basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIORSERTIFIKAAT-EKSAMEN/
NASIONALE SENIORSERTIFIKAAT-EKSAMEN

WISKUNDE V2

2019

PUNTE: 150

TYD: 3 uur

Hierdie vraestel bestaan uit 14 bladsye, 1 inligtingsblad en 'n antwoordeboek van 25 bladsye.

INSTRUKSIES EN INLIGTING

Lees die volgende instruksies aandagtig deur voordat die vraestel beantwoord word.

1. Hierdie vraestel bestaan uit 10 vrae.

2. Beantwoord AL die vrae in die SPESIALE ANTWOORDEBOEK wat verskaf word.

3. Dui ALLE berekeninge, diagramme, grafieke, ens. wat jy gebruik in die beantwoording van die vrae, duidelik aan.

4. Slegs antwoorde sal NIE noodwendig volpunte verdien NIE.

5. Jy kan 'n goedgekeurde wetenskaplike sakrekenaar gebruik (nieprogrammeerbaar en niegrafies), tensy anders vermeld.

6. Indien nodig, rond antwoorde tot TWEE desimale plekke af, tensy anders gemeld.

7. Diagramme is NIE noodwendig volgens skaal geteken NIE.

8. 'n Inligtingsblad met formules is aan die einde van die vraestel ingesluit.

9. Skryf netjies en leesbaar.

VRAAG 1

Elke kind in 'n groep vierjarige kinders het dieselfde legkaart gekry om te voltooi. Die tyd (in minute) wat dit elke kind geneem het om die legkaart te voltooi, word in die tabel hieronder getoon.

TYD GENEEM (t), (IN MINUTE)	**GETAL KINDERS**
$2 < t \leq 6$	2
$6 < t \leq 10$	10
$10 < t \leq 14$	9
$14 < t \leq 18$	7
$18 < t \leq 22$	8
$22 < t \leq 26$	7
$26 < t \leq 30$	2

1.1 Hoeveel kinders het die legkaart voltooi? (1)

1.2 Bereken die geskatte gemiddelde tyd wat dit geneem het om die legkaart te voltooi. (2)

1.3 Voltooi die kumulatiewefrekwensie-kolom in die tabel wat in die ANTWOORDEBOEK gegee word. (2)

1.4 Skets 'n kumulatiewefrekwensie-grafiek (ogief) om die data voor te stel op die rooster wat in die ANTWOORDEBOEK gegee word. (3)

1.5 Gebruik die grafiek om die mediaantyd wat dit geneem het om die legkaart te voltooi, te bepaal. (2)

[10]

VRAAG 2

Leerders wat 'n punt van minder as 50% in 'n Wiskundetoets behaal het, is gekies om 'n rekenaargebaseerde program as deel van 'n ingrypingstrategie te gebruik. 'n Tweede toets is na afloop van die program geskryf om die doeltreffendheid van die ingrypingstrategie te bepaal. Die punt (as 'n persentasie) wat 15 van hierdie leerders in beide toetse behaal het, word in die tabel hieronder gegee.

LEERDER	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**	**L11**	**L12**	**L13**	**L14**	**L15**
TOETS 1 (%)	10	18	23	24	27	34	34	36	37	39	40	44	45	48	49
TOETS 2 (%)	33	21	32	20	58	43	49	48	41	55	50	45	62	68	60

2.1 Bepaal die vergelyking van die kleinstekwadrate-regressielyn. (3)

2.2 'n Leerder het 15 uit 'n totaal van 50 punte vir die eerste toets behaal.

2.2.1 Skryf die leerder se punt vir hierdie toets as 'n persentasie neer. (1)

2.2.2 Voorspel die leerder se punt vir die tweede toets. Gee jou antwoord tot die naaste heelgetal. (2)

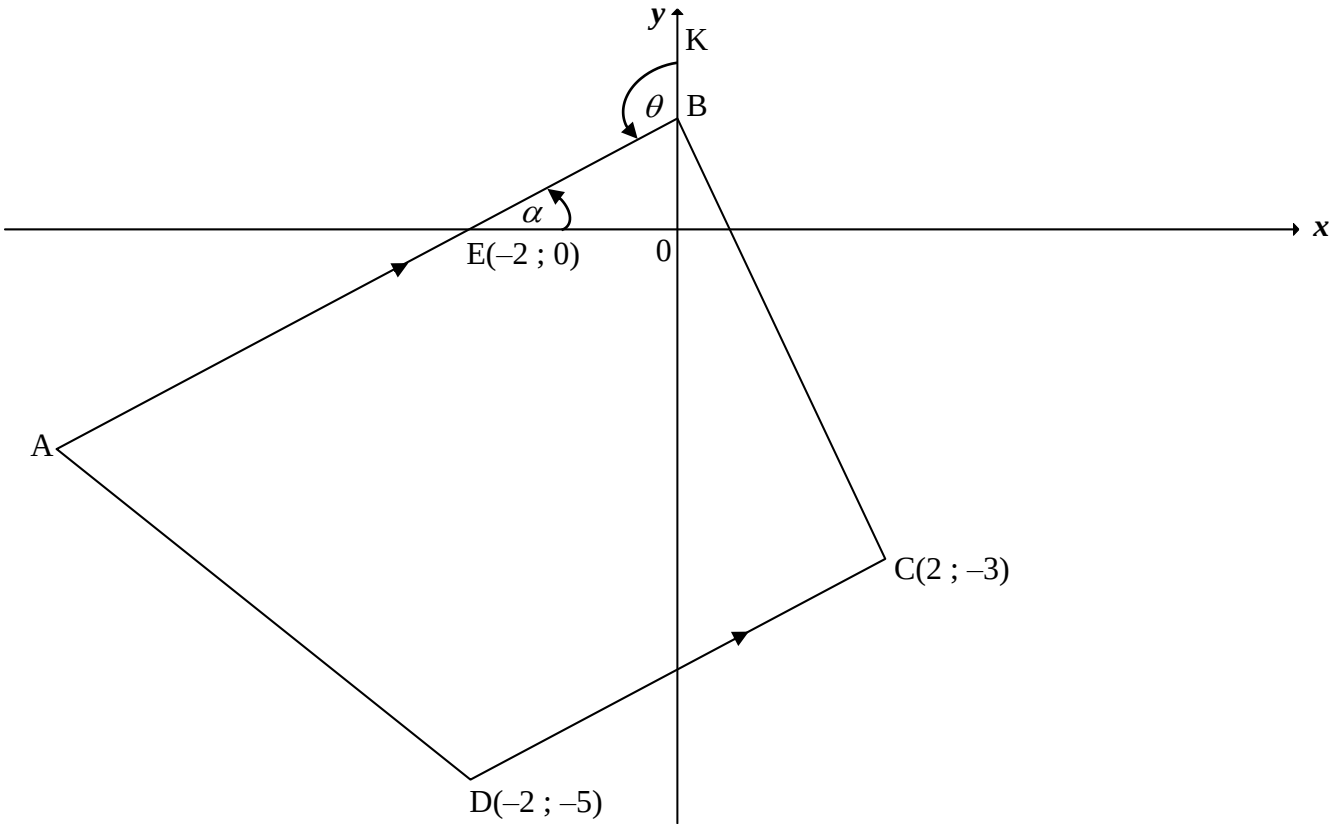
2.3 Vir die 15 leerders hierbo is die gemiddelde punt van die tweede toets 45,67% en die standaardafwyking is 13,88%. Die onderwyser besef dat hy vergeet het om die punte van die laaste vraag by die totale punt van elkeen van hierdie leerders te tel. Al die leerders het volpunte vir die laaste vraag behaal. Nadat die punte van die laaste vraag bygetel is, is die nuwe gemiddelde punt 50,67%.

2.3.1 Wat is die standaardafwyking nadat die punte vir die laaste vraag by elke leerder se totaal getel is? (2)

2.3.2 Wat is die totale punt van die laaste vraag? (2)
[10]

VRAAG 3

In die diagram is A, B, C(2 ; –3) en D(–2 ; –5) die hoekpunte van 'n trapesium met AB || DC. E(–2 ; 0) is die *x*-afsnit van AB. Die inklinasie van AB is α. K lê op die *y*-as en $\hat{KBE} = \theta$.



3.1 Bepaal:

3.1.1 Die middelpunt van EC (2)

3.1.2 Die gradiënt van DC (2)

3.1.3 Die vergelyking van AB in die vorm $y = mx + c$ (3)

3.1.4 Die grootte van θ (3)

3.2 Bewys dat AB $\perp$ BC. (3)

3.3 Die punte E, B en C lê op die omtrek van 'n sirkel. Bepaal:

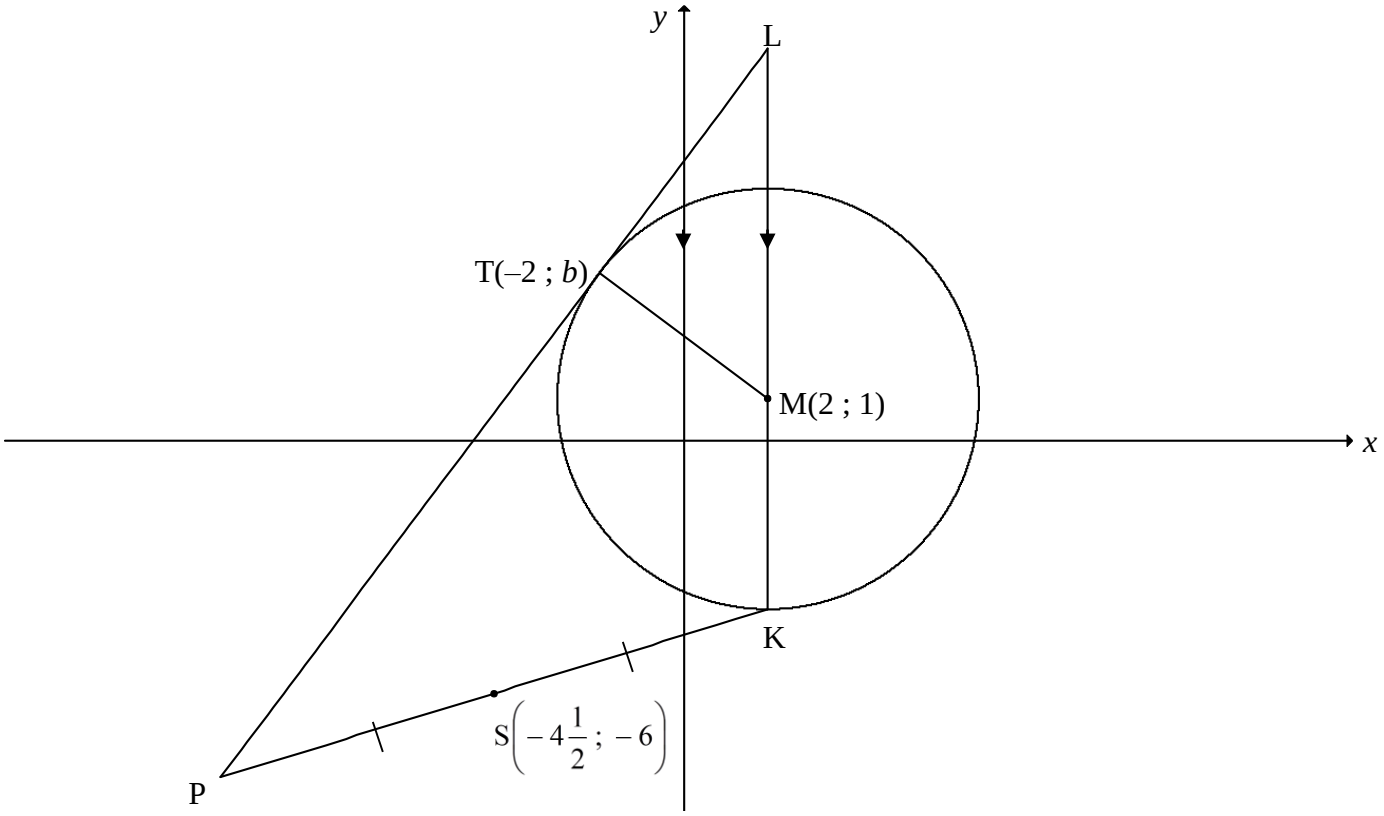
3.3.1 Die middelpunt van die sirkel (1)

3.3.2 Die vergelyking van die sirkel in die vorm $(x-a)^2 + (y-b)^2 = r^2$ (4)

[18]

VRAAG 4

In die diagram is M(2 ; 1) die middelpunt van die sirkel. Radius KM is verleng na L, 'n punt buite die sirkel, sodanig dat KML || *y*-as. LTP is 'n raaklyn aan die sirkel by T(–2 ; *b*). $S\left(-4\frac{1}{2}\ ;\ -6\right)$ is die middelpunt van PK.



