basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P2

NOVEMBER 2017

MARKS: 150

TIME: 3 hours

This question paper consists of 14 pages, 1 information sheet and an answer book of 28 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

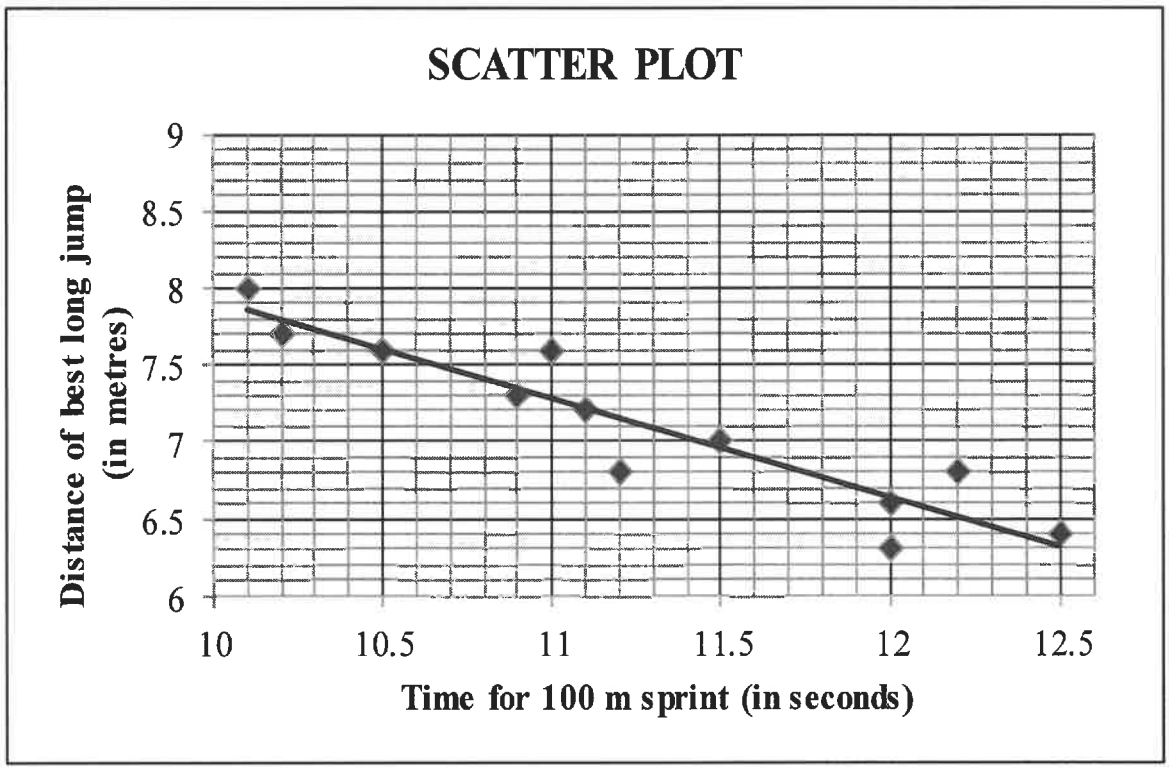
1. This question paper consists of 11 questions.
2. Answer ALL the questions in the ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers 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

The table below shows the time (in seconds, rounded to ONE decimal place) taken by 12 athletes to run the 100 metre sprint and the distance (in metres, rounded to ONE decimal place) of their best long jump.

Time for 100 m sprint (in seconds)	10,1	10,2	10,5	10,9	11	11,1	11,2	11,5	12	12	12,2	12,5
Distance of best long jump (in metres)	8	7,7	7,6	7,3	7,6	7,2	6,8	7	6,6	6,3	6,8	6,4

The scatter plot representing the data above is given below.



The equation of the least squares regression line is $\hat{y} = a + bx$.

1.1 Determine the values of a and b. (3)

1.2 An athlete runs the 100 metre sprint in 11,7 seconds. Use $\hat{y} = a + bx$ to predict the distance of the best long jump of this athlete. (2)

1.3 Another athlete completes the 100 metre sprint in 12,3 seconds and the distance of his best long jump is 7,6 metres. If this is included in the data, will the gradient of the least squares regression line increase or decrease? Motivate your answer without any further calculations. (2)
[7]

QUESTION 2

In an experiment, a group of 23 girls were presented with a page containing 30 coloured rectangles. They were asked to name the colours of the rectangles correctly as quickly as possible. The time, in seconds, taken by each of the girls is given in the table below.

12	13	13	14	14	16	17	18	18	18	19	20
21	21	22	22	23	24	25	27	29	30	36	

2.1 Calculate:

2.1.1 The mean of the data (2)

2.1.2 The interquartile range of the data (3)

2.2 The standard deviation of the times taken by the girls is 5,94. How many girls took longer than ONE standard deviation from the mean to name the colours? (2)

2.3 Draw a box and whisker diagram to represent the data on the number line provided in the ANSWER BOOK. (3)

2.4 The five-number summary of the times taken by a group of 23 boys in naming the colours of the rectangles correctly is (15 ; 21 ; 23,5 ; 26 ; 38).

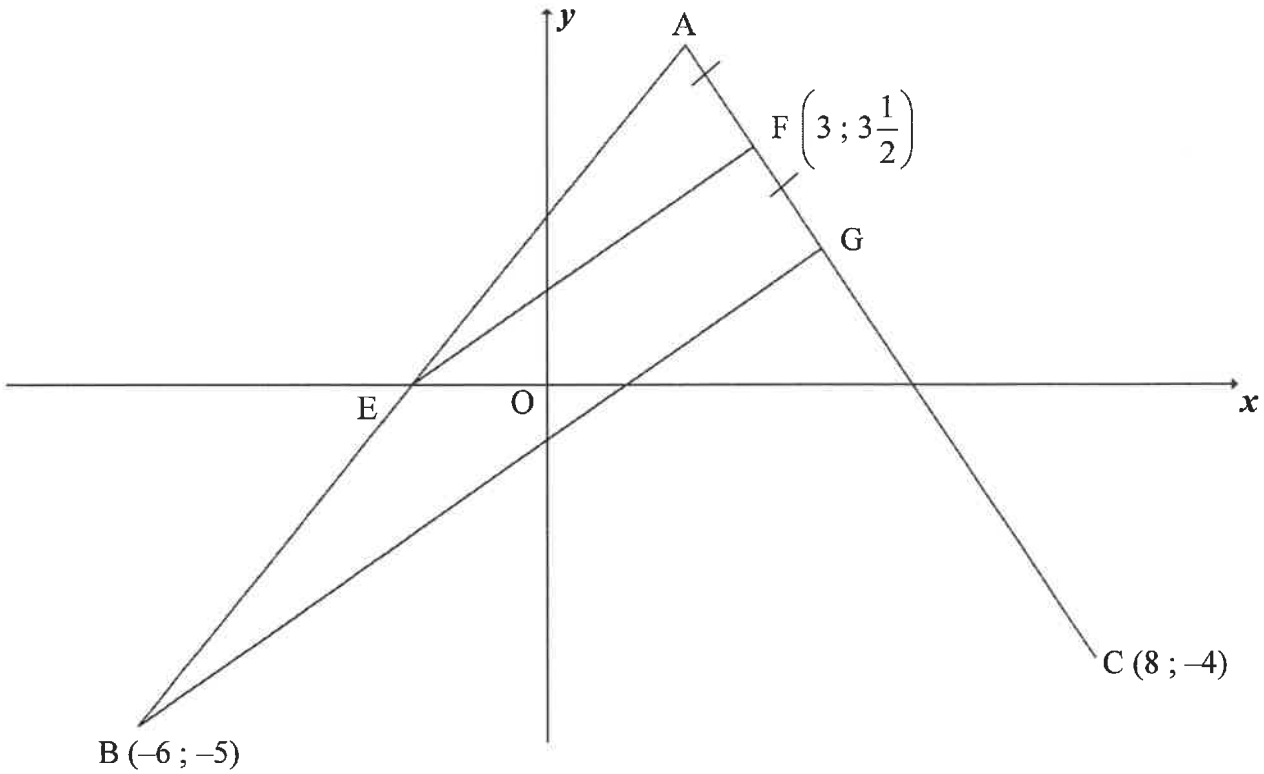
2.4.1 Which of the two groups, girls or boys, had the lower median time to correctly name the colours of the rectangles? (1)

2.4.2 The first three learners who named the colours of all 30 rectangles correctly in the shortest time will receive a prize. How many boys will be among these three prizewinners? Motivate your answer. (2)

[13]

QUESTION 3

In the diagram, A, B(–6 ; –5) and C(8 ; –4) are points in the Cartesian plane. $F\left(3;3\frac{1}{2}\right)$ and G are points on line AC such that AF = FG. E is the *x*-intercept of AB.



3.1 Calculate:

3.1.1 The equation of AC in the form $y = mx + c$ (4)

3.1.2 The coordinates of G if the equation of BG is $7x - 10y = 8$ (3)

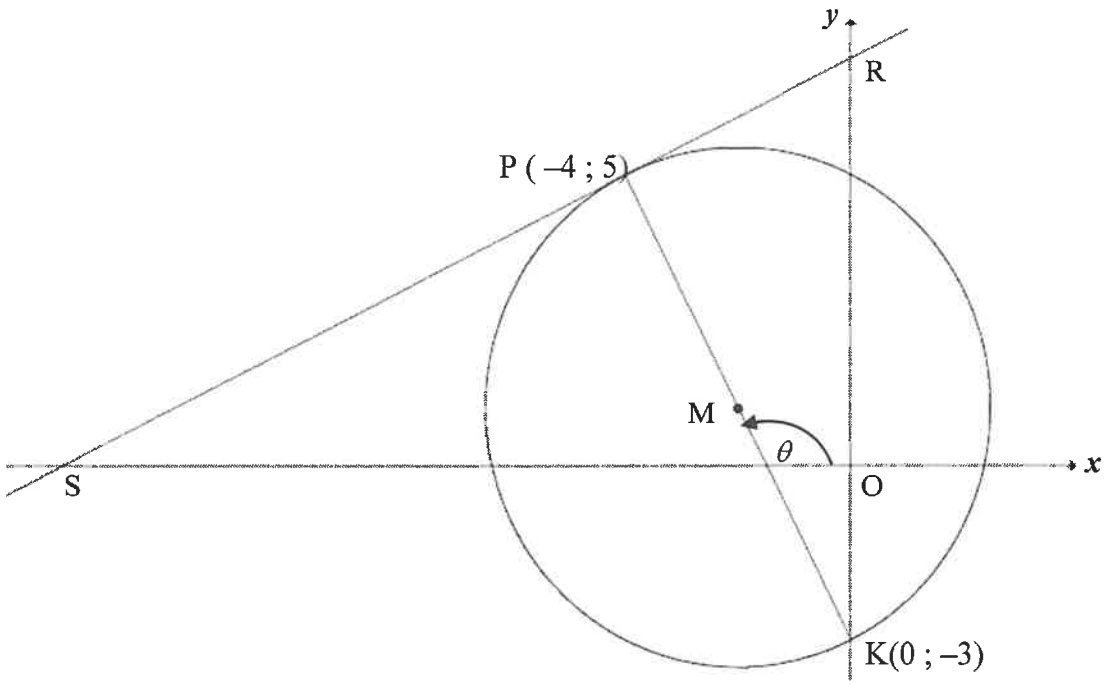
3.2 Show by calculation that the coordinates of A is (2 ; 5). (2)

3.3 Prove that EF || BG. (4)

3.4 ABCD is a parallelogram with D in the first quadrant. Calculate the coordinates of D. (4)
[17]

QUESTION 4

In the diagram, P(–4 ; 5) and K(0 ; –3) are the end points of the diameter of a circle with centre M. S and R are respectively the x- and y-intercept of the tangent to the circle at P. θ is the inclination of PK with the positive x-axis.



4.1 Determine:

4.1.1 The gradient of SR (4)

4.1.2 The equation of SR in the form $y = mx + c$ (2)

4.1.3 The equation of the circle in the form $(x-a)^2 + (y-b)^2 = r^2$ (4)

4.1.4 The size of $P\hat{K}R$ (3)

4.1.5 The equation of the tangent to the circle at K in the form $y = mx + c$ (2)

4.2 Determine the values of t such that the line $y = \frac{1}{2}x + t$ cuts the circle at two different points. (3)

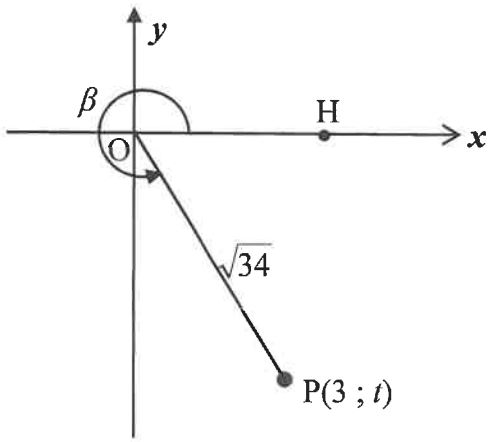
4.3 Calculate the area of ΔSMK. (5)
[23]

QUESTION 5

5.1 Given: $\dfrac{\sin(A-360°).\cos(90°+A)}{\cos(90°-A).\tan(-A)}$

Simplify the expression to a single trigonometric ratio. (6)

5.2 In the diagram, P(3 ; t) is a point in the Cartesian plane. OP $=\sqrt{34}$ and $\hat{HOP}=\beta$ is a reflex angle.



Without using a calculator, determine the value of:

5.2.1 t (2)

5.2.2 $\tan\beta$ (1)

5.2.3 $\cos 2\beta$ (4)

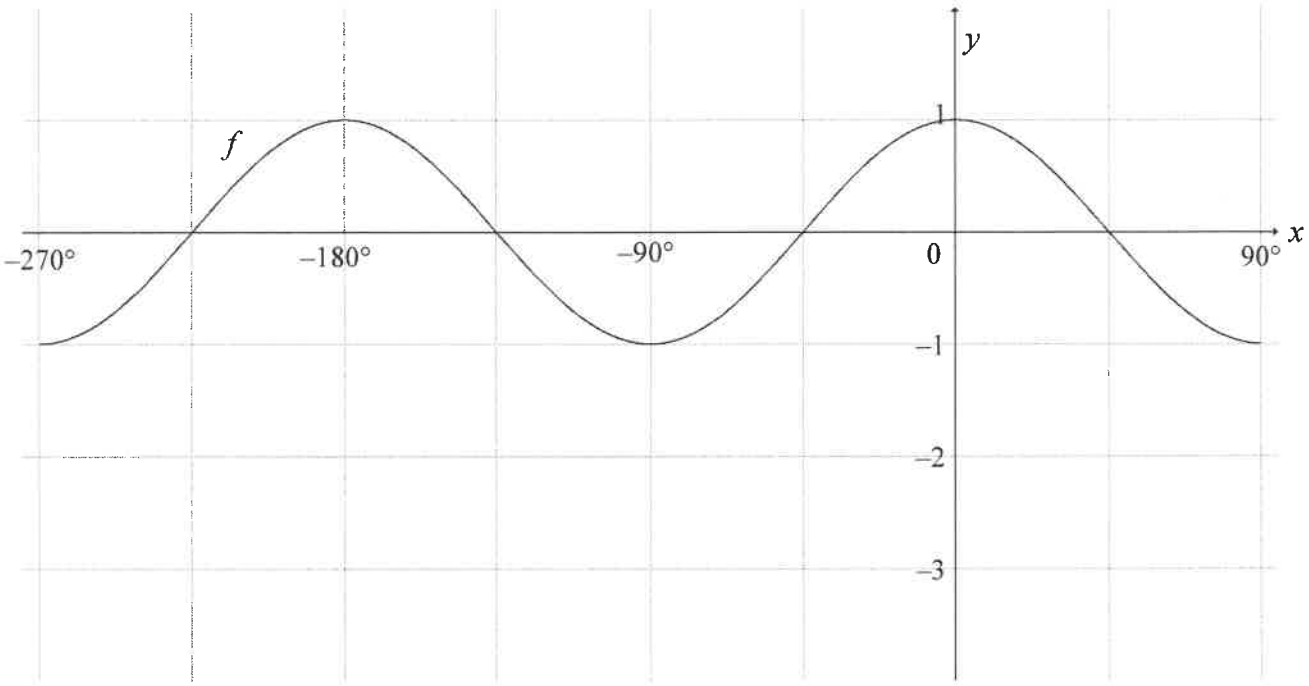
5.3 Prove:

5.3.1 $\sin(A+B)-\sin(A-B)=2\cos A.\sin B$ (2)

5.3.2 **Without using a calculator,** that $\sin 77°-\sin 43°=\sin 17°$ (4)
[19]

QUESTION 6

In the diagram, the graph of $f(x) = \cos 2x$ is drawn for the interval $x \in [-270°; 90°]$.



