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basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/
NATIONAL SENIOR CERTIFICATE EXAMINATIONS

MATHEMATICS P2

MAY/JUNE 2023

MARKS: 150

TIME: 3 hours

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

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers 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.

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QUESTION 1

1.1 The owner of a small company wishes to establish whether advertising in a regional newspaper is effective. The table below shows the amount spent on advertising and the corresponding sales figures for the last 9 years.

Amount spent on advertising (in rands) (x)	21 300	23 700	24 800	30 540	24 100	40 680	22 400	35 250	29 110
Sales (in rands) (y)	311 500	326 700	349 200	470 000	316 100	564 200	314 000	487 300	392 900

1.1.1 Determine the equation of the least squares regression line for the data. (3)

1.1.2 Predict the sales for a year in which the company will spend R28 500 on advertising. (2)

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

1.1.4 Describe the association between the amount spent on advertising in the regional newspaper and the sales of this company. (1)

1.2 The profit that the small company made over the same 9 years is given in the table below.

Profit (in rands)	110 750	107 376	152 338	244 480	144 021	275 994	121 900	207 636	187 700

1.2.1 Calculate the mean profit made over the 9 years. (2)

1.2.2 Write down the standard deviation for the data. (1)

1.2.3 Determine the number of years in which the company made a profit that was greater than one standard deviation above the mean. (2)

[12]

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QUESTION 2

The ages of the people who attended a music concert was summarised in the table below.

AGE	NUMBER OF PEOPLE
$5 < x \leq 15$	20
$15 < x \leq 25$	25
$25 < x \leq 35$	60
$35 < x \leq 45$	90
$45 < x \leq 55$	55
$55 < x \leq 65$	40
$65 < x \leq 75$	30

2.1 Write down the modal class of the data. (1)

2.2 How many people attended the music concert? (1)

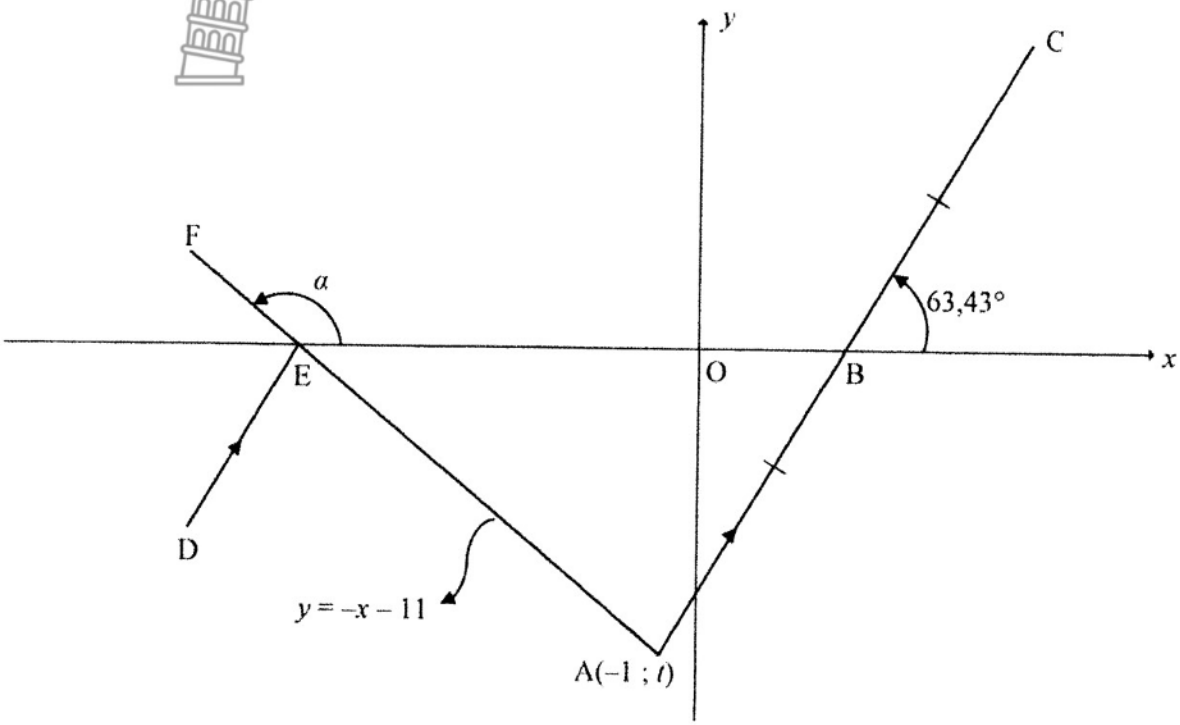
2.3 On the grid provided in the ANSWER BOOK, draw a cumulative frequency graph (ogive) to represent the above data. (4)

2.4 Use the cumulative frequency graph to determine the median age of the people who attended the music concert. (2)
[8]

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QUESTION 3

In the diagram, the equation of line AF is $y = -x - 11$. B, a point on the x-axis, is the midpoint of the straight line joining A$(-1 ; t)$ and C. The angles of inclination of AF and AC are α and 63,43° respectively. AF cuts the x-axis in E. D is a point such that DE ∥ AC.



3.1 Calculate the:

3.1.1 Value of t (2)

3.1.2 Size of α (2)

3.1.3 Gradient of AC, to the nearest whole number (2)

3.2 Determine the equation of AC in the form $y = mx + k$. (2)

3.3 Calculate the:

3.3.1 Coordinates of C (3)

3.3.2 Size of FÊD (3)

3.4 G is a point such that EAGC, in that order, is a parallelogram.

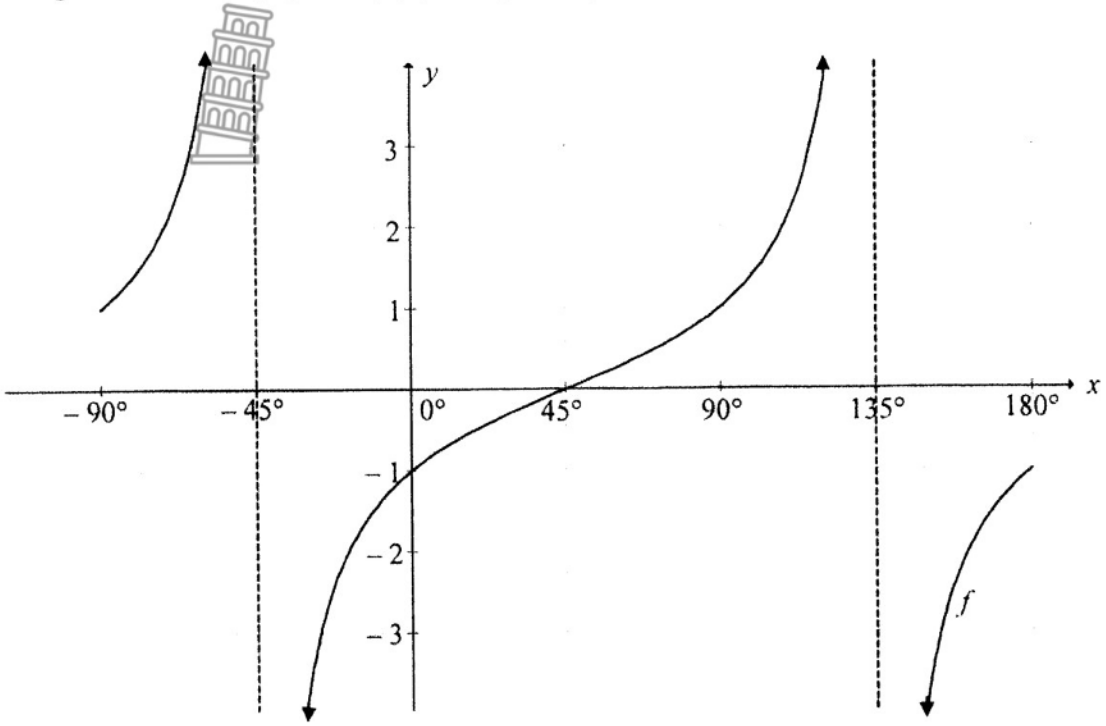
Determine the equation of a circle centred at G and passing through the point B.
Write your answer in the form $(x-a)^2 + (y-b)^2 = r^2$. (4)

[18]

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QUESTION 6

In the diagram below, the graph of $f(x) = \tan(x - 45°)$ is drawn for $x \in [-90° ; 180°]$.



6.1 Write down the period of f. (1)

6.2 Draw the graph of $g(x) = -\cos 2x$ for the interval $x \in [-90° ; 180°]$ on the grid given in the ANSWER BOOK. Show ALL intercepts with the axes, as well as the minimum and maximum points of the graph. (3)

6.3 Write down the range of g. (1)

6.4 The graph of g is shifted $45°$ to the left to form the graph of h. Determine the equation of h in its simplest form. (2)

6.5 Use the graph(s) to determine the values of x in the interval $x \in [-90° ; 90°]$ for which:

6.5.1 $f(x) > 1$ (2)

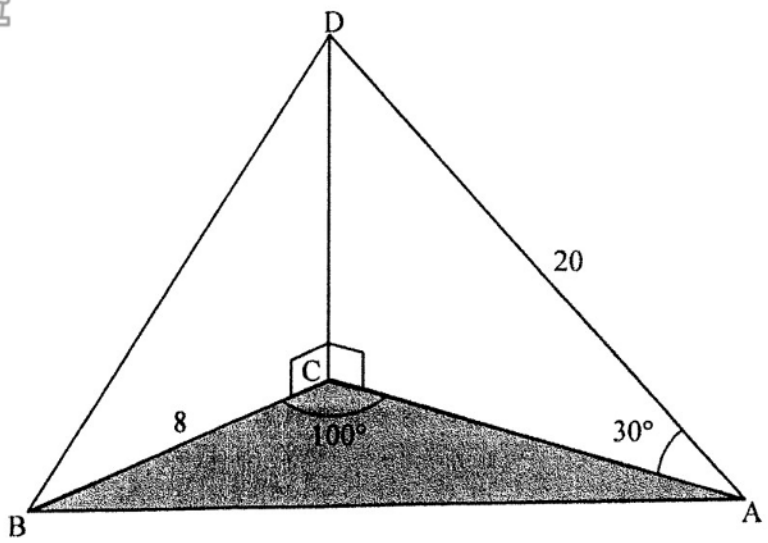
6.5.2 $2\cos 2x - 1 > 0$ (4)

[13]

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QUESTION 7

In the diagram, A, B and C are points in the same horizontal plane. D is a point directly above C, that is DC ⊥ AC and DC ⊥ BC. It is given that $A\hat{C}B=100°$, $C\hat{A}D=30°$, AD = 20 units and BC = 8 units.