4.1 As gegee word dat die radius van die sirkel 5 eenhede is, toon dat $b = 4$. (4)

4.2 Bepaal:

4.2.1 Die koördinate van K (2)

4.2.2 Die vergelyking van die raaklyn LTP in die vorm $y = mx + c$ (4)

4.2.3 Die oppervlakte van ΔLPK (7)

4.3 'n Ander sirkel met vergelyking $(x-2)^2 + (y-n)^2 = 25$ word geskets. Bepaal, met 'n verduideliking, vir watter waarde(s) van n die twee sirkels mekaar uitwendig sal raak. (4)
[21]

VRAAG 5

5.1 Skryf die volgende uitdrukkings in terme van $\sin 11°$, **sonder om 'n sakrekenaar te gebruik**:

5.1.1 $\sin 191°$ (1)

5.1.2 $\cos 22°$ (1)

5.2 Vereenvoudig $\cos(x-180°) + \sqrt{2}\sin(x+45°)$ na 'n enkele trigonometriese verhouding. (5)

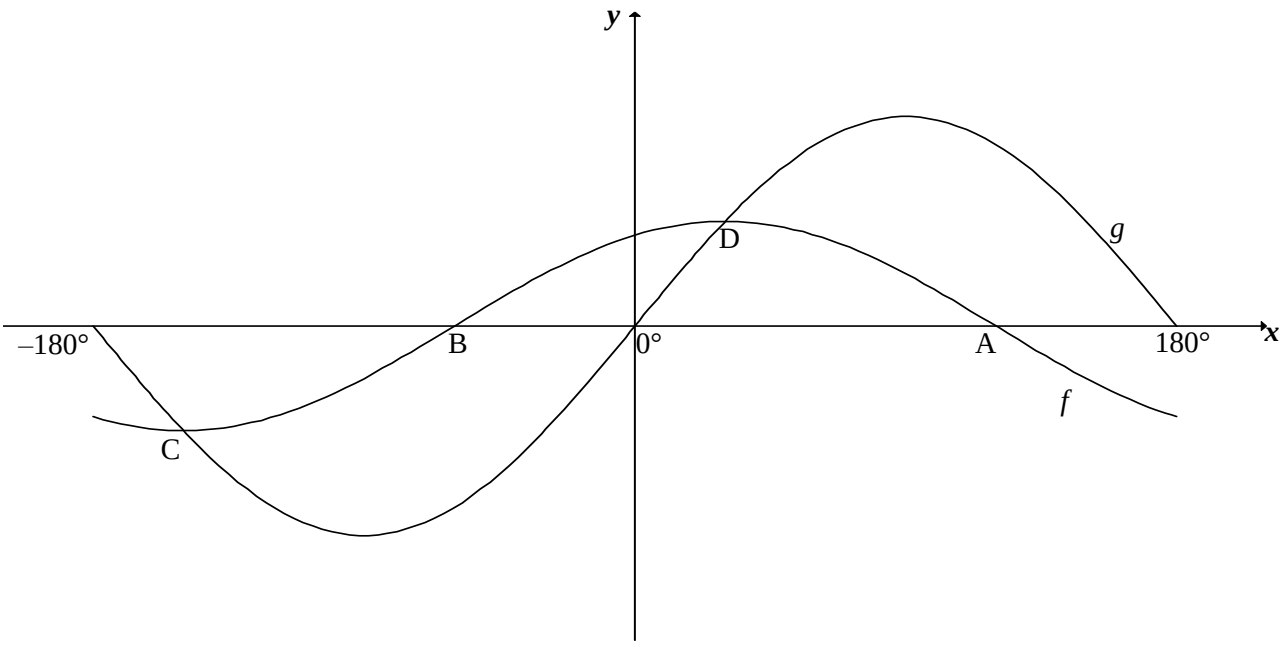
5.3 Gegee: $\sin P + \sin Q = \frac{7}{5}$ en $\hat{P} + \hat{Q} = 90°$

Bepaal die waarde van $\sin 2P$, **sonder om 'n sakrekenaar te gebruik**. (5)
[12]

VRAAG 6

6.1 Bepaal die algemene oplossing van $\cos(x-30°) = 2\sin x$. (6)

6.2 In die diagram is die grafieke van $f(x) = \cos(x-30°)$ en $g(x) = 2\sin x$ geskets vir die interval $x \in [-180°;180°]$. A en B is die x–afsnitte van f. Die twee grafieke sny mekaar by C en D, onderskeidelik die minimum en maksimum draaipunte van f.



6.2.1 Skryf die koördinate neer van:

(a) A (1)

(b) C (2)

6.2.2 Bepaal die waardes van x in die interval $x \in [-180°; 180°]$, waarvoor:

(a) Beide grafieke stygend is (2)

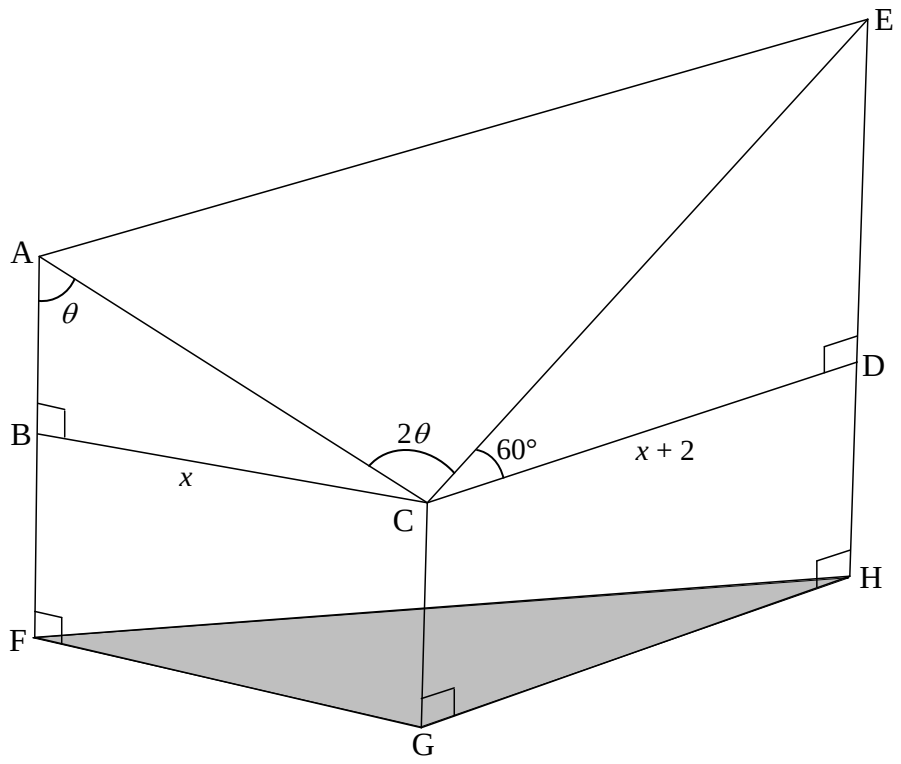
(b) $f(x+10°) > g(x+10°)$ (2)

6.2.3 Bepaal die waardeversameling van $y = 2^{2\sin x + 3}$ (5)

[18]

VRAAG 7

In die diagram hieronder is CGFB en CGHD reghoekige permanente mure en vertikaal tot die horisontale vlak FGH. Staalpale is by FB en HD opgerig en is na A en E onderskeidelik verleng. ΔACE vorm die dak van 'n vermaaklikheidsentrum.
BC = x, CD = $x + 2$, $B\hat{A}C = \theta$, $A\hat{C}E = 2\theta$ en $E\hat{C}D = 60°$



7.1 Bereken die lengte van:

7.1.1 AC in terme van x en θ (2)

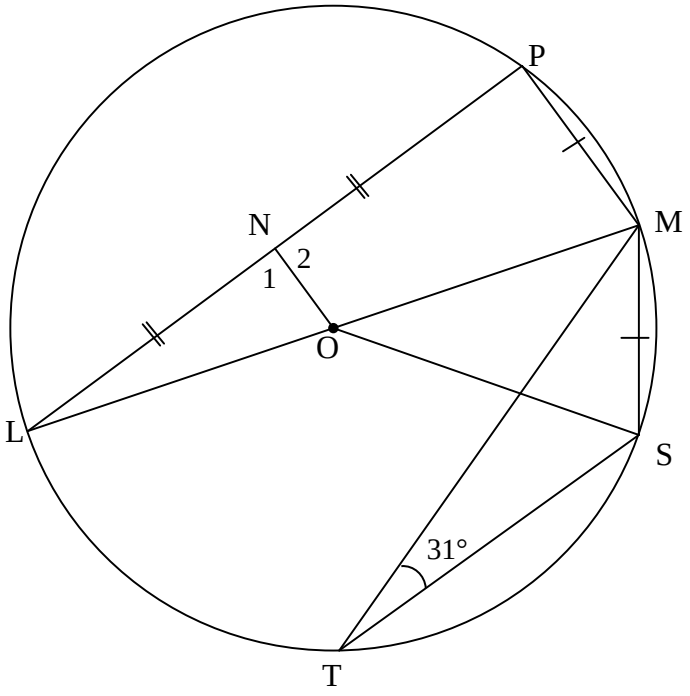
7.1.2 CE in terme van x (2)

7.2 Toon aan dat die oppervlakte van die dak ΔACE as $2x(x+2)\cos\theta$ gegee word. (3)

7.3 As $\theta = 55°$ en BC = 12 meter, bereken die lengte van AE. (4)
[11]

VRAAG 8

8.1 In die diagram is O die middelpunt van die sirkel en LOM is die middellyn van die sirkel. ON halveer koord LP by N. T en S is punte op die sirkel aan die teenoorgestelde kant van LM met betrekking tot P. Koorde PM, MS, MT en ST word getrek. PM = MS en $M\hat{T}S = 31°$



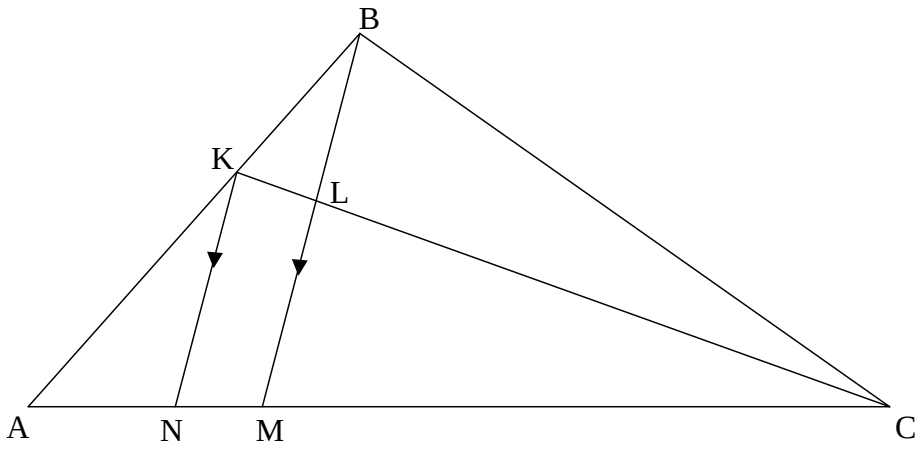
8.1.1 Bepaal, met redes, die grootte van elk van die volgende hoeke:

(a) $M\hat{O}S$ (2)

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

8.1.2 Bewys dat $ON = \frac{1}{2}MS$. (4)

8.2 In ΔABC in die diagram is K 'n punt op AB sodat AK **:** KB = 3 **:** 2. N en M is punte op AC sodat KN || BM. BM sny KC by L. AM **:** MC = 10 **:** 23.



Bepaal, met redes, die verhouding van:

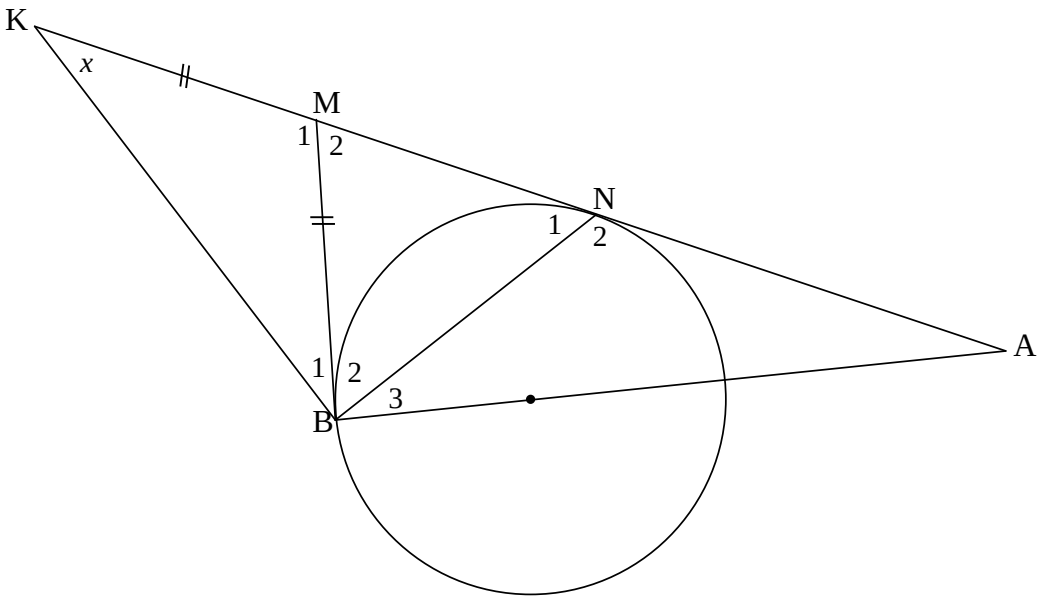
8.2.1 $\frac{AN}{AM}$ (2)

8.2.2 $\frac{CL}{LK}$ (3)

[13]

VRAAG 9

In die diagram word raaklyne vanaf punt M buite die sirkel getrek om die sirkel by B en N te raak. Die reguitlyn vanaf B wat deur die middelpunt van die sirkel gaan, ontmoet MN verleng in A. NM word verleng na K sodanig dat MK = MB. BK en BN word getrek.
Laat $\hat{K} = x$.