6.1 Draw the graph of $g(x) = 2\sin x - 1$ for the interval $x \in [-270°; 90°]$ on the grid given in your ANSWER BOOK. Show ALL the intercepts with the axes, as well as the turning points. (4)

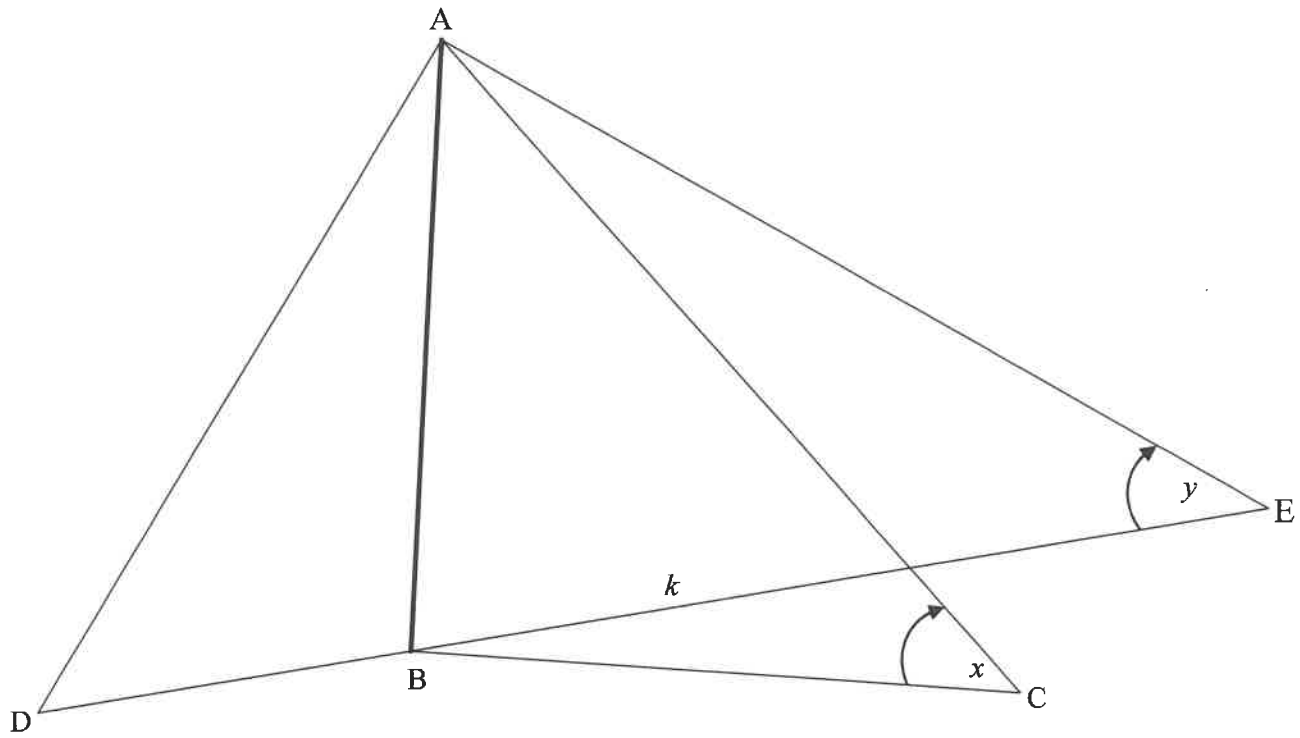
6.2 Let A be a point of intersection of the graphs of f and g. Show that the x-coordinate of A satisfies the equation $\sin x = \dfrac{-1+\sqrt{5}}{2}$. (4)

6.3 Hence, calculate the coordinates of the points of intersection of graphs of f and g for the interval $x \in [-270°; 90°]$. (4)

[12]

QUESTION 7

AB represents a vertical netball pole. Two players are positioned on either side of the netball pole at points D and E such that D, B and E are on the same straight line. A third player is positioned at C. The points B, C, D and E are in the same horizontal plane. The angles of elevation from C to A and from E to A are x and y respectively. The distance from B to E is k.



7.1 Write down the size of $A\hat{B}C$. (1)

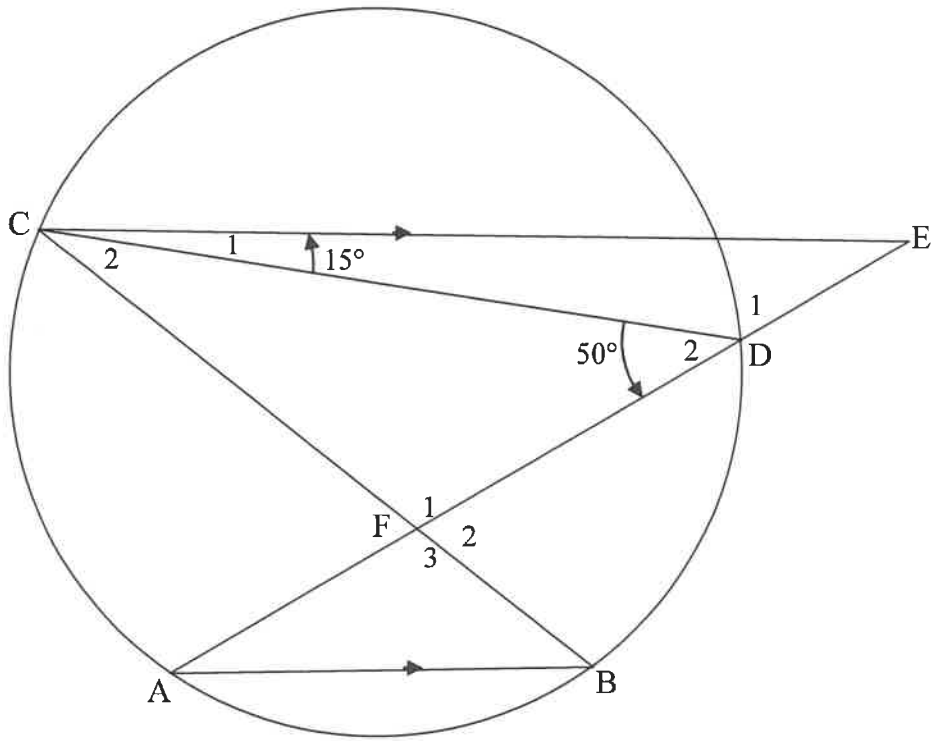
7.2 Show that $AC = \dfrac{k.\tan y}{\sin x}$ (4)

7.3 If it is further given that $D\hat{A}C = 2x$ and AD = AC, show that the distance DC between the players at D and C is $2k\tan y$. (5)
[10]

Give reasons for your statements in QUESTIONS 8, 9, 10 and 11.

QUESTION 8

In the diagram, points A, B, D and C lie on a circle. CE || AB with E on AD produced. Chords CB and AD intersect at F. $\hat{D}_2 = 50°$ and $\hat{C}_1 = 15°$.



8.1 Calculate, with reasons, the size of:

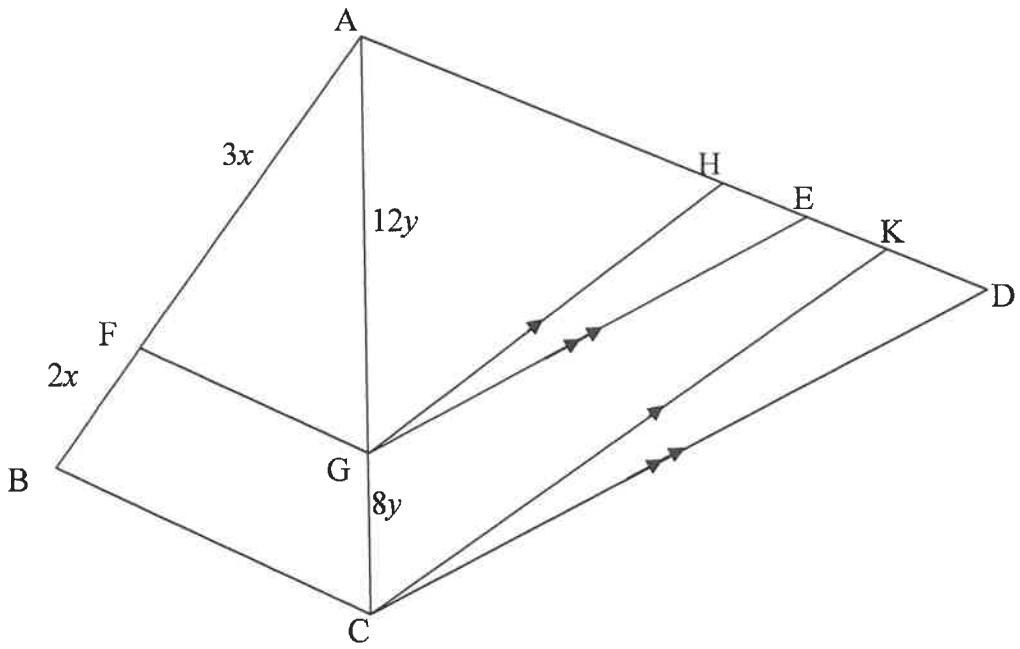
8.1.1 $\hat{A}$ (3)

8.1.2 $\hat{C}_2$ (2)

8.2 Prove, with a reason, that CF is a tangent to the circle passing through points C, D and E. (2)
[7]

QUESTION 9

In the diagram, ΔABC and ΔACD are drawn. F and G are points on sides AB and AC respectively such that AF = $3x$, FB = $2x$, AG = $12y$ and GC = $8y$. H, E and K are points on side AD such that GH || CK and GE || CD.



9.1 Prove that:

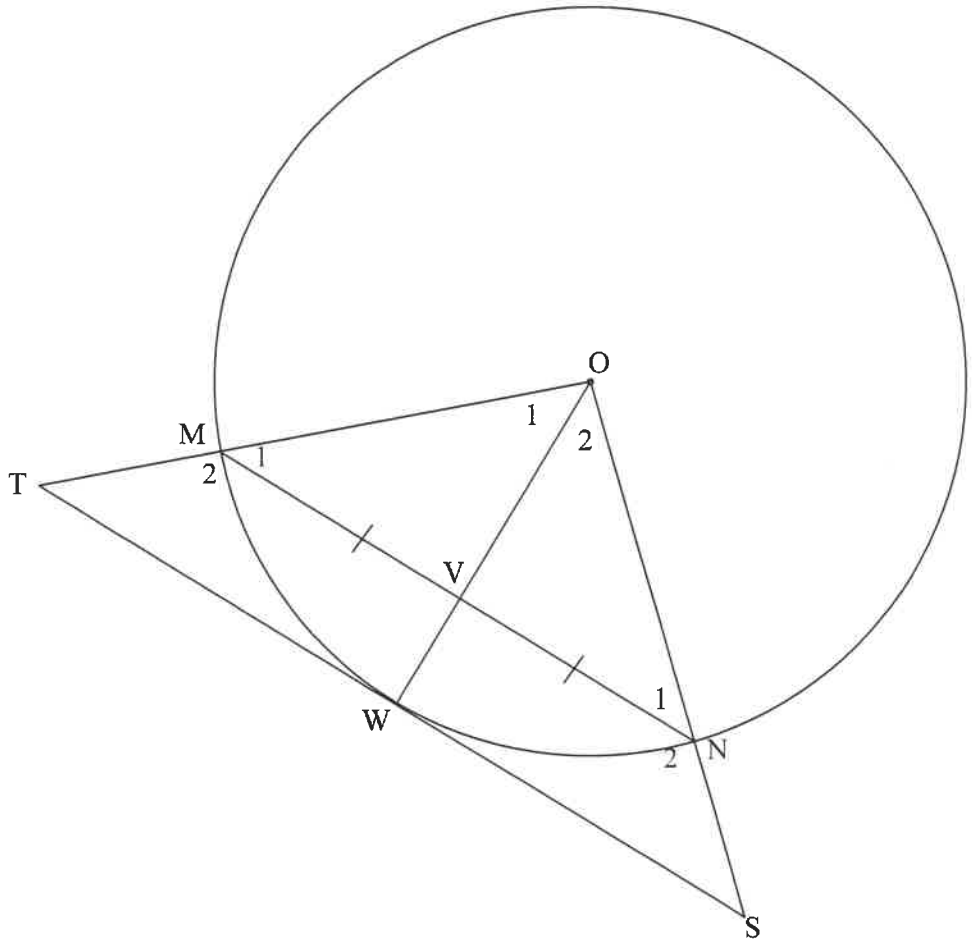
9.1.1 FG || BC (2)

9.1.2 $\frac{AH}{HK} = \frac{AE}{ED}$ (3)

9.2 If it is further given that AH = 15 and ED = 12, calculate the length of EK. (5)
[10]

QUESTION 10

In the diagram, W is a point on the circle with centre O. V is a point on OW. Chord MN is drawn such that MV = VN. The tangent at W meets OM produced at T and ON produced at S.



10.1 Give a reason why OV ⊥ MN. (1)

10.2 Prove that:

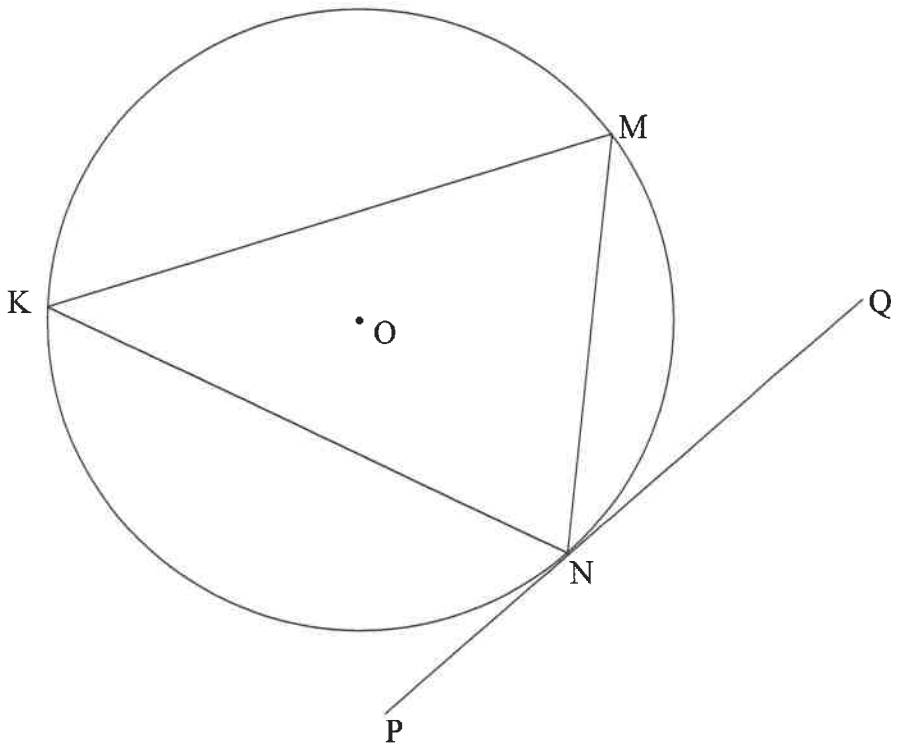
10.2.1 MN || TS (2)

10.2.2 TMNS is a cyclic quadrilateral (4)

10.2.3 OS . MN = 2ON . WS (5)
[12]

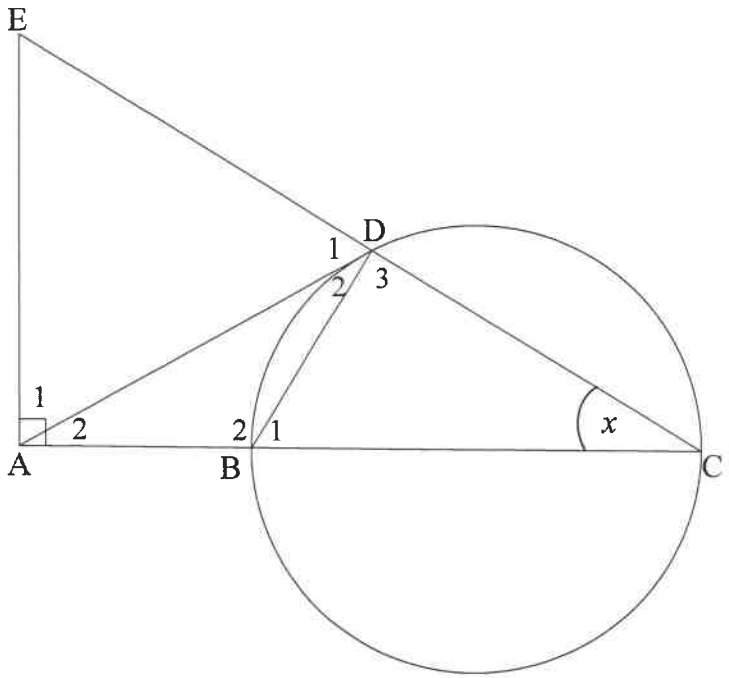
QUESTION 11

11.1 In the diagram, chords KM, MN and KN are drawn in the circle with centre O. PNQ is the tangent to the circle at N.



Prove the theorem which states that $M\hat{N}Q = \hat{K}$. (5)

11.2 In the diagram, BC is a diameter of the circle. The tangent at point D on the circle meets CB produced at A. CD is produced to E such that EA ⊥ AC. BD is drawn.
Let $\hat{C} = x$.