7.1 Calculate the length of:

7.1.1 AC (2)

7.1.2 AB (3)

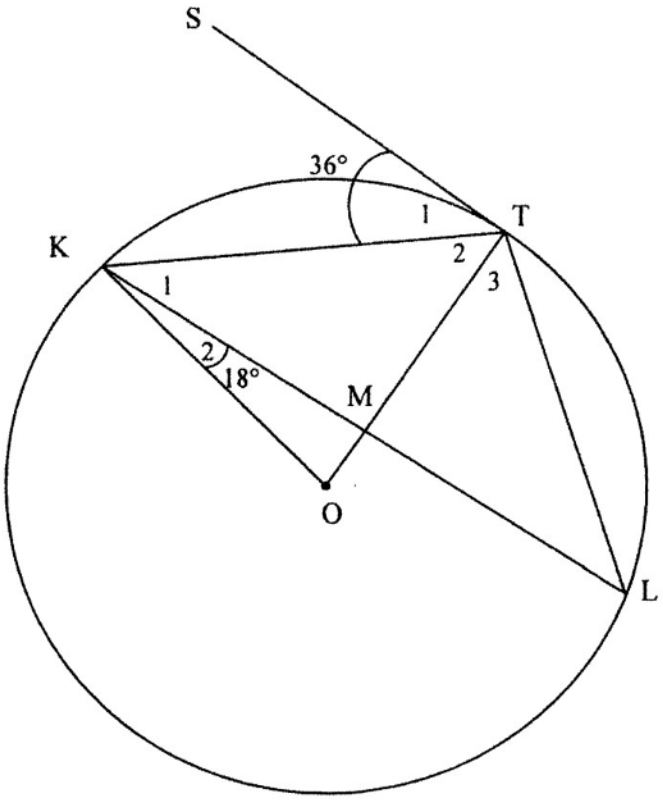
7.2 If it is further given that $A\hat{B}D = 73,4°$, calculate the size of $A\hat{D}B$. (3)

[8]

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QUESTION 8

8.1 In the diagram, O is the centre of the circle. K, T and L are points on the circle. KT, TL, KL, OK and OT are drawn. OT intersects KL at M. ST is a tangent to the circle at T. $S\hat{T}K = 36°$ and $O\hat{K}L = 18°$.



8.1.1 Determine, giving reasons, the size of:

(a) $\hat{T}_2$ (2)

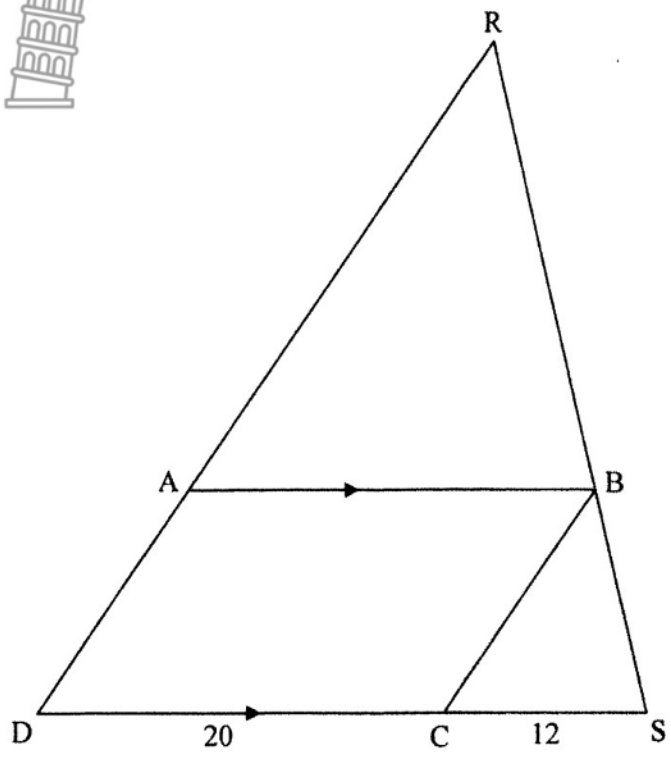
(b) $\hat{L}$ (2)

(c) $K\hat{O}T$ (2)

8.1.2 Prove, giving reasons, that KM = ML. (3)

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8.2 In the diagram, ΔRDS is drawn. A, B and C are points on RD, RS and DS respectively such that AB || DS and RB : BS = 5 : 3. DC = 20 units and CS = 12 units.



8.2.1 Prove, giving reasons, that BC || AD. (3)

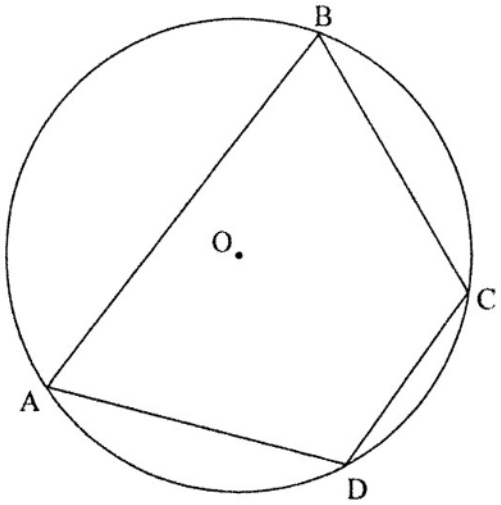
8.2.2 If it is further given that RD = 48 units, calculate, giving reasons, the value of the ratio AD : AB. (3)

[15]

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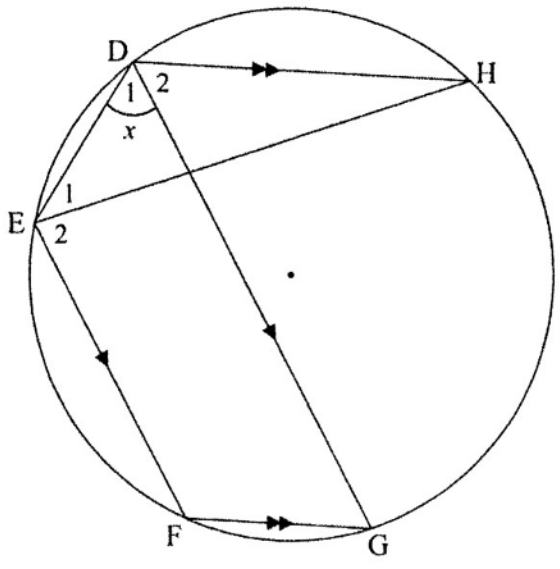
QUESTION 9

9.1 In the diagram, O is the centre of the circle. ABCD is a cyclic quadrilateral.



Use the diagram in the ANSWER BOOK to prove the theorem which states that the opposite angles of a cyclic quadrilateral are supplementary, that is prove that $\hat{B} + \hat{D} = 180°$. (5)

9.2 In the diagram, DEFG is a cyclic quadrilateral such that EF || DG. H is another point on the circle such that DH || FG. Chord EH is drawn. Let $\hat{D}_1 = x$.



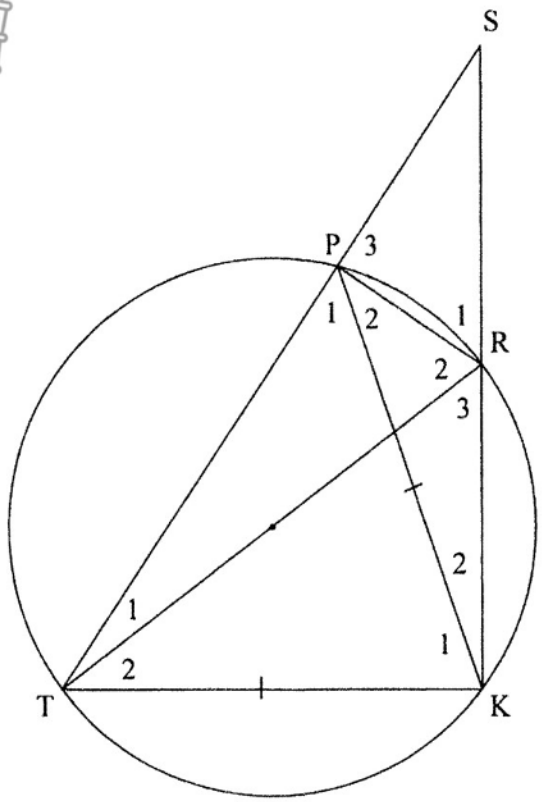
Prove, giving reasons, that $\hat{D}_1 = \hat{D}_2$. (4)

[9]

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QUESTION 10

In the diagram, TR is a diameter of the circle. PRKT is a cyclic quadrilateral. Chords TP and KR are produced to intersect at S. Chord PK is drawn such that PK = TK.



10.1 Prove, giving reasons, that:

10.1.1 SR is a diameter of a circle passing through points S, P and R (4)

10.1.2 $\hat{S} = \hat{P}_2$ (5)

10.1.3 $\Delta SPK \,|||\, \Delta PRK$ (3)

10.2 If it is further given that SR = RK, prove that $ST = \sqrt{6}RK$. (5)
[17]

TOTAL: 150

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INFORMATION SHEET

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

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

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

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

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

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

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

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

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

In ΔABC:

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

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

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

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

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

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

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

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

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

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Candidate Barcode label/Stafieskodeplakker

SC/NSC Answer Book
SS/NSS-antwoordeboek

Senior Certificate/National Senior Certificate/*Senior Sertifikaat/Nasionale Senior Sertifikaat* (Grade 12/*Graad 12*) 2023

CENTRE NUMBER / *SENTRUMNOMMER*	
EXAMINATION NUMBER / *EKSAMENNOMMER*	
DATE / *DATUM*	
BOOK NUMBER / *BOEKNOMMER*	OF / *VAN* ____ BOOKS / *BOEKE*
SUBJECT CODE / *VAKKODE*	
PAPER NUMBER / *VRAESTELNOMMER*	2
SUBJECT NAME / *VAKNAAM*	**MATHEMATICS/*WISKUNDE***

MARKER/*NASIENER*				MODERATOR'S INITIALS IN RELEVANT BLOCK / *MODERATOR SE VOORLETTERS IN RELEVANTE BLOKKIE*									
Question / *Vraag*	Marks / *Punte*	Marker's Code & Initials / *Nasiener se Kode & Voorletters*	Marks / *Punte*	SM	Marks / *Punte*	DCM / *AHN*	Marks / *Punte*	CM / *HN*	Marks / *Punte*	IM	Marks / *Punte*	EM
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
TOTAL / *TOTAAL*												

CONTROLLED AND CERTIFIED CORRECT (SURNAME AND INITIALS OF EA) / *GEKONTROLEER EN AS KORREK GESERTIFISEER (VAN EN VOORLETTERS VAN EA)*		READ INSTRUCTIONS ON THE NEXT PAGE / *LEES INSTRUKSIES OP VOLGENDE BLADSY*

This answer book consists of 24 pages./*Hierdie antwoordeboek bestaan uit 24 bladsye.*