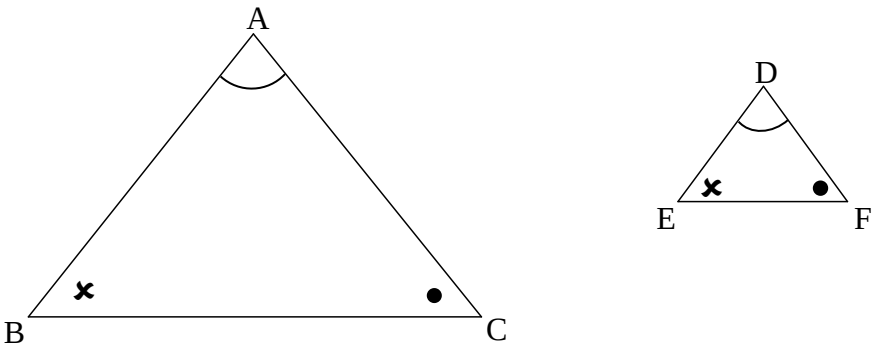


9.1 Bepaal, met redes, die grootte van $\hat{N}_1$, in terme van *x*. (6)

9.2 Bewys dat BA 'n raaklyn aan die sirkel is wat deur K, B en N gaan. (5)
[11]

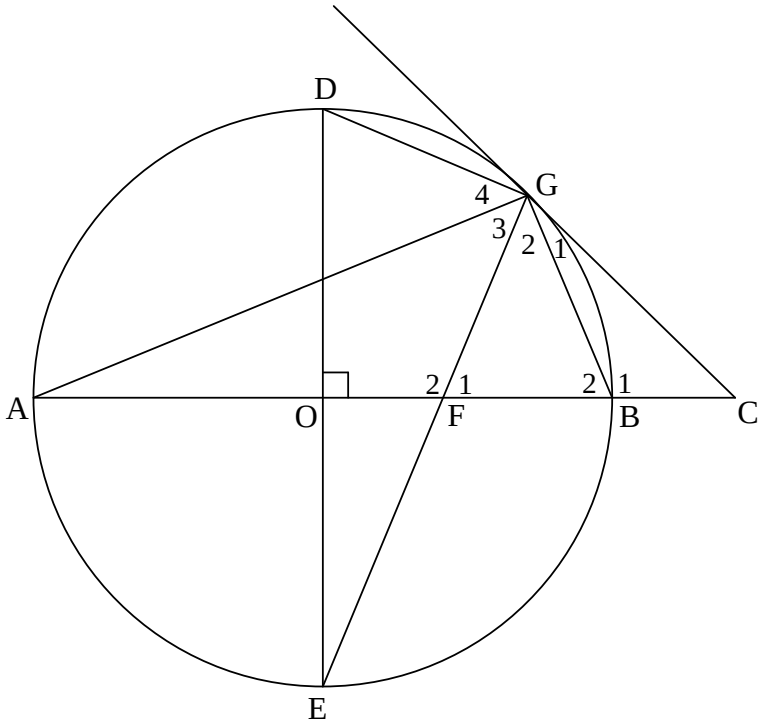
VRAAG 10

10.1 In die diagram is ΔABC en ΔDEF geskets so dat $\hat{A} = \hat{D}$, $\hat{B} = \hat{E}$ en $\hat{C} = \hat{F}$.



Gebruik die diagram in die ANTWOORDEBOEK om die stelling te bewys wat beweer dat as twee driehoeke gelykhoekig is, dan is die ooreenstemmende sye eweredig (in dieselfde verhouding), dus $\frac{AB}{DE} = \frac{AC}{DF}$. (6)

10.2 In die diagram is O die middelpunt van die sirkel en CG is 'n raaklyn aan die sirkel by G. Die reguitlyn vanaf C wat deur O gaan, sny die sirkel by A en B. Middellyn DOE is loodreg op AC. GE en CA sny by F. Koorde DG, BG en AG is getrek.



10.2.1 Bewys dat:

(a) DGFO 'n koordevierhoek is (3)

(b) GC = CF (5)

10.2.2 Indien dit verder gegee word dat CO = 11 eenhede en DE = 14 eenhede, bereken:

(a) Die lengte van BC (3)

(b) Die lengte van CG (5)

(c) Die grootte van $\hat{E}$ (4)
[26]

TOTAAL: 150

INLIGTINGSBLAD: WISKUNDE

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

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

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

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

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

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

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

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

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

In ΔABC: $\dfrac{a}{\sin \mathrm{A}} = \dfrac{b}{\sin \mathrm{B}} = \dfrac{c}{\sin \mathrm{C}}$

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

$$\text{oppervlakte } \Delta\mathrm{ABC} = \frac{1}{2}\mathrm{ab.sinC}$$

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

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

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

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

$$\mathrm{P(A)} = \frac{n(\mathrm{A})}{n(\mathrm{S})} \qquad \mathrm{P(A\ of\ B) = P(A) + P(B) - P(A\ en\ B)}$$

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

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

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)*

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 and Initials** *Nasiener se kode en Voorletters*	**Marks** *Punte*			**SM**	**Marks** *Punte*			**DCM** *AHN*	**Marks** *Punte*			**CM** *HN*	**Marks** *Punte*			**IM**	**Marks** *Punte*			**EM**
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 25 pages./*Hierdie antwoordeboek bestaan uit 25 bladsye*.

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 verskaf 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 question paper.	*5. Lees die instruksies, wat op jou eksamenrooster gedruk is, sorgvuldig deur, asook enige ander instruksies wat op elke vraestel 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, clearly indicate 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 verskaf 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.*

QUESTION/*VRAAG* 1

TIME TAKEN (*t*) (IN MINUTES)/ *TYD GENEEM (t) (IN MINUTE)*	**NUMBER OF CHILDREN/ *GETAL KINDERS***
$2 < t \leq 6$	2
$6 < t \leq 10$	10
$10 < t \leq 14$	9
$14 < t \leq 18$	7
$18 < t \leq 22$	8
$22 < t \leq 26$	7
$26 < t \leq 30$	2

	Solution/*Oplossing*	**Marks *Punte***
1.1		(1)
1.2		(2)

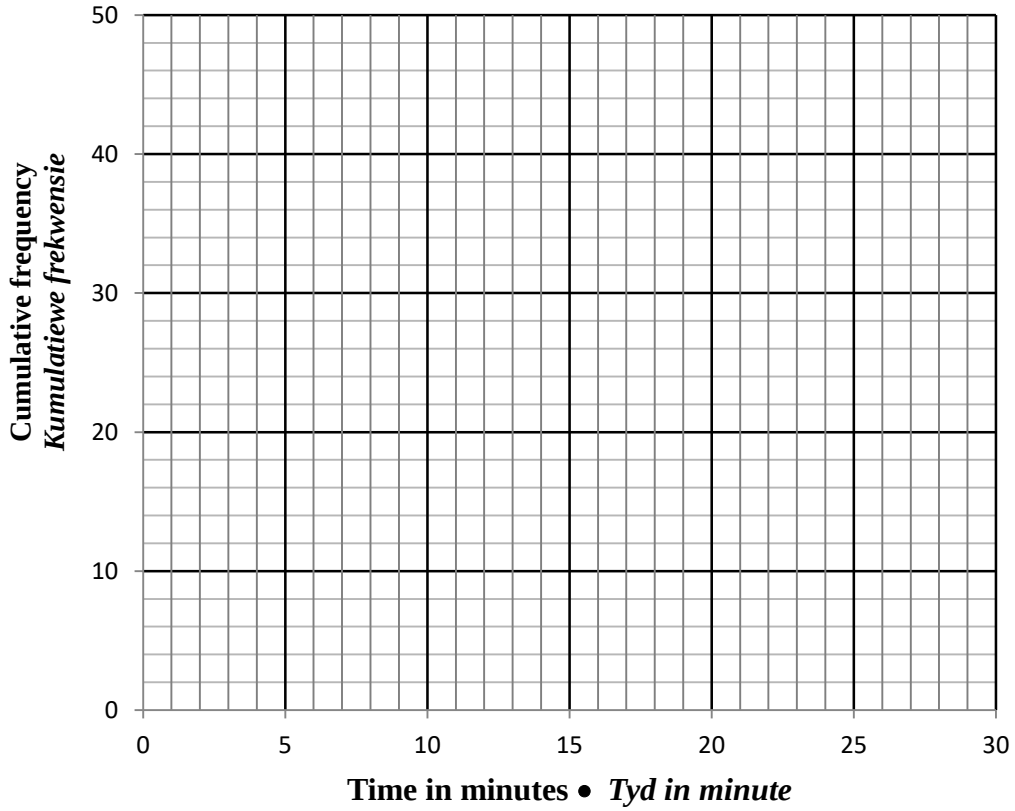
1. 3

Time in minutes (t) ***Tyd in minute* (t)**	**Number of children** ***Getal kinders***	**Cumulative frequency** ***Kumulatiewe frekwensie***
$2 < t \leq 6$	2	
$6 < t \leq 10$	10	
$10 < t \leq 14$	9	
$14 < t \leq 18$	7	
$18 < t \leq 22$	8	
$22 < t \leq 26$	7	
$26 < t \leq 30$	2	

(2)

1. 4

CUMULATIVE FREQUENCY GRAPH (OGIVE)
KUMULATIEWEFREKWENSIEGRAFIEK (OGIEF)



(3)

1.5

(2)

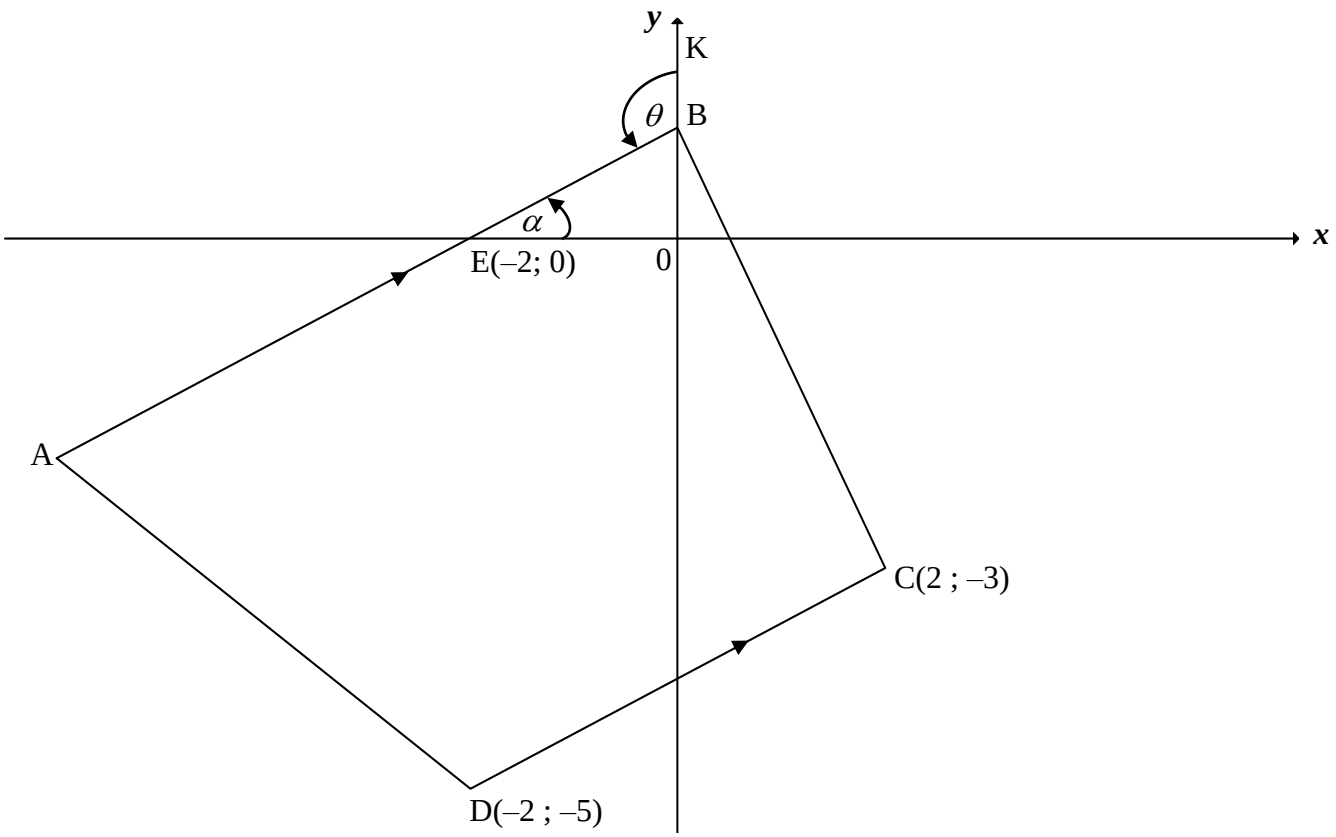
[10]

QUESTION/*VRAAG* 2

LEARNER/ *LEERDER*	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**	**L11**	**L12**	**L13**	**L14**	**L15**
TEST 1/ *TOETS 1* (%)	10	18	23	24	27	34	34	36	37	39	40	44	45	48	49
TEST 2/ *TOETS 2* (%)	33	21	32	20	58	43	49	48	41	55	50	45	62	68	60

	Solution/*Oplossing*	**Marks *Punte***
2.1		(3)
2.2.1		(1)
2.2.2		(2)
2.3.1		(2)
2.3.2		(2)
		[10]

