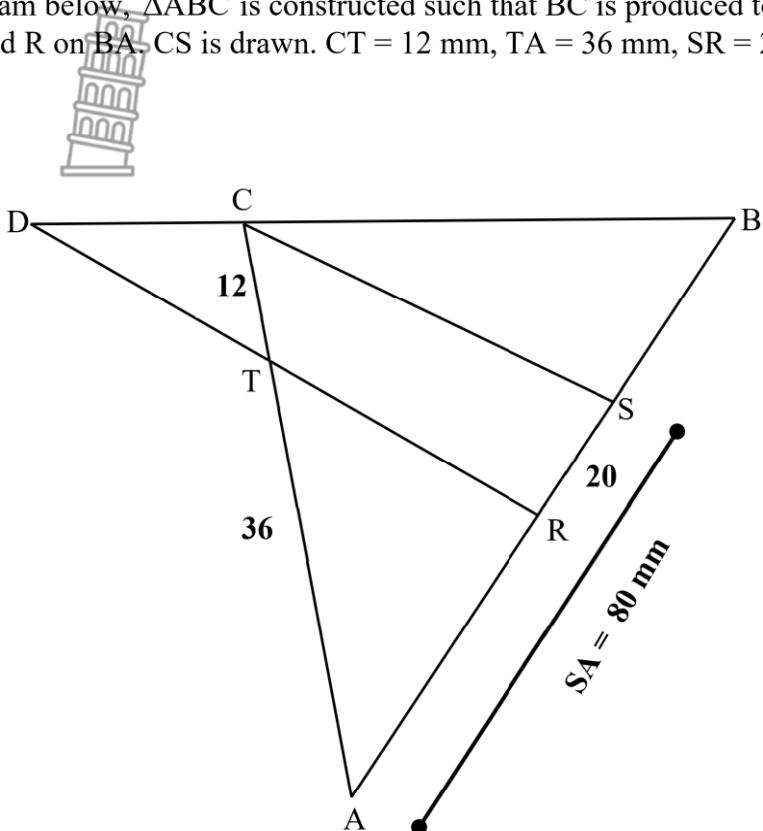
8.2 Prove that XRY is a tangent to the circle passing through R, T and O. (3)

[12]



QUESTION 9

In the diagram below, $\triangle ABC$ is constructed such that BC is produced to D . DR is drawn, with point T on AC and R on BA . CS is drawn. $CT = 12 \text{ mm}$, $TA = 36 \text{ mm}$, $SR = 20 \text{ mm}$ and $SA = 80 \text{ mm}$.



9.1 Prove that $CS \parallel TR$.

(3)

9.2 It is further given that $AR = \frac{2}{3} RB$, $BC = 2x$ and $CD = \frac{1}{2}x + 1$.

Calculate the value of x .

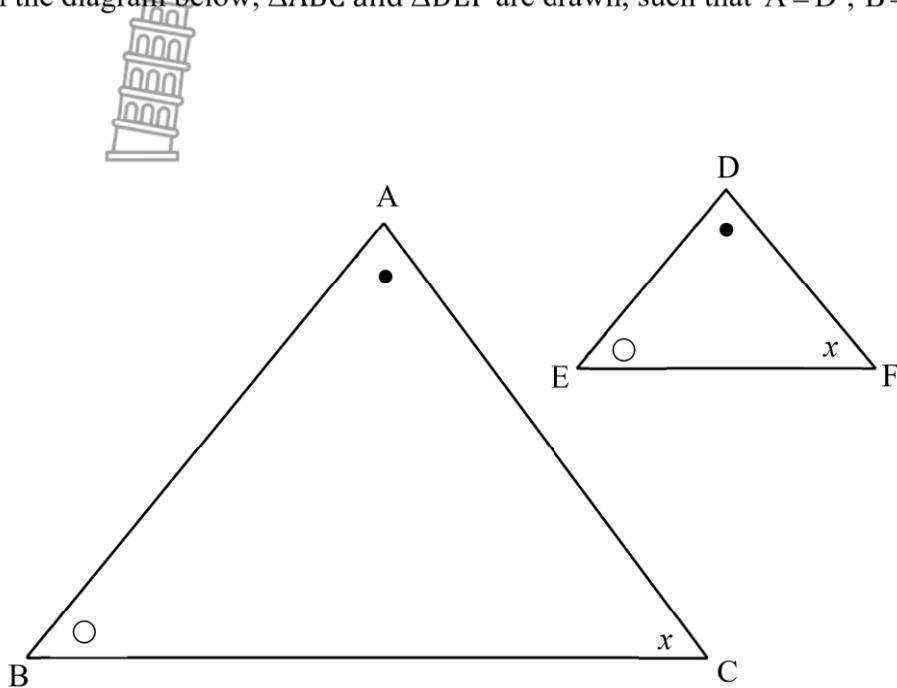
(6)

[9]



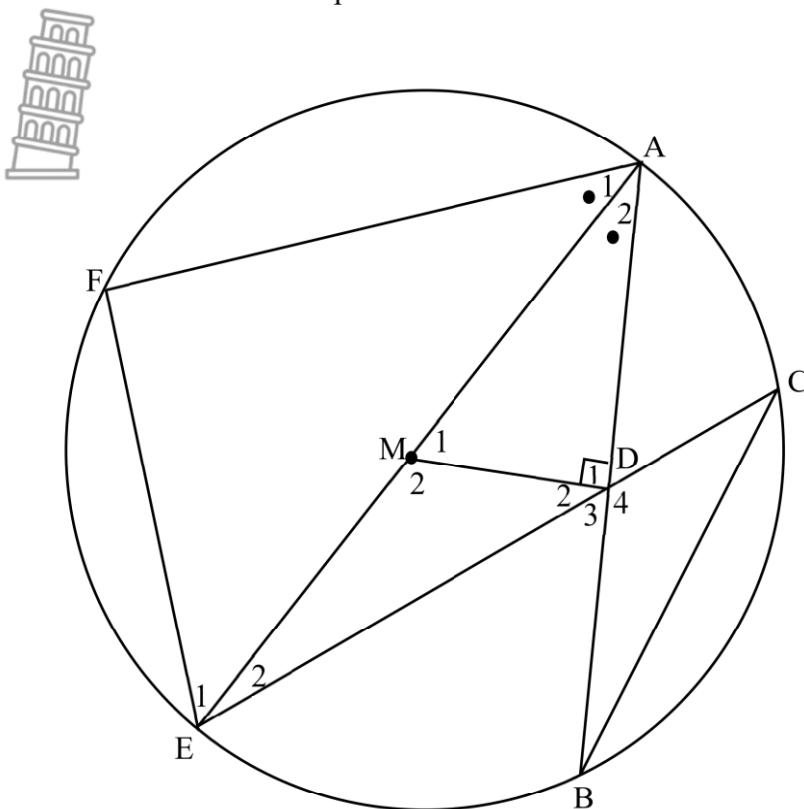
QUESTION 10

10.1 In the diagram below, $\triangle ABC$ and $\triangle DEF$ are drawn, such that $\hat{A} = \hat{D}$, $\hat{B} = \hat{E}$ and $\hat{C} = \hat{F}$.