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PLEASE FOLLOW THESE INSTRUCTIONS CAREFULLY	*VOLG ASSEBLIEF HIERDIE INSTRUKSIES NOUKEURIG*
1. Clearly write your examination number and centre number in the space provided and attach your barcode label in the space provided.	1. *Skryf jou eksamennommer en sentrumnommer duidelik in die ruimtes verskaf en plak jou stafieskodeplakker in die ruimte verskaf.*
2. Remember that your own name (or the name of your school) may not appear anywhere on or in this answer book.	2. *Onthou dat jou eie naam (of die naam van jou skool) nie op of in hierdie antwoordeboek mag voorkom nie.*
3. Answer ALL questions in the spaces provided.	3. *Beantwoord ALLE vrae in die ruimtes wat voorsien is.*
4. No pages may be torn from this answer book.	4. *Geen bladsye mag uit hierdie antwoordeboek geskeur word nie.*
5. Read the instructions printed on your timetable carefully as well as any other instructions which may be given in each examination paper.	5. *Lees die instruksies wat op jou eksamenrooster gedruk is, sorgvuldig deur, asook enige ander instruksies wat op elke eksamenvraestel gegee word.*
6. Candidates may not retain an answer book or remove it from the examination room.	6. *Geen antwoordeboek mag deur die kandidaat behou of uit die eksamenlokaal verwyder word nie.*
7. Answers must be written in black/blue ink as distinctly as possible. Do not write in the margins.	7. *Skryf die antwoorde so duidelik moontlik met swart/blou ink. Laat die kantlyne oop.*
8. Write the numbers of the questions you have answered on the front cover of the answer book where marks are to be recorded.	8. *Skryf die nommers van die vrae wat jy beantwoord het op die voorblad van die antwoordeboek waar die punte aangebring word.*
9. If you require additional space for your answers: 9.1 Use the additional space provided at the end of the answer book. 9.2 When answering a question in the additional space, indicate clearly the question number in the column on the LHS. 9.3 Rule off after each answer.	9. *In geval jy bykomende ruimte benodig vir jou antwoorde:* *9.1 Gebruik die bykomende ruimte wat aan die einde van die antwoordeboek voorsien word.* *9.2 As 'n vraag in die bykomende ruimte beantwoord word, dui duidelik die vraagnommer in die kolom aan die LK aan.* *9.3 Trek 'n lyn na elke antwoord.*
10. Draw a neat line through any work/rough work that must not be marked.	10. *Trek 'n netjiese lyn deur enige werk/rofwerk wat nie nagesien moet word nie.*

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QUESTION/*VRAAG* 1

1.1

Amount spent on advertising (in rands)/ ***Bedrag aan advertensies spandeer (in rand)*** **(*x*)**	21 300	23 700	24 800	30 540	24 100	40 680	22 400	35 250	29 110
Sales (in rands)/ ***Verkope (in rand)*** **(*y*)**	311 500	326 700	349 200	470 000	316 100	564 200	314 000	487 300	392 900

	Solution/*Oplossing*	**Marks** ***Punte***
1.1.1		(3)
1.1.2		(2)
1.1.3		(1)
1.1.4		(1)

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1.2

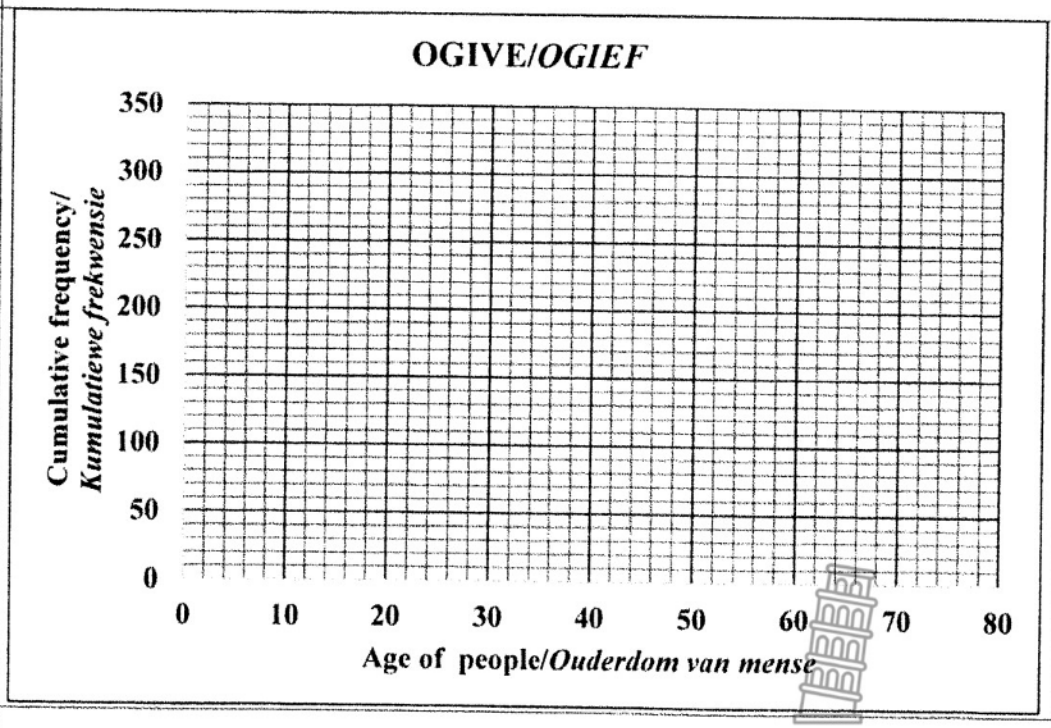
Profit (in rands)/ *Wins (in rand)*	110 750	107 376	152 338	244 480	144 021	275 994	121 900	207 636	187 700

	Solution/*Oplossing*	**Marks *Punte***
1.2.1		(2)
1.2.2		(1)
1.2.3		(2)
		[12]

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QUESTION/*VRAAG* 2

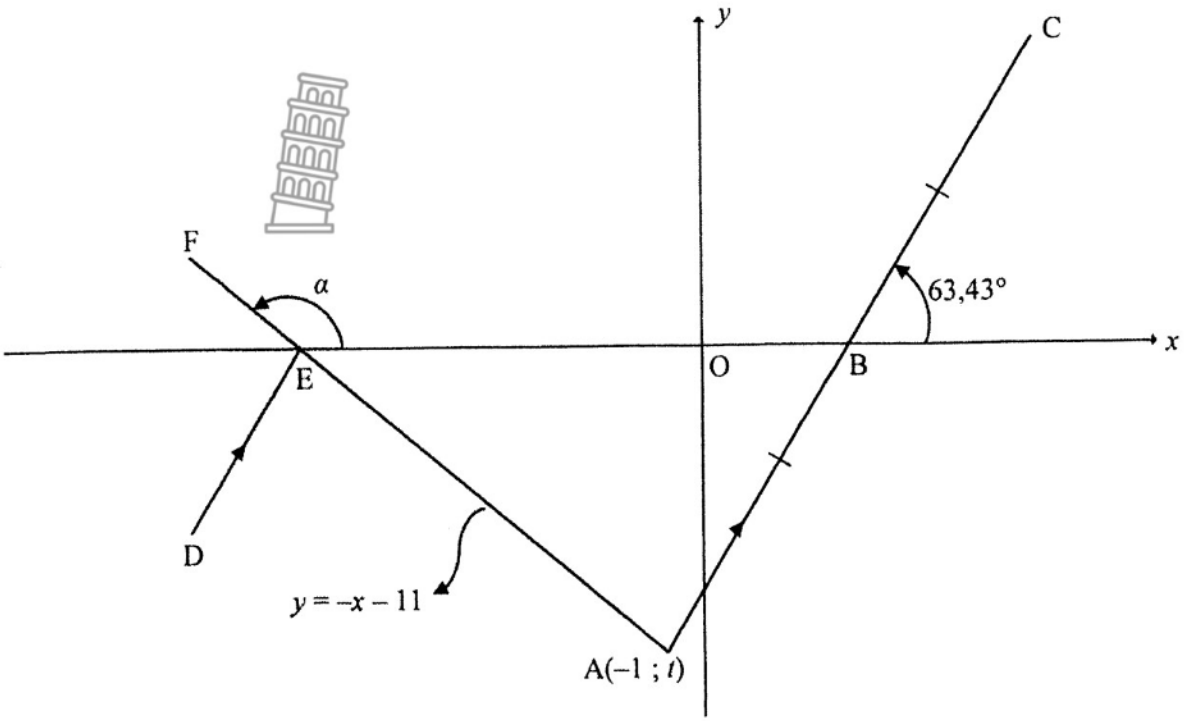
AGE/*OUDERDOM*	NUMBER OF PEOPLE/ *GETAL MENSE*
$5 < x \leq 15$	20
$15 < x \leq 25$	25
$25 < x \leq 35$	60
$35 < x \leq 45$	90
$45 < x \leq 55$	55
$55 < x \leq 65$	40
$65 < x \leq 75$	30

	Solution/*Oplossing*	Marks *Punte*
2.1		(1)
2.2		(1)
2.3	**OGIVE/*OGIEF*** 	(4)
2.4		(2)
		[8]

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QUESTION/*VRAAG* 3



	Solution/*Oplossing*	**Marks** ***Punte***
3.1.1		(2)
3.1.2		(2)
3.1.3		(2)
3.2		(2)

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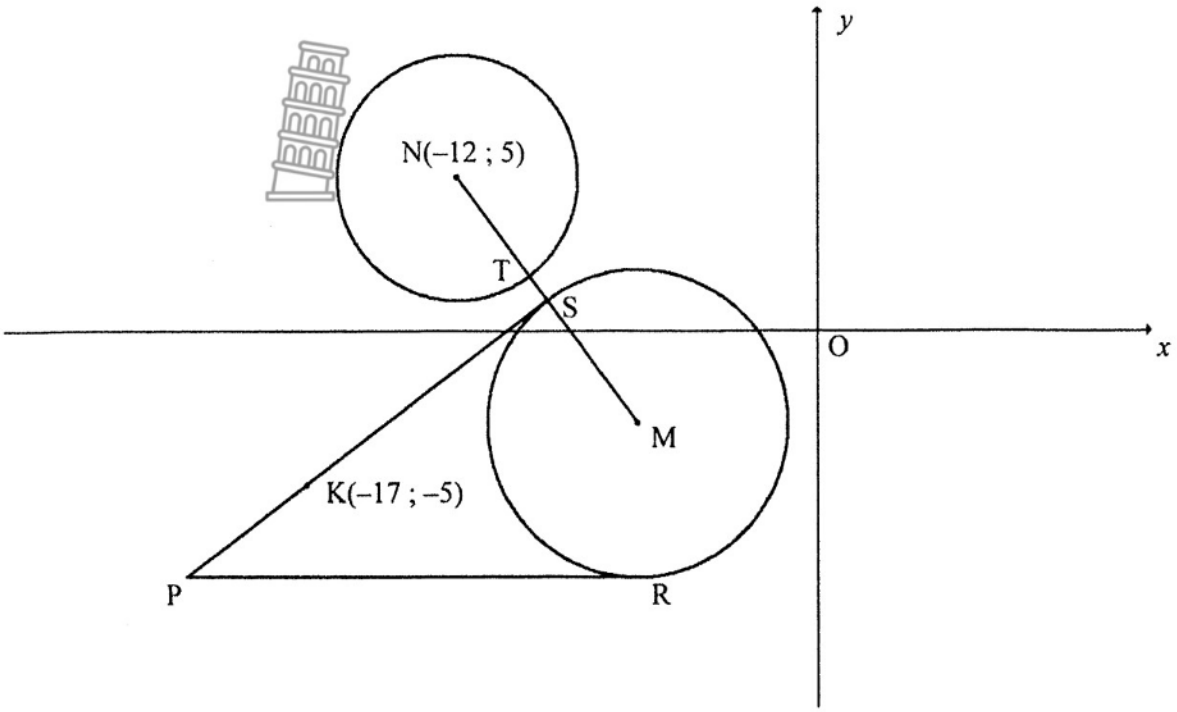
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	Solution/*Oplossing*	Marks *Punte*
3.3.1		(3)
3.3.2		(3)
3.4		(4)
		[18]