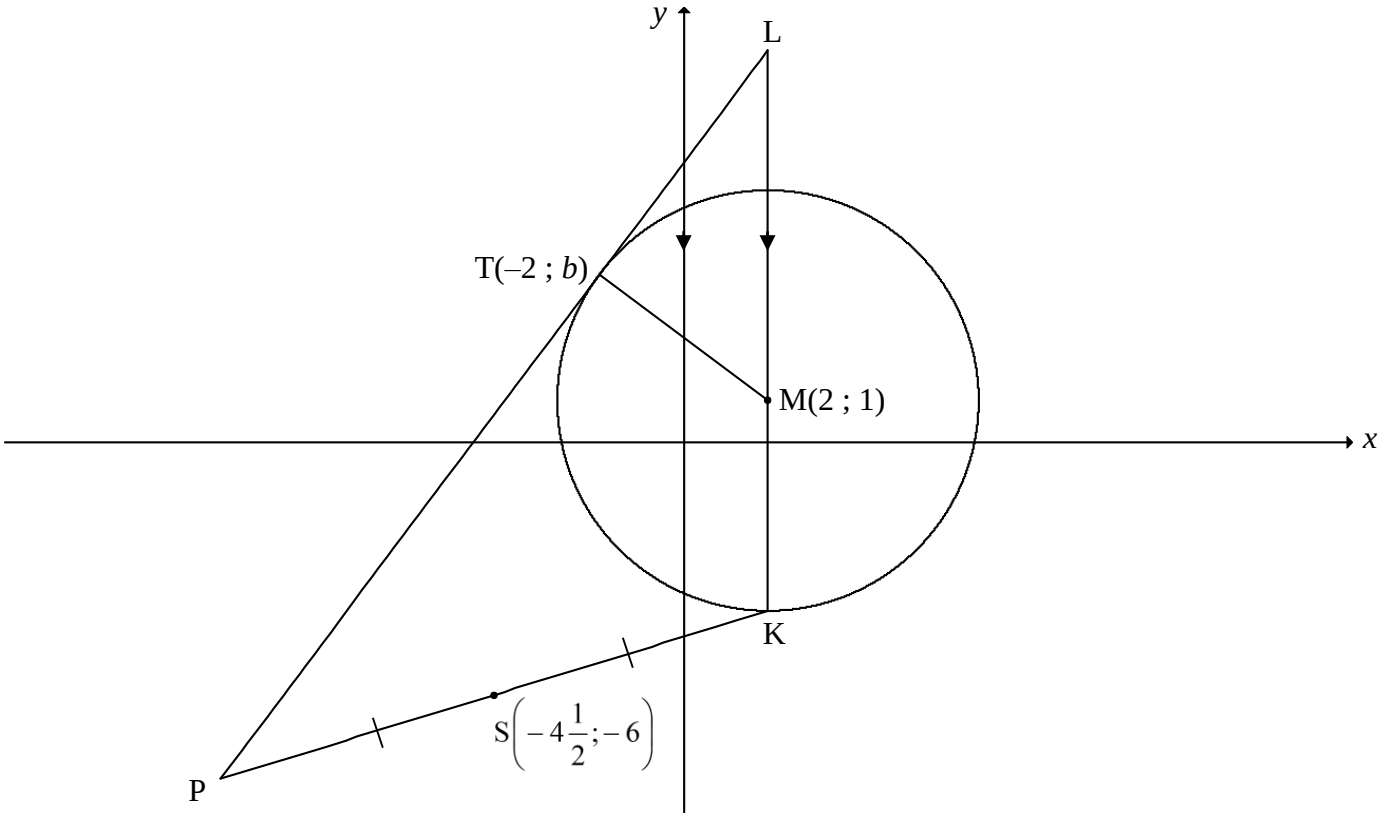
QUESTION/*VRAAG* 3



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

	Solution/*Oplossing*	**Marks** ***Punte***
3.1.3		(3)
3.1.4		(3)
3.2		(3)
3.3.1		(1)
3.3.2		(4)
		[18]

QUESTION/*VRAAG* 4



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

	Solution/*Oplossing*	**Marks** ***Punte***
4.2.2		(4)
4.2.3		(7)
4.3		(4)
		[21]

QUESTION/*VRAAG* 5

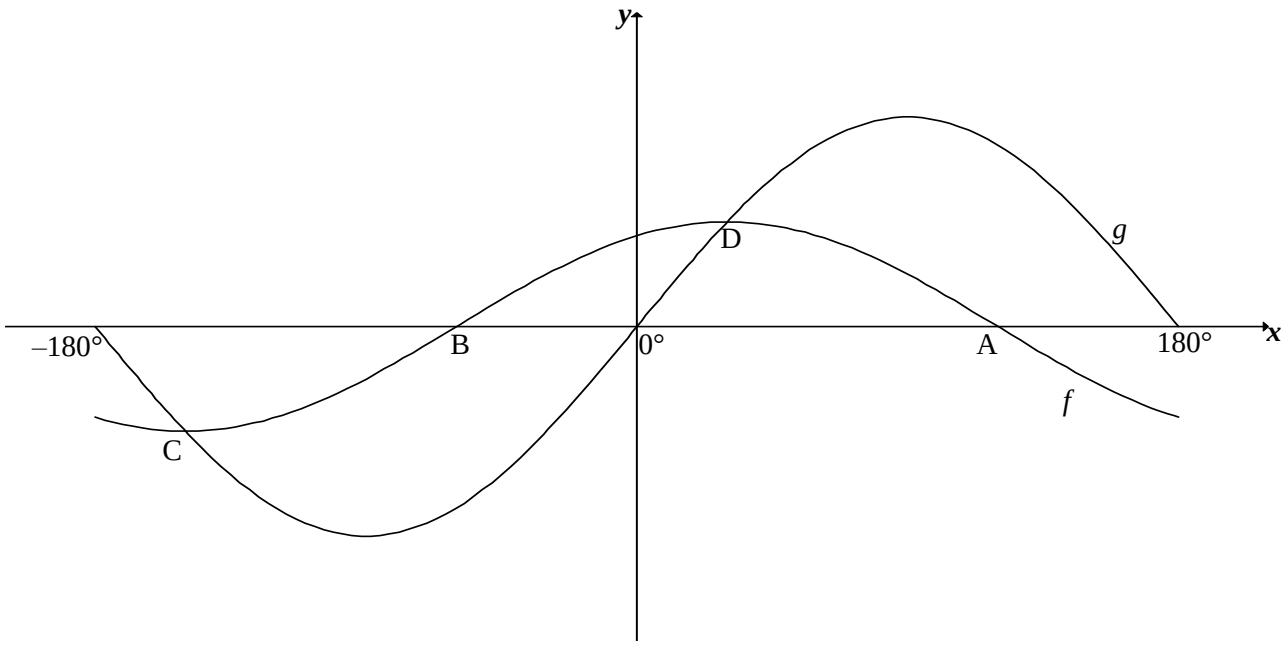
	Solution/*Oplossing*	**Marks** ***Punte***
5.1.1		(1)
5.1.2		(1)
5.2		(5)

	Solution/*Oplossing*	**Marks** ***Punte***
5.3		
		(5)
		[12]

QUESTION/*VRAAG* 6

	Solution/*Oplossing*	**Marks** ***Punte***
6.1		(6)

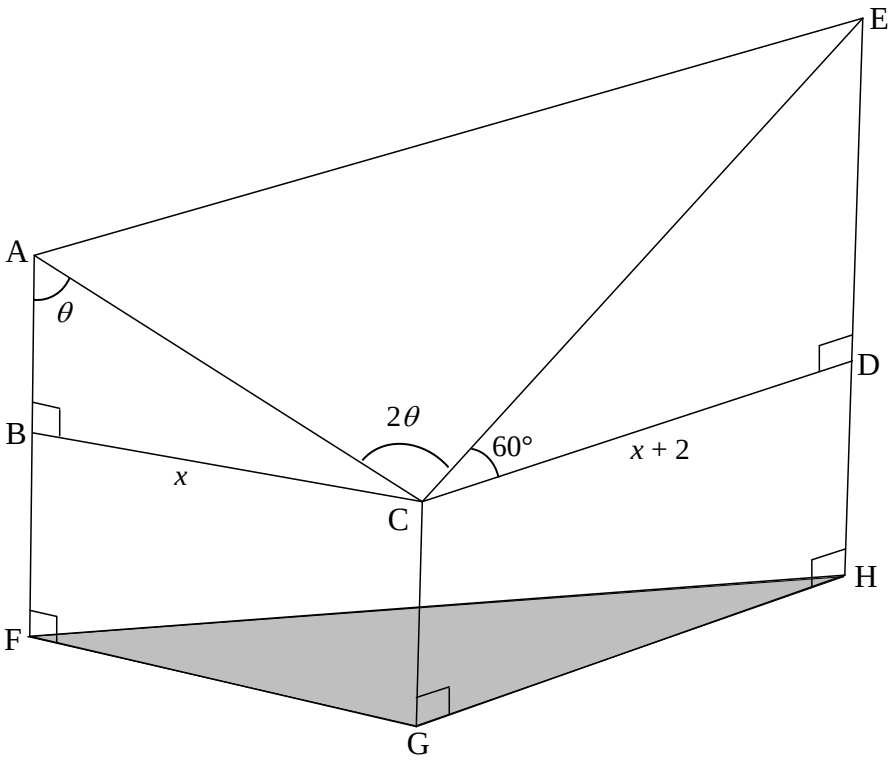
6.2



	Solution/*Oplossing*	**Marks** ***Punte***
6.2.1(a)		(1)
6.2.1(b)		(2)
6.2.2(a)		(2)
6.2.2(b)		(2)

6.2.3		(5)
		[18]

QUESTION/*VRAAG* 7



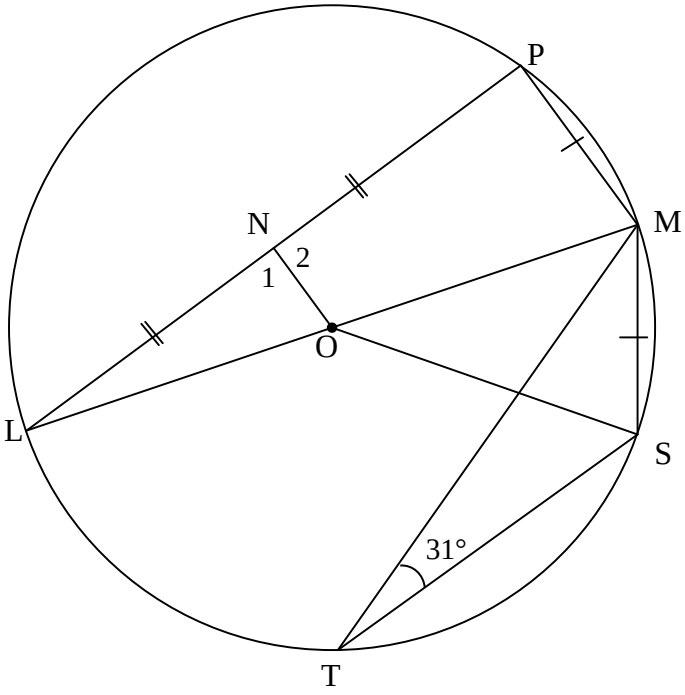
	Solution/*Oplossing*	**Marks** ***Punte***
7.1.1		(2)
7.1.2		(2)

	Solution/*Oplossing*	**Marks** ***Punte***
7.2		(3)
7.3		(4)
		[11]

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

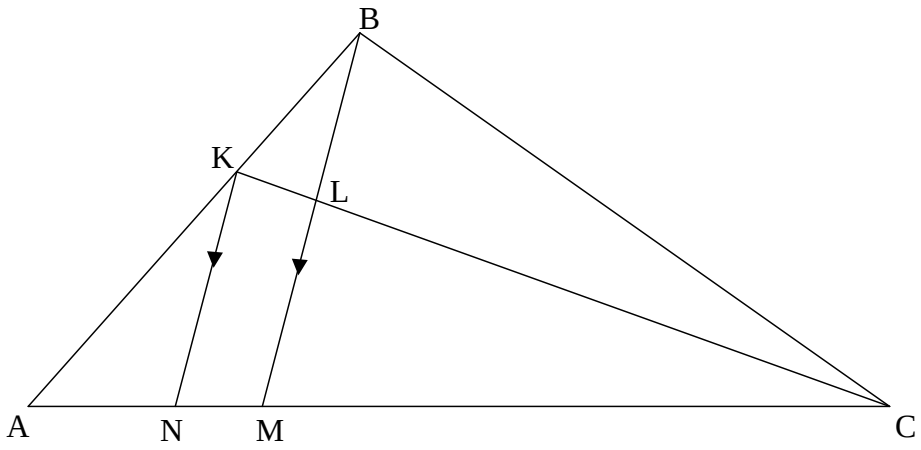
QUESTION/*VRAAG 8*

8.1



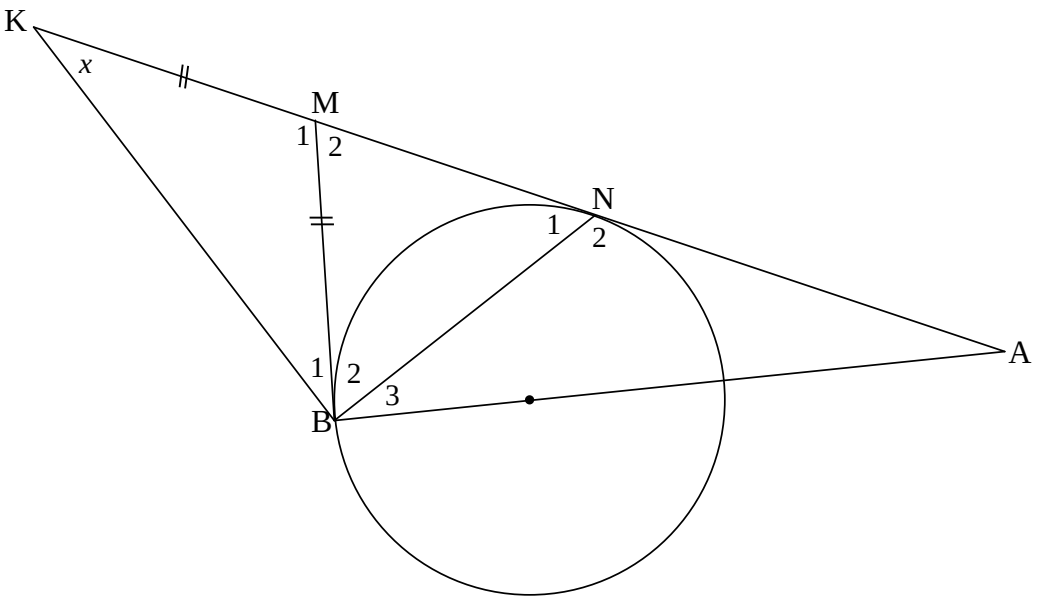
	Solution/*Oplossing*	**Marks** ***Punte***
8.1.1(a)		(2)
8.1.1(b)		(2)
8.1.2		(4)