Prove the theorem which states that if two triangles are equiangular, then the corresponding sides are in proportion, that is $\frac{AB}{DE} = \frac{AC}{DF}$. (6)

- 10.2 In the diagram below, diameter EMA of a circle with centre M bisects \hat{FAB} . MD is perpendicular to the chord AB. ED produced meets the circle at C. Chords CB and FE are drawn.



10.2.1 Prove that $\Delta AEF \sim \Delta AMD$. (4)

10.2.2 Determine the numerical value of $\frac{AF}{AD}$. (3)

10.2.3 Prove that $AD^2 = CD \times DE$. (6)
[19]

TOTAL: 150



INFORMATION SHEET

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



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

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

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

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

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

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

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

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

$$S_\infty = \frac{a}{1-r}; -1 < r < 1$$

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

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

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

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

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

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

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

$$m = \tan \theta$$

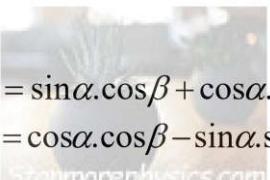
$$(x-a)^2 + (y-b)^2 = r^2$$

In ΔABC :

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

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

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



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

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

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

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

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

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

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

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

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



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

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

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



GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION *VOORBEREIDENDE EKSAMEN*

2023

MARKING GUIDELINES/NASIENRIGLYNE

MATHEMATICS/WISKUNDE (PAPER/VRAESTEL 2) (10612)

19 pages/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 to solve a problem is NOT acceptable.

LET WEL:

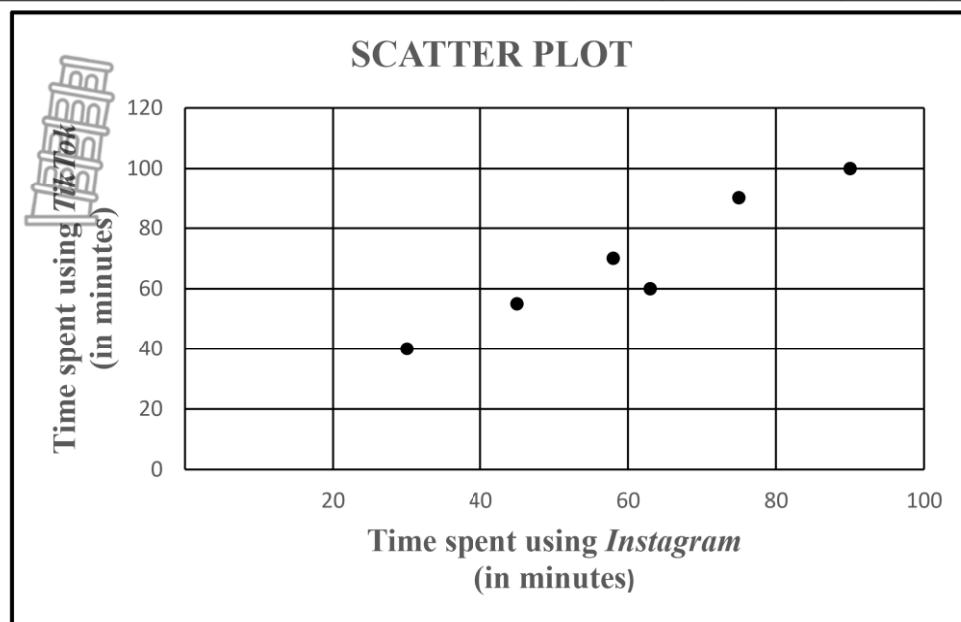
- As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.
- As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, sien die doodgetrekte poging na.
- Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.
- Aannames 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.) <i>'n Punt vir 'n korrekte bewering</i> (<i>'n Punt vir 'n bewering is onafhanklik van die rede.</i>)
R	A mark for a correct reason (A reason mark may only be awarded if the statement is correct.) <i>'n Punt vir 'n korrekte rede</i> (<i>'n Punt word slegs vir die rede toegeken as die bewering korrek is.</i>)
S/R	Award a mark if the statement AND reason are both correct. (<i>Ken 'n punt toe as beide die bewering EN rede korrek is.</i>)



QUESTION/VRAAG 1

TIME USED ON <i>INSTAGRAM</i> (in minutes)	30	45	58	63	75	90
TIME USED ON <i>TIKTOK</i> (in minutes)	40	55	70	60	90	100

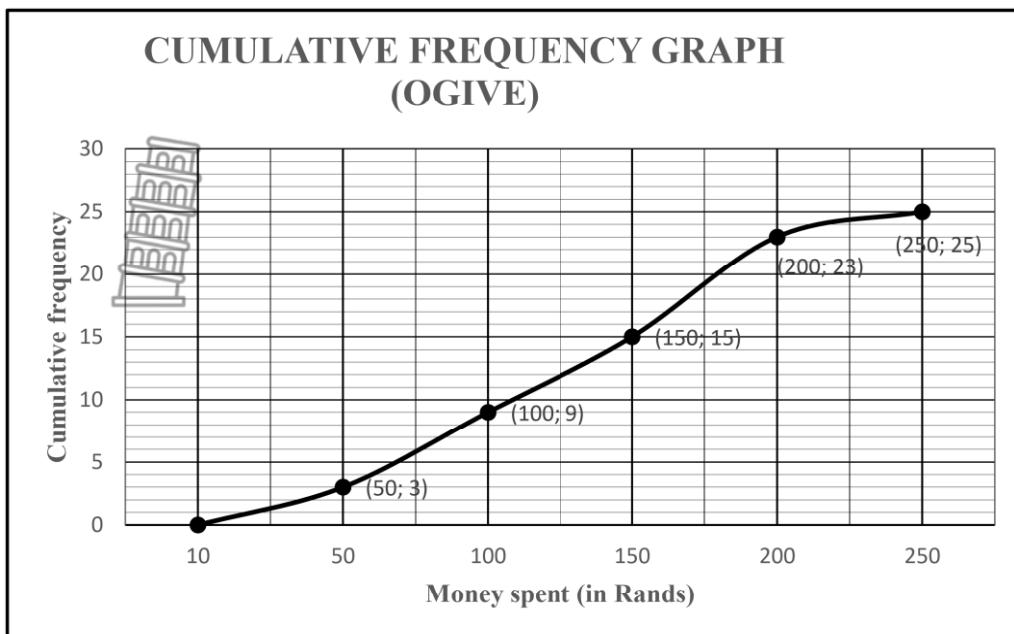


1.1	$r = 0,96$	✓ answer/antwoord (1)
1.2	Very strong /Baie sterk	✓ answer/antwoord Accept: Strong Aanvaar: Sterk (1)
1.3	$a = 8,12$ $b = 1,01$ $\hat{y} = 8,12 + 1,01x$	✓ $a = 8,12$ ✓ $b = 1,01$ ✓ $\hat{y} = 8,12 + 1,01x$ Answer only: Full marks Slegs antwoord: Volpunte (3)
1.4	$\hat{y} = 8,12 + 1,01(115)$ $= 124,27 \approx 124$ minutes/minute OR $\hat{y} = 124,80 \approx 125$ minutes / minute (calculator)	✓ substitute/vervang 115 ✓ answer/antwoord OR ✓ ✓ answer/antwoord (2)