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QUESTION/*VRAAG* 4



	Solution/*Oplossing*	**Marks** ***Punte***
4.1		(2)
4.2.1		(2)
4.2.2		(4)

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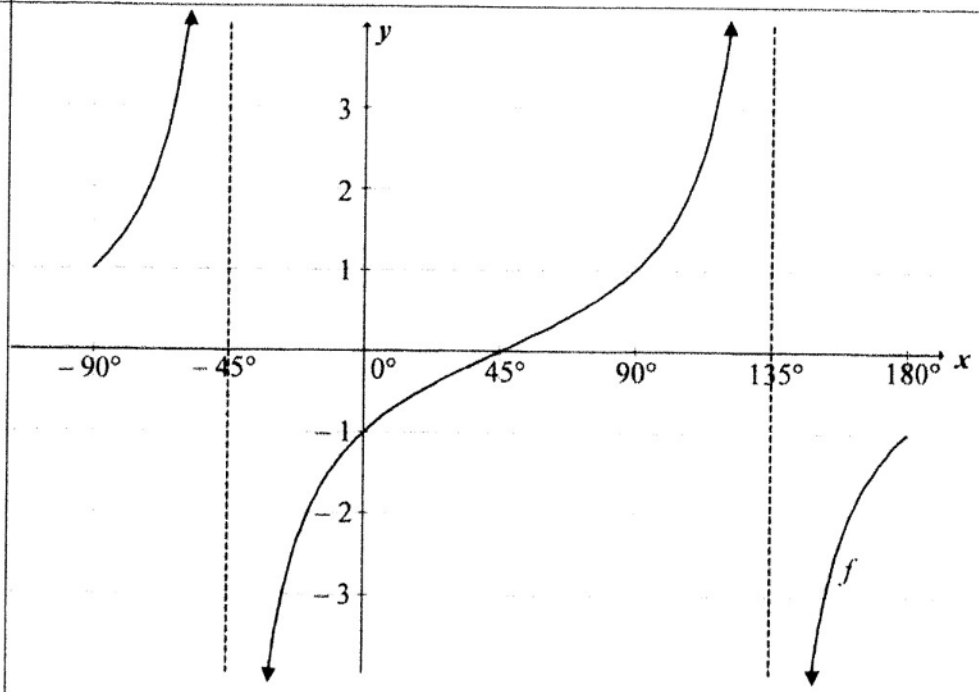
	Solution/*Oplossing*	Marks *Punte*
4.3.1		(2)
4.3.2		(5)
4.4.1		(5)
4.4.2		(2)
		[22]

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	Solution/*Oplossing*	Marks *Punte*
5.5.1		(4)
5.5.2		(3)
		[28]

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QUESTION/*VRAAG* 6

	Solution/*Oplossing*	Marks *Punte*
6.1		(1)
6.2		(3)
6.3		(1)
6.4		(2)
6.5.1		(2)

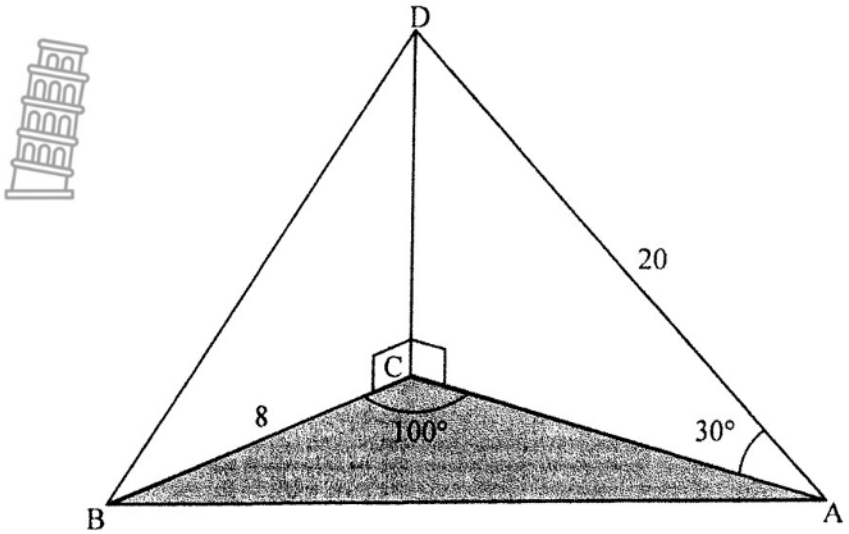
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	Solution/*Oplossing*	Marks *Punte*
6.5.2		(4)
		[13]



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QUESTION/*VRAAG* 7



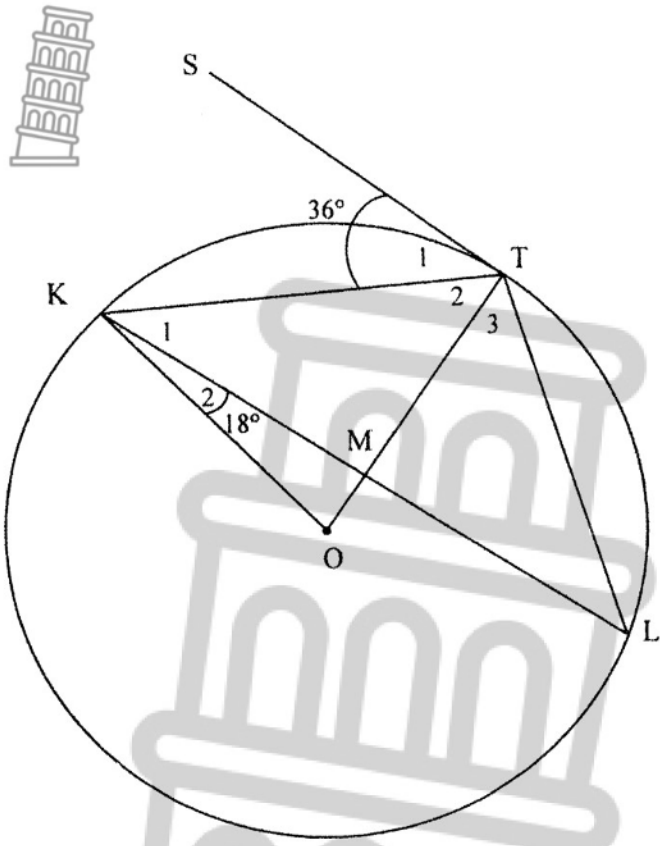
	Solution/*Oplossing*	**Marks** ***Punte***
7.1.1		(2)
7.1.2		(3)
7.2		(3)
		[8]

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Give reasons for your statements in QUESTIONS 8, 9 and 10.
Gee redes vir jou bewerings in VRAAG 8, 9 en 10.

QUESTION/*VRAAG* 8

8.1

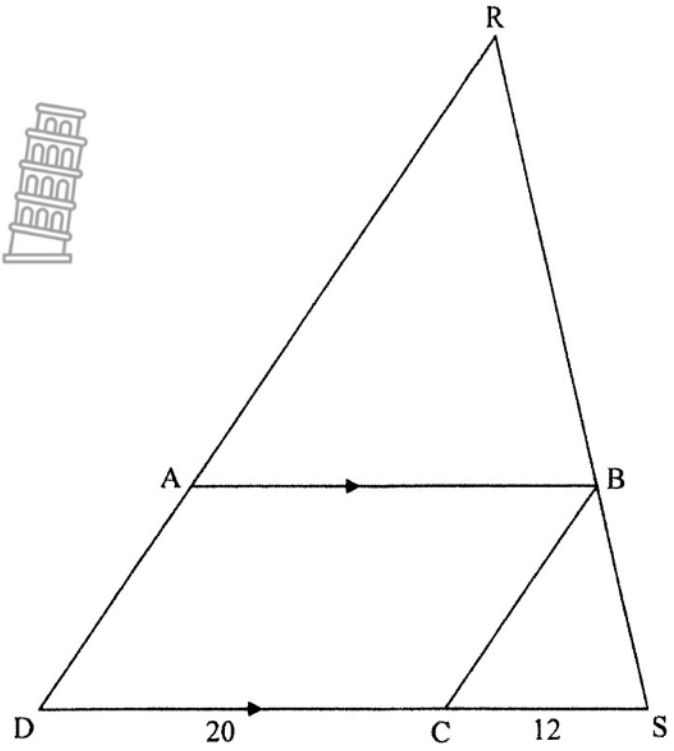


	Solution/*Oplossing*	**Marks** ***Punte***
8.1.1(a)		(2)
8.1.1(b)		(2)
8.1.1(c)		(2)
8.1.2		(3)

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8.2



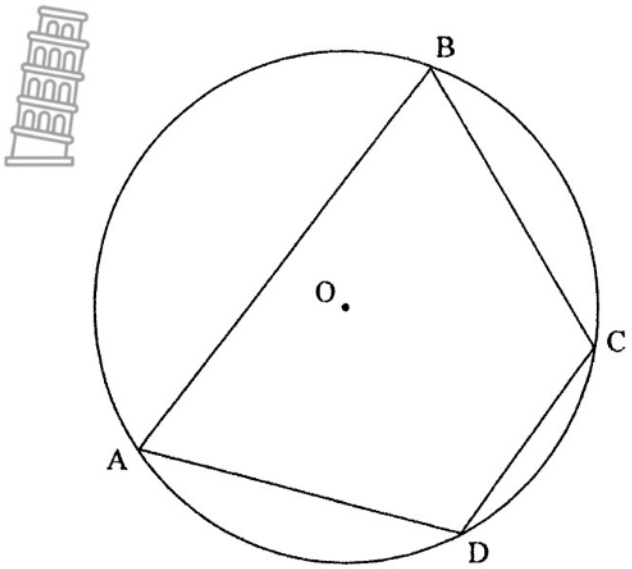
	Solution/*Oplossing*	Marks *Punte*
8.2.1		(3)
8.2.2		(3)
		[15]