11.2.1 Give a reason why:

(a) $\hat{D}_3 = 90°$ (1)

(b) ABDE is a cyclic quadrilateral (1)

(c) $\hat{D}_2 = x$ (1)

11.2.2 Prove that:

(a) AD = AE (3)

(b) $\Delta ADB \,|||\, \Delta ACD$ (3)

11.2.3 It is further given that BC = 2AB = 2r.

(a) Prove that $AD^2 = 3r^2$ (2)

(b) Hence, prove that ΔADE is equilateral. (4)
[20]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

In ΔABC:

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

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

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

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

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

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

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

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

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

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Candidate Barcode Label/*Stafieskodeplakker*

National Senior Certificate Answer Book
Nasionale Seniorsertifikaat-antwoordeboek

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

Sequence No. on mark sheet
Volgnommer op puntestaat:

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
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CONTROLLED AND CERTIFIED CORRECT
(SURNAME AND INITIALS OF EA)
GEKONTROLEER EN AS KORREK GESERTIFISEER
(VAN EN VOORLETTERS VAN EA)

READ INSTRUCTIONS ON NEXT PAGE.
LEES INSTRUKSIES OP VOLGENDE BLADSY.

This answer book consists of 28 pages./*Hierdie antwoordeboek bestaan uit 28 bladsye.*

FOLLOW THESE INSTRUCTIONS CAREFULLY	VOLG HIERDIE INSTRUKSIES NOUKEURIG
1. Clearly write your examination number and centre number in the spaces provided and attach your barcode label in the space provided.	1. Skryf jou eksamennommer en sentrumnommer duidelik in die ruimtes soos verskaf en plak jou stafieskodeplakker in die ruimte soos 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. No pages may be torn from this answer book.	3. Geen bladsye mag uit hierdie antwoordeboek geskeur word nie.
4. Read the instructions printed on your timetable carefully as well as any other instructions which may be given in each examination paper.	4. Lees die instruksies wat op jou eksamenrooster gedruk is, sorgvuldig deur, asook enige ander instruksies wat in elke eksamenvraestel gegee word.
5. Candidates may not retain any answer book or remove them from the examination room.	5. Geen antwoordeboek mag deur die kandidaat behou of uit die eksamenlokaal verwyder word nie.
6. Answers must be written in black/blue ink as distinctly as possible.	6. Skryf die antwoorde so duidelik moontlik met swart/blou.
7. Draw a neat line through any work/rough work that must not be marked.	7. Trek 'n netjiese lyn deur enige werk/rofwerk wat nie nagesien moet word nie.

QUESTION/*VRAAG* 1

Time for 100 m sprint (in seconds) ***Tyd vir 100 m-naelloop (in sekondes)***	10,1	10,2	10,5	10,9	11	11,1	11,2	11,5	12	12	12,2	12,5
Distance of best long jump (in metres) ***Afstand van beste sprong in verspring (in meter)***	8	7,7	7,6	7,3	7,6	7,2	6,8	7	6,6	6,3	6,8	6,4

	Solution/*Oplossing*	**Marks** ***Punte***
1.1		(3)
1.2		(2)
1.3		(2)
		[7]

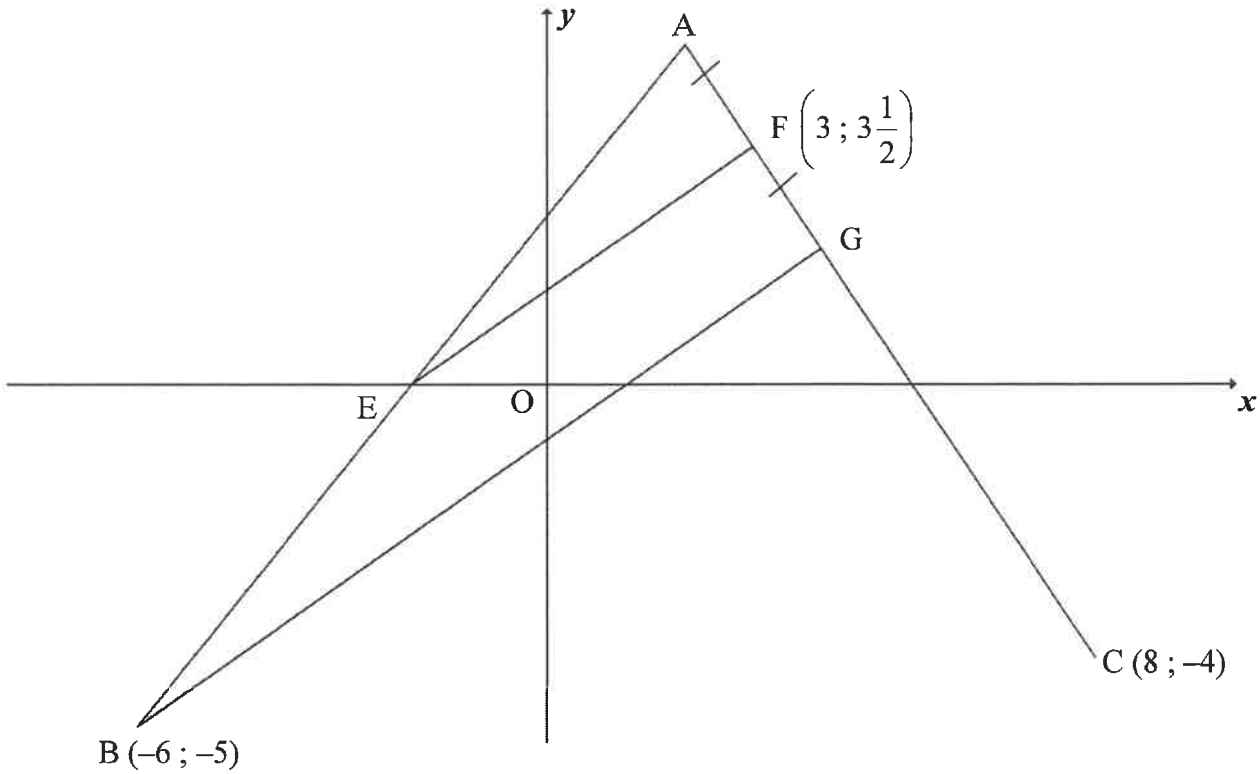
QUESTION/*VRAAG* 2

12	13	13	14	14	16	17	18	18	18	19	20
21	21	22	22	23	24	25	27	29	30	36	

	Solution/*Oplossing*	**Marks** ***Punte***
2.1.1		(2)
2.1.2		(3)
2.2		(2)
2.3	10 12 14 16 18 20 22 24 26 28 30 32 34 36 38	(3)

	Solution/*Oplossing*	**Marks** ***Punte***
2.4.1		(1)
2.4.2		(2)
		[13]

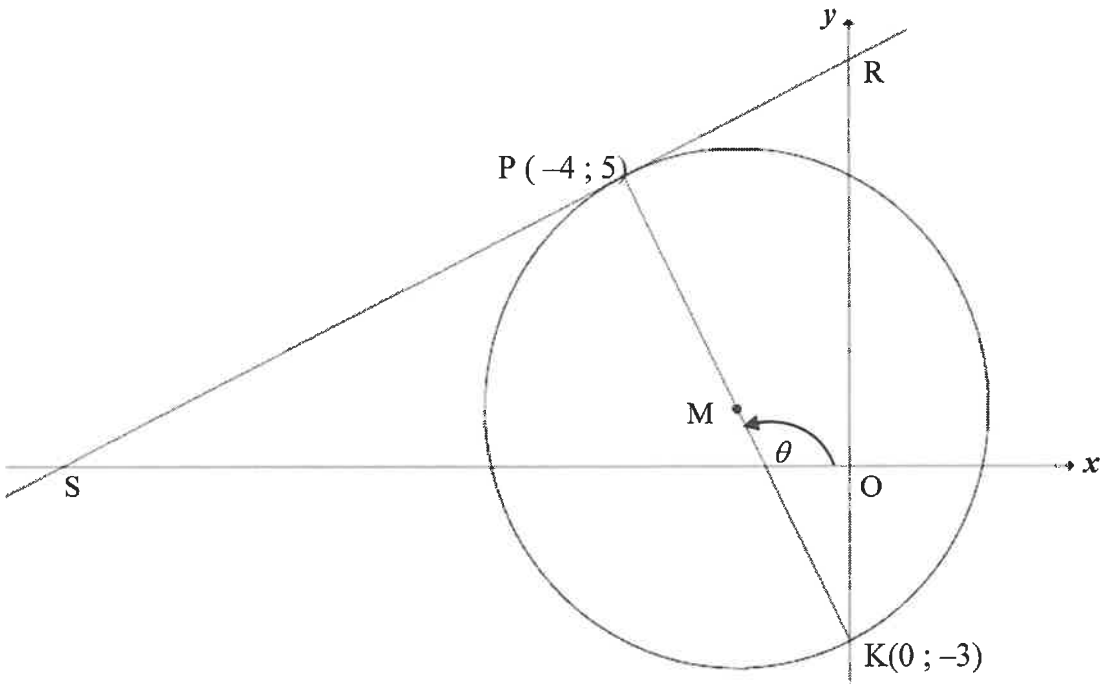
QUESTION/*VRAAG* 3



	Solution/*Oplossing*	**Marks** ***Punte***
3.1.1		(4)
3.1.2		

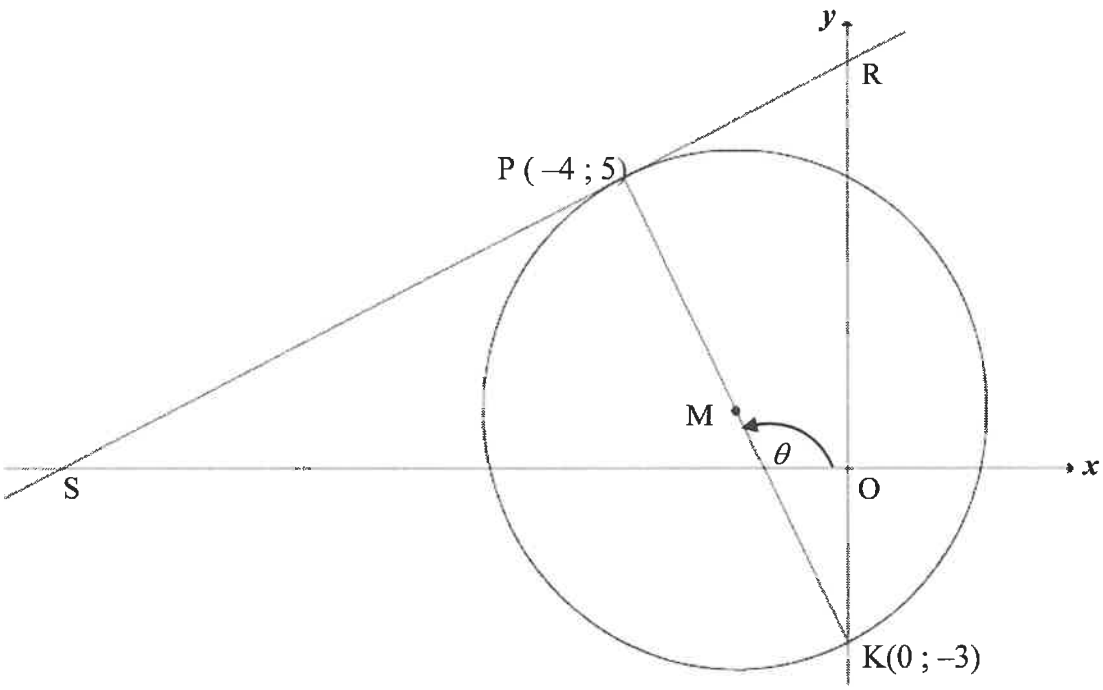
	Solution/*Oplossing*	**Marks** ***Punte***
3.1.2 (cont./ *vervolg*)		(3)
3.2		(2)
3.3		(4)
3.4		(4)
		[17]

QUESTION/*VRAAG* 4



	Solution/*Oplossing*	**Marks** ***Punte***
4.1.1		(4)
4.1.2		(2)

	Solution/*Oplossing*	**Marks** ***Punte***
4.1.3		(4)
4.1.4		(3)
4.1.5		(2)
4.2		(3)

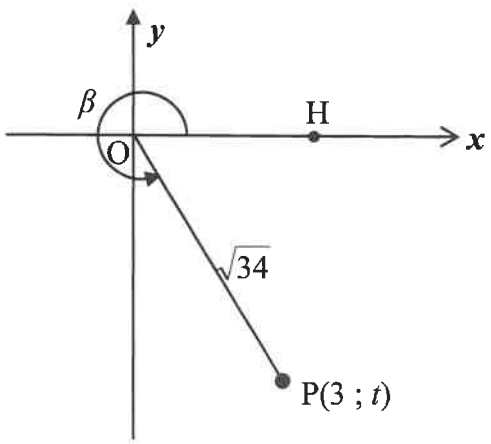


	Solution/*Oplossing*	Marks *Punte*
4.3		(5)
		[23]

QUESTION/*VRAAG* 5

	Solution/*Oplossing*	**Marks** ***Punte***
5.1		(6)

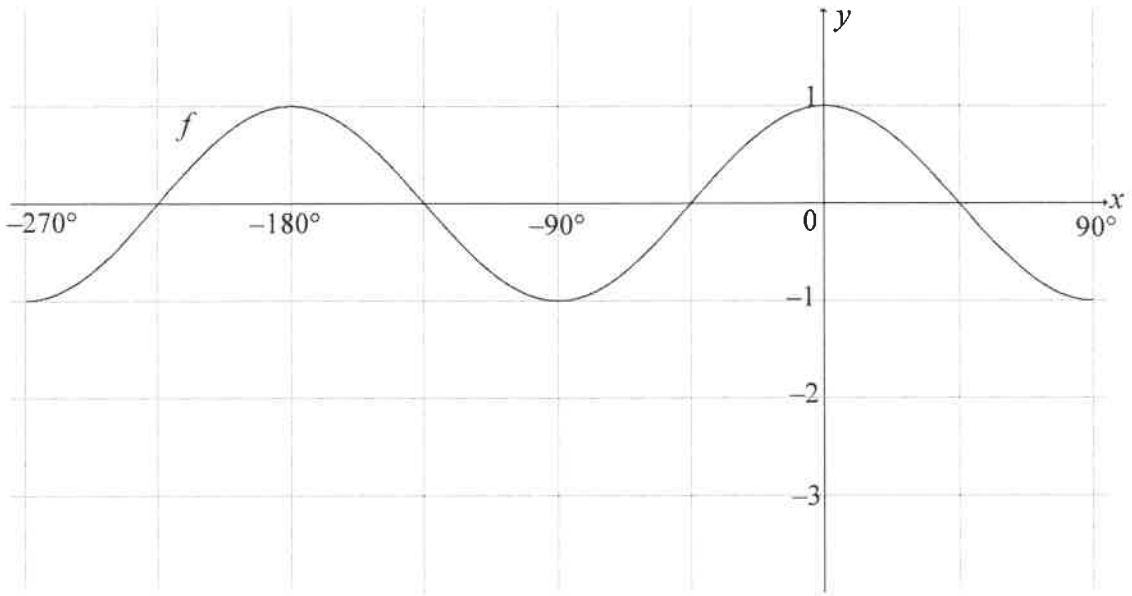
5.2



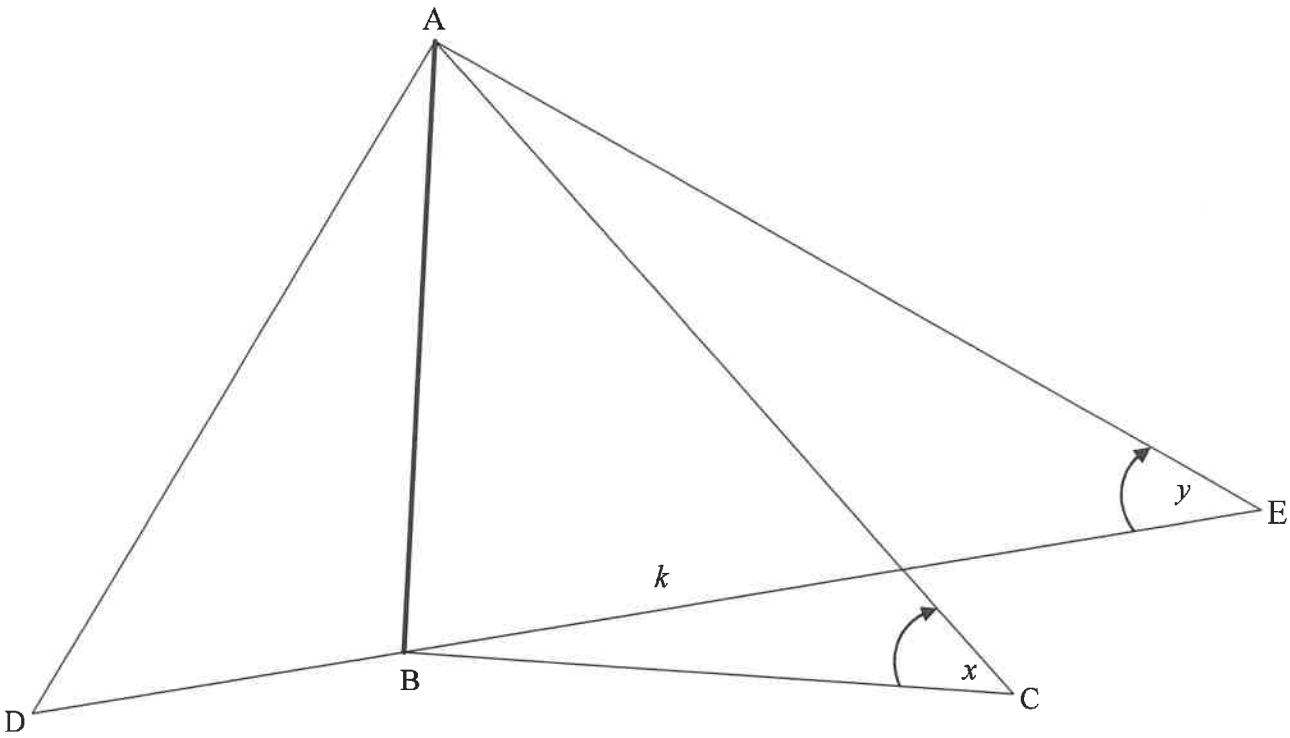
5.2.1		(2)