1.5 $73,4 = \frac{\sum x}{10}$ OR/OF $73,4 = \frac{\sum x}{20}$ <p>Total/Totaal = 734 minutes/minute</p> <p>Total for Instagram and TikTok = 1 468 minutes</p> <p>Totaal vir Instagram en TikTok = 1 468 minute</p>  $\frac{1\ 468}{60} = 24,47$ <p>\therefore Yes I agree. More than a day was spent./</p> <p>\therefore Ja, ek stem saam. Meer as 'n dag is spandeer.</p>	\checkmark 1 468 minutes/minute \checkmark $\frac{1468}{60} = 24,47$ hours/ure \checkmark conclusion/gevolgtrekking (3) [10]
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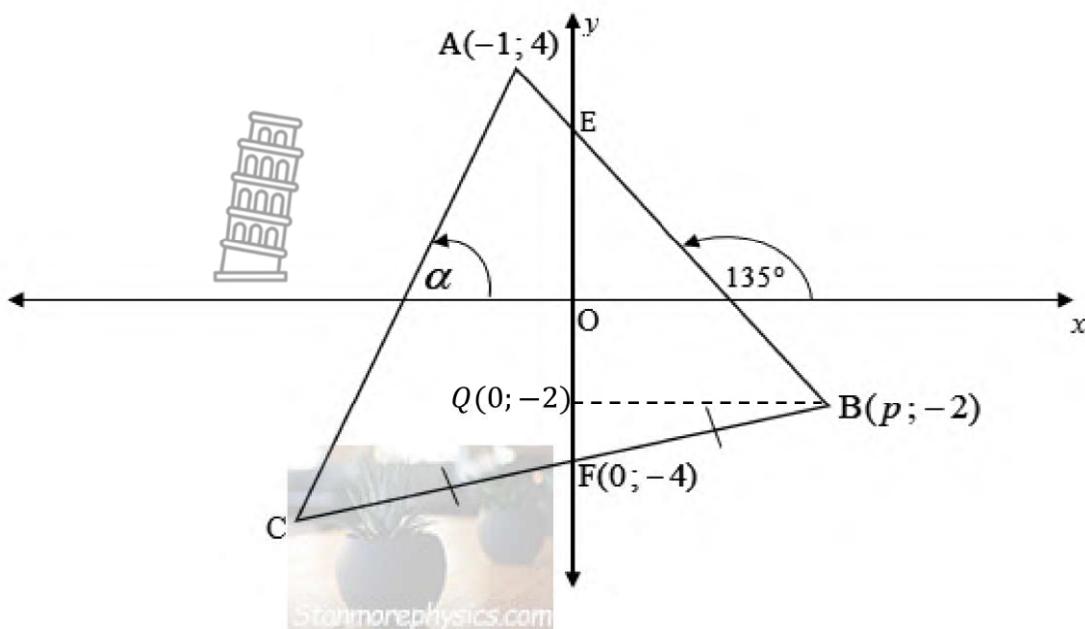


QUESTION/VRAAG 2



2.1.1	25 learners/leerders	✓ answer/Antwoord (1)
2.1.2	$a = 3$ $b = 6$	✓ $a = 3$ ✓ $b = 6$ (2)
2.1.3	$25 - 19 = 6$ learners/leerders $\frac{6}{25} \times 100 = 24\%$ $\therefore 24\%$ of the learners spent more than R175/ <i>van die leerders het meer as R175 gespandeer</i>	✓ 6 ✓ 24% (2)
2.2	$\bar{x} - 2\sigma = 4,8$ $13,20 - 2\sigma = 4,8$ $-2\sigma = -8,4$ $\sigma = 4,2$ OR $\bar{x} + 2\sigma = 9,2$ $13,20 + 2\sigma = 9,2$ $2\sigma = -4$ OR The interval is incorrect/meaningless because $13,20 < 9,2$ which is mean < upperlimit, therefore no further calculations can be done. / Die gegewe interval is verkeerd / betekenisloos, want $13,20 < 9,2$, dit is die gemiddeld < boonste limiet. Dus kan geen verdere berekenings gemaak word nie.	✓ ✓ equation/ vergelyking ✓ ✓ $\sigma = 4,2$ OR ✓ ✓ equation/ vergelyking ✓ ✓ $2\sigma = -4$ OR ✓ ✓ ✓ ✓ explanation/verduideliking (4)
		[9]

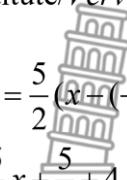
QUESTION/VRAAG 3



3.1	$m_{AB} = \tan 135^\circ = -1$	<input checked="" type="checkbox"/> $m_{AB} = \tan 135^\circ$ <input checked="" type="checkbox"/> answer (2)
3.2	$m_{AB} = \frac{-2-4}{p-(-1)}$ $-1 = \frac{-6}{p+1}$ $p+1 = 6$ $p = 5$	<input checked="" type="checkbox"/> correct substitution of A and B into gradient formula/korrekte substitusie van A en B in die gradiënt formule <input checked="" type="checkbox"/> equate to/gelykstel aan -1 (2)
3.3	$\frac{5+x_c}{2} = 0 \quad \text{and/en} \quad \frac{-2+y_c}{2} = -4$ $x_c = -5 \quad \text{and/en} \quad y_c = -8 + 2$ $C(-5; -6) \quad y_c = -6$	<input checked="" type="checkbox"/> $x_c = -5$ <input checked="" type="checkbox"/> $y_c = -6$ (2)

NOTE: Does not have to be in coordinate form
Let op: Dit is nie nodig om in koördinaatvorm te skryf nie.