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QUESTION/*VRAAG* 9

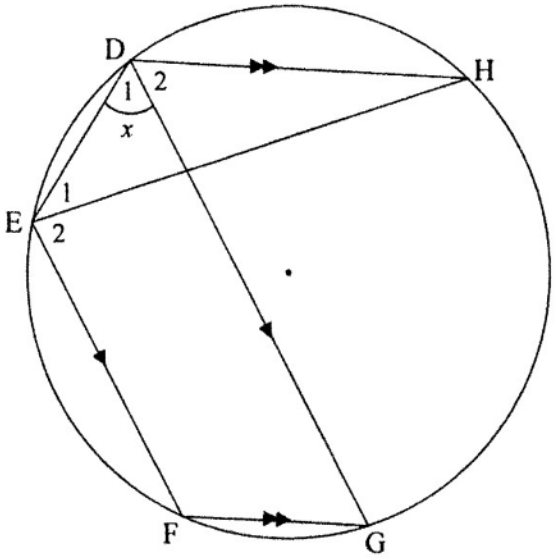
9.1



	Solution/*Oplossing*	**Marks** ***Punte***
		(5)

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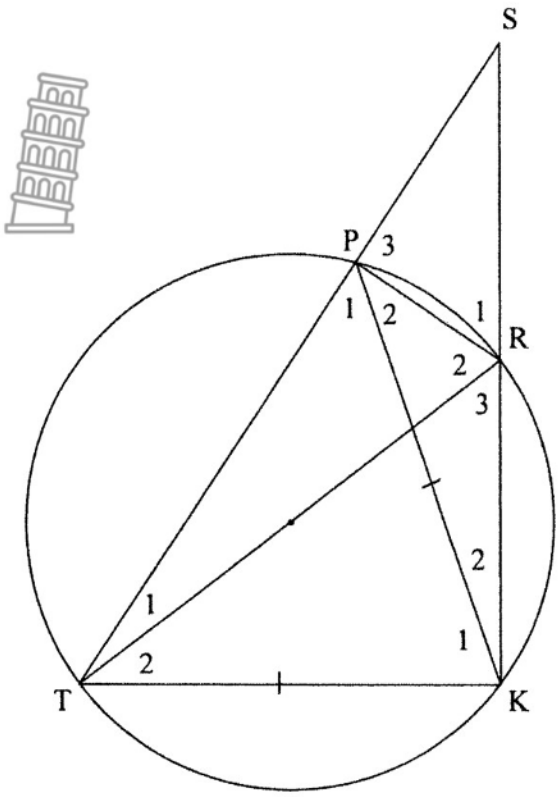
9.2



	Solution/*Oplossing*	Marks *Punte*
		(4)
		[9]

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QUESTION/*VRAAG* 10



	Solution/*Oplossing*	**Marks** ***Punte***
10.1.1		(4)
10.1.2		(5)

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	Solution/*Oplossing*	Marks *Punte*
10.1.3		(3)
10.2		(5)
		[17]

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	Additional space/*Bykomende ruimte*	Marks *Punte*
	 	

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TOTAL/*TOTAAL*: 150

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MATHEMATICS P2/*WISKUNDE V2*

MARKING GUIDELINES/*NASIENRIGLYNE*

MAY/JUNE/*MEI/JUNIE* 2023

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MARKS: 150
PUNTE: 150

These marking guidelines consist of 21 pages./
Hierdie nasienriglyne bestaan uit 21 bladsye.

Prof Rajendran Govender
Approved by Umalusi External Moderator on 15 May 2023

Approved
2023-05-15

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NOTE:

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

LET WEL:

- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, 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 • *MEETKUNDE*	
S	**A mark for a correct statement** ***(A statement mark is independent of a reason)***
	'n Punt vir 'n korrekte bewering ***('n Punt vir 'n bewering is onafhanklik van die rede)***
R	**A mark for the correct reason** ***(A reason mark may only be awarded if the statement is correct)***
	'n Punt vir 'n korrekte rede ***('n Punt word slegs vir die rede toegeken as die bewering korrek is)***
S/R	**Award a mark if statement AND reason are both correct**
	Ken 'n punt toe as die bewering EN rede beide korrek is



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QUESTION/*VRAAG 1*

1.1.1	$a = 1730{,}22$ $b = 13{,}96$ $\hat{y} = 1730{,}22 + 13{,}96x$	✓ $a = 1730{,}22$ ✓ $b = 13{,}96$ ✓ equation (3)
1.1.2	$\hat{y} = 1730{,}22 + 13{,}96x$ $\hat{y} = 1730{,}22 + 13{,}96(28500)$ $\hat{y} = \text{R}399\,590{,}22$ **OR/*OF*** $\hat{y} =$ R399 599,64 (calc)	✓ substitution ✓ answer (2) ✓✓ answer (2)
1.1.3	$r = 0{,}98002\ldots$ $r = 0{,}98$	✓ answer (1)
1.1.4	There is a very strong positive correlation between the amount spent on advertising and sales. / *Daar is 'n baie sterk positiewe korrelasie tussen die bedrag spandeer op advertensie en die verkope.*	✓ strong positive / *sterk positief* (1)
1.2.1	$\bar{x} = \frac{1\,552195}{9}$ $\bar{x} = 172466{,}11$	✓ $\bar{x} = \frac{1\,552195}{9}$ ✓ answer (2)
1.2.2	$\sigma = 56950{,}09$	✓ answer (1)
1.2.3	$\bar{x} + \sigma$ $= 172466{,}11 + 56950{,}09$ $= 229416{,}20$ 2 years/*jaar*	✓ $\bar{x} + \sigma$ ✓ answer (2)
		[12]

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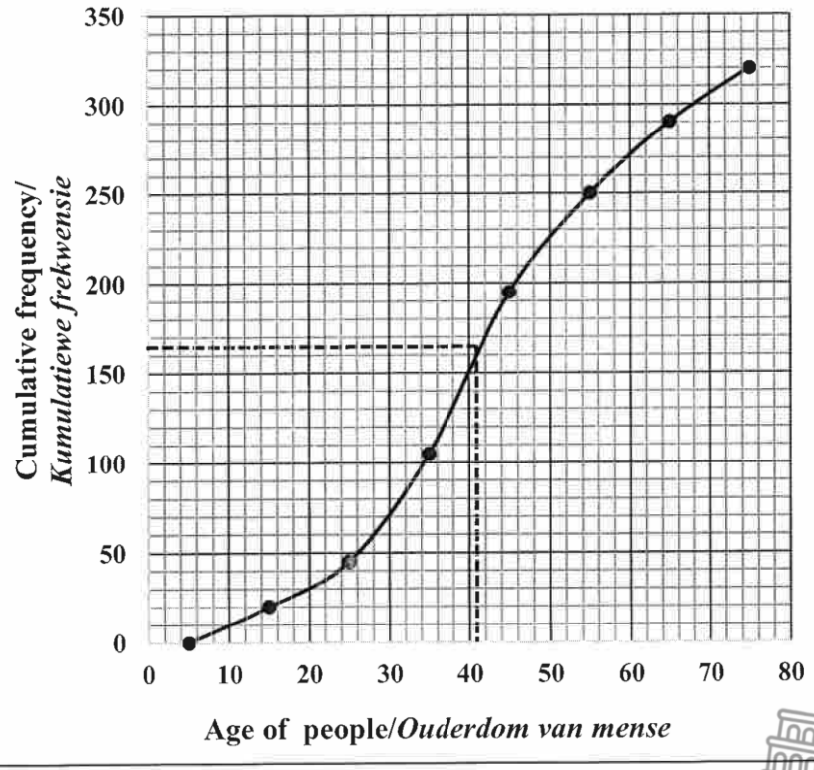
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QUESTION/*VRAAG 2*

2.1	$35 < x \leq 45$	✓ answer (1)
2.2	320 people/*mense*	✓ answer (1)
2.3		

AGE	NUMBER OF PEOPLE	CUMULATIVE FREQUENCY
$5 < x \leq 15$	20	20
$15 < x \leq 25$	25	45
$25 < x \leq 35$	60	105
$35 < x \leq 45$	90	195
$45 < x \leq 55$	55	250
$55 < x \leq 65$	40	290
$65 < x \leq 75$	30	320

OGIVE/*OGIEF*



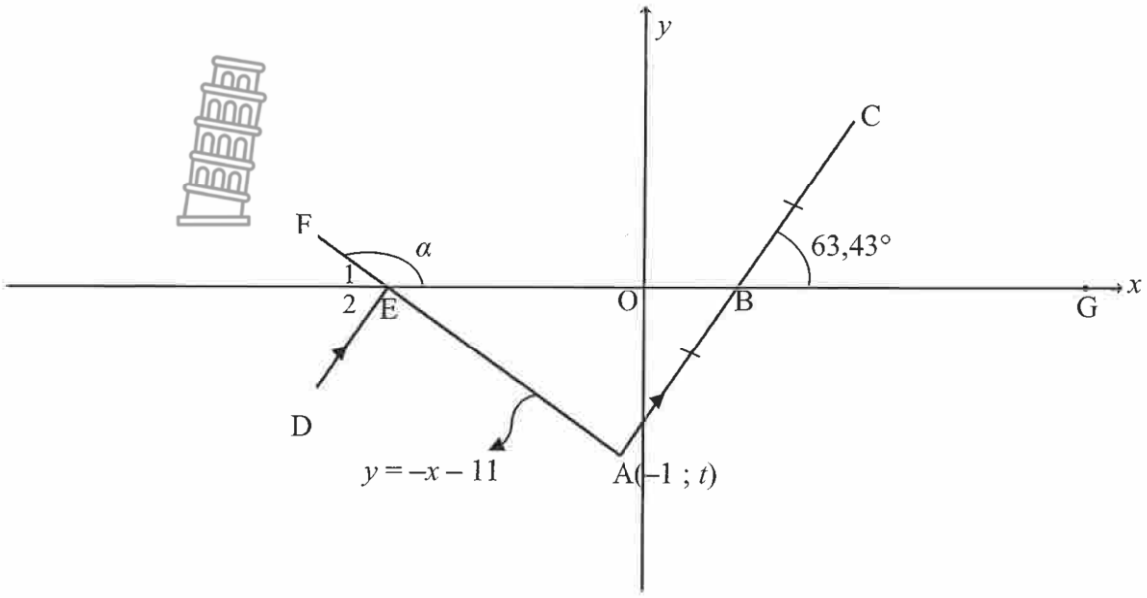
✓ cumulative frequency
✓ grounding
✓ plotting at upper limit
✓ shape (4)