	Solution/*Oplossing*	**Marks** ***Punte***
5.2.2		(1)
5.2.3		(4)
5.3.1		(2)
5.3.2		(4)
		[19]

QUESTION/*VRAAG* 6

	Solution/*Oplossing*	Marks *Punte*
6.1		(4)
6.2		(4)
6.3		(4)
		[12]

QUESTION/*VRAAG* 7

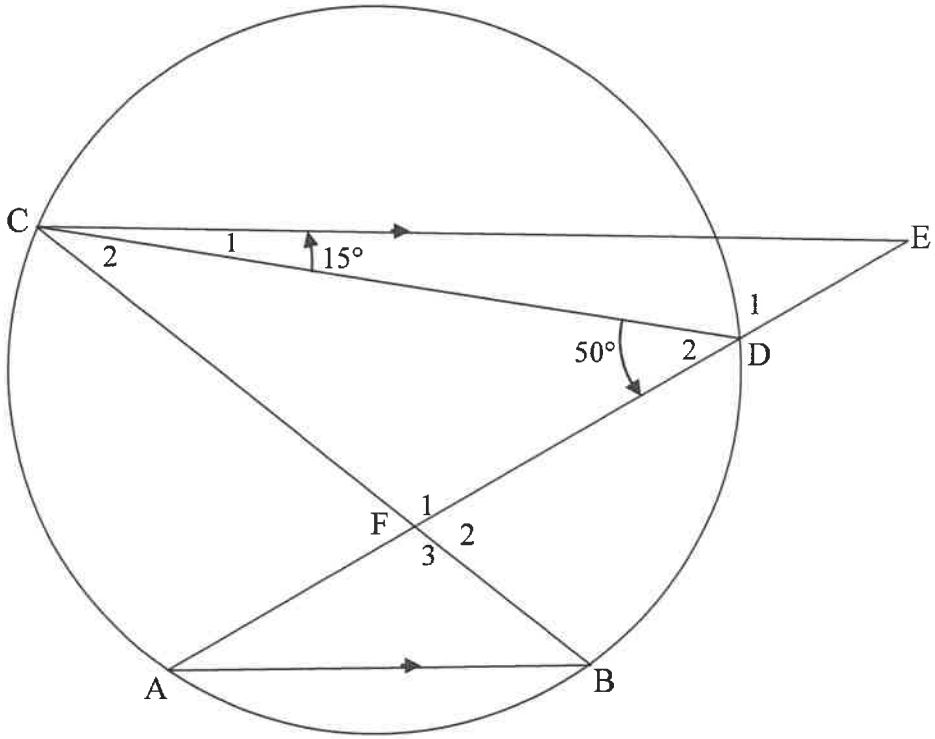


	Solution/*Oplossing*	**Marks** ***Punte***
7.1		(1)
7.2		(4)

	Solution/*Oplossing*	**Marks** ***Punte***
7.3		(5)
		[10]

Give reasons for your statements in QUESTIONS 8, 9, 10 and 11.
Gee redes vir jou bewerings in VRAAG 8, 9, 10 en 11.

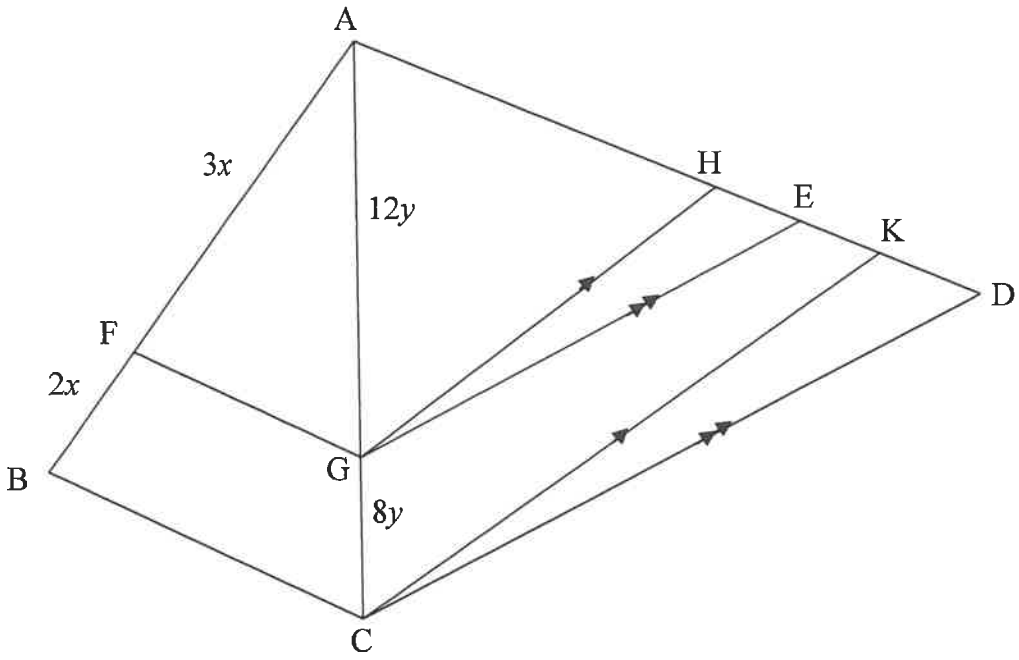
QUESTION/*VRAAG* 8



	Solution/*Oplossing*	**Marks** ***Punte***
8.1.1		(3)

	Solution/*Oplossing*	**Marks** ***Punte***
8.1.2		(2)
8.2		(2)
		[7]

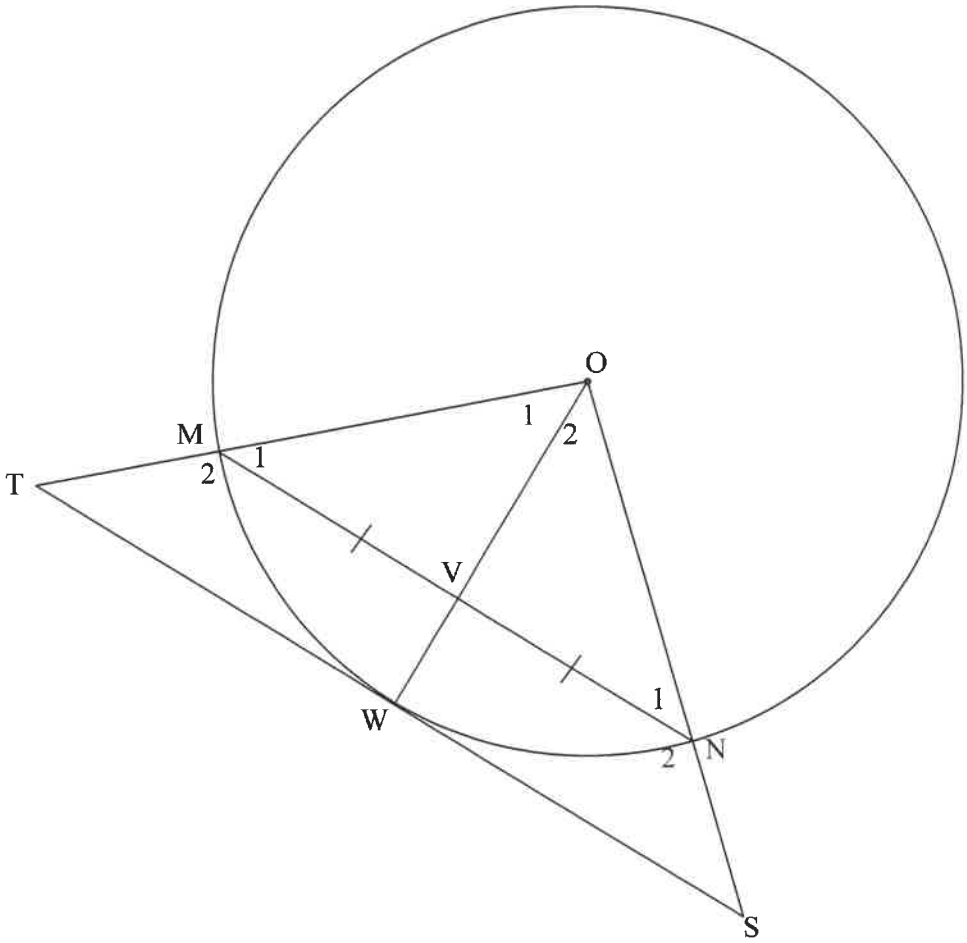
QUESTION/*VRAAG* 9



	Solution/*Oplossing*	**Marks** ***Punte***
9.1.1		(2)
9.1.2		(3)

	Solution/*Oplossing*	**Marks** ***Punte***
9.2		(5)
		[10]

QUESTION/*VRAAG* 10

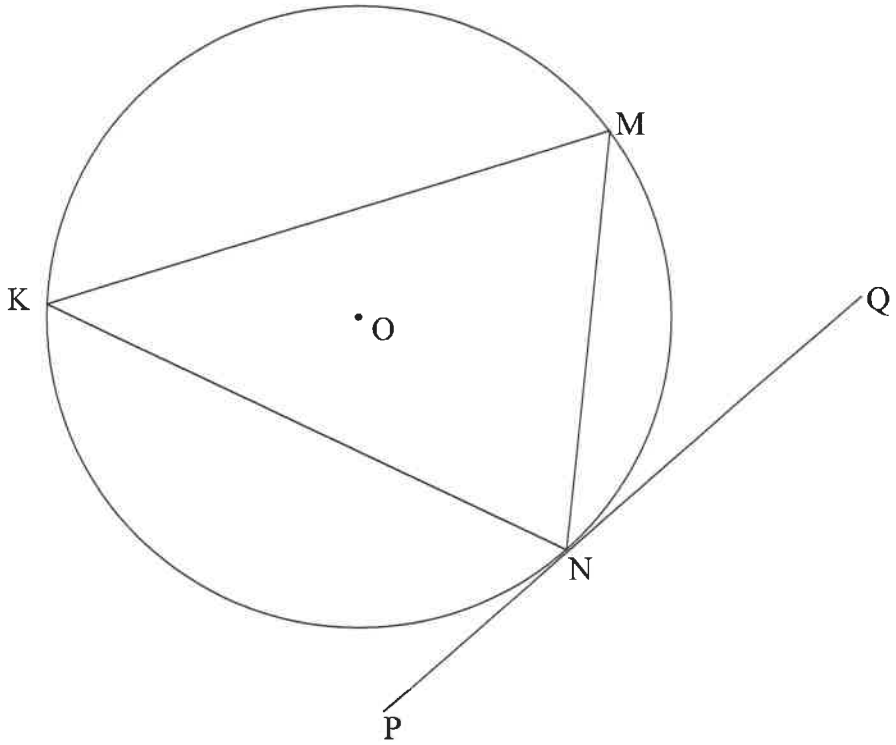


	Solution/*Oplossing*	**Marks** ***Punte***
10.1		(1)
10.2.1		(2)

	Solution/*Oplossing*	**Marks** ***Punte***
10.2.2		(4)
10.2.3		(5)
		[12]

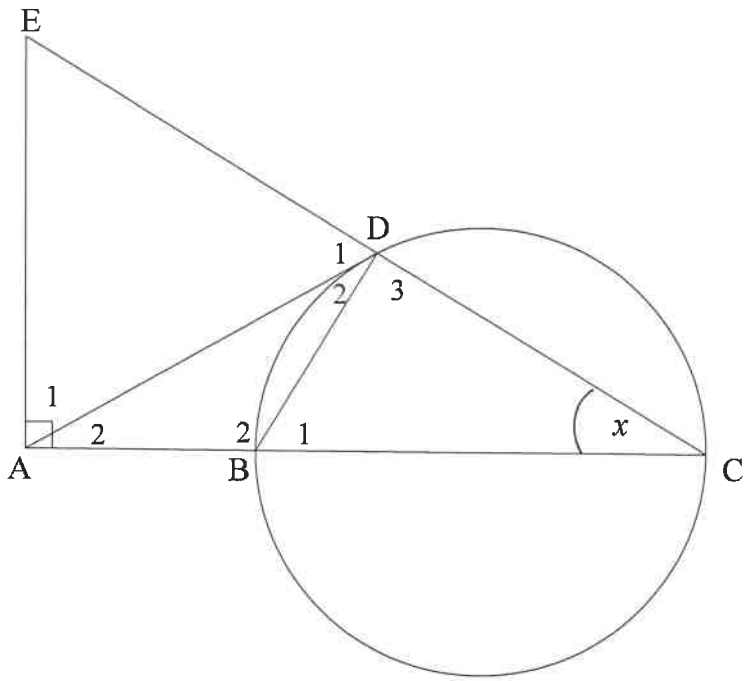
QUESTION/*VRAAG* 11

11.1

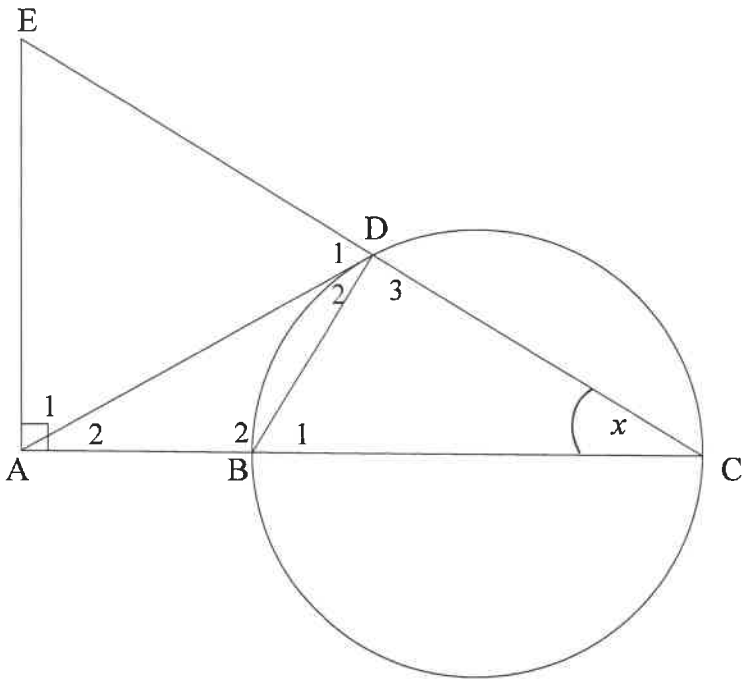


	Solution/*Oplossing*	**Marks** ***Punte***
		(5)

11.2



	Solution/*Oplossing*	**Marks** ***Punte***
11.2.1(a)		(1)
11.2.1(b)		(1)
11.2.1(c)		(1)
11.2.2(a)		(3)



	Solution/*Oplossing*	**Marks** ***Punte***
11.2.2(b)		(3)
11.2.3(a)		(2)

	Solution/*Oplossing*	**Marks** ***Punte***
11.2.3(b)		(4)
		[20]

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

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

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

TOTAL/*TOTAAL*: 150

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE 12/*GRAAD* 12

MATHEMATICS P2/*WISKUNDE V2*

NOVEMBER 2017

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE:* *150*

These marking guidelines consist of 29 pages.
Hierdie nasienriglyne bestaan uit 28 bladsye.