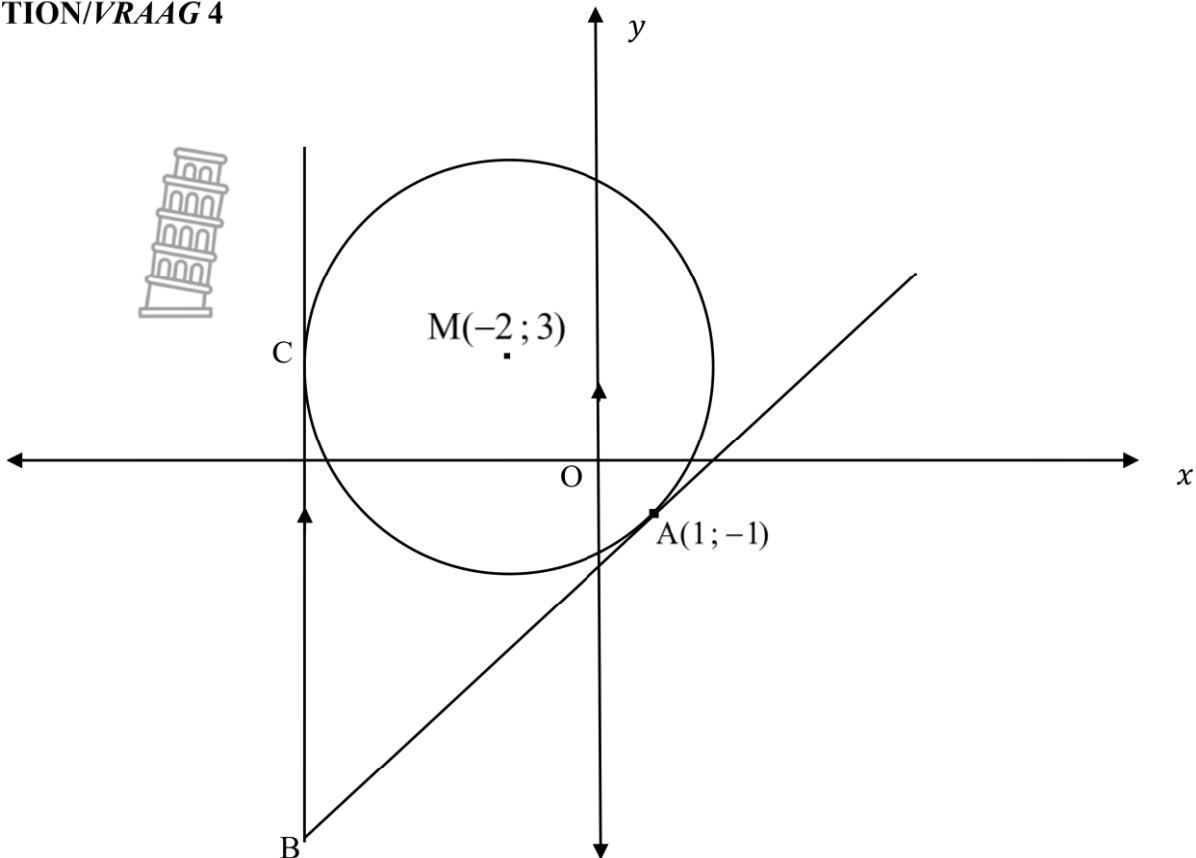


3.4	$m_{AC} = \frac{4 - (-6)}{-1 - (-5)} = \frac{10}{4} = \frac{5}{2}$ Substitute/Vervang A(-1 ; 4)  $y - 4 = \frac{5}{2}(x + (-1))$ OR/OF $4 = \frac{5}{2}(-1) + c$ $y = \frac{5}{2}x + \frac{5}{2} + 4$ $4 = \frac{-5}{2} + c$ $y = \frac{5}{2}x + \frac{13}{2}$ $c = 6\frac{1}{2}$ $y = \frac{5}{2}x + 6,5$ $y = \frac{5}{2}x + 6\frac{1}{2}$	✓ correct substitution of A and C into gradient formula/korrekte substitusie van A en C in die gradiënt formule ✓ $m_{AC} = \frac{5}{2}$ ✓ subs of m and point A or C/vervang m en punt A of C ✓ equation/vergelyking (4)
3.5	$\tan \alpha = \frac{5}{2}$ $\alpha = 68,20^\circ$ $\hat{CAB} = 135^\circ - 68,20^\circ$ (Ext \angle of Δ) $= 66,8^\circ$	✓ $\tan \alpha = \frac{5}{2}$ ✓ $\alpha = 68,20^\circ$ ✓ answer/antwoord (3)
3.6	Subst./Vervang A (-1 ; 4) OF/OF Subst/Vervang B(5; -2) $E : 4 = -1(-1) + c$ OR/OF $y + 2 = -1(x - 5)$ $3 = c$ $y + 2 = -x + 5$ $y = -x + 3$ E(0 ; 3) F(0 ; -4) Area/Opp $\Delta BEF = \frac{1}{2} \times EF \times \perp h$ $= \frac{1}{2} \times 7 \times 5$ $= 17,5$ square units/vierkante eenhede OR/OF $E : 4 = -1(-1) + c$ $3 = c$ E(0 ; 3) $\hat{FEB} = 45^\circ$ $BE^2 = (5 - 0)^2 + (-2 - 3)^2$ $BE = \sqrt{50}$ Area/Opp $\Delta BEF = \frac{1}{2} \times EF \times BE \times \sin \hat{FEB}$ $= \frac{1}{2} \times 7 \times \sqrt{50} \times \sin 45^\circ$ $= 17,5$ square units / vierkante eenhede	✓ value of c/waarde van c ✓ \perp height/hoogte = 5 ✓ answer/antwoord (3) OR/OF ✓ value of c/waarde van c  ✓ $BE = \sqrt{50}$ ✓ answer/antwoord (3)

	<p>OR/OF</p> <p>$E : 4 = -1(-1) + c$ $3 = c$ $E(0 ; 3)$</p> <p> $\text{Area} / \text{Opp } \Delta \text{EQB} = \frac{1}{2} \times 2 \times 5 = 5$</p> <p> $\text{Area} / \text{Opp } \Delta \text{EQB} = \frac{1}{2} \times 5 \times 5 = 12,5$</p> <p> $\text{Area} / \text{Opp } \Delta \text{EFB} = 5 + 12,5$ $= 17,5 \text{ square units} / \text{vierkante eenhede}$</p>	<p>OR/OF</p> <p>✓ value of c/waarde van c</p> <p>✓ \perp height/hoogte = 5</p> <p>✓ answer/antwoord (3)</p>
3.7	<p>$AK = 5\sqrt{5}$</p> $\sqrt{(t+1)^2 + (t-4)^2} = (5\sqrt{5})$ $t^2 + 2t + 1 + t^2 - 8t + 16 = 125$ $t^2 - 3t - 54 = 0$ $(t-9)(t+6) = 0$ $t = 9 \text{ (n.a.) or/of } t = -6$ <p>$K(-6 ; -6)$</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>NOTE: Must be in coordinate form. <i>Let op: Moet in koördinaatvorm wees.</i></p> </div>	<p>✓ substitute A and K into distance formula/ <i>vervang A en K in die afstandformule</i></p> <p>✓ equating/gelykstelling</p> <p>✓ standard form/ <i>standaardvorm</i></p> <p>✓ factors/faktore</p> <p>✓ $K(-6 ; -6)$</p> <p>(5)</p>



QUESTION/VRAAG 4

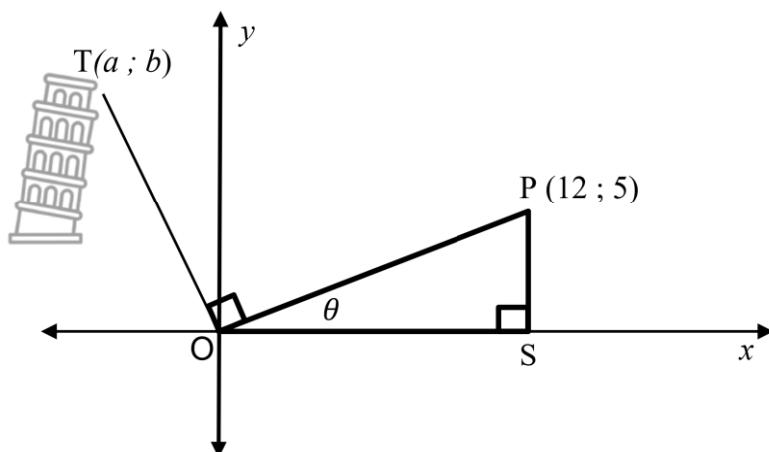


<p>4.1</p> $(x+2)^2 + (y-3)^2 = r^2$ $(1+2)^2 + (-1-3)^2 = r^2$ $9+16 = r^2$ $\therefore (x+2)^2 + (y-3)^2 = 25$ <p>OR/OF</p> $AM = \sqrt{(-2-1)^2 + (3+1)^2}$ $AM = \sqrt{9+16}$ $r=5$ $\therefore r^2=25$ $\therefore (x+2)^2 + (y-3)^2 = 25$	<p>✓ subs of M and A into the distance formula/ vervang M en A in die afstandformule ✓ $r^2=25$ ✓ equation/vergelyking</p> <p>OR/OF</p> <p>✓ subs of M and A into the distance formula/ vervang M en A in die afstandformule ✓ $r^2=25$ ✓ equation/vergelyking (3)</p>
<p>4.2</p> $C(-2-5; 3) \text{ (by symmetry/deur simmetrie)}$ $C(-7; 3)$	$\checkmark x_C = -7$ $\checkmark y_C = 3$ (2)