2.4	Median = 41	✓✓ answer (2)
		[8]

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QUESTION/*VRAAG 3*



3.1.1	$y=-x-11$ A$(-1\ ;\ t)$ $t=-(-1)-11$ $t=-10$	✓ substitution ✓ value of t (2)
3.1.2	$\tan\alpha=-1$ $ref.\angle=45°$ $\therefore\alpha=135°$	✓ $\tan\alpha=-1$ ✓ 135° (2)
3.1.3	$\tan 63{,}43°=m_{AC}$ $m_{AC}=2$	✓ $\tan 63{,}43°=m_{AC}$ ✓ answer (2)
3.2	$m_{AC}=2$ A$(-1\ ;-10)$ $y=2x+k$ $-10=2(-1)+k$ $k=-8$ $y=2x-8$ **OR/*OF*** $y-y_1=2(x-x_1)$ $y-(-10)=2(x-(-1))$ $y=2x-8$	✓ substitution of m and A ✓ equation (2)

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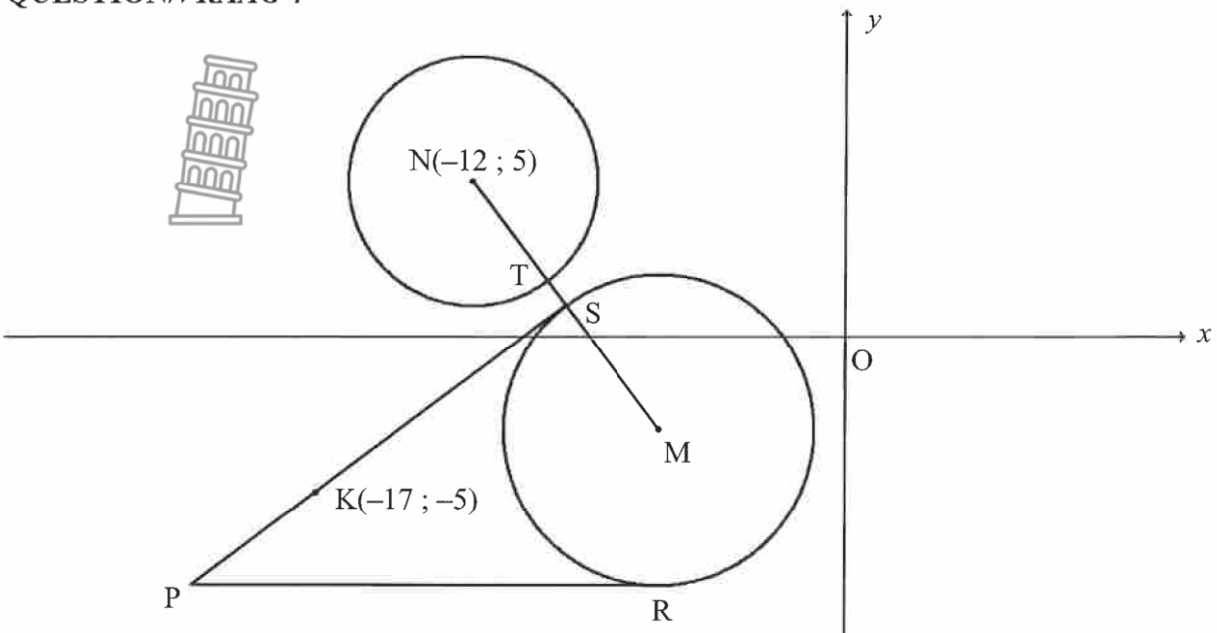
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3.3.1	$y=2x-8$ $0=2x-8$ $x_B=4$ $\frac{x_C+(-1)}{2}=4$ $\qquad$ $\frac{y_C+(-10)}{2}=0$ $x_C=9$ $\qquad$ $y_C=10$ **OR/*OF*** by translation / *met translasie* $A\rightarrow B\ (x;y)\rightarrow(x+5;y+10)$ $B\rightarrow C\ (4;0)\rightarrow(4+5;\ 0+10)=(9\ ;10)$	✓ $x_B=4$ ✓ $x_C=9$ ✓ $y_C=10$ (3) ✓ $(x+5;y+10)$ ✓ $x_C=9$ ✓ $y_C=10$ (3)
3.3.2	$A\hat{B}E=63,43°$ [vert. opp ∠'s =] $\hat{E}_2=63,43°$ [corres. ∠'s, DE ‖ AB] $\hat{E}_1=45°$ [∠s on a str line] $F\hat{E}D=108,43°$ **OR/*OF*** $E\hat{A}B=135°-63,43°$ $E\hat{A}B=71,57°$ $D\hat{E}A=E\hat{A}B=71,57°$ $F\hat{E}D=108,43°$ **OR/*OF*** $A\hat{B}E=63,43°$ [vert. opp ∠'s] $D\hat{E}O=116,57°$ [co-int. ∠'s, DE ‖ AB] $F\hat{E}D=360°-(116,57°+135°)$ $=108,43°$	✓ $A\hat{B}E=63,43°$ ✓ $\hat{E}_1=45°$ ✓ $F\hat{E}D=108,43°$ (3) ✓ $E\hat{A}B=71,57°$ ✓ $D\hat{E}A=E\hat{A}B=71,57°$ ✓ $F\hat{E}D=108,43°$ (3) ✓ $A\hat{B}E=63,43°$ ✓ $D\hat{E}O=116,57°$ ✓ $F\hat{E}D=108,43°$ (3)
3.4	$y=0$ $x_E=-11$ $\frac{x_G+(-11)}{2}=4$ $x_G=19$ $(x-19)^2+y^2=15^2$ $(x-19)^2+y^2=225$	✓ $x_E=-11$ ✓ $x_G=19$ ✓ $(x-19)^2+y^2$ ✓ 225 (4)
		[18]

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QUESTION/*VRAAG 4*



4.1	$M(-6;-3)$	✓ –6 ✓ –3 (2)
4.2.1	$x^2+y^2+24x-10y+153=0$ $(x+12)^2+(y-5)^2=-153+144+25$ $(x+12)^2+(y-5)^2=16$ $r^2=16$ $r=4$ units	✓ $r^2=-153+144+25$ ✓ length of radius (2)
4.2.2	$NM=\sqrt{(-12-(-6))^2+(5-(-3))^2}$ NM = 10 units SM = 5 units $\therefore$ TS = 10 – 5 – 4 = 1 unit	✓ substitution into distance formula ✓ NM = 10 units ✓ SM = 5 units ✓ answer (4)
4.3.1	R(–6 ; –8) $y=-8$	✓ $y_R=-8$ ✓ equation (2)

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4.3.2	$m_{NM} = \frac{5-(-3)}{-12-(-6)}$ $m_{NM} = -\frac{4}{3}$ $m_{tangent} = \frac{3}{4}$ $-5 = \frac{3}{4}(-17) + c$ **OR/*OF*** $y - y_1 = \frac{3}{4}(x - x_1)$ $c = \frac{31}{4}$ $y-(-5) = \frac{3}{4}(x-(-17))$ $y = \frac{3}{4}x + \frac{31}{4}$ $y = \frac{3}{4}x + \frac{31}{4}$ **OR/OF** NS = SM = 5 $S\left(\frac{-12-6}{2}; \frac{5-3}{2}\right)$ S (– 9 ; 1) $m_{SK} = \frac{1-(-5)}{-9+17}$ $= \frac{6}{8} = \frac{3}{4}$ $y+5 = \frac{3}{4}(x+17)$ $y = \frac{3}{4}x + \frac{31}{4}$ *or* $y = \frac{3}{4}x + 7\frac{3}{4}$	✓ substitution ✓ $m_{NM} = -\frac{4}{3}$ ✓ $m_{tangent} = \frac{3}{4}$ ✓ substitution of *m* and N ✓ equation (5) ✓ S midpoint ✓ coordinates of S ✓ $m_{tangent} = \frac{3}{4}$ ✓ substitution of *m* and K(–17 ; –5) or S ✓ equation (5)
4.4.1	$-8 = \frac{3}{4}x + \frac{31}{4}$ $-32 = 3x + 31$ $3x = -63$ $x = -21$ P(–21 ; –8) R(–6 ; –8) PR = PS = 15 units [tangents from same point] MS = MR = 5 units Perimeter PSMR = 15 + 15 + 5 + 5 = 40 units	✓ $-8 = \frac{3}{4}x + \frac{31}{4}$ ✓ $x = -21$ ✓ PR = PS = 15 units ✓ MS = MR = 5 units ✓ answer (5)

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4.4.2	$\frac{\text{area of } \Delta NPS}{\text{area of quadrilateral PSMR}}$ $\frac{\frac{1}{2}NS.SP}{\frac{1}{2}SP.MS+\frac{1}{2}MR.PR}$ $=\frac{\frac{1}{2}(5)(15)}{2\left(\frac{1}{2}\right)(5)(15)}$ $=\frac{1}{2}$ **OR** $\Delta NPS \equiv \Delta SPM \equiv \Delta MPR$ $\frac{\text{area of } \Delta NPS}{\text{area of quadrilateral PSMR}}$ $=\frac{1}{2}$	✓ substitution ✓ answer (2) ✓ congruent ✓ answer (2)
		[22]

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QUESTION/*VRAAG 5*

5.1	$\dfrac{1-\sin(-\theta)\cos(90°+\theta)}{\cos(\theta-360°)}$ $=\dfrac{1-(-\sin\theta)(-\sin\theta)}{\cos\theta}$ $=\dfrac{1-\sin^2\theta}{\cos\theta}$ $=\dfrac{\cos^2\theta}{\cos\theta}$ $=\cos\theta$	✓ $-\sin\theta$ ✓ $-\sin\theta$ ✓ $\cos\theta$ ✓ $\cos^2\theta$ ✓ answer (5)
5.2.1	$\cos200°$ $=-\cos20°$ $=-p$	✓ reduction ✓ answer (2)
5.2.2	$\sin(-70°)$ $=-\sin70°$ $=-\cos20°$ $=-p$ **OR/*OF*** $\sin(-70°)$ $=-\sin70°$ $=-p$	✓ reduction ✓ answer (2) ✓ reduction ✓ answer (2)
5.2.3	$\sin10°$ $\cos(2(10°))=1-2\sin^2 10°$ $2\sin^2 10°=1-\cos20°$ $\sin10°=\sqrt{\dfrac{1-\cos20°}{2}}$ $\sin10°=\sqrt{\dfrac{1-p}{2}}$ **OR/*OF*** $\sin10°$ $\sin(30°-20°)$ $=\sin30°\cos20°-\cos30°\sin20°$ $=\dfrac{1}{2}p-\dfrac{\sqrt{3}}{2}\sqrt{1-p^2}=\dfrac{p-\sqrt{3}\sqrt{1-p^2}}{2}$	✓ double angle ✓ $\sin10°$ as subject ✓ answer (3) ✓ using special angle ✓ expanding ✓ answer (3)