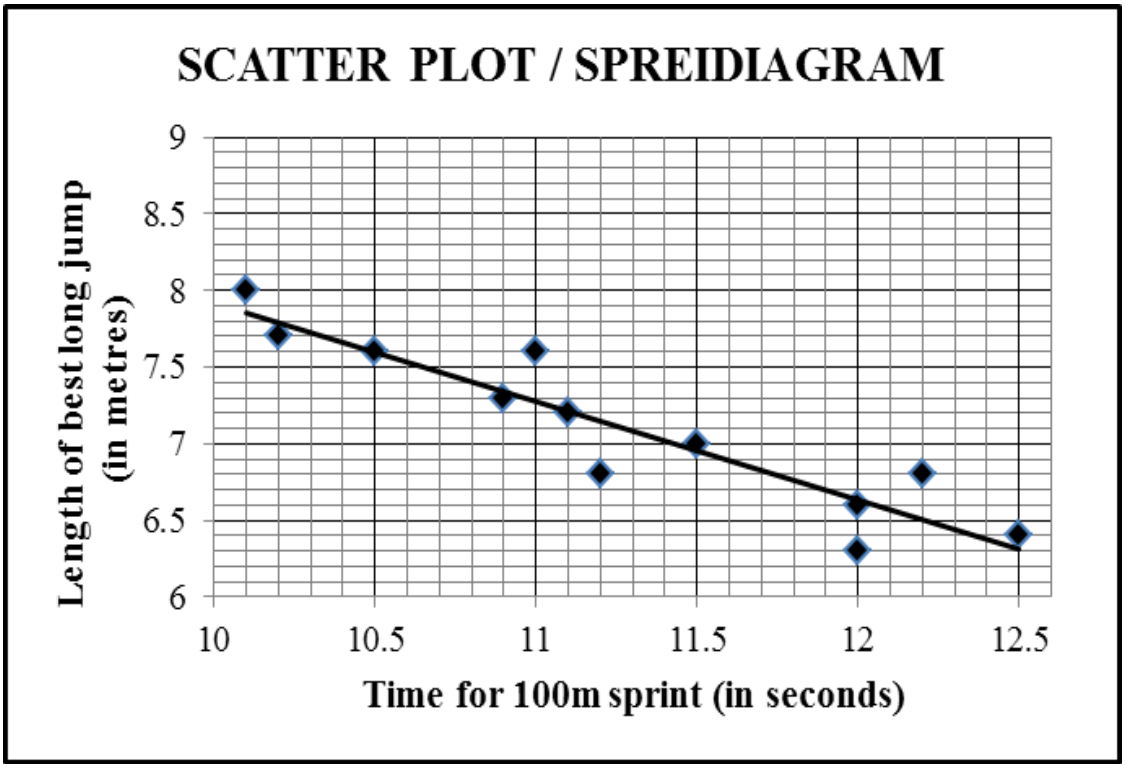
NOTE:
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.
- Consistent accuracy applies in ALL aspects of the marking guidelines. Stop marking at the second calculation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

NOTA:
- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, merk die doodgetrekte poging.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.*
- *Aanvaar van antwoorde/waardes om 'n probleem op te los, word NIE toegelaat nie.*

GEOMETRY	
S	**A mark for a correct statement** **(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 a 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 the statement AND reason are both correct.**
	Ken 'n punt toe as beide die bewering EN rede korrek is.

QUESTION/*VRAAG* 1

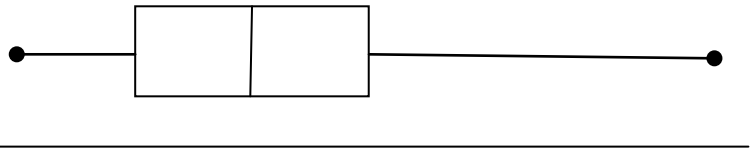
Time for 100 m sprint (in seconds) ***Tyd vir 100 m-naelloop (in sekondes)***	10,1	10,2	10,5	10,9	11	11,1	11,2	11,5	12	12	12,2	12,5
Distance of best long jump (in metres) ***Afstand van beste sprong in verspring (in meter)***	8	7,7	7,6	7,3	7,6	7,2	6,8	7	6,6	6,3	6,8	6,4



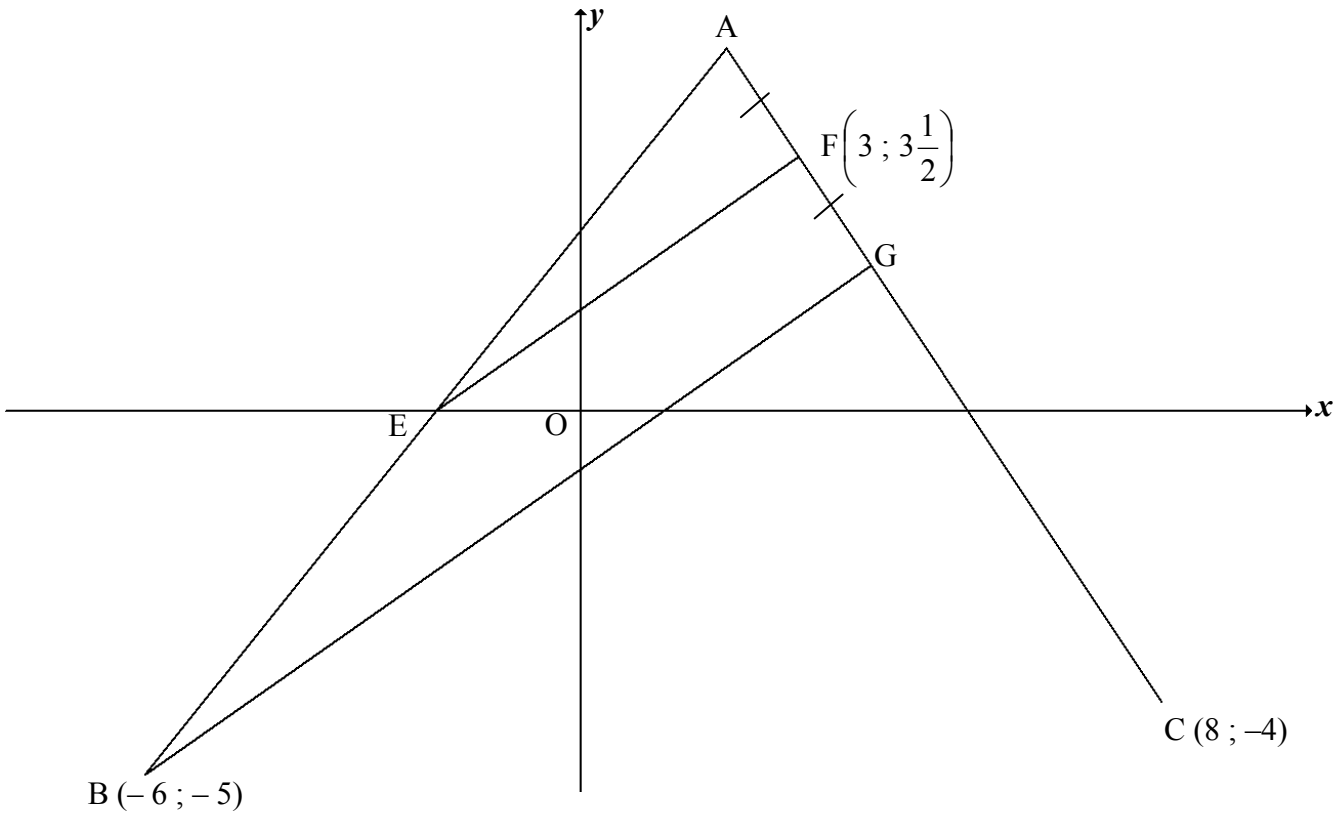
1.1	$a = 14{,}343\ldots = 14{,}34$ $b = -0{,}642\ldots = -0{,}64$	✓✓ value of a ✓ value of b (3)
1.2	$y = 14{,}34 - 0{,}64(11{,}7)$ $= 6{,}85$ **OR/OF** $y = 6{,}83$ (calculator / *sakrekenaar*)	✓ substitution correctly ✓ answer (2) ✓✓answer (2)
1.3	The gradient increases / *Die gradient neem toe* The point (12,3 ; 7,6) lies some distance above the current data. */Die punt (12,3 ; 7,6) lê bokant die huidige data.*	✓ increases/*neem toe* ✓ reasoning in words/ *redenasie in woorde* (2) **[7]**

QUESTION/*VRAAG* 2

12	13	13	14	14	16	17	18	18	18	19	20
21	21	22	22	23	24	25	27	29	30	36	

2.1.1	$\bar{x} = \frac{472}{23}$ $\bar{x} = 20{,}52$ seconds / *sekonde*	✓ $\frac{472}{23}$ ✓ answer (2)
2.1.2	$Q_1 = 16$ $Q_3 = 24$ IQR/*IKO* = $Q_3 - Q_1$ $= 24 - 16 = 8$	✓ Q_1 ✓ Q_3 ✓ answer (3)
2.2	20,52 + 5,94 = 26,46 $\therefore > 26{,}46$ $\therefore$ 4 girls/*dogters*	✓ 26,46 ✓ answer (2)
2.3	 **12** 14 **16** 18 **20** 22 **24** 26 28 30 **36**	✓ whiskers ending at 12 & 36 ✓ $Q_1 = 16$ & $Q_3 = 24$ (box) ✓ $Q_2 = 20$ (3)
2.4.1	Girls / *Meisies*	✓ answer (1)
2.4.2	Five-number summary of boys: (15 ; 21 ; 23,5 ; 26 ; 38) **None** of the boys / ***Nie een*** *van die seuns* ***nie*** 5 girls completed in less than 15 seconds which was the minimum time taken by the boys. *5 meisies voltooi in minder as 15 sekondes, wat die minimumtyd is wat die seuns geneem het.*	✓ answer ✓ reason/*rede* (2) **[13]**

QUESTION/*VRAAG* 3



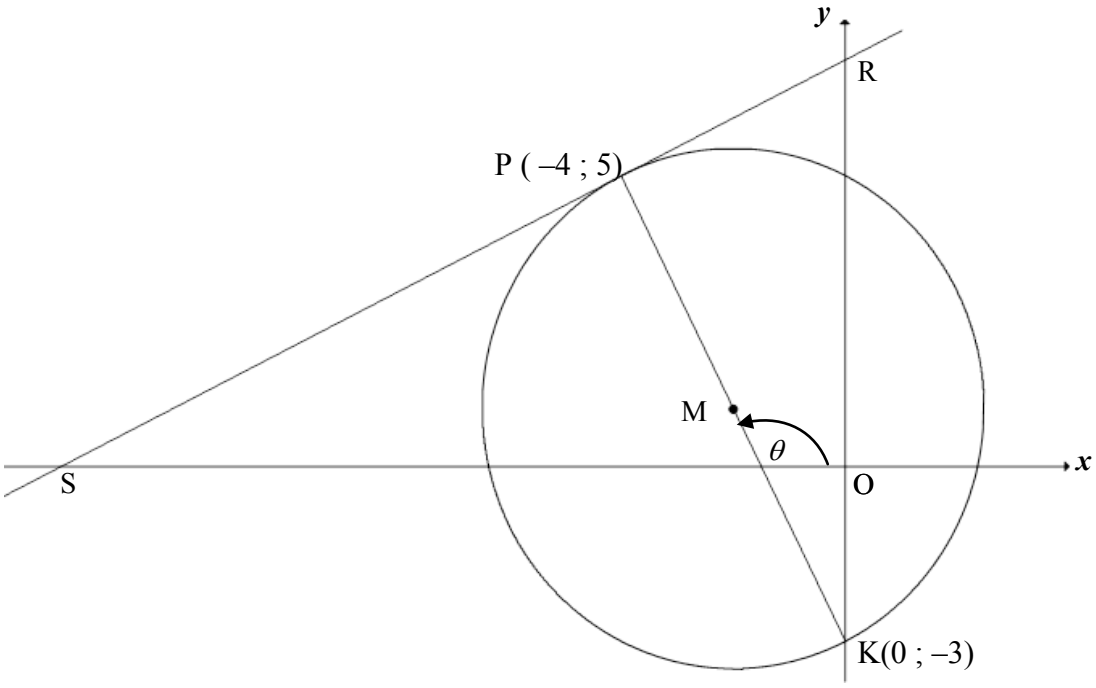
3.1.1	$m_{FC} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{3\frac{1}{2} - (-4)}{3 - 8}$ $= -\frac{3}{2}$ $y = mx + c$ $\qquad$ $y - y_1 = m(x - x_1)$ $y = -\frac{3}{2}x + c$ $-4 = -\frac{3}{2}(8) + c$ **OR/*OF*** $(y - (-4)) = -\frac{3}{2}(x - 8)$ $c = 8$ $\qquad$ $y + 4 = -\frac{3}{2}x + 12$ $y = -\frac{3}{2}x + 8$ $\qquad$ $y = -\frac{3}{2}x + 8$ **OR/*OF***	✓ substitution of (8 ; –4) & $\left(3\,;3\frac{1}{2}\right)$ ✓ gradient ✓ substitution of m and (8 ; –4) ✓ equation of AC (4)

	$m_{FC} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{(-4) - \left(3\frac{1}{2}\right)}{8 - 3}$ $= -\frac{3}{2}$ $y = mx + c$ $\qquad$ $y - y_1 = m(x - x_1)$ $3\frac{1}{2} = -\frac{3}{2}(3) + c$ $\qquad$ $\left(y - 3\frac{1}{2}\right) = -\frac{3}{2}(x - 3)$ $c = 8$ $\qquad$ **OR/*OF*** $\qquad$ $\left(y - 3\frac{1}{2}\right) = -\frac{3}{2}x + \frac{9}{2}$ $y = -\frac{3}{2}x + 8$ $\qquad$ $y = -\frac{3}{2}x + 8$	✓ substitution of (8 ; –4) & $\left(3 ; 3\frac{1}{2}\right)$ ✓ gradient ✓ substitution of *m* and $\left(3 ; 3\frac{1}{2}\right)$ ✓ equation of AC (4)
3.1.2	AC: $3x + 2y = 16$ and BG: $7x - 10y = 8$ $15x + 10y = 80$ $\underline{7x - 10y = 8}$ $22x = 88$ $x = 4$ $3(4) + 2y = 16$ $y = 2$ $\therefore$ G(4 ; 2) **OR/*OF*** BG: $7x - 10y = 8$ $\quad \therefore y = \frac{7}{10}x - \frac{8}{10}$ $\therefore \frac{7}{10}x - \frac{8}{10} = -\frac{3}{2}x + 8$ [CA from 3.1.1] $\frac{11}{5}x = \frac{44}{5}$ $x = 4$ $3(4) + 2y = 16$ $y = 2$ $\therefore$ G(4 ; 2)	✓ method /*metode*: solving simultaneously / *los gelyktydig op* ✓ *x* coordinate ($x > 0$) ✓ *y* coordinate (3) ✓ method: equating *metode: stel vgls gelyk* ✓ *x* coordinate ($x > 0$) ✓ *y* coordinate (3)
3.2	$\frac{x_A + 4}{2} = 3$ and $\frac{y_A + 2}{2} = 3\frac{1}{2}$ $\therefore$ A(2 ; 5) **OR/*OF*** by translation/*deur translasie*: $x_A = 3 - (4 - 3) = 2$ $y_A = 3\frac{1}{2} + (3\frac{1}{2} - 2) = 5$ $\therefore$ A(2 ; 5)	✓ equation ito *x* ✓ equation ito *y* (2) ✓ equation ito *x* ✓ equation ito *y* (2)

3.3	The coordinates of the midpt of AB / *Die koordinaat van midpt van AB is*: $\left(\frac{2+(-6)}{2};\frac{5+(-5)}{2}\right)=(-2\ ;\ 0)$ **But the *y*-coordinate of E is 0** **∴ E(–2 ; 0) is the midpoint of AB** ∴ EF || BG [midpoint theorem/*middelpuntst* ***OR/OF*** line divides 2 sides of Δ in prop/*lyn verdeel 2 sye van Δ in dies verh*] **OR/*OF*** The coordinates of the midpt of AB / *Die koordinaat van midpt van AB is*: $\left(\frac{2+(-6)}{2};\frac{5+(-5)}{2}\right)=(-2\ ;\ 0)$ $AE=\sqrt{(-2-2)^2+(0-5)^2}=\sqrt{41}$ $EB=\sqrt{(-2-(-6))^2+(0-(-5))^2}=\sqrt{41}$ ∴ In ΔABG: **AE = EB** and AF = FG ∴ EF || BG [midpoint theorem/*middelpuntst*] **OR/*OF*** Equation of AB: $y-(-5)=\left(\frac{5-(-5)}{2-(-6)}\right)(x-(-6))$ $y+5=\frac{10}{8}x+\frac{15}{2}\qquad \therefore y=\frac{5}{4}x+\frac{5}{2}$ x-intercept of AB: $0=\frac{5}{4}x+\frac{5}{2}\quad \therefore x=-2$ ∴ E(–2 ; 0) $m_{EF}=\frac{3\frac{1}{2}-0}{3-(-2)}=\frac{7}{10}$ $m_{EF}=m_{BG}=\frac{7}{10}$ ∴ EF || BG BG: $7x-10y=8$ $\therefore\quad y=\frac{7}{10}x-\frac{8}{10}$ $\therefore\ m_{BG}=\frac{7}{10}$	✓ subst A & B into midpt formula ✓ *y c*oordinate = 0 ✓ E = midpt ✓ Reason (4) ✓ subst A & B into midpt formula ✓ lengths of AE & EB ✓ AE = EB or E = midpt ✓ Reason (4) ✓ equation of AB ✓ coordinates of E ✓ gradient of EF ✓ gradient EF = gradient BG (4)