4.3	$m_{AM} = \frac{3 - (-1)}{-2 - 1} = -\frac{4}{3}$ $m_{AB} = \frac{3}{4}$ (radius \perp tangent/raaklyn) $y - (-1) = \frac{3}{4}(x - 1)$ (subst./vervang A(1 ; -1))  $y = \frac{3}{4}x - \frac{3}{4} - 1$ $y = \frac{3}{4}x - \frac{7}{4}$	✓ subs A and M into gradient formula/ <i>vervang A en M in die gradiëntformule</i> ✓ $m_{radius} = -\frac{4}{3}$ ✓ $m_{tangent} = \frac{3}{4}$ ✓ substitute m and A/ <i>vervang m en A</i> ✓ equation/ <i>vergelyking</i> (5)
4.4	B(-7 ; y_B) subs./vervang B(-7; y_B) into eqn of AB/in die vergelyking van AB $y_B = \frac{3}{4}(-7) - \frac{7}{4}$ $y_B = -7$ B(-7 ; -7) BC = 10 units/eenhede	✓ subs./vervang x = -7 ✓ $y_B = -7$ ✓ BC = 10 (3)
4.5	$(x-1)^2 + (y+1)^2 = 1$	✓ LHS/LK ✓ RHS/RK (2)
4.6	$r_2 - r_1 < MN < r_2 + r_1$ $1 < p + 2 < 9$ or/of $1 < -2 - p < 9$ $-1 < p < 7$ or/of $3 < -p < 11$ $-1 < p < 7$ or/of $-11 < p < -3$ OR/OF Two circles will touch when:/ Twee sirkels sal sny indien: Distance between centre/Afstand tussen middelpunte = $r_1 + r_2$ or /of distance between centres/ Afstand tussen middelpunte = $r_2 - r_1$ $\sqrt{(p+2)^2 + (3-3)^2} = 4 + 5$ or / of $\sqrt{(p+2)^2 + (3-3)^2} = 5 - 4$ $(p+2)^2 = 9^2$ or / of $(p+2)^2 = 1$ $p+2 = \pm 9$ or / of $p+2 = \pm 1$ $p = \pm 9 - 2$ or / of $p = -2 \pm 1$ $p = -11$ or / of $p = 7$ or / of $p = -3$ or / of $p = -1$ Two circles intersect in two different points if / twee sirkels sny in twee verskillende punte as $-11 < p < -3$ or $-1 < p < 7$	✓ value of 1 and 9 (Sum and difference of radii)/Waarde van 1 en 9 (som en verskil van radiusse) ✓✓ $-1 < p < 7$ ✓✓ $-11 < p < -3$ (5) OR/OF ✓ value of 1 and 9 (Sum and difference of radii)/Waarde van 1 en 9 (som en verskil van radiusse)  ✓✓ $-1 < p < 7$ ✓✓ $-11 < p < -3$ (5)

QUESTION/VRAAG 5

5.1



5.1.1	$\tan \theta = \frac{5}{12}$	✓ answer/antwoord (1)
5.1.2	$r^2 = 5^2 + 12^2$ $r = 13$ $\sin \theta = \frac{5}{13}$	✓ value of/waarde van r ✓ answer/antwoord Answer only: Full marks Slegs antwoord: Volpunte (2)
5.1.3	$\cos(90^\circ + \theta) = \frac{a}{19,5}$ $-\sin \theta = \frac{a}{19,5}$ $-\frac{5}{13} = \frac{a}{19,5}$ $a = \frac{-5 \times 19,5}{13}$ $a = -7,5$	✓ ratio/verhouding ✓ $-\sin \theta$ ✓ substitute/vervang $\sin \theta$ ✓ value of/waarde van a (4)
5.2	$\begin{aligned} & \frac{\sin(360^\circ - 2x) \cdot \sin(-x)}{\sin(90^\circ + x)} + 2 \cos^2(180^\circ + x) \\ &= \frac{(-\sin 2x) \cdot (-\sin x)}{\cos x} + 2 \cos^2 x \\ &= \frac{(-2 \sin x \cos x) \cdot (-\sin x)}{\cos x} + 2 \cos^2 x \\ &= 2 \sin^2 x + 2 \cos^2 x \\ &= 2(\sin^2 x + \cos^2 x) \\ &= 2 \end{aligned}$	✓ $-\sin 2x$ ✓ $-\sin x$ ✓ $\cos x$ ✓ $2 \cos^2 x$ ✓ $\sin 2x = 2 \sin x \cos x$ ✓ answer/antwoord (6)

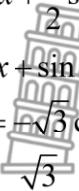
5.3	$\cos 42^\circ = 2 \cos^2 21^\circ - 1$ $\sqrt{k} = 2 \sin^2 69^\circ - 1$ $\frac{\sqrt{k} + 1}{2} = \sin^2 69^\circ$	✓ double angle expansion/ <i>dubbelhoek uitbreiding</i> ✓ co-function/ <i>ko-funksie</i> ✓ answer/ <i>antwoord</i> (3)
5.4.1	 $\begin{aligned} \text{LHS/LK} &= \frac{\sin 5x \cdot \cos 3x - \cos 5x \cdot \sin 3x}{\tan 2x} - 1 \\ &= \frac{\sin(5x - 3x)}{\sin 2x} - 1 \\ &= \frac{\sin 2x}{\cos 2x} \\ &= \cos 2x - 1 \\ &= (1 - 2 \sin^2 x) - 1 \\ &= -2 \sin^2 x \\ &= RHS \end{aligned}$	✓ $\sin(5x - 3x)$ ✓ $\tan 2x = \frac{\sin 2x}{\cos 2x}$ ✓ $\cos 2x - 1$ ✓ double angle identity/ <i>dubbelhoek identiteit</i> (4)
5.4.2	Undefined if/ <i>Ongedefinieerd as</i> $\tan 2x = 0$ $x = 0^\circ$ or/of $\tan 2x$ is undefined if/ <i>ongedefinieerd as</i> $2x = 90^\circ$ $x = 45^\circ$	✓ $x = 0^\circ$ ✓ $x = 45^\circ$ (2)
5.5.1	$\begin{aligned} f(x) &= 2 \cos x - \sin^2 x \\ &= 2 \cos x - (1 - \cos^2 x) \\ &= 2 \cos x - 1 + \cos^2 x \\ &= \cos^2 x + 2 \cos x + 1 - 1 - 1 \\ &= (\cos x + 1)^2 - 2 \end{aligned}$	✓ identity/ <i>identiteit</i> ✓ completing the square/ <i>voltooi die vierkant</i> (2)
5.5.2	Maximum of/ <i>Maksimum van</i> $\cos x = 1$ Max. of/ <i>Maks. van</i> $(\cos x + 1)^2$ is $(1+1)^2 = 4$ Max. of/ <i>Maks. van</i> $(\cos x + 1)^2 - 2$ is 2	✓ Max. of/ <i>Maks. van</i> $\cos x = 1$ ✓ answer/ <i>antwoord</i> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Answer only: Full marks Slegs antwoord: Volpunte </div>