8.2



	Solution/*Oplossing*	**Marks** ***Punte***
8.2.1		(2)
8.2.2		(3)
		[13]

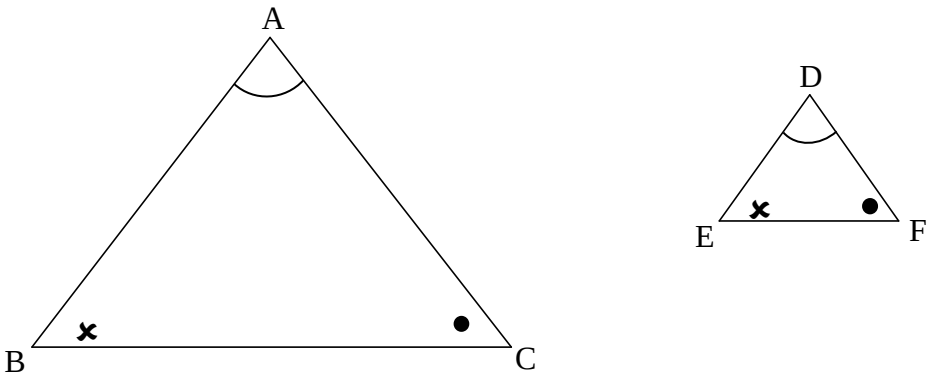
QUESTION/*VRAAG* 9



	Solution/*Oplossing*	**Marks** ***Punte***
9.1		(6)
9.2		(5)
		[11]

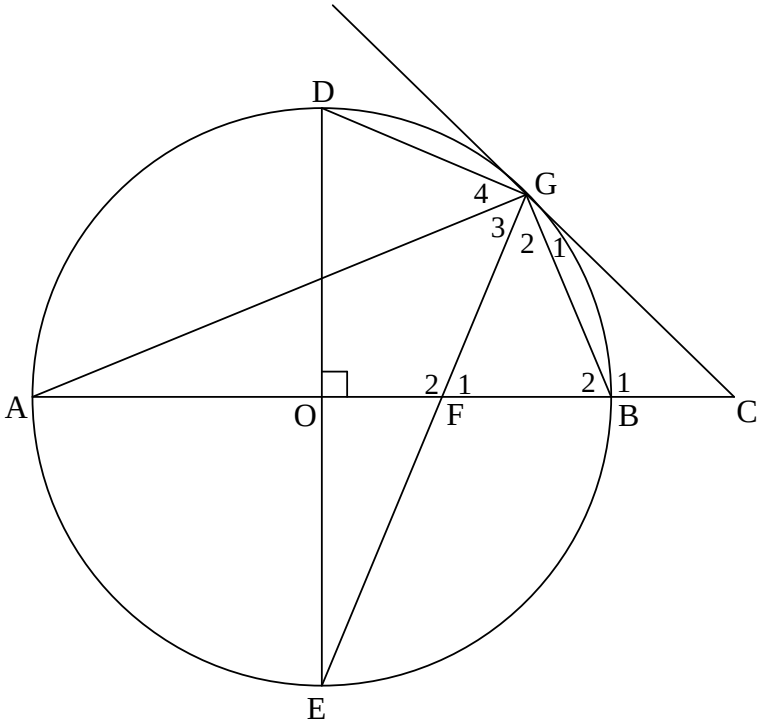
QUESTION/*VRAAG* 10

10.1



	Solution/*Oplossing*	**Marks** ***Punte***
		(6)

10.2



	Solution/*Oplossing*	**Marks** ***Punte***
10.2.1(a)		(3)
10.2.1(b)		(5)
10.2.2(a)		(3)

	Solution/*Oplossing*	**Marks** ***Punte***
10.2.2(b)		(5)
10.2.2(c)		(4)
		[26]

TOTAL/*TOTAAL*: 150

	Additional space/*Bykomende ruimte*	**Marks** ***Punte***

	Additional space/*Bykomende ruimte*	**Marks** ***Punte***

RE-MARK/RE-CHECK ***HERMERK/HERSIEN***				
Question ***Vraag***	**Marks** ***Punte***			**Initials** ***Voorletters***
TOTAL ***TOTAAL***				
HASH TOTAL ***KAF-TOTAAL***				

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/
SENIORSERTIFIKAAT-EKSAMEN
NATIONAL SENIOR CERTIFICATE EXAMINATIONS/
NASIONALE SENIORSERTIFIKAAT-EKSAMEN

MATHEMATICS P2/
WISKUNDE V2

MARKING GUIDELINES/*NASIENRIGLYNE*

2019

MARKS: 150
PUNTE: 150

These marking guidelines consist of 20 pages.
Hierdie nasienriglyne bestaan uit 20 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 memorandum. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

NOTA:
- *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.*
- *Om antwoorde/waardes te aanvaar om 'n probleem op te los, word NIE toegelaat NIE.*

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

QUESTION/*VRAAG* 1

1.1

45 children

✓ answer (1)

1.2

$$\bar{x} = \frac{\sum fx}{n} = \frac{(4\times 2)+(8\times 10)+(12\times 9)+(16\times 7)+(20\times 8)+(24\times 7)+(28\times 2)}{45}$$

$\bar{x} = \frac{692}{45}$ OR $\bar{x} = 15{,}38$ minutes

Answer only: full marks

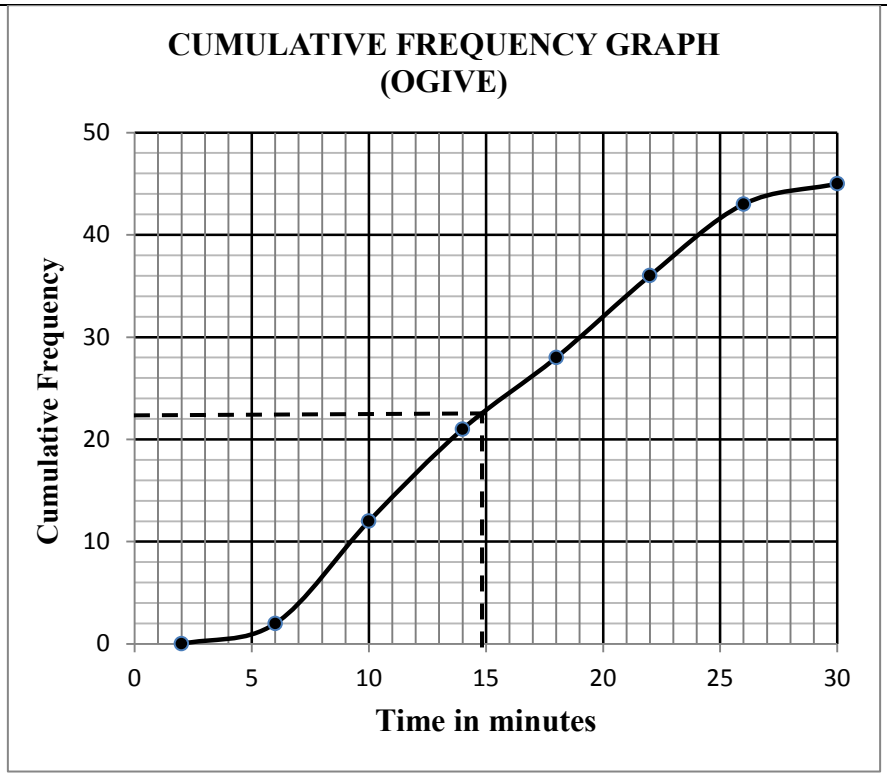
✓ 692
✓ answer (2)

1.3

Time taken (t) (in minutes)	Number of children	Cumulative frequency
$2 < t \leq 6$	2	2
$6 < t \leq 10$	10	12
$10 < t \leq 14$	9	21
$14 < t \leq 18$	7	28
$18 < t \leq 22$	8	36
$22 < t \leq 26$	7	43
$26 < t \leq 30$	2	45

✓ first 4 cum freq correct
✓ last 3 cum freq correct (2)

1.4



✓ plotting cum freq at upper limits correctly (all points)
✓ shape (smooth)
✓ grounding (2;0) (3)

1.5

On graph at the y-value of 22,5 or 23
Median = ± 15 minutes.

Answer only: full marks

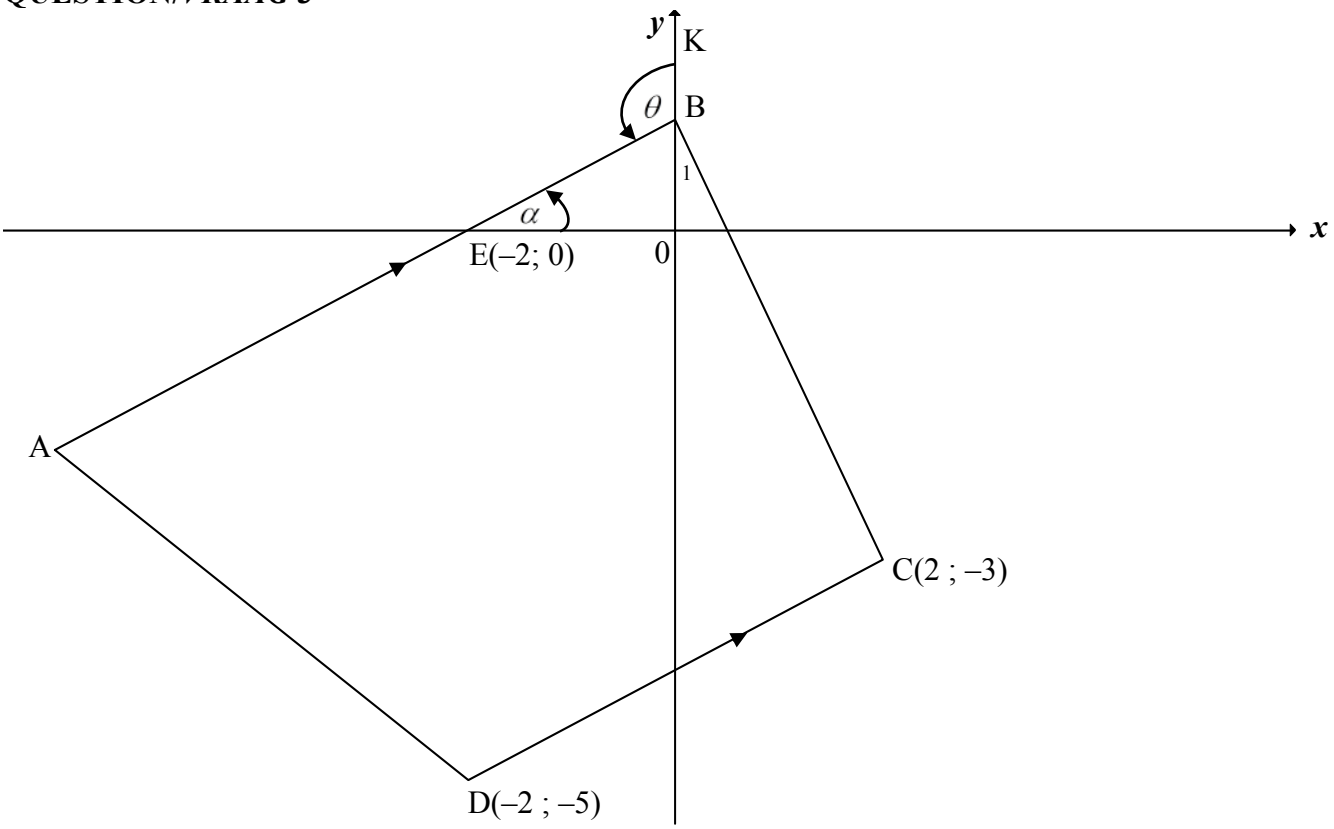
✓ graph
✓ answer (2)

[10]