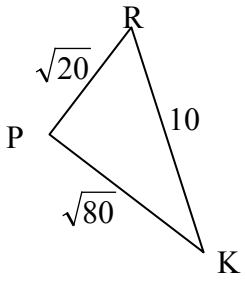
3.4	Midpoint of AC = $\left(5\ ;\ \frac{1}{2}\right)$ $\frac{x_D+(-6)}{2}=5$ and $\frac{y_D+(-5)}{2}=\frac{1}{2}$ $\therefore$ D(16 ; 6)	✓✓ $\left(5\ ;\ \frac{1}{2}\right)$ ✓ *x* value ✓ *y* value (4)
	OR/*OF* by translation/*dmv translasie*: D(16 ; 6)	✓ method finding *x* ✓ method finding *y* ✓ *x* value ✓ *y* value (4)
	OR/*OF* $m_{BC}=\frac{-5-(-4)}{-6-8}=\frac{1}{14}$ and $m_{AB}=\frac{5-(-5)}{2-(-6)}=\frac{5}{4}$ AD: $y-5=\frac{1}{14}(x-2) \Rightarrow y=\frac{1}{14}x+\frac{34}{7}$ CD: $y+4=\frac{5}{4}(x-8) \Rightarrow y=\frac{5}{4}x-14$ $\frac{5}{4}x-14=\frac{1}{14}x+\frac{34}{7}$ $\therefore \quad x=16$ $y=6$	✓✓ equating ✓ *x* value ✓ *y* value (4) **[17]**

QUESTION/*VRAAG* 4



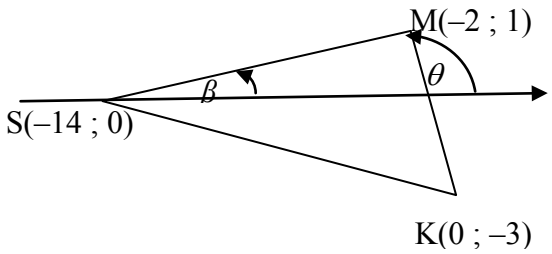
4.1.1	$m_{PK} = \frac{5-(-3)}{-4-0}$ $= -2$ PK ⊥ SR [radius ⊥ tangent/*raaklyn*] $\therefore\ m_{PK} \times m_{RS} = -1$ $\therefore m_{RS} = \frac{1}{2}$	✓ substitution P & K into gradient formula ✓ gradient of PK ✓ PK ⊥ SR **OR** r ⊥ tangent ✓ answer (4)
4.1.2	$y = \frac{1}{2}x + c$ $5 = \frac{1}{2}(-4) + c$ **OR/*OF*** $(y-5) = \frac{1}{2}(x-(-4))$ $c = 7$ $(y-5) = \frac{1}{2}x + 2$ $y = \frac{1}{2}x + 7$ $y = \frac{1}{2}x + 7$	✓ substitution of *m* and P ✓ equation (2)

4.1.3	$M\left(\frac{-4+0}{2}\ ;\ \frac{5+(-3)}{2}\right)$ $\therefore$ M(–2 ; 1) $r^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$ $r^2 = (-2+4)^2 + (1-5)^2$ $\therefore r^2 = 20$ $\therefore (x+2)^2 + (y-1)^2 = 20$ *or* $(\sqrt{20})^2$ **OR/*OF*** $M\left(\frac{-4+0}{2}\ ;\ \frac{5+(-3)}{2}\right)$ $\therefore$ M(–2 ; 1) $(x+2)^2 + (y-1)^2 = r^2$ $(-4+2)^2 + (5-1)^2 = r^2$ $\therefore r^2 = 20$ $\therefore (x+2)^2 + (y-1)^2 = 20$ *or* $(\sqrt{20})^2$ **OR/*OF*** $M\left(\frac{-4+0}{2}\ ;\ \frac{5+(-3)}{2}\right)$ $\therefore$ M(–2 ; 1) PK $= \sqrt{(-4-0)^2 + (5-(-3))^2} = \sqrt{80}$ $r = \frac{\sqrt{80}}{2} = \sqrt{20}$ $\therefore (x+2)^2 + (y-1)^2 = 20$ *or* $(\sqrt{20})^2$	✓ *x* value of M ✓ *y* value of M ✓ $r^2 = 20$ ✓ equation (4) ✓✓ M (– 2 ; 1) $r^2 = 20$ ✓ equation (4) ✓✓ M (– 2 ; 1) $r^2 = 20$ ✓ equation (4)

4.1.4	$\tan\theta = m_{PK} = -2$ $\therefore\ \theta = 180° - 63{,}43°$ $= 116{,}57°$ $P\hat{K}R = 116{,}57° - 90°$ [ext $\angle$ of ΔMOK] $= 26{,}57°$	✓ $\tan\theta = -2$ ✓ size of θ ✓ answer (3)
	OR/*OF*  In ΔRPK: $PK = \sqrt{(0-(-4))^2 + (-3-5)^2} = \sqrt{80}$ $PR = \sqrt{(-4-0)^2 + (5-7)^2} = \sqrt{20}$ $RK = 10$ $\cos P\hat{K}R = \frac{PK^2 + KR^2 - PR^2}{2.PK.KR} = \frac{(\sqrt{80})^2 + (10)^2 - (\sqrt{20})^2}{2(\sqrt{80})(10)}$ $= \frac{2\sqrt{5}}{5}$ $P\hat{K}R = 26{,}57°$	✓ lengths of PK, PR & RK ✓ correct values into cos rule ✓ answer (3)
	OR/*OF* $\sin P\hat{K}R = \frac{\sqrt{20}}{10}$ **OR/*OF*** $\cos P\hat{K}R = \frac{\sqrt{80}}{10}$ $P\hat{K}R = 26{,}57°$ $P\hat{K}R = 26{,}57°$	✓ lengths of sides ✓ ratio ✓ answer (3)
	OR/*OF* $\tan P\hat{K}R = \frac{\sqrt{20}}{\sqrt{80}}$ $P\hat{K}R = 26{,}57°$	✓ lengths of sides ✓ ratio ✓ answer (3)

4.1.5	RS || tangent at K(0 ; – 3) $\therefore m_{PS} = m_{tang} = \frac{1}{2}$ $\therefore y = \frac{1}{2}x - 3$ **OR/*OF*** $m_{PK} = \frac{1-5}{-2+4} = -2$ $m_{PK} \times m_{tang} = -1$ [radius ⊥ tangent/*raaklyn*] $\therefore m_{tang} = \frac{1}{2}$ $\therefore y = \frac{1}{2}x - 3$	✓ gradient ✓ equation (2) ✓ gradient ✓ equation (2)
4.2	$t \in (-3 ; 7)$ **OR/*OF*** $-3 < t < 7$	✓ – 3 (A) ✓ 7 (CA from 4.1.2) ✓ correct inequality (3) ✓ – 3 (A) ✓ 7 (CA from 4.1.2) ✓ correct inequality (3)
4.3	RS: $y = \frac{1}{2}x + 7$ ∴ S(–14 ; 0) $SP = \sqrt{(-14-(-4))^2 + (0-5)^2} = \sqrt{100+25} = \sqrt{125}$ Area ΔSMK = $\frac{1}{2}$. MK . SP = $\frac{1}{2}(\sqrt{20})(\sqrt{125})$ = 25 square units	✓ coordinates of S ✓ length of SP ✓ correct base & height into Area rule ✓ correct substitution ✓ answer (5)

OR/OF



Let β = inclination of SM/ *inklinasie van SM*

RS: $y = \frac{1}{2}x + 7$ $\therefore$ S(–14 ; 0) ✓ coordinates of S

$SM = \sqrt{(-14-(-2))^2 + (0-1)^2} = \sqrt{145}$ ✓ length of SM

$\tan\beta = \frac{1-0}{-2-(-14)} = \frac{1}{12}$ $\therefore$ $\beta = 4{,}76°$

$\therefore S\hat{M}K = 116{,}57° - 4{,}76°$ [ext $\angle$ of Δ]
$= 111{,}81°$ ✓ size of/*grootte v* $S\hat{M}K$

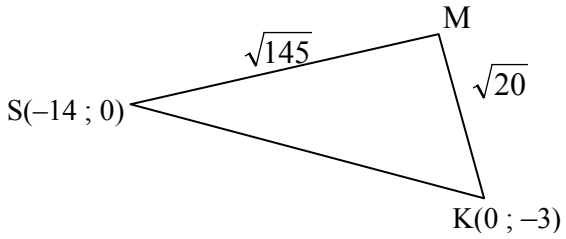
Area $\Delta SMK = \frac{1}{2}(SM)(MK).\sin S\hat{M}K$

$= \frac{1}{2}(\sqrt{145})(\sqrt{20}).\sin 111{,}81°$ ✓ correct substitution into area rule

$= 24{,}9985 = 25$ square units ✓ answer

(5)

OR/*OF*



RS: $y = \frac{1}{2}x + 7$ $\therefore$ S(–14 ; 0) ✓ coordinates of S

$SK = \sqrt{(-14-0)^2 + (0+3)^2} = \sqrt{205}$ ✓ length of SK

$\cos S\hat{M}K = \frac{(\sqrt{145})^2 + (\sqrt{20})^2 - (\sqrt{205})^2}{2(\sqrt{145})(\sqrt{20})} = -\frac{2\sqrt{29}}{29}$

$S\hat{M}K = 111{,}80°$ ✓ size of /*grootte v* $S\hat{M}K$

Area $\Delta SMK = \frac{1}{2}(SM)(MK).\sin S\hat{M}K$

$= \frac{1}{2}(\sqrt{145})(\sqrt{20}).\sin 111{,}81°$ ✓ correct substitution into area rule

$= 24{,}9985 = 25$ square units ✓ answer

(5)

	OR/*OF*	
	Produce KS to T	
	RS: $y = \frac{1}{2}x + 7 \quad \therefore$ S(–14 ; 0)	✓ coordinates of S
	$SK = \sqrt{(-14-0)^2 + (0+3)^2} = \sqrt{205}$	✓ length of SK & SM
	$SM = \sqrt{(-14-(-2))^2 + (0-1)^2} = \sqrt{145}$	
	$m_{SK} = -\frac{3}{14} \Rightarrow T\hat{S}O = 167{,}91°$	
	$m_{SM} = \frac{1}{12} \Rightarrow M\hat{S}O = 4{,}76°$	
	$M\hat{S}K = 180° - 167{,}91° + 4{,}76° = 16{,}85°$	✓ size of /*grootte v* $M\hat{S}K$
	$\text{Area } \Delta SMK = \frac{1}{2}(SM)(SK).\sin M\hat{S}K$	
	$= \frac{1}{2}(\sqrt{145})(\sqrt{205}).\sin 16{,}85°$	✓ correct substitution into area rule
	$= 24{,}9985 = 25$ square units	✓ answer
		(5)

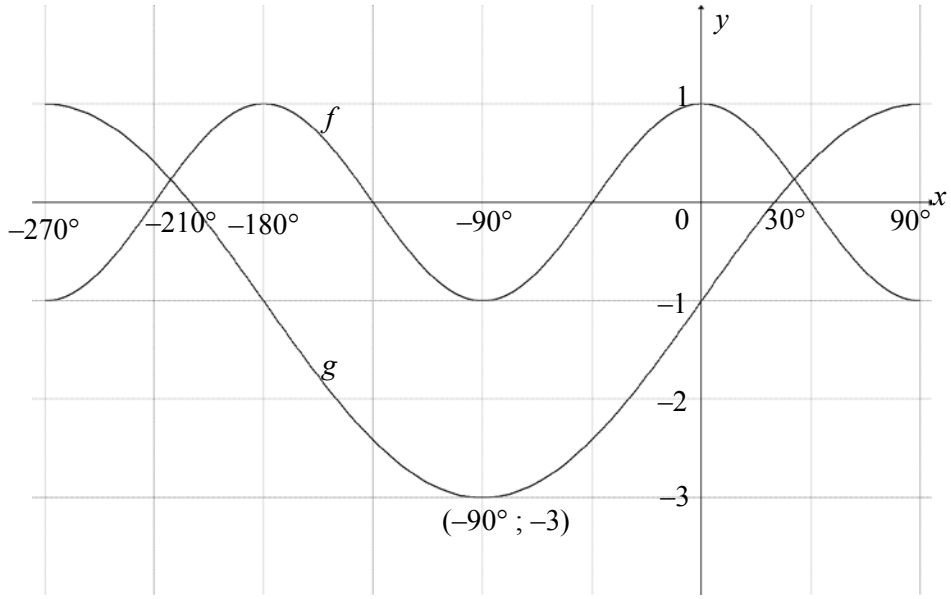
QUESTION/*VRAAG* 5

5.1	$\frac{\sin(A-360°).\cos(90°+A)}{\cos(90°-A).\tan(-A)}$ $=\frac{\sin A(-\sin A)}{\sin A(-\tan A)}$ $=\frac{\sin A}{\left(\frac{\sin A}{\cos A}\right)}$ $=\cos A$	✓ sin A ✓ –sin A ✓ sin A ✓ –tan A ✓ $\tan A=\frac{\sin A}{\cos A}$ ✓ answer (6)
5.2.1	$t^2=(\sqrt{34})^2-(3)^2$ $\therefore t=-5$	✓ substitution ✓ answer (2)
5.2.2	$\tan\beta=\frac{-5}{3}$	✓ correct ratio (1)
5.2.3	$\cos 2\beta = 2\cos^2\beta-1$ $=2\left(\frac{3}{\sqrt{34}}\right)^2-1$ $=2\left(\frac{9}{34}\right)-1$ $=-\frac{16}{34}$ OR $-\frac{8}{17}$ **OR/*OF*** $\cos 2\beta=1-2\sin^2\beta$ $=1-2\left(-\frac{5}{\sqrt{34}}\right)^2$ $=1-2\left(\frac{25}{34}\right)$ $=-\frac{16}{34}$ OR $-\frac{8}{17}$ **OR/*OF*** $\cos 2\beta=\cos^2\beta-\sin^2\beta$ $=\left(\frac{3}{\sqrt{34}}\right)^2-\left(-\frac{5}{\sqrt{34}}\right)^2$ $=\frac{9}{34}-\frac{25}{34}$ $=-\frac{16}{34}$ OR $-\frac{8}{17}$	✓ compound formula ✓ substitution ✓ simplification ✓ answer (4) ✓ compound formula ✓ substitution ✓ simplification ✓ answer (4) ✓ compound formula ✓ substitution ✓ simplification ✓ answer (4)

5.3.1	LHS = sin(A + B) – sin(A – B) = sin A.cos B + cos A.sin B – (sin A. cos B – cos A. sin B) = sin A.cos B + cos A.sin B – sin A. cos B + cos A. sin B = 2cos A.sin B = RHS	✓ compound formula ✓ compound formula (2)
5.3.2	$\sin 77° - \sin 43° = \sin(60° + 17°) - \sin(60° - 17°)$ $= 2\cos 60°.\sin 17°$ $= 2 \times \frac{1}{2} \times \sin 17°$ $= \sin 17°$ **OR/*OF*** $\sin 77° - \sin 43° = \sin(60° + 17°) - \sin(60° - 17°)$ $= (\sin 60° \cos 17° + \cos 60° \sin 17°) -$ $(\sin 60° \cos 17° - \cos 60° \sin 17°)$ $= \frac{\sqrt{3}}{2}\cos 17° + \frac{1}{2}\sin 17° - \frac{\sqrt{3}}{2}\cos 17° + \frac{1}{2}\sin 17°$ $= \sin 17°$	✓ 60° + 17° ✓ 60° – 17° ✓ simplify ✓ $\frac{1}{2}$ (4) ✓ 60° + 17° ✓ 60° – 17° ✓ expansion ✓ $\frac{1}{2}$ (4) **[19]**

QUESTION/*VRAAG* 6

6.1



✓ (–90° ; –3)
✓ (0 ; –1)
✓ x – intercepts: –210° & 30°
✓ shape

(4)

6.2

$\cos 2x = 2\sin x - 1$
$1 - 2\sin^2 x = 2\sin x - 1$
$2\sin^2 x + 2\sin x - 2 = 0$
$\sin^2 x + \sin x - 1 = 0$
$\sin x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
$= \dfrac{-1 \pm \sqrt{1^2 - 4(1)(-1)}}{2(1)}$
$\sin x = \dfrac{-1+\sqrt{5}}{2}$, since $\sin x = \dfrac{-1-\sqrt{5}}{2} < -1$ has no solution

✓ $\cos 2x = 1 - 2\sin^2 x$
✓ standard form
✓ using quadratic formula
✓ substitution into quadratic formula