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	OR/*OF* $\sin 10°$ $\sin(70°-60°)$ $=\sin 70°\cos 60°-\cos 70°\sin 60°$ $=p.\frac{1}{2}-\sqrt{1-p^2}\times\frac{\sqrt{3}}{2}=\frac{p-\sqrt{3}\sqrt{1-p^2}}{2}$ **OR/*OF*** $\sin 10°$ $=\cos 80°$ $\cos(60°+20°)$ $=\cos 60°\cos 20°-\sin 60°\sin 20°$ $=\frac{1}{2}p-\frac{\sqrt{3}}{2}.\sqrt{1-p^2}$	✓ using special angle ✓ expanding ✓ answer (3) ✓ using special angle ✓ expanding ✓ answer (3)
5.3	$\cos(A+55°)\cos(A+10°)+\sin(A+55°)\sin(A+10°)$ $=\cos[A+55°-(A+10°)]$ $=\cos 45°$ $=\frac{1}{\sqrt{2}}$ or $\frac{\sqrt{2}}{2}$	✓✓ compound identity ✓ answer (3)
5.4.1	LHS $=\frac{\cos 2x+\sin 2x-\cos^2 x}{\sin x-2\cos x}$ RHS $=-\sin x$ $=\frac{\cos^2 x-\sin^2 x+2\sin x\cos x-\cos^2 x}{\sin x-2\cos x}$ $=\frac{-\sin^2 x+2\sin x\cos x}{\sin x-2\cos x}$ $=\frac{-\sin x(\sin x-2\cos x)}{\sin x-2\cos x}$ $=-\sin x$ $\therefore$ LHS = RHS	✓ $\cos^2 x-\sin^2 x$ ✓ $2\sin x\cos x$ ✓ common factor of $-\sin x$ (3)
5.4.2	$\frac{\cos 2x+\sin 2x-\cos^2 x}{-3\sin^2 x+6\sin x\cos x}$ $=\frac{\cos 2x+\sin 2x-\cos^2 x}{-3\sin x(\sin x-2\cos x)}$ $=\frac{\cos 2x+\sin 2x-\cos^2 x}{(\sin x-2\cos x)}\times\frac{1}{-3\sin x}$ $=(-\sin x)\times\frac{1}{-3\sin x}$ $=\frac{1}{3}$	✓ common factor of $-3\sin x$ ✓ substitution ✓ answer (3)

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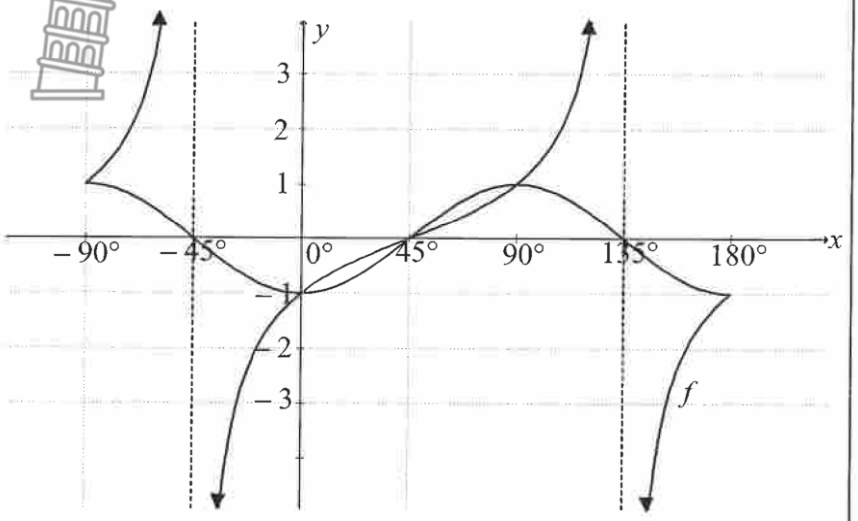
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5.5.1	$3\tan 4x = -2\cos 4x$ $3\left(\frac{\sin 4x}{\cos 4x}\right) = -2\cos 4x$ $3\sin 4x + 2\cos^2 4x = 0$ $3\sin 4x + 2(1-\sin^2 4x) = 0$ $-2\sin^2 4x + 3\sin 4x + 2 = 0$ $2\sin^2 4x - 3\sin 4x - 2 = 0$ $(2\sin 4x + 1)(\sin 4x - 2) = 0$ $\sin 4x = -\frac{1}{2}$ or $\sin 4x \neq 2$	✓ identity ✓ $1-\sin^2 4x$ ✓ standard form ✓ factors (4)
5.5.2	$\sin 4x = -\frac{1}{2}$ *ref.* $\angle = 30°$ $4x = 210° + k.360°$ or $4x = 330° + k.360°$ $x = 52{,}5° + k.90°$; $k \in Z$ $x = 82{,}5° + k.90°$; $k \in Z$	✓ 210° ; 330° ✓ 52,5° ; 82,5° ✓ $k.90°$; $k \in Z$ (3)
		[28]

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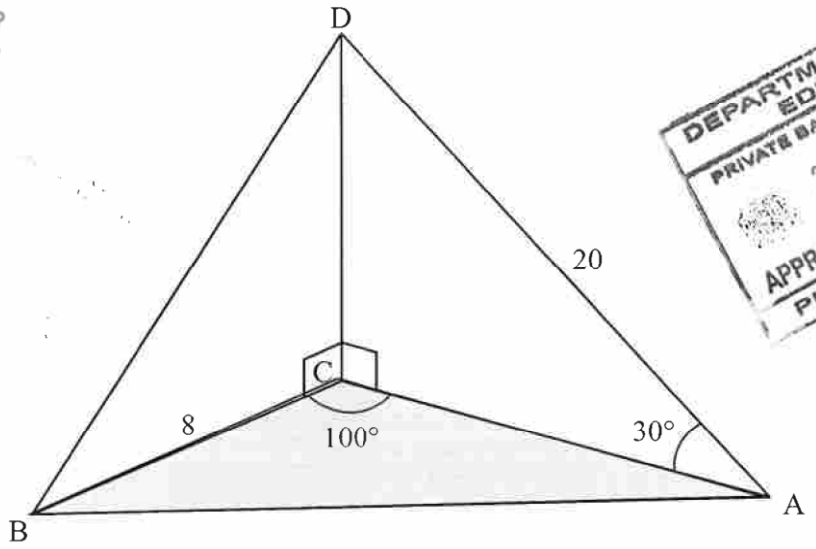
QUESTION/VRAAG 6

6.1	Period = 180°	✓ answer (1)
6.2		✓ x-intercepts ✓ turning points ✓ end points (3)
6.3	$y \in [-1;1]$ **OR/*OF*** $-1 \le y \le 1$	✓ answer (1)
6.4	$g(x) = -\cos 2x$ $g(x+45°) = -\cos 2(x+45°)$ $= -\cos(2x+90°)$ $= \sin 2x$	✓ $-\cos 2(x+45°)$ ✓ answer (2)
6.5.1	$x \in (-90°;-45°)$ **OR/*OF*** $-90° < x < -45°$	✓✓ $x \in (-90°;-45°)$ (2)
6.5.2	$2\cos 2x - 1 > 0$ $\cos 2x > \frac{1}{2}$ $-\cos 2x < -\frac{1}{2}$ $x \in (-30°;30°)$ **OR/*OF*** $-30° < x < 30°$	✓ $\cos 2x > \frac{1}{2}$ ✓ $-\cos 2x < -\frac{1}{2}$ ✓ $x = \pm 30°$ ✓ interval (4)
		[13]

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QUESTION/*VRAAG 7*



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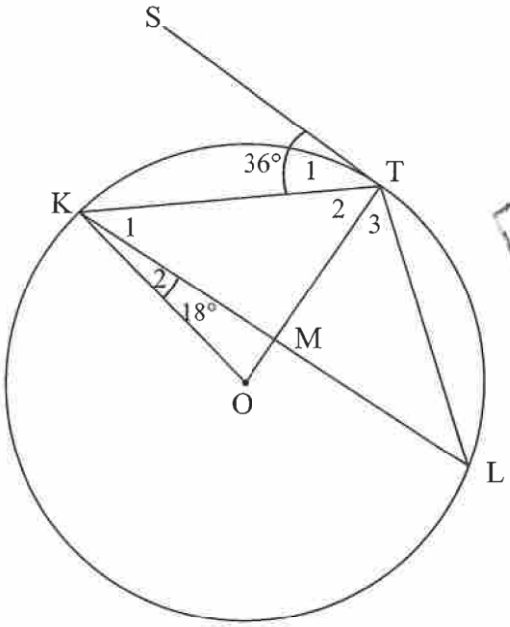
7.1.1	$\frac{AC}{20} = \cos 30°$ $AC = 20\cos 30°$ $AC = 10\sqrt{3} = 17{,}32$ units **OR/*OF*** $\frac{AC}{\sin 60°} = \frac{20}{\sin 90°}$ $\therefore AC = 20\sin 60 = 17{,}32$	✓ trig ratio ✓ answer (2) ✓ trig ratio ✓ answer (2)
7.1.2	$AB^2 = AC^2 + BC^2 - 2AC.BC\cos A\hat{C}B$ $AB^2 = \left(10\sqrt{3}\right)^2 + 8^2 - 2\left(10\sqrt{3}\right)(8)\cos 100°$ $AB = 20{,}30$ units	✓ cosine formula ✓ substitution into cosine formula ✓ answer (3)
7.2	$\frac{\sin A\hat{D}B}{AB} = \frac{\sin A\hat{B}D}{AD}$ $\frac{\sin A\hat{D}B}{20{,}3} = \frac{\sin 73{,}4°}{20}$ $\sin A\hat{D}B = \frac{20{,}3\sin 73{,}4°}{20}$ $A\hat{D}B = 76{,}58°$	✓ sine formula in ΔABD ✓ substitution into sine formula ✓ answer (3)
		[8]