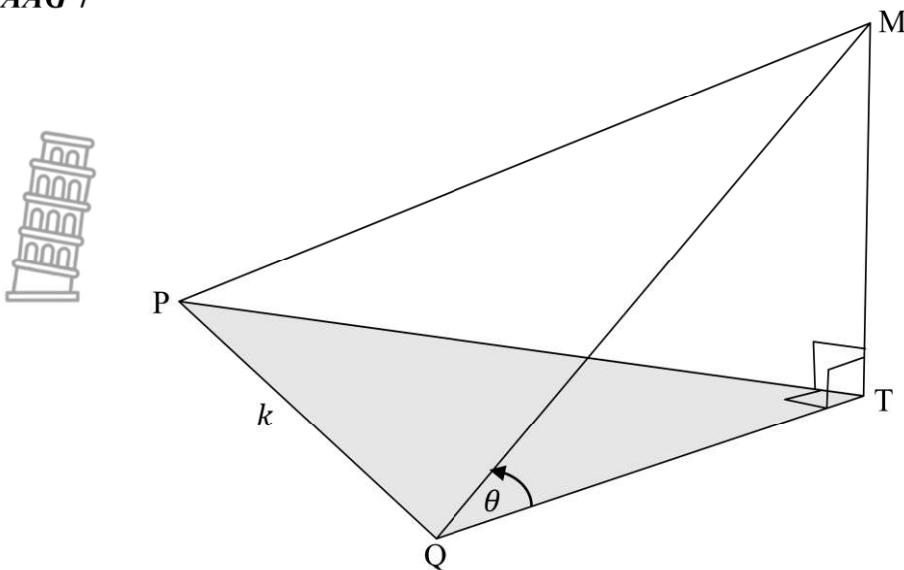
(2)

[26]

QUESTION/VRAAG 6

6.1	$\cos(x - 30^\circ) + 2 \sin x = 0$ $\cos x \cos 30^\circ + \sin x \sin 30^\circ + 2 \sin x = 0$ $\frac{\sqrt{3}}{2} \cos x + \frac{1}{2} \sin x + 2 \sin x = 0$  $\sqrt{3} \cos x + \sin x + 4 \sin x = 0$ $5 \sin x = -\sqrt{3} \cos x$ $\tan x = -\frac{\sqrt{3}}{5}$	✓ expansion of compound angle/ <i>uitbreiding van saamgestelde hoek</i> ✓ special angles/ <i>spesiale hoeke</i> ✓ simplification/ <i>vereenvoudiging</i> ✓ $5 \sin x = -\sqrt{3} \cos x$ (4)
6.2	$\tan x = -\frac{\sqrt{3}}{5}$ ref. angle/ <i>verwys. hoek</i> = $19,106 ..^\circ$ $x = 160,89^\circ + k \cdot 180^\circ; k \in \mathbb{Z}$ $x = -19,11^\circ$ or/of $x = 160,89^\circ$ OR/OF $\tan x = -\frac{\sqrt{3}}{5}$ $x = -19,11^\circ + k \cdot 180^\circ; k \in \mathbb{Z}$ $x = -19,11^\circ$ or $x = 160,89^\circ$	✓ ref angle/ <i>verwys. hoek</i> ✓ $x = -19,11^\circ$ ✓ $x = 160,89^\circ$ OR/OF ✓ $x = -19,11^\circ + k \cdot 180^\circ; k \in \mathbb{Z}$ ✓ $x = -19,11^\circ$ ✓ $x = 160,89^\circ$ (3)
6.3.1	Amplitude = 2	✓ answer/ <i>antwoord</i> (1)
6.3.2		
	✓ both x -intercepts/ <i>albei x-afsnitte</i> ✓ turning points/ <i>draaipunte</i> $(-150^\circ; -1)$, $(30^\circ; 1)$, $(210^\circ; -1)$ ✓ shape/ <i>vorm</i>	 (3)
6.3.3	(a) $x \in (-19,11^\circ; 160,89^\circ)$ or $-19,11^\circ < x < 160,89^\circ$ (b) $x = 180^\circ$	✓ Correct intervals/ <i>korrekte intervalle</i> ✓ Correct notations/ <i>korrekte notasies</i> (2)
		✓ answer (1)
		[14]

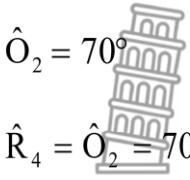
QUESTION/VRAAG 7



7.1	$\text{Area} / \text{Opp} = \frac{1}{2} \times k \times 2k \times \sin \hat{M}PQ$ $2k^2 \cdot \sin \theta \cos \theta = \frac{1}{2} \times k \times 2k \times \sin \hat{M}PQ$ $k^2 \cdot \sin 2\theta = k^2 \times \sin \hat{M}PQ$ $\sin 2\theta = \sin \hat{M}PQ$ $\hat{M}PQ = 2\theta$	✓ subs in area rule/vervang in opp. reël ✓ area of/van $\Delta MPQ = k^2 \times \sin \hat{M}PQ$ ✓ $2k^2 \cdot \sin \theta \cos \theta = k^2 \sin 2\theta$ (3)
7.2	$MQ^2 = k^2 + (2k)^2 - 2(k)(2k) \cos 2\theta$ $MQ^2 = k^2 + 4k^2 - 4k^2 \cos 2\theta$ $= 5k^2 - 4k^2 \cos 2\theta$ $= 5k^2 - 4k^2(1 - 2 \sin^2 \theta)$ $= 5k^2 - 4k^2 + 8k^2 \sin^2 \theta$ $= k^2 + 8k^2 \sin^2 \theta$ $= k^2(1 + 8 \sin^2 \theta)$ $MQ = k\sqrt{1 + 8 \sin^2 \theta}$	✓ correct subst into cosine rule/korrekte substitusie in die cos reël ✓ $5k^2 - 4k^2 \cos 2\theta$ ✓ $\cos 2\theta = 1 - 2 \sin^2 \theta$ ✓ $k^2(1 + 8 \sin^2 \theta)$ (4)
7.3	$MQ = 139,5\sqrt{1 + 8 \sin^2 42^\circ}$ $MQ = 298,6045..$ $\frac{MT}{MQ} = \sin \theta$ $MT = 298,6045.. \times \sin 42^\circ$ $MT = 199,805..$ $MT \approx 200 m$	✓ value of/waarde van MQ ✓ ratio/verhouding ✓ $MT = 200 m$  (3) <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> 1 mark penalty for incorrect rounding/ Penaliseer met 1 punt vir verkeerde afronding </div>