(4)

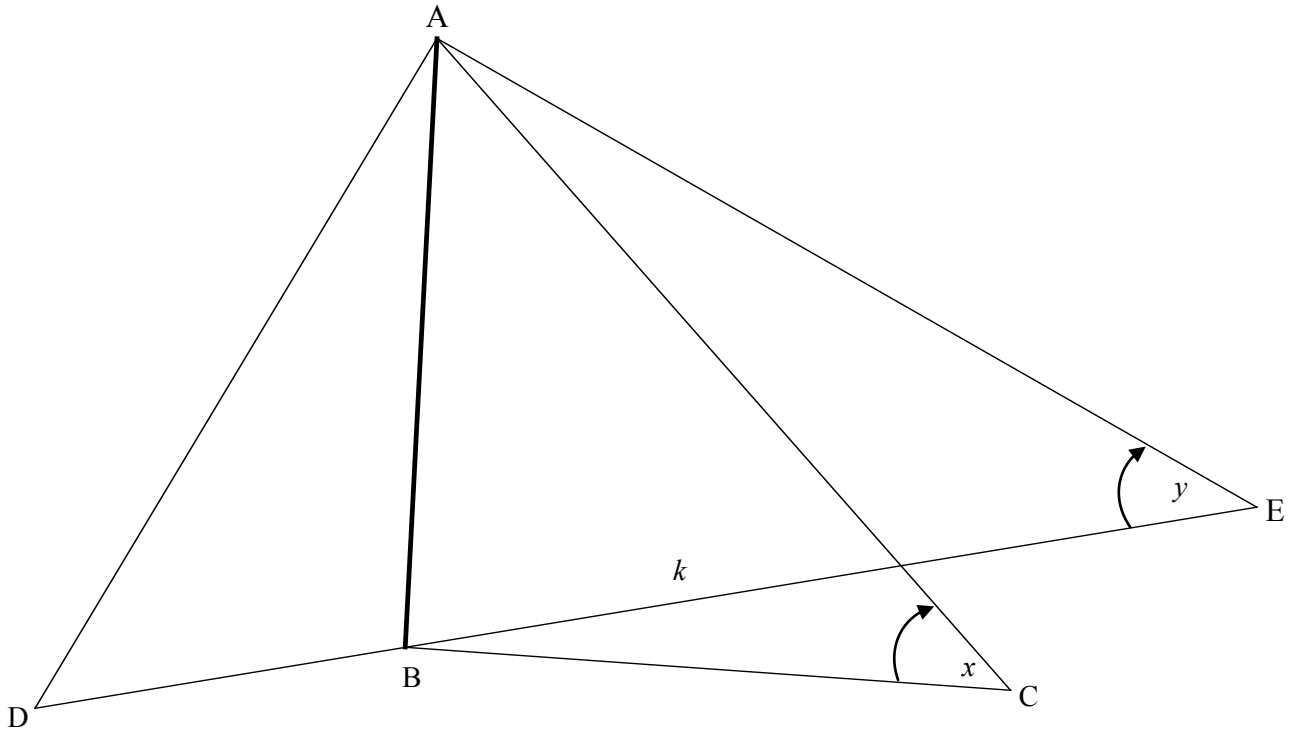
6.3

$\sin x = \dfrac{-1+\sqrt{5}}{2} = 0{,}618...$
Reference $\angle = 38{,}17°$
$\therefore x = 38{,}17° + k.360°$ or $x = 141{,}83° + k.360°$; $k \in Z$
$\therefore x = 38{,}17°$ or $-218{,}17°$
$y = 0{,}24$
$\therefore$ Points of intersection/*snypunte*:
$(38{,}17° ; 0{,}24)$ and $(-218{,}17° ; 0{,}24)$

✓ 38,17°
✓ 141,83°
✓ –218,17°
✓ 0,24

(4)
[12]

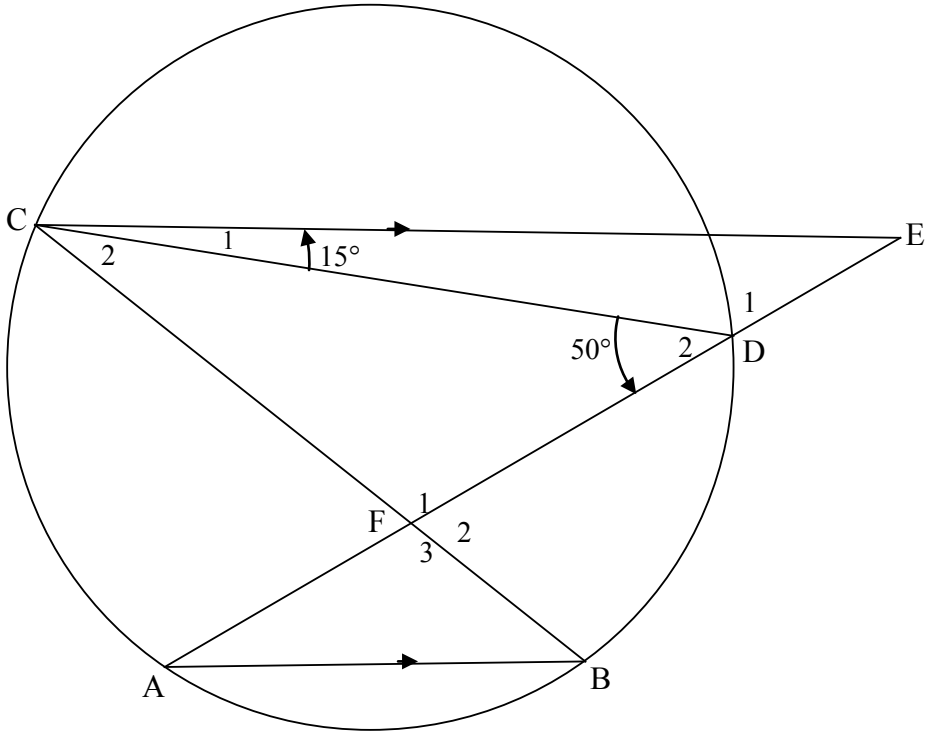
QUESTION/*VRAAG* 7



7.1	$A\hat{B}C = 90°$	✓ answer (1)
7.2	In Δ ABE: $\frac{AB}{BE} = \tan y$ $AB = k \tan y$ In Δ ABC**:** $\frac{AB}{AC} = \sin x$ $AC = \frac{AB}{\sin x}$ $= \frac{k \tan y}{\sin x}$	✓ correct ratio ✓ value AB ✓ correct ratio ✓ AC as subject and substitution (4)

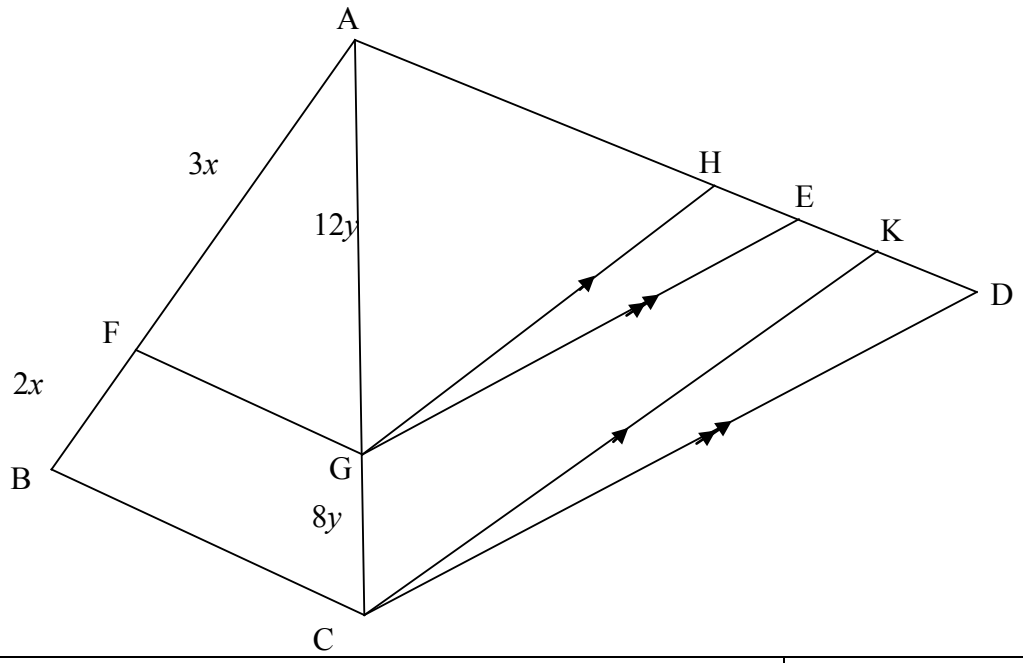
7.3	$\hat{ADC} = \hat{ACD} = \frac{180° - 2x}{2} = 90° - x$	✓ $90° - x$
	$\frac{DC}{\sin 2x} = \frac{AC}{\sin(90° - x)}$	✓subst into sine rule
	$\frac{DC}{2\sin x \cos x} = \frac{AC}{\cos x}$	✓ $2\sin x \cos x$
	$DC = \frac{AC(2\sin x \cos x)}{\cos x}$	✓ $\cos x$
	$= \frac{k\tan y}{\sin x} \cdot \frac{2\sin x \cos x}{\cos x}$	✓ substitution
	$= 2k\tan y$	(5)
	OR/*OF*	
	$DC^2 = AD^2 + AC^2 - 2AD.AC\cos 2x$	✓substitution into cos rule
	$= AC^2 + AC^2 - 2AC^2\cos 2x$	
	$= 2AC^2(1 - \cos 2x)$	✓ factorisation
	$= 2AC^2(1 - 1 + \sin^2 x)$	✓ $1 - 2\sin^2 x$
	$= 4AC^2\sin^2 x$	✓ DC ito AC and $\sin x$
	$DC = 2AC.\sin x$	
	$= 2\left(\frac{k.\tan y}{\sin x}\right).\sin x$	✓ substitution
	$= 2k.\tan y$	(5)
	OR/*OF*	
	$DC^2 = AD^2 + AC^2 - 2AD.AC\cos 2x$	✓correct cos rule
	$= 2\left(\frac{k\tan y}{\sin x}\right)^2 - 2\left(\frac{k\tan y}{\sin x}\right)^2\cos 2x$	✓ substitution
	$= \frac{2k^2\tan^2 y}{\sin^2 x} - \frac{2k^2\tan^2 y}{\sin^2 x}(1 - 2\sin^2 x)$	✓ $1 - 2\sin^2 x$
	$= \frac{2k^2\tan^2 y}{\sin^2 x} - \frac{2k^2\tan^2 y}{\sin^2 x} + 4k^2\tan^2 y$	✓ squaring and multiplication
	$DC = \sqrt{4k^2\tan^2 y}$	✓ $\sqrt{4k^2\tan^2 y}$
	$= 2k\tan y$	(5) **[10]**

QUESTION/*VRAAG* 8



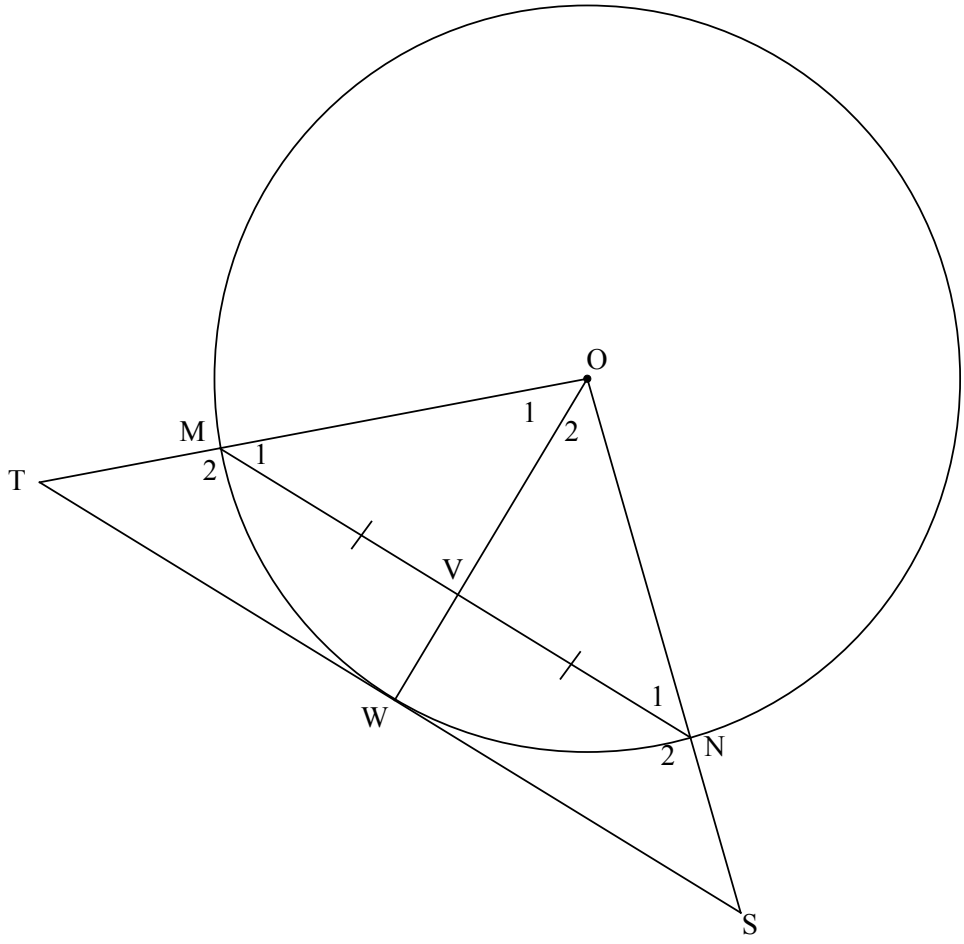
8.1.1	$\hat{E} = 50° - 15° = 35°$ [ext ∠ of Δ/*buite ∠ van Δ*] $\hat{A} = 35°$ [alt ∠s / *verwiss ∠e*; CE ∥ AB] **OR/*OF*** $\hat{E} = 180° - (130° + 15°) = 35°$ [str line; ∠s of Δ/*rt lyn;∠e van Δ*] $\hat{A} = 35°$ [alt ∠s / *verwiss ∠e*; CE ∥ AB] **OR/*OF*** $\hat{B} = 50°$ [∠s in same segment/*∠e in dieselfde segment*] $\hat{C}_2 + 15° = 50°$ [alt ∠s / *verwiss ∠e*; CE ∥ AB] $\therefore \hat{C}_2 = 35°$ $\hat{A} = 35°$ [∠s in same segment/*∠e in dieselfde segment*]	✓ S ✓S ✓ R (3) ✓ S ✓S ✓ R (3) ✓ S ✓S ✓ R (3)
8.1.2	$\hat{C}_2 = 35°$ [∠s in same segment/*∠e in dieselfde segment*]	✓ S ✓ R (2)
8.2	$\hat{C}_2 = \hat{E}$ [from 8.1.1 and 8.1.2] ∴ CF is a tangent to the circle [converse tan chord theorem] ∴ *CF is 'n raaklyn aan die sirkel [omgekeerde raakl koordst]*	✓ S ✓ R (2) **[7]**

QUESTION/*VRAAG* 9



9.1.1	$\frac{AF}{BF}=\frac{3x}{2x}=\frac{3}{2}$ & $\frac{AG}{CG}=\frac{12y}{8y}=\frac{3}{2}$ $\therefore \frac{AF}{BF}=\frac{AG}{CG}$ $\therefore$ FG || BC [conv prop th/*omg eweredigh st.* **OR** line divides 2 sides of Δ in prop/*lyn verdeel 2 sye v Δ in dies verh*]	✓ $\frac{AF}{BF}=\frac{AG}{CG}$ ✓R (2)
9.1.2	$\frac{AG}{GC}=\frac{AH}{HK}$ [prop theorem/*eweredigh st*; GH || CK **OR** line || to 1 side of Δ/*lyn || 1 sy van Δ*] $\frac{AG}{GC}=\frac{AE}{ED}$ [prop theorem/*eweredigh st*; GE || CD] $\therefore \frac{AH}{HK}=\frac{AE}{ED}$	✓S ✓ R ✓ S (3)
9.2	$\frac{AE}{ED}=\frac{3}{2}$ and $\frac{AH}{HK}=\frac{3}{2}$ $\frac{AE}{12}=\frac{3}{2}$ and $\frac{15}{HK}=\frac{3}{2}$ $\therefore$ AE = 18 and HK = 10 $\therefore$ HE = AE – AH = 18 – 15 = 3 $\therefore$ EK = HK – HE = 10 – 3 = 7 **OR/*OF*** AD = 30 KD = AD – AH – HK = 30 – 15 – 10 = 5 EK = ED – KD = 12 – 5 = 7	✓ use of ratios ✓ AE = 18 ✓ HK = 10 ✓ HE = 3 **or** KD = 5 ✓ EK = 7 (5) **[10]**