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QUESTION/*VRAAG 8*

8.1

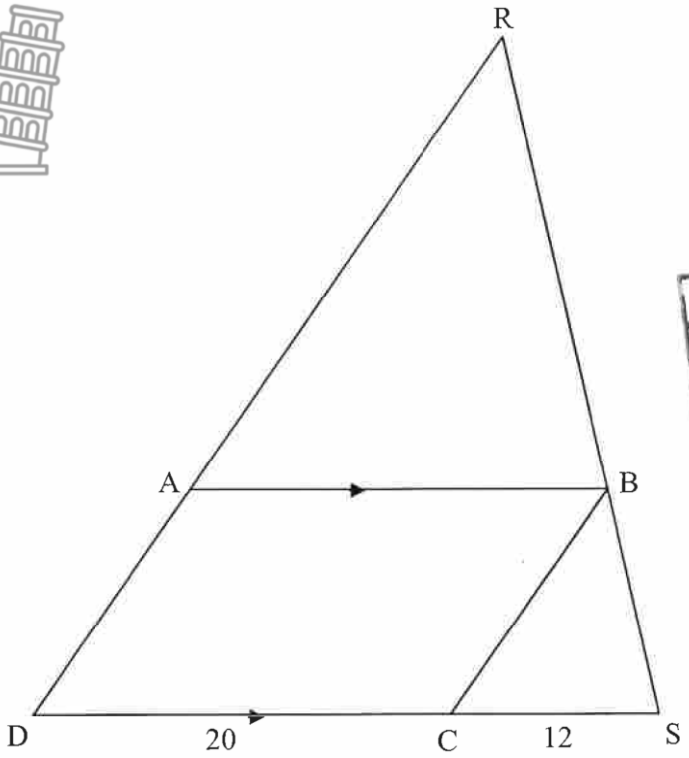


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8.1.1(a)	$\hat{T}_2 = 54°$	[tan ⊥ rad]	✓ S ✓R (2)
8.1.1(b)	$\hat{L}=36°$	[tan - chord theorem]	✓ S ✓R (2)
8.1.1(c)	$K\hat{O}T=72°$	[∠ at centre = 2×∠ at circumference]	✓ S ✓R (2)
	OR/*OF*		
	$O\hat{K}T=\hat{T}_2=54°$	[∠s opposite = radii]	✓ S/R
	$K\hat{O}T=180°-(54°+54°)$ $=72°$	[sum of int ∠'s of Δ]	✓ S (2)
8.1.2	$K\hat{M}O=180°-(18°+72°)$ $=90°$	[sum of int ∠'s of Δ]	✓ S ✓ S
	∴ KM = ML	[line from centre ⊥ to chord]	✓ R (3)
	OR/*OF*		
	$O\hat{K}T=54°$	[∠s opposite = radii]	
	$\hat{K}_1=54°-18°=36°$		✓ S
	$T\hat{M}K=90°$	[sum of int ∠'s of Δ]	✓ S
	∴ KM = ML	[line from centre ⊥ to chord]	✓ R (3)

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8.2



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8.2.1	$\frac{DC}{CS}=\frac{20}{12}=\frac{5}{3}$ $\therefore \frac{DC}{CS}=\frac{RB}{BS}$ $\therefore$ BC $\|\|$ DR [converse line $\|\|$ one side of Δ OR sides in the same proportion] $\therefore$ BC $\|\|$ AD	✓ S ✓ S ✓ R (3)
8.2.2	$\frac{AR}{AD}=\frac{RB}{BS}$ [line $\|\|$ one side of Δ] **OR**[Prop Theorem AB $\|\|$ DS] $\frac{AR}{AD}=\frac{5}{3}$ $\frac{48-AD}{AD}=\frac{5}{3}$ $\therefore 5AD = 144-3AD$ $AD = 18$ AB = 20 [opp sides of parm] $\therefore$ AD : AB = 18 : 20 = 9 : 10	✓ $\frac{AR}{AD}=\frac{5}{3}$ ✓ AD = 18 ✓ ratio (3)

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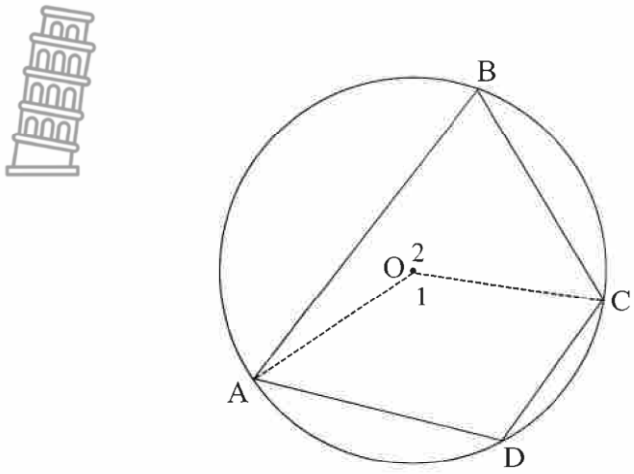
	OR/OF $\frac{AR}{RD}=\frac{5}{8}$.....prop thm AB || DS $\frac{AR}{48}=\frac{5}{8}$ $\therefore AR=30 \quad \text{and} \quad AD=18$ $\therefore \frac{AR}{RD}=\frac{AB}{DS}$.....$\|\|\| \Delta's$ $\therefore AB=20$ $\therefore AB:AD=18:20=9:10$	✓ $\frac{AR}{RD}=\frac{5}{8}$ ✓ AD = 18 ✓ ratio (3)
		[15]

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QUESTION/*VRAAG 9*

9.1

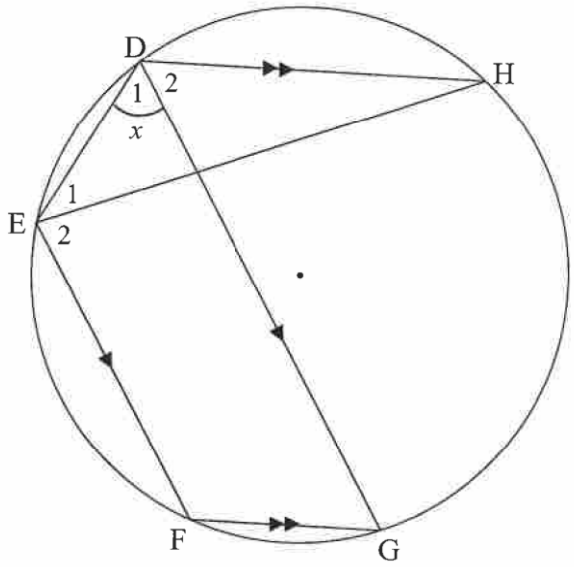


9.1	Constr: Draw radii OA and OC. Proof: $\hat{O}_1 = 2\hat{B}$ [∠ at centre = 2×∠ at circumference] $\hat{O}_2 = 2\hat{D}$ [∠ at centre = 2×∠ at circumference] $\hat{O}_1 + \hat{O}_2 = 360°$ [revolution] $2\hat{B} + 2\hat{D} = 360°$ [revolution] $\therefore \hat{B} + \hat{D} = 180°$	✓ Construction ✓ S ✓ R ✓ S/R ✓ S (5)

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9.2



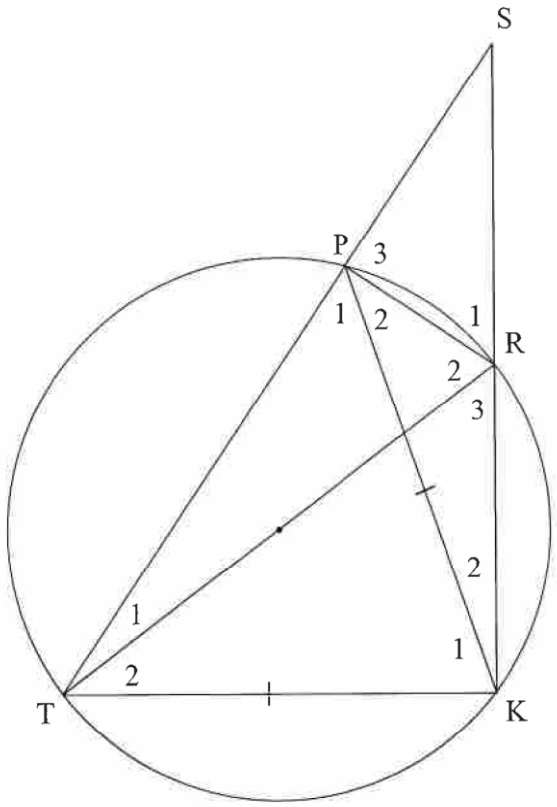
9.2	$E\hat{F}G = 180° - \hat{D}_1$	[opp ∠'s of cyclic quad]	✓S ✓ R
	$\therefore E\hat{F}G = 180° - x$		
	$E\hat{F}G = 180° - \hat{G}$	[co-int ∠'s; EF || DG]	✓S / R
	$\hat{G} = x$		
	But $\hat{G} = \hat{D}_2$	[alt ∠'s; DH || FG]	✓ S / R
	$\therefore \hat{D}_1 = \hat{D}_2 = x$		
			(4)
			[9]

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QUESTION/VRAAG 10

10.1



10.1.1	$T\hat{P}R = 90°$	[∠ in semi-circle]	✓S ✓R
	$S\hat{P}R = 90°$	[∠'s on a straight line]	✓S
	∴ SR is a diameter	[converse ∠ in semi-circle]	✓R
			(4)
	OR		
	$T\hat{K}R = 90°$	[∠ in semi-circle]	✓S ✓R
	$S\hat{P}R = 90°$	[ext ∠ of cyclic quad]	✓S
	∴ SR is a diameter	[converse ∠ in semi-circle]	✓R
		OR	(4)
		[chord subtends a right angle]	

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10.1.2	$\hat{R}_1 = P\hat{T}K$ [ext ∠ of cyclic quad] $\hat{P}_1 = P\hat{T}K = \hat{R}_1$ [∠s opp equal sides] $\hat{S} + \hat{R}_1 = \hat{P}_1 + P_2$ [ext ∠ of Δ] $\therefore \hat{S} = \hat{P}_2$ [$\hat{R}_1 = \hat{P}_1$]	✓S ✓R ✓S /R ✓S ✓R (5)
10.1.3	In ΔSPK and ΔPRK $\hat{S} = \hat{P}_2$ [proved] $\hat{K}_2 = \hat{K}_2$ [common] ΔSPK ||| ΔPRK [∠, ∠, ∠] **OR/*OF*** In ΔSPK and ΔPRK $\hat{S} = \hat{P}_2$ [proved] $\hat{K}_2 = \hat{K}_2$ [common] $S\hat{P}K = P\hat{R}K$ [sum of ∠s in Δ] ΔSPK ||| ΔPRK	✓S ✓S ✓S/R (3) ✓S ✓S ✓S/R (3)
10.2	$\frac{PK}{RK} = \frac{SK}{PK}$ [ΔSPK ||| ΔPRK] $PK^2 = SK.RK$ $ST^2 = SK^2 + TK^2$ [Pythagoras] $TK = PK$ [Given] $ST^2 = SK^2 + PK^2$ $ST^2 = SK^2 + SK.RK$ $ST^2 = (2RK)^2 + 2RK.RK$ $ST^2 = 6RK^2$ $ST = \sqrt{6}RK$	✓S ✓S ✓$PK^2 = SK.RK$ ✓$SK = 2RK$ ✓$ST^2 = 6RK^2$ (5)
		[17]

TOTAL/TOTAAL: 150

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