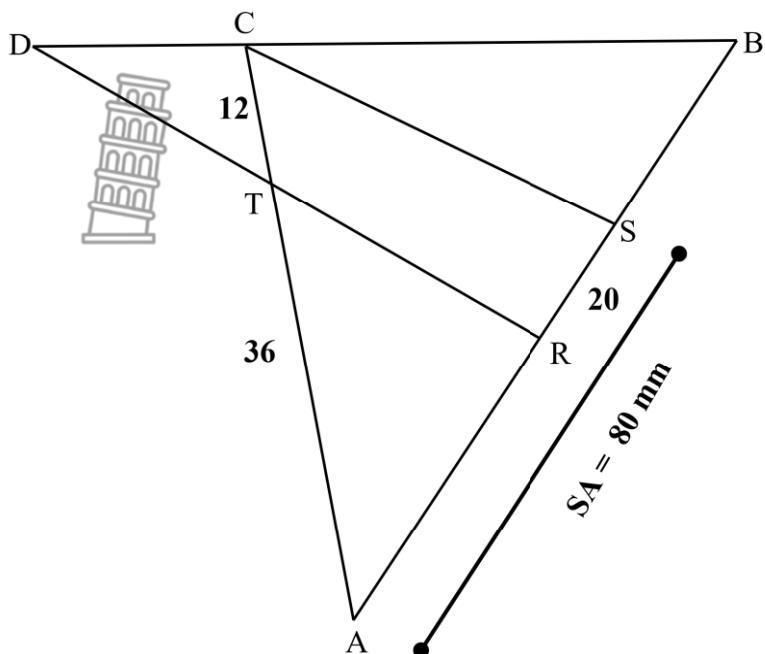
QUESTION/VRAAG 8

8.1		
8.1.1	$\hat{S}_1 = 10^\circ$ $\angle \text{centre} = 2 \times \angle \text{at circumference}/\text{midpt}$ $\angle = 2 \times \text{omtrek } \angle$	$\checkmark S$ $\checkmark R$ (2)
8.1.2	$\hat{R}_3 = 20^\circ$ Alt \angle 's/Verwiss. \angle^e , $RQ//YO$	$\checkmark S/R$ (1)
8.1.3	$\hat{P} = 150^\circ$ opposite \angle^s of cyclic quad/teenoorst. \angle^e van koordevierhoek	$\checkmark S$ $\checkmark R$ (2)
8.1.4	$\hat{R}_3 + \hat{R}_4 = 90^\circ$ radius \perp tangent/raaklyn $\hat{R}_4 = 90^\circ - 20^\circ = 70^\circ$ $\hat{S}_2 = \hat{R}_4 = 70^\circ$ tan chord theorem/raaklyn koord stelling OR/OF $\hat{R}_1 + \hat{R}_2 = 90^\circ$ radius \perp tangent/raaklyn $\hat{R}_1 = 80^\circ$ $\hat{Q}_2 = 80^\circ$ tan chord theorem/raaklyn koord stelling $\hat{S}_2 = 70^\circ$ sum of \angle^s in a triangle/binne \angle^e van 'n drieelhoek	$\checkmark R$ $\checkmark S$ $\checkmark S \checkmark R$ OR/OF $\checkmark R$ $\checkmark S$ $\checkmark S /R$ $\checkmark S$ (4)

8.2	$\hat{T}_1 = 90^\circ$  $\hat{O}_2 = 70^\circ$ $\hat{R}_4 = \hat{O}_2 = 70^\circ$ $\therefore \text{XRY is a tangent/} n \text{ raaklyn}$	line from centre to midpoint of chord/lyn <i>vanaf middelpunt tot middelpunt van koord</i> sum of \angle^s in a triangle/binne \angle^e van 'n driehoek converse tan chord theorem/omgekeerde raaklyn koord stelling	✓ S/R ✓ S ✓ R (3)
	OR/OF $\hat{R}_1 + \hat{R}_2 = 90^\circ$ $\hat{T}_1 = 90^\circ$ $\hat{O}RY = \hat{T}_1$ $\therefore \text{XRY is a tangent/} n \text{ raaklyne}$	radius \perp tangent/raaklyn line from centre to midpoint of chord/lyn <i>vanaf middelpunt tot middelpunt koord</i> converse tan chord theorem/omgekeerde raaklyn koord stelling	✓ S/R ✓ R (3)



QUESTION/VRAAG 9



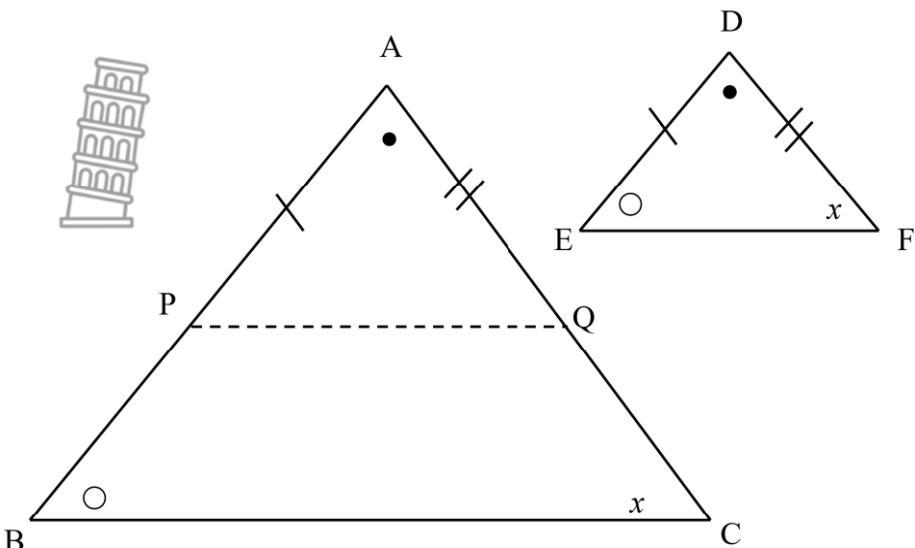
9.1	$\frac{CT}{TA} = \frac{12}{36} = \frac{1}{3}$ $\frac{SR}{RA} = \frac{20}{60} = \frac{1}{3}$ $\therefore \frac{CT}{TA} = \frac{SR}{RA}$ $\therefore CS \parallel TR$	\sqrt{S} \sqrt{S} \sqrt{R}	(3)
	OR/OF $\frac{SR}{SA} = \frac{20}{80} = \frac{1}{4}$ $\frac{CT}{CA} = \frac{12}{48} = \frac{1}{4}$ $\therefore \frac{CT}{CA} = \frac{SR}{SA}$ $\therefore CS \parallel TR$	\sqrt{S} \sqrt{S} \sqrt{R}	(3)

9.2	$\frac{AR}{RB} = \frac{2}{3}$ $\frac{60}{RB} = \frac{2}{3}$ $RB = 90 \text{ mm}$ $\therefore SB = 70 \text{ mm}$  $\frac{BS}{SR} = \frac{BC}{CD}$ proportion theorem/eweredigheidstelling CS TR $\frac{70}{20} = \frac{2x}{\frac{1}{2}x + 1}$ $40x = 35x + 70$ $x = 14 \text{ mm}$ <p>OR/OF</p> $2k = 60$ $\therefore k = 30$ $\therefore 3k = 90$ $\frac{SR}{RB} = \frac{DC}{DB}$ prop. theorem/eweredigheidstelling CS TR $\frac{20}{90} = \frac{\frac{1}{2}x + 1}{\frac{5}{2}x + 1}$ $5x + 2 = \frac{9}{2}x + 9$ $\frac{1}{2}x = 7$ $\therefore x = 14 \text{ mm}$	✓S ✓ value of/waarde van RB ✓S ✓R ✓ substitution/ substitusie ✓ answer/antwoord (6) ✓ value of/waarde van k ✓ value of/waarde van 3k ✓S ✓R ✓ substitution/ substitusie ✓ answer/antwoord (6) [9]
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QUESTION/VRAAG 10

10.1

**NB: No construction/Geen konstruksie nie 0/6**

On AB, mark off AP = DE and on AC, mark off AQ = DF./Op AB, merk AP = DE of en op AC, merk AQ = DF af.