QUESTION/*VRAAG* 2

2.1	$a = 12{,}44$ $b = 0{,}98$ $y = 12{,}44 + 0{,}98x$ Answer only: full marks	✓ value of a ✓ value of b ✓ equation (3)
2.2.1	Percentage $= \frac{15}{50} \times 100$ $= 30\%$	✓ answer (1)
2.2.2	$\hat{y} = 12{,}44 + 0{,}98x$ $\hat{y} = 12{,}44 + 0{,}98(30)$ $\hat{y} = 41{,}84$ $= 42$ Answer only: full marks **OR** $\hat{y} = 41{,}87$ (if using calculator) $\hat{y} = 42$ **OR** $\hat{y} = \frac{21}{50}$	✓ substitution of 30 ✓ answer as integer (2) ✓ value of y ✓ answer as integer (2) ✓ ✓ answer (2)
2.3.1	standard deviation =13,88	✓ ✓ answer (2)
2.3.2	$x = 50{,}67 - 45{,}67$ $= 5\%$ Answer only: full marks	✓ $50{,}67 - 45{,}67$ ✓ answer (2)
		[10]

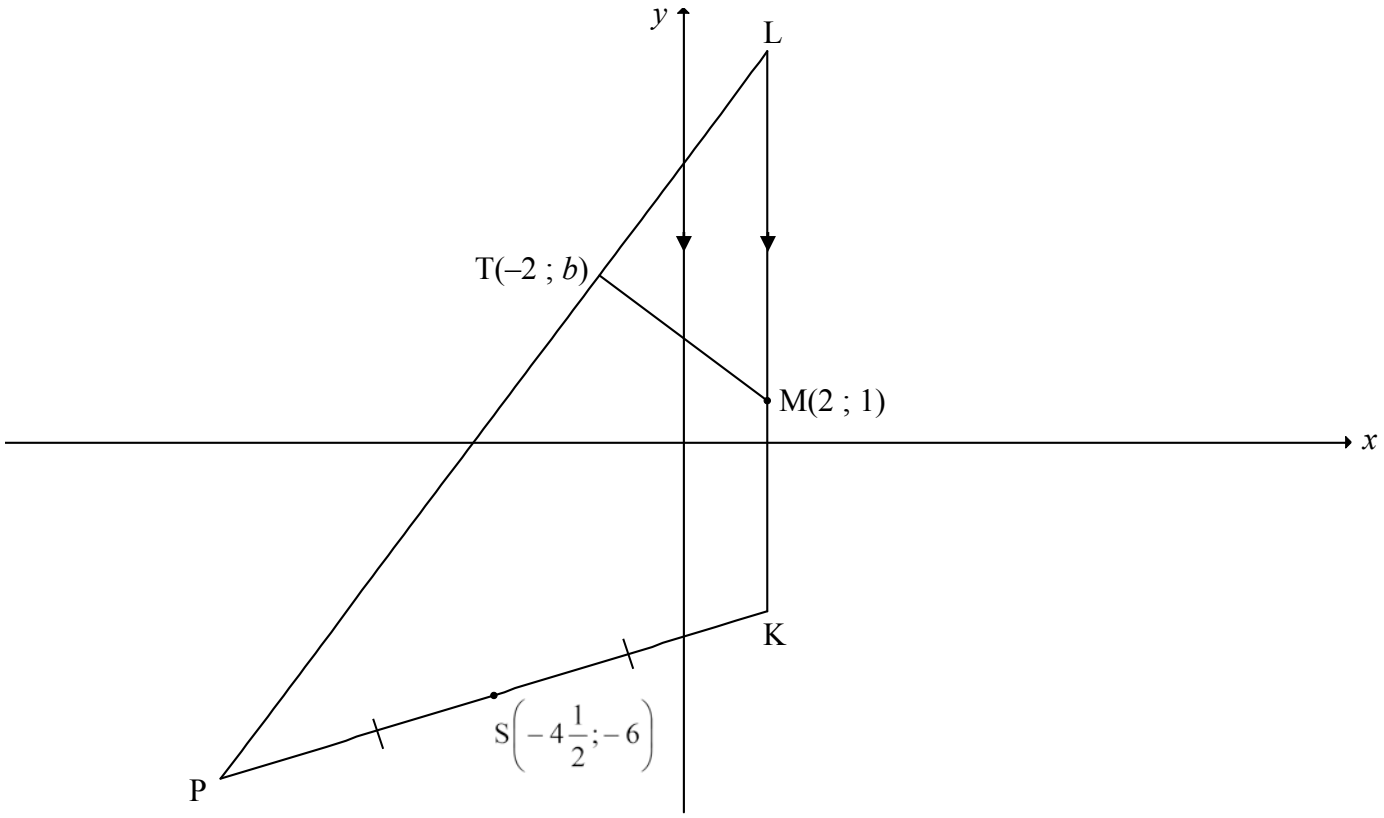
QUESTION/*VRAAG* 3



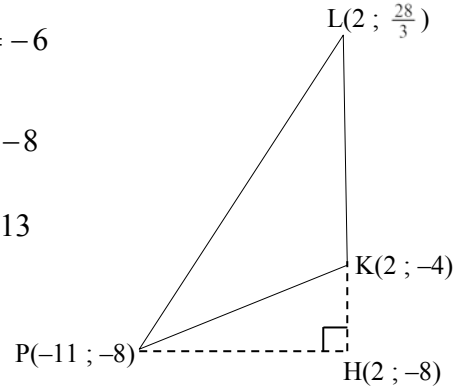
3.1.1	Midpoint of EC: $=\left(\frac{-2+2}{2}\ ;\ \frac{0+(-3)}{2}\right)=\left(0\ ;\ \frac{-3}{2}\right)$	✓ x value ✓ y value (2)
3.1.2	$m_{DC}=\frac{-3-(-5)}{2-(-2)}$ OR $\frac{-5-(-3)}{-2-2}$ $=\frac{2}{4}=\frac{1}{2}$ Answer only: full marks	✓ substitution ✓ answer (2)
3.1.3	$m_{AB}=\frac{1}{2}$ [AB ‖ DC] $y=\frac{1}{2}x+c$ $y-y_1=\frac{1}{2}(x-x_1)$ $0=\frac{1}{2}(-2)+c$ **OR** $y-0=\frac{1}{2}(x-(-2))$ $c=1$ $\therefore y=\frac{1}{2}x+1$	✓ $m_{AB}=\frac{1}{2}$ ✓ substitution of $(-2;0)$ ✓equation (3)
3.1.4	$\tan\alpha=m_{AB}=\frac{1}{2}$ $\alpha=26{,}57°$ $\theta=90°+26{,}57°$ [ext ∠of Δ] $=116{,}57°$	✓ $\tan\alpha=\frac{1}{2}$ ✓ value of α ✓ value of θ (3)

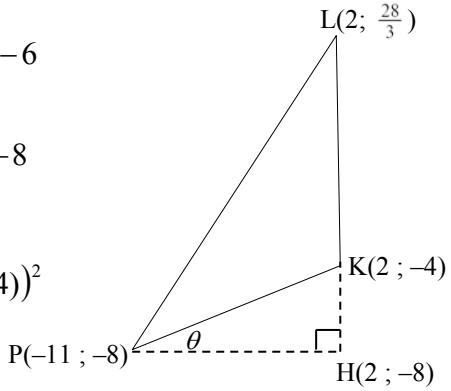
3.2	B(0 ; 1) $m_{BC}=\frac{1-(-3)}{0-2}$ **OR** $m_{BC}=\frac{(-3)-1}{2-0}$ $=-2$ $=-2$ $m_{AB}\times m_{BC}=\frac{1}{2}\times -2$ $=-1$ $\therefore AB\perp BC$	✓ coordinates of B ✓ $m_{BC}=-2$ ✓ product of gradients = –1 (3)
3.3.1	$A\hat{B}C=90°$ $\therefore$ EC is diameter [converse: $\angle$ in semi circle] $\therefore$ centre of circle $=\left(0\ ;\ -\frac{3}{2}\right)$	✓ answer (1)
3.3.2	$(x-0)^2+\left(y+\frac{3}{2}\right)^2=r^2$ $(-2-0)^2+\left(0+\frac{3}{2}\right)^2=r^2$ **OR** $(2-0)^2+\left(-3-\left(\frac{-3}{2}\right)\right)^2=r^2$ **OR** $(0-0)^2+\left(1-\left(\frac{-3}{2}\right)\right)^2=r^2$ **OR** $r=\frac{EC}{2}=\frac{\sqrt{(-2-2)^2+(0-(-3))^2}}{2}$ **OR** $r=1-(-\frac{3}{2})$ $\therefore\ r^2=\frac{25}{4}$ or $r=\frac{5}{2}$ $x^2+\left(y+\frac{3}{2}\right)^2=\frac{25}{4}$	✓ substitution of centre ✓ correct substitution of E(–1 ; 0), B(0 ; 1) or C(2 ; –3) to calculate r^2 or r ✓ value of r^2 or r ✓ equation (4)
		[18]

QUESTION/*VRAAG* 4



4.1	$(x-2)^2+(y-1)^2=25$ $(-2-2)^2+(b-1)^2=25$ $(b-1)^2=9$ $b-1=\pm 3$ $\therefore b=4$ or $b\neq -2$ **OF** $(x-2)^2+(y-1)^2=25$ $(-2-2)^2+(b-1)^2=25$ $16+b^2-2b+1=25$ $b^2-2b-8=0$ $\therefore b=4$ or $b\neq -2$	✓ equation of the circle ✓substitution of point T ✓simplification ✓ answer (4)
4.2.1	K(2 ; 1 – 5) ∴ K(2 ; –4) Answer only: full marks	✓ *x* value ✓ *y* value (2)
4.2.2	$m_{MT}=\frac{4-1}{-2-2}=-\frac{3}{4}$ $m_{PL}=\frac{4}{3}$ [radius ⊥ tangent] $y=\frac{4}{3}x+c$ $4=\frac{4}{3}(-2)+c$ $c=\frac{20}{3}$ $y=\frac{4}{3}x+\frac{20}{3}$	✓ m_{MT} ✓ $m_{PL}=\frac{4}{3}$ ✓ substitution of m_{PL} and the point T ✓ equation (4)

	OR $m_{MT} = \frac{4-1}{-2-2} = -\frac{3}{4}$ $m_{PL} = \frac{4}{3}$ [radius $\perp$ tangent] $y - y_1 = \frac{4}{3}(x - x_1)$ $y - 4 = \frac{4}{3}(x + 2)$ $y = \frac{4}{3}x + \frac{20}{3}$ **OR** P(–11 ; –8) $m_{PL} = \frac{4-(-8)}{-2-(-11)}$ $= \frac{4}{3}$ $y = \frac{4}{3}x + c$ $-8 = \frac{4}{3}(-11) + c$ $c = \frac{20}{3}$ $y = \frac{4}{3}x + \frac{20}{3}$	✓ m_{MT} ✓ $m_{PL} = \frac{4}{3}$ ✓ substitution of m_{PL} and the point T ✓ equation (4) ✓ coordinates of P ✓ $m_{PL} = \frac{4}{3}$ ✓ substitution of m_{PL} and the point P or T ✓ equation (4)
4.2.3	$y_L = \frac{4}{3}(2) + \frac{20}{3} = \frac{28}{3}$ $L\left(2 ; \frac{28}{3}\right)$ and $K(2 ; -4)$: $LK = \frac{28}{3} - (-4) = \frac{40}{3}$ <u>Coordinates of P:</u> $\frac{x+2}{2} = -4\frac{1}{2}$ and $\frac{y-4}{2} = -6$ $\therefore x = -11$ $y = -8$ $\therefore P(-11; -8)$ $\perp$ height $(PH) = 2 - (-11) = 13$ $\text{Area } \Delta PKL = \frac{1}{2}(LK)(PH)$ $= \frac{1}{2}\left(\frac{40}{3}\right)(13)$ $= \frac{260}{3}$ **OR** 86,67 square units  	✓ $y_L = \frac{28}{3}$ ✓ length of LK ✓ x_P ✓ y_P ✓ length of $\perp$ height ✓ substitution into the area formula ✓ answer (7)