Draw/Trek PQ.

Proof/Bewys:

In $\triangle APQ$ and/en $\triangle DEF$

$$\hat{A} = \hat{D} \quad \text{given/gegee}$$

$$AQ = DF \quad \text{construction/konstruksie}$$

$$AP = DE \quad \text{construction/konstruksie}$$

$$\therefore \triangle APQ \equiv \triangle DEF \quad S\angle S$$

✓ construction/
konstruksie

$$\hat{A}PQ = \hat{D}$$

$$\hat{A}PQ = \hat{B} \quad [\hat{D} = \hat{B}]$$

$\therefore PQ \parallel BC$ corresponding angles are equal/ooreenk. hoeke is gelyk

✓ S ✓ R

✓ S

$$\frac{AB}{AP} = \frac{AC}{AQ} \quad \text{line } \parallel \text{ to one side of } \Delta/\text{lyn } \parallel \text{ aan een sy van } \Delta$$

✓ R

$$AP = DE \text{ and/en } AQ = DF$$

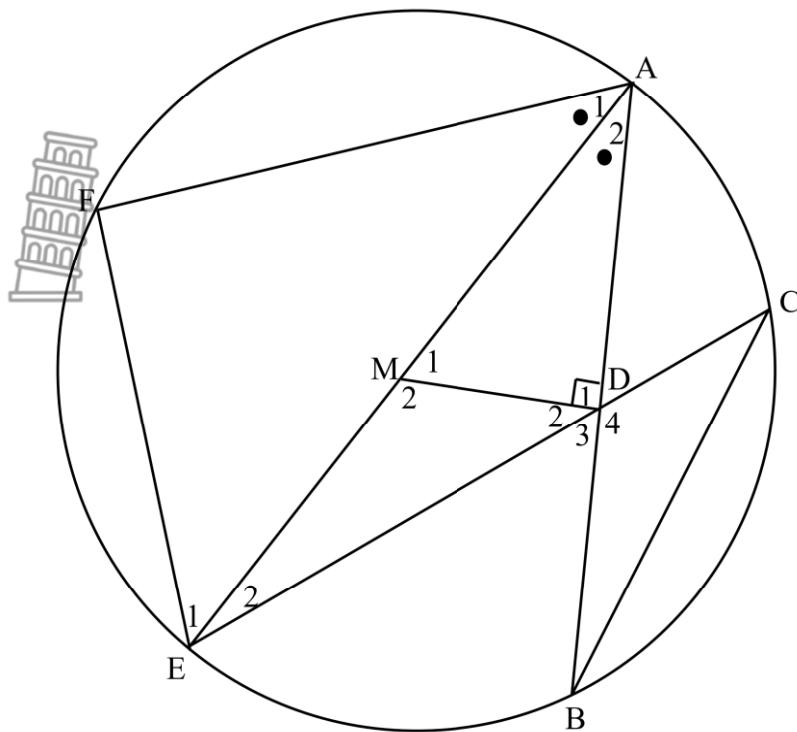
✓ S/R

$$\therefore \frac{AB}{DE} = \frac{AC}{DF}$$

(6)



10.2



10.2.1	$\hat{F} = 90^\circ$ In ΔAEF and/or ΔAMD $\hat{A}_1 = \hat{A}_2$ $\hat{F} = \hat{D}_1 = 90^\circ$ $\therefore \Delta AEF \parallel \Delta AMD$ OR/OF	\angle in semi-circle/halwe sirkel given/gegee proved/bewys $\angle\angle\angle$ OR/OF	$\checkmark S/R$ $\checkmark S$ $\checkmark S$ $\checkmark R$ (4)
	$\hat{F} = 90^\circ$ In ΔAEF and/or ΔAMD $\hat{A}_1 = \hat{A}_2$ $\hat{F} = \hat{D}_1 = 90^\circ$ $\hat{E}_1 = \hat{M}_1$ $\therefore \Delta AEF \parallel \Delta AMD$	\angle in semi-circle/halwe sirkel given/gegee proved/bewys sum of \angle 's in Δ /binne \angle e van Δ	$\checkmark S/R$ $\checkmark S$ $\checkmark S$ $\checkmark R$ (4)

10.2.2	$\frac{AF}{AD} = \frac{AE}{AM}$ but/maar $AE = 2AM$ $\frac{AF}{AD} = \frac{2AM}{AM} = 2$ 	$\Delta AEF \parallel\!\!\! \Delta AMD$ $\checkmark S/R$ $\checkmark S$ \checkmark answer/antwoord (3)
10.2.3	In ΔCDB and/en ΔADE  $\hat{C} = \hat{A}_2$ $\angle s$ in same segment/ $\angle e$ in dieselfde segment $\hat{D}_4 = \hat{E}\hat{A}$ vertically opposite \angle 's/regoorstaande $\angle e$ $\Delta CDB \parallel\!\!\! \Delta ADE$ $\therefore \frac{CD}{AD} = \frac{DB}{DE}$ but/maar $AD = DB$ $\frac{CD}{AD} = \frac{AD}{DE}$ $\therefore AD^2 = CD \times DE$	\checkmark identifying Δs / identifiseer Δe $\checkmark S/R$ $\checkmark S$ $\checkmark R$ $\checkmark S$ $\checkmark S/R$ (6)
	OR/OF In ΔCDB and/en ΔADE $\hat{C} = \hat{A}_2$ $\angle s$ in same segment/ $\angle e$ in dieselfde segment $\hat{D}_4 = \hat{E}\hat{A}$ vertically opposite \angle 's/regoorstaande $\angle e$ $\hat{B} = \hat{E}_2$ $\angle s$ in same segment/ $\angle e$ in dieselfde segment $\Delta CDB \parallel\!\!\! \Delta ADE$ $\therefore \frac{CD}{AD} = \frac{DB}{DE}$ but/maar $AD = DB$ $\frac{CD}{AD} = \frac{AD}{DE}$ $\therefore AD^2 = CD \times DE$ 	OR/OF \checkmark identifying Δs / identifiseer Δe $\checkmark S/R$ $\checkmark S$ $\checkmark R$ $\checkmark S$ $\checkmark S/R$

TOTAL/TOTAAL: 150