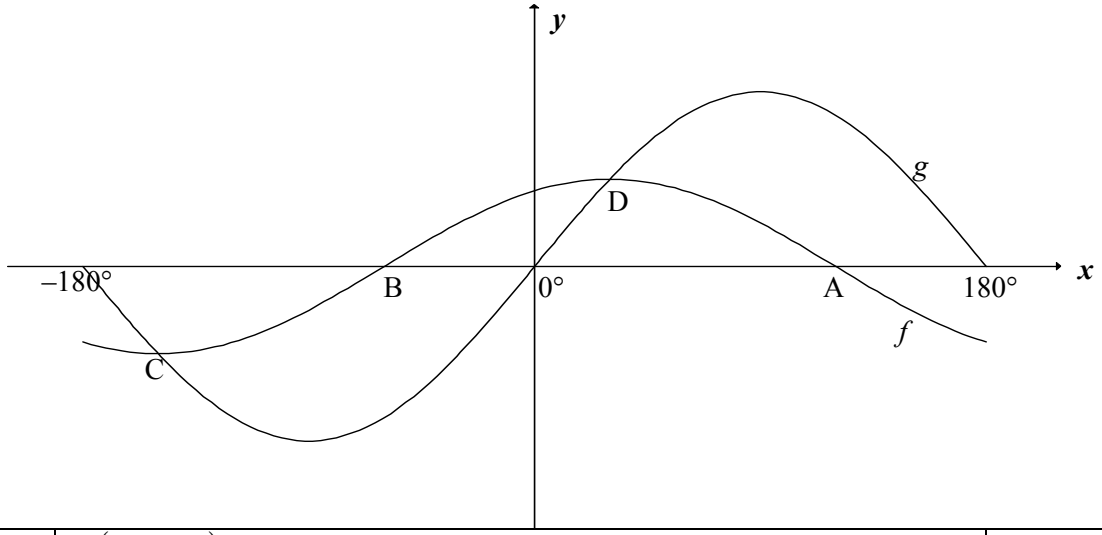
4.2.3	**OR** $y_L = \frac{4}{3}(2) + \frac{20}{3} = \frac{28}{3}$ $L\left(2\ ;\ \frac{28}{3}\right)$ and $K(2\ ;-4)$: $LK = \frac{28}{3} - (-4) = \frac{40}{3}$ Coordinates of P: $\frac{x+2}{2} = -4\frac{1}{2}$ and $\frac{y-4}{2} = -6$ $\therefore\ x = -11 \qquad y = -8$ $\therefore P(-11;-8)$ $PK^2 = (-11-2)^2 + (-8-(-4))^2$ $PK = \sqrt{185}$ units $m_{PK} = \frac{-8-(-4)}{-11-2} = \frac{4}{13}$ $\tan\theta = \frac{4}{13} \quad \therefore \theta = 17{,}1027...°$ $\therefore P\hat{K}L = 90° + 17{,}1027...° = 107{,}1°$ Area $\Delta PKL = \frac{1}{2}(PK)(LK).\sin P\hat{K}L$ $= \frac{1}{2}\left(\sqrt{185}\right)\left(\frac{40}{3}\right)\sin 107{,}10°$ = 86,67 square units  	✓ $y_L = \frac{28}{3}$ ✓ length of LK ✓ x_P ✓ y_P ✓ $P\hat{K}L$ ✓ substitution into the area rule ✓ answer (7)
4.3	The centres of the two circles lie on the same vertical line $x = 2$. and the sum of the radii = 10 $n - 1 = 10$ or $1 - n = 10$ $n = 11$ or $n = -9$ Answer only: full marks	✓ correct method ✓ sum of radii = 10 ✓ $n = 11$ ✓ $n = -9$ (4)
		[21]

QUESTION/*VRAAG* 5

5.1.1	$\sin 191°$ $= -\sin 11°$	✓ $-\sin 11°$ (1)
5.1.2	$\cos 22°$ $= \cos(2 \times 11°)$ $= 1 - 2\sin^2 11°$	 ✓ answer (1)
5.2	$\cos(x - 180°) + \sqrt{2}\sin(x + 45°)$ $= -\cos x + \sqrt{2}(\sin x \cos 45° + \cos x \sin 45°)$ $= -\cos x + \sqrt{2}\left(\sin x\left(\frac{1}{\sqrt{2}}\right) + \cos x\left(\frac{1}{\sqrt{2}}\right)\right)$ $= -\cos x + \sin x + \cos x$ $= \sin x$ **OR** $\cos(x - 180°) + \sqrt{2}\sin(x + 45°)$ $= -\cos x + \sqrt{2}(\sin x \cos 45° + \cos x \sin 45°)$ $= -\cos x + \sqrt{2}\left(\sin x\left(\frac{\sqrt{2}}{2}\right) + \cos x\left(\frac{\sqrt{2}}{2}\right)\right)$ $= -\cos x + \sin x + \cos x$ $= \sin x$	 ✓ $-\cos x$ ✓ expansion ✓ special angle ratios ✓simplification of last 2 terms ✓answer (5) ✓ $-\cos x$ ✓ expansion ✓ special angle ratios ✓simplification of last 2 terms ✓answer (5)
5.3	$\sin P + \sin Q = \sin P + \cos P$ $(\sin P + \cos P)^2 = \left(\frac{7}{5}\right)^2$ $\sin^2 P + 2\sin P \cos P + \cos^2 P = \frac{49}{25}$ $2\sin P \cos P = \frac{49}{25} - 1$ $\sin 2P = \left(\frac{49}{25} - \frac{25}{25}\right)$ $= \frac{24}{25}$	✓ $\sin Q = \cos P$ ✓ squaring ✓ expansion ✓ $\sin^2 P + \cos^2 P = 1$ ✓answer (5)
		[12]

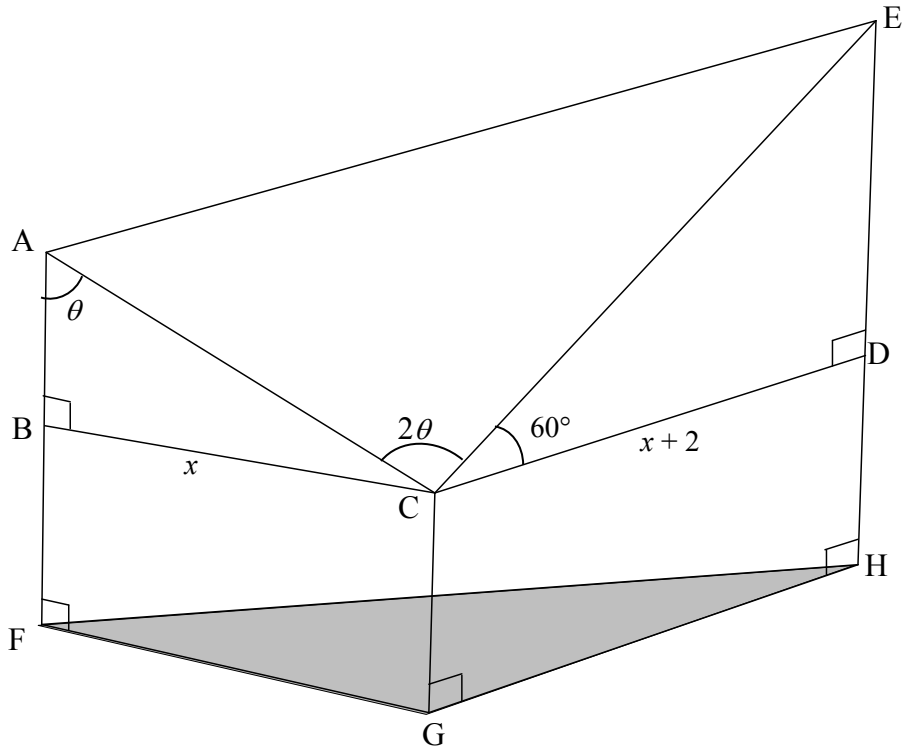
QUESTION/*VRAAG* 6

6.1	$\cos(x-30°) = 2\sin x$ $\cos x\cos 30° + \sin x\sin 30° = 2\sin x$ $\frac{\sqrt{3}}{2}\cos x + \frac{1}{2}\sin x = 2\sin x$ $\frac{\sqrt{3}}{2}\cos x = \frac{3}{2}\sin x$ $\tan x = \frac{\sqrt{3}}{3}$ $x = 30° + k.180°;\quad k \in Z$ **OR** $x = 30° + k.360°$ or $x = 210° + k.360°;\quad k \in Z$	✓ expansion ✓ special ∠s ✓ simplification ✓ equation in tan ✓ $30°$ ✓ $k.180°;\ k \in Z$ **OR** ✓ $30°$ and $210°$ ✓ $k.360°;\quad k \in Z$ (6)



6.2.1(a)	$A(120° ; 0)$	✓ answer (1)
6.2.1(b)	$C(-150° ; -1)$	✓ x value ✓ y value (2)
6.2.2(a)	$x \in (-90° ; 30°)$ OR $-90° < x < 30°$	✓ endpoints ✓ correct interval (2)
6.2.2(b)	$x \in (-160° ; 20°)$ OR $-160° < x < 20°$	✓endpoints ✓correct interval (2)
6.2.3	$y = 2^{2\sin x + 3}$ Range of $y = 2\sin x$: $y \in [-2 ; 2]$ **OR** $-2 \le y \le 2$ Range of $y = 2\sin x + 3$: $y \in [1 ; 5]$ **OR** $1 \le y \le 5$ Range: $y = 2^{2\sin x + 3}$: $y \in [2 ; 32]$ **OR** $2 \le y \le 32$ Answer only: full marks	✓ 1 ✓ 5 ✓ 2 ✓ 32 ✓ correct interval (5)
		[18]

QUESTION/*VRAAG* 7

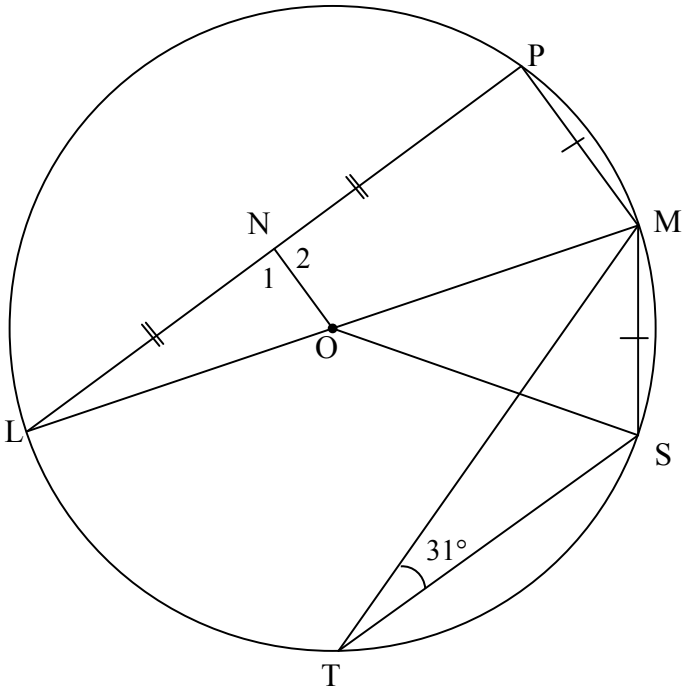


7.1.1	$\sin\theta=\frac{x}{AC}$ **OR** $\frac{\sin\theta}{x}=\frac{\sin 90°}{AC}$ $AC=\frac{x}{\sin\theta}$ $AC=\frac{x}{\sin\theta}$	✓ trig ratio ✓ simplification (2)
7.1.2	$\cos 60°=\frac{x+2}{CE}$ **OR** $\frac{\sin 30}{x+2}=\frac{\sin 90°}{CE}$ $CE=\frac{x+2}{\cos 60°}$ $CE=\frac{x+2}{\sin 30°}$ $=\frac{x+2}{\frac{1}{2}}=2(x+2)$ $=2(x+2)$	✓ trig ratio ✓ making CE the subject (2)
7.2	Area $\Delta ACE=\frac{1}{2}AC.EC.\sin A\hat{C}E$ $=\frac{1}{2}\left(\frac{x}{\sin\theta}\right)(2(x+2))\sin 2\theta$ $=\frac{x(x+2)\times 2\sin\theta\cos\theta}{\sin\theta}$ $=2x(x+2)\cos\theta$	✓ use area rule correctly ✓ substitution of $\frac{x}{\sin\theta}(2(x+2))$ ✓ substitution of $\sin 2\theta$ (3)

7.3	$EC = 2(12 + 2) = 28$ $AE^2 = AC^2 + EC^2 - 2(AC)(EC)\cos A\hat{C}E$ $= \left(\frac{12}{\sin 55°}\right)^2 + 28^2 - 2\left(\frac{12}{\sin 55°}\right)(28)\cos 110°$ $AE = 35,77m$	✓ EC ✓ use cosine rule correctly ✓ substitution ✓ answer (4)
		[11]

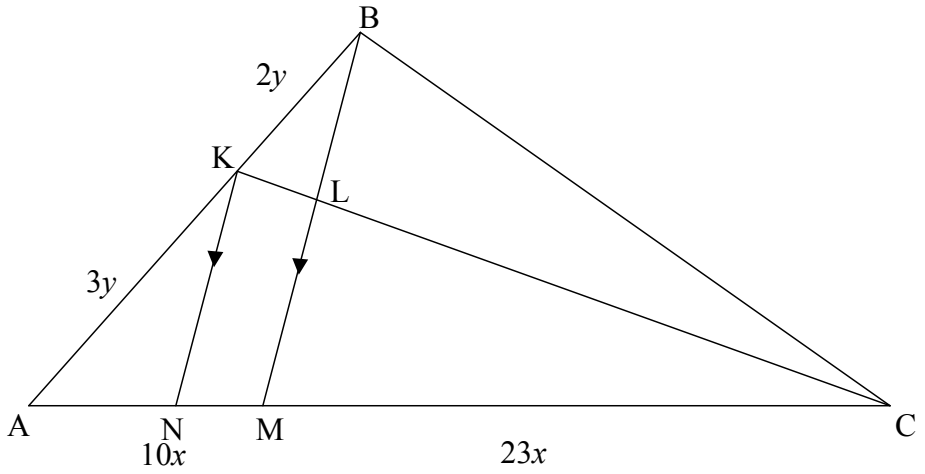
QUESTION/*VRAAG* 8

8.1



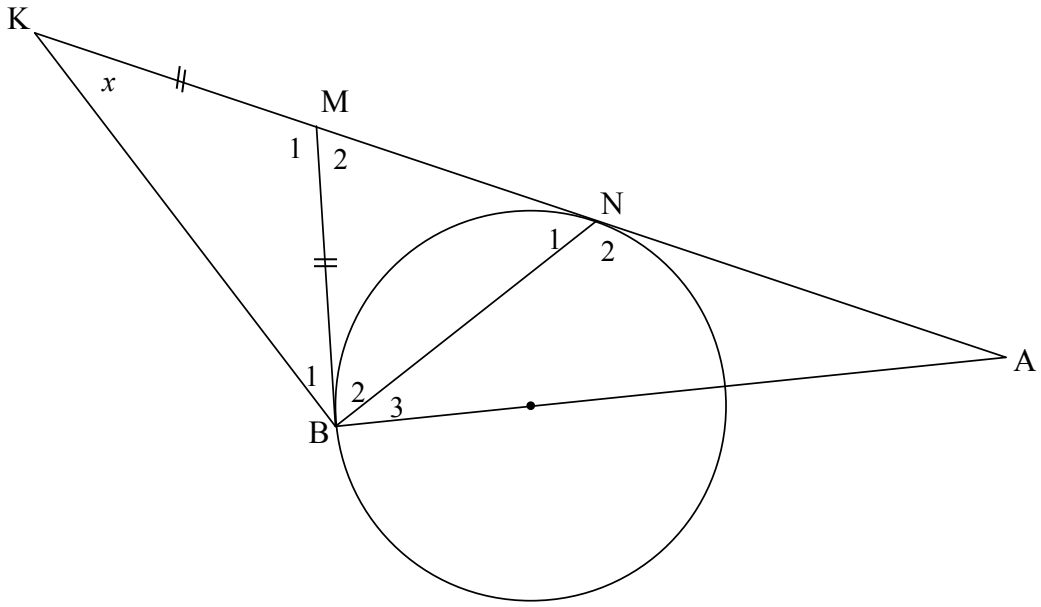
8.1.1(a)	$M\hat{O}S = 62°$ [∠ at centre = 2× ∠ at circumf/*middelpts∠ =2omtreks∠*]	✓ S ✓ R (2)
8.1.1(b)	$\hat{L} = 31°$ [equal chords; equal ∠s /= *koorde; = ∠e*]	✓ S ✓ R (2)
8.1.2	LN = NP and LO = OM ∴ ON = $\frac{1}{2}$PM [midpoint theorem/*middelpuntstelling*] ∴ ON = $\frac{1}{2}$MS [PM = MS] **OR** $\hat{N}_1 = 90°$ [line from centre to midpt chord/*lyn v midpt na midpt kd*] $\hat{P} = 90°$ [∠ in semi-circle/*∠ in halfsirkel*] $\hat{L}$ is common/*gemeen* ∴ ΔNLO ||| Δ PLM (∠∠∠) $\frac{NL}{PL} = \frac{NO}{PM} = \frac{1}{2}$ ∴ ON = $\frac{1}{2}$PM ∴ ON = $\frac{1}{2}$MS [PM = MS]	✓ LO = OM ✓ S ✓ R ✓ S (4) ✓ S R ✓ S/R ✓ S ✓ S (4)

8.2



8.2.1	$\frac{AN}{AM}=\frac{AK}{AB}$ [line || one side of Δ **OR** prop theorem; KN ||BM/ *lyn || sy van Δ **OR** eweredigheidst; KN||BM*] $\frac{AN}{AM}=\frac{3y}{5y}=\frac{3}{5}$	✓ R ✓ S (2)
8.2.2	$\frac{AM}{MC}=\frac{10x}{23x}$ [given] $AM = 5y = 10x \quad \therefore \quad y = 2x$ $\frac{LC}{KL}=\frac{MC}{NM}$ [line || one side of Δ **OR** prop theorem; KN ||LM/ *lyn || sy van Δ **OR** eweredigheidst; KN||BM*] $=\frac{23x}{2y}=\frac{23x}{4x}=\frac{23}{4}$ **OR** $\frac{AM}{MC}=\frac{10x}{23x}$ [given] $\frac{AN}{MN}=\frac{3y}{2y}=\frac{6x}{4x}$ $\frac{LC}{KL}=\frac{MC}{NM}$ [line || one side of Δ **OR** prop theorem; KN ||LM/ *lyn || sy van Δ **OR** eweredigheidst; KN||BM*] $=\frac{23x}{2y}=\frac{23x}{4x}=\frac{23}{4}$	✓ S ✓ R ✓ S (3) ✓ S ✓ R ✓ S (3)
		[13]

QUESTION/*VRAAG* 9

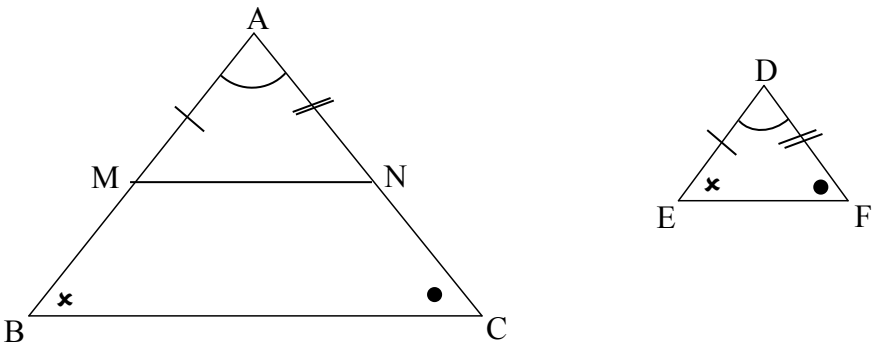


9.1	$\hat{B}_1 = x$ [$\angle$'s opp = sides/*$\angle$e teenoor = sye*]	✓S
	$\hat{M}_2 = 2x$ [ext $\angle$ of Δ] **OR** $\hat{M}_1 = 180° - 2x$ [$\angle$s of Δ]	✓S ✓R
	BM = MN [2 tans from a common point/*raaklyne vanuit dieselfde punt*]	✓S ✓R
	$\hat{N}_1 = \frac{180° - 2x}{2} = 90° - x$ [$\angle$'s opp = sides/*$\angle$e teenoor = sye*]	✓answer (6)
	OR	
	NM = BM [2 tans from a common point/*raaklyne vanuit dieselfde punt*]	✓S ✓R
	$\hat{B}_2 = \hat{N}_1$ [$\angle$'s opp = sides/*$\angle$e teenoor = sye*]	✓S ✓R
	$\hat{B}_1 = x$ [$\angle$'s opp = sides/*$\angle$e teenoor = sye*]	✓S
	In Δ KBN:	
	$x + x + \hat{B}_2 + \hat{N}_1 = 180°$ [sum of $\angle$'s of Δ]	
	$2x + 2\hat{N}_1 = 180°$	
	$x + \hat{N}_1 = 90°$	
	$\hat{N}_1 = 90° - x$	✓answer (6)
9.2	$M\hat{B}A = \hat{B}_2 + \hat{B}_3 = 90°$ [tangent⊥diameter/*raaklyn⊥middellyn*]	✓S ✓ R
	$\hat{B}_3 = 90° - \hat{B}_2$	
	$= 90° - (90° - x) = x$	✓ S
	$\hat{B}_3 = \hat{K} = x$	✓ S
	∴ AB is a tangent/*raaklyn* converse tan-chord theorem/ *omgekeerde raakl koordst*]]	✓ R (5)

	OR $\hat{B}_2 = \hat{N}_1$ $\hat{B}_1 + \hat{B}_2 = x + (90° - x) = 90°$ $\therefore$ KN is diameter/*middellyn* [converse $\angle$ in semi-circle/ *omgekeerde $\angle$ in halfsirkel*] $M\hat{B}A = \hat{B}_2 + \hat{B}_3 = 90°$ [tangent $\perp$ diameter] $\therefore$ AB is a tangent/*raaklyn* converse tan-chord theorem/ *omgekeerde raakl koordst*]]	✓S ✓ R ✓ S ✓ R ✓ R (5)
		[11]

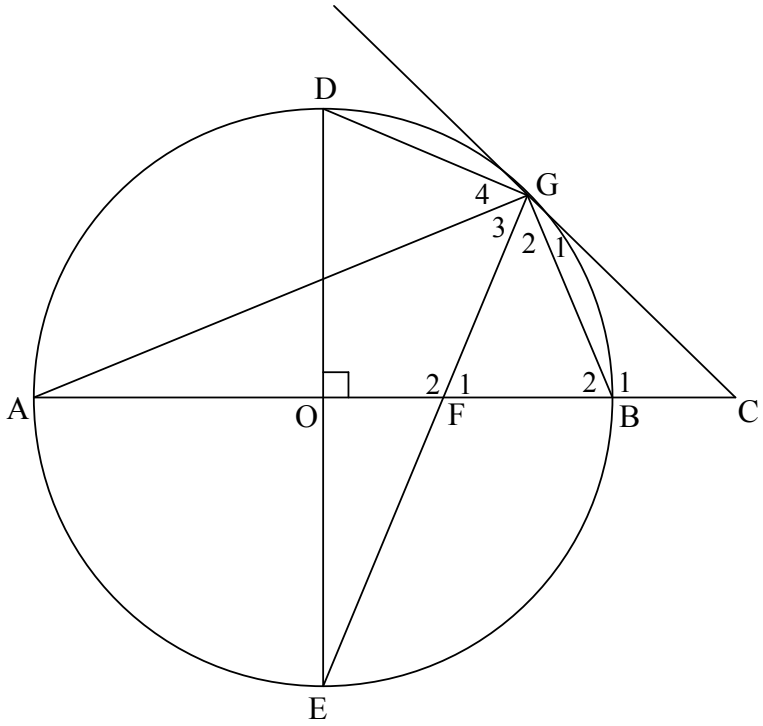
QUESTION/*VRAAG* 10

10.1



10.1	Constr: Let M and N lie on AB and AC respectively such that AM = DE and AN = DF. Draw MN. *Konst: Merk M en N op AB en AC onderskeidelik af sodanig dat AM = DE en AN = DF. Verbind MN.* Proof: In Δ AMN and Δ DEF AM = DE [Constr] AN = DF [Constr] $\hat{A} = \hat{D}$ [Given] $\therefore\ \Delta AMN \equiv \Delta DEF$ (SAS) $\therefore A\hat{M}N = \hat{E} = \hat{B}$ MN || BC [corresp ∠'s are equal/*ooreenkomstige ∠e* =] $\frac{AB}{AM} = \frac{AC}{AN}$ [line || one side of Δ **OR** prop theorem; MN ||BC] $\therefore\ \frac{AB}{DE} = \frac{AC}{DF}$ [AM = DE and AN = DF]	✓Constr / *Konstr* ✓ $\Delta AMN \equiv \Delta DEF$ ✓SAS ✓MN || BC and R ✓ $\frac{AB}{AM} = \frac{AC}{AN}$ ✓R (6)

10.2



10.2.1(a)	$D\hat{O}B = 90°$ $D\hat{G}F = \hat{G}_3 + \hat{G}_4 = 90°$ [∠ in semi-circle/*∠ in halfsirkel*] $D\hat{O}B + D\hat{G}F = 180°$ ∴ DGFO is a cyclic quad. [converse: opp ∠s of cyclic quad/ *omgekeerde teenoorst ∠e v koordevh*] OR ∠s of quad = 180°/*∠e van koordevh = 180°*] **OR** $E\hat{O}B = 90°$ $D\hat{G}F = \hat{G}_3 + \hat{G}_4 = 90°$ [∠ in semi-circle/*∠ in halfsirkel*] $E\hat{O}B = D\hat{G}F$ ∴ DGFO is a cyclic quad. . [converse: ext ∠ = opp int ∠/ *omgekeerde buite∠ = teenoorst ∠*] OR ext∠ of quad = opp int ∠/*buite∠ v vh = teenoorst ∠*]	✓ S ✓R ✓ R (3) ✓ S ✓R ✓ R (3)
10.2.1(b)	$\hat{F}_1 = \hat{D}$ [ext ∠of cyclic quad/buite∠ v koordevh] $\hat{G}_1 + \hat{G}_2 = \hat{D}$ [tan-chord theorem/raakl koordst] $\therefore \hat{F}_1 = \hat{G}_1 + \hat{G}_2$ ∴ GC = CF [sides opp equal ∠s/sye teenoor = ∠e]	✓ S ✓ R ✓ S ✓ R ✓ R (5)

10.2.2(a)	AB = DE = 14 [diameters/*middellyne*] ∴ OB = 7 units ∴ BC = OC – OB = 11 – 7 = 4 units Answer only: full marks	✓ S ✓ S ✓ S (3)
10.2.2(b)	In ΔCGB and ΔCAG $\hat{G}_1 = \hat{A} = x$ [tan-chord theorem/*raakl koordst*] $\hat{C} = \hat{C}$ [common] $\Delta CGB \text{ ||| } \Delta CAG$ [∠, ∠, ∠] $\frac{CG}{CA} = \frac{CB}{CG}$ $\frac{CG}{18} = \frac{4}{CG}$ $CG^2 = 72$ $CG = \sqrt{72}$ or $6\sqrt{2}$ *or* 8,49 units	✓ S/R ✓ S ✓ S ✓ CA = 18 ✓answer (5)
10.2.2(c)	OF = OC – FC $= 11 - \sqrt{72}$ $\tan E = \frac{OF}{OE}$ $= \frac{11-\sqrt{72}}{7} = 0,36$ $\hat{E} = 19,76°$ **OR** OF = OC – FC $= 11 - \sqrt{72}$ $FE^2 = OE^2 + OF^2$ $= 7^2 + (11-\sqrt{72})^2$ FE = 7,437.. = 7,44 $\cos E = \frac{OE}{FE}$ *OR* $\sin E = \frac{OF}{FE}$ $= \frac{7}{7,44} = 0,94$ $= \frac{11-\sqrt{72}}{7,44} = 0,338$ $\hat{E} = 19,76°$ $\hat{E} = 19,76°$	✓ OF ✓ trig ratio ✓ substitution ✓ answer (4) ✓ OF ✓ trig ratio ✓ substitution ✓ answer (4)
		[26]

	TOTAL/*TOTAAL*:	**150**