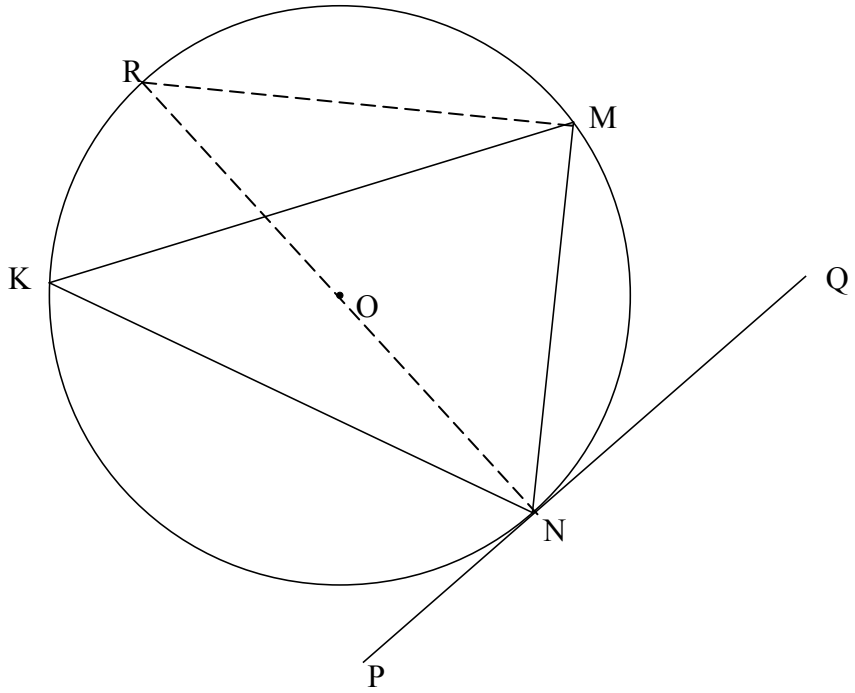
QUESTION/*VRAAG* 10



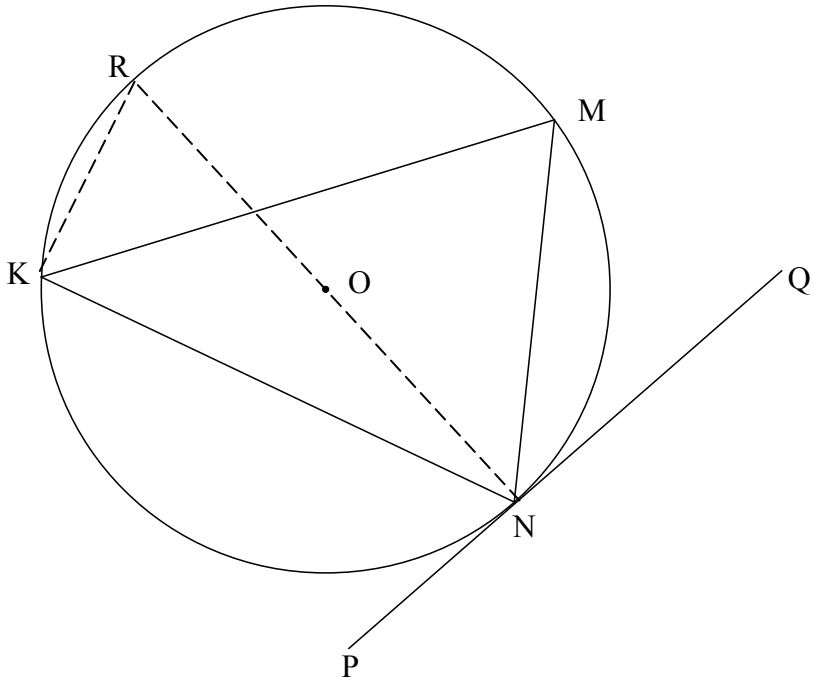
10.1	Line from centre to midpoint of chord/ *lyn vanaf midpt na midpt van koord*	✓ R (1)
10.2.1	$O\hat{W}T = O\hat{W}S = 90°$ [radius ⊥ tangent/*raaklyn*] $\therefore$ MN || TS [corresp ∠s =/*ooreenkomstige ∠e* = **OR** co-int ∠s 180°/*ko-binne∠e 180°* **OR** alternate ∠s/*verwiss ∠e*]	✓ R ✓ R (2)
10.2.2	$\hat{M}_1 = \hat{N}_1$ [∠s opp = sides/ *∠e teenoor = sye*] $\hat{M}_1 = \hat{T}$ [corresp ∠s/*ooreenk ∠e*; MN || TS] $\therefore \hat{N}_1 = \hat{T}$ $\therefore$ TMNS is a cyclic quadrilateral [conv: ext∠ cyclic quad] TMNS *is 'n koordevierhoek* [*omgek: buite∠ kdvh*] **OR/*OF*** $\hat{M}_1 = \hat{N}_1$ [∠s opp = sides/*∠e teenoor = sye*] $\hat{N}_1 = \hat{S}$ [corresp ∠s/*ooreenk ∠e*; MN || TS] $\therefore \hat{S} = \hat{M}_1$ $\therefore$ TMNS is a cyclic quadrilateral [conv: ext∠ cyclic quad] TMNS *is 'n koordevierhoek* [*omgek: buite∠ kdvh*]	✓ S ✓ S ✓ S ✓ R (4) ✓ S ✓ S ✓ S ✓ R (4)

10.2.3	In ΔOVN and ΔOWS $\hat{O}_2 = \hat{O}_2$ [common/*gemeenskaplik*] $O\hat{V}N = O\hat{W}S = 90°$ [from 10.1] $O\hat{N}V = O\hat{S}W$ [sum ∠s Δ/*som ∠e Δ*] $\therefore \Delta OVN \text{ ||| } \Delta OWS$ [∠, ∠, ∠] $\therefore \frac{VN}{WS} = \frac{ON}{OS}$ But $VN = \frac{1}{2}MN$ [given] $\therefore \frac{\frac{1}{2}MN}{WS} = \frac{ON}{OS}$ $\therefore OS.MN = 2ON.\ WS$ **OR/*OF*** In ΔOVM and ΔOWS $O\hat{V}M = O\hat{W}S = 90°$ [from 10.1] $O\hat{M}V = O\hat{S}W$ [sum ∠s Δ/*som ∠e Δ*] $\therefore \Delta OVM \text{ ||| } \Delta OWS$ [∠, ∠, ∠] $\therefore \frac{OM}{OS} = \frac{VM}{WS}$ But $VN = \frac{1}{2}MN$ [given] $\therefore \frac{\frac{1}{2}MN}{WS} = \frac{OM}{OS}$ $\therefore OS.MN = 2ON.\ WS$ [VM = VN] **OR/*OF*** If any other 2 Δs are used, first need to prove that TW = WS by proving ΔOWT ≡ ΔOWS In ΔOVM and ΔOWT $\hat{O}_1 = \hat{O}_1$ [common/*gemeenskaplik*] $O\hat{V}M = O\hat{W}T = 90°$ [from 10.1] $O\hat{M}V = O\hat{T}W$ [sum ∠s Δ/*som ∠e Δ*] $\therefore \Delta OVM \text{ ||| } \Delta OWT$ [∠, ∠, ∠] $\therefore \frac{VM}{WT} = \frac{OM}{OT}$ But $VN = VM = \frac{1}{2}MN$ [given] and WT = WS and OT = OS [ΔOWT ≡ ΔOWS] $\therefore \frac{\frac{1}{2}MN}{WS} = \frac{ON}{OS}$ $\therefore OS.MN = 2ON.\ WS$	✓ S; S; S **OR** S; S; R ✓ΔOVN ||| ΔOWS ✓ $\frac{VN}{WS} = \frac{ON}{OS}$ ✓ $VN = \frac{1}{2}MN$ ✓ substitution (5) ✓ S; S; S **OR** S; S; R ✓ΔOVM ||| ΔOWS ✓ $\frac{OM}{OS} = \frac{VM}{WS}$ ✓ $VN = \frac{1}{2}MN$ ✓ substitution (5) ✓ ✓ similarity ✓✓ congruency ✓ $VN = VM = \frac{1}{2}MN$ (5) **[12]**

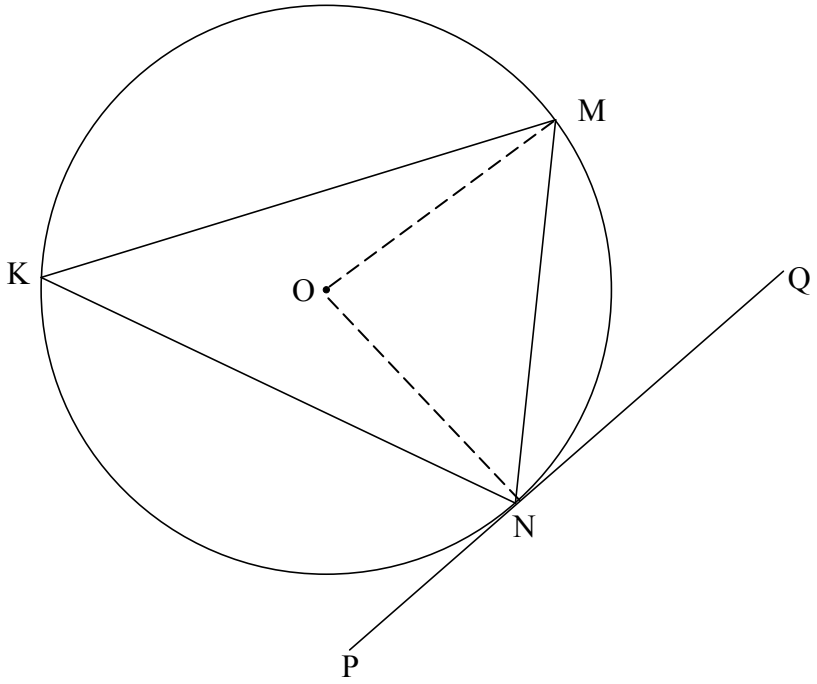
QUESTION/*VRAAG* 11



11.1	Construction: Draw diameter NR and draw RM *Konstruksie: Trek middellyn NR en verbind RM* $O\hat{N}M + M\hat{N}Q = 90°$ [radius ⊥ tangent/*raaklyn*] $N\hat{M}R = 90°$ [∠ in semi circle/*semi-sirkel*] $\therefore M\hat{R}N = 180° - (90° + 90° - M\hat{N}Q)$ [sum ∠s Δ] $= M\hat{N}Q$ but $M\hat{R}N = M\hat{K}N$ [∠s same segment/*∠e dieselfde segment*] $\therefore M\hat{N}Q = \hat{K}$ **OR/*OF***	✓ construction ✓ S /R ✓ S/ R ✓ S ✓ S / R (5)

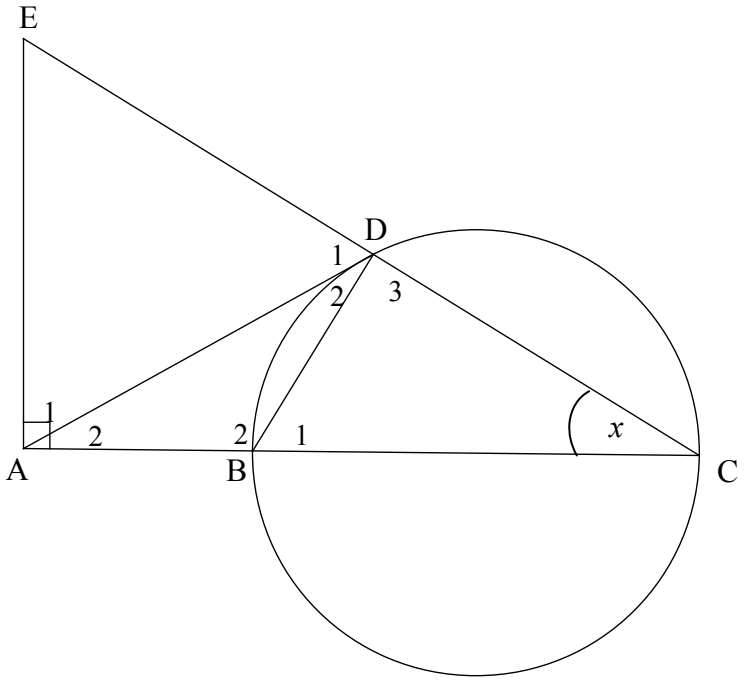


11.1	Construction: Draw diameter NR and draw RK *Konstruksie: Trek middellyn NR en verbind RK* $M\hat{N}Q + R\hat{N}M = 90°$ [radius ⊥ tangent/*raaklyn*] $N\hat{K}R = 90°$ [∠ in semicircle/*semi-sirkel*] $\therefore M\hat{K}N = 90° - R\hat{K}M$ $= 90° - R\hat{N}M$ [∠s same segment/*∠e dieselfde segment*] $\therefore M\hat{N}Q = \hat{K}$	✓ construction ✓ S /R ✓ S/ R ✓ S ✓ S / R (5)



11.1	Construction: Draw radii ON and OM *Konstruksie: Trek radiusse ON en OM* $M\hat{O}N = 2\hat{K}$ [∠ at centre = 2∠ at circumf/*midpts∠ = 2 omtreks∠*] $O\hat{N}M + O\hat{M}N = 180° - 2\hat{K}$ [∠s of Δ/*∠e van Δ*] $O\hat{N}M = O\hat{M}N = \frac{180° - 2\hat{K}}{2} = 90° - \hat{K}$ [∠s opp = sides/*∠e teenoor = sye*] $O\hat{N}Q = 90°$ [radius⊥tangent/*radius⊥raaklyn*] $\therefore M\hat{N}Q = \hat{K}$	✓ construction ✓ S /R ✓ S ✓ S/ R ✓ S / R (5)

11.2



11.2.1(a)	Angle in a semi circle/ *Hoek in halfsirkel*	✓ R (1)
11.2.1(b)	Exterior ∠of quad = opp interior ∠/ *Buite ∠ van vierh = teenoorst binne ∠* **OR/*OF*** Opp ∠s of quad supplementary/ *Teenoorst ∠e van vierh is supplementêr*	✓ R (1)
11.2.1(c)	tangent chord theorem/ *raaklyn koord stelling*	✓ R (1)
11.2.2(a)	In ΔAEC $\hat{E} = 180° - (90° + x)$ [sum ∠s Δ] $= 90° - x$ $\hat{D}_1 = 180° - (90° + x)$ [∠s on a straight line] $= \hat{E} = 90° - x$ ∴ AD = AE [sides opp = ∠s/ *sye teenoor = ∠e*]	✓ S ✓ S ✓ R (3)
11.2.2(b)	In ΔADB and ΔACD $\hat{A}_2 = \hat{A}_2$ [common] $\hat{D}_2 = \hat{C}$ [proven] $\hat{B}_2 = \hat{D}_2 + \hat{D}_3$ [sum $\angle^e$ Δ] ∴ΔADB ||| ΔACD **OR/*OF*** In ΔADB and ΔACD $\hat{A}_2 = \hat{A}_2$ [common] $\hat{D}_2 = \hat{C}$ [proven] ∴ΔADB ||| ΔACD [∠, ∠, ∠]	✓ S ✓ S ✓ S (3) ✓ S ✓ S ✓ R (3)

11.2.3(a)	$\frac{AD}{AC}=\frac{AB}{AD}$ [||| Δs] $AD^2 = AC \cdot AB$ $= 3r \times r$ $= 3r^2$	✓ ratio ✓ substitution (2)
11.2.3(b)	$AD = AE = \sqrt{3}r$ [from 11.2.2(a) &11.2.3(a)] $AB = r$ and $BC = 2r$ $\therefore AC = 3r$ <u>In ΔACE:</u> $\tan \hat{E} = \frac{AC}{AE}$ $= \frac{3r}{\sqrt{3}r} = \sqrt{3}$ $\therefore \hat{E} = 60°$ $\therefore \hat{D}_1 = 60°$ [from 11.2.2(a)] $\therefore \hat{A}_1 = 60°$ [$\angle$s of $\Delta = 180°$] $\therefore \Delta ADE$ is equilateral/*is gelyksydig* **OR/*OF*** $\frac{AD}{AC}=\frac{DB}{CD}$ [||| Δs] $\frac{\sqrt{3}r}{3r}=\frac{DB}{CD}$ $\tan x = \frac{1}{\sqrt{3}}$ $\therefore$ In ΔBDC: $x = 30°$ $\therefore \hat{E} = 60°$ $\therefore \hat{D}_1 = 60°$ [from 11.2.2(a)] $\therefore \hat{A}_1 = 60°$ [$\angle$s of $\Delta = 180°$] $\therefore \Delta ADE$ is equilateral/*is gelyksydig* **OR/*OF*** $\frac{AD}{AC}=\frac{DB}{CD}$ [||| Δs] $\frac{\sqrt{3}r}{3r}=\frac{DB}{CD}$ $\therefore BD = \frac{CD}{\sqrt{3}}$ $DC^2 = BC^2 - DB^2$ $= 4r^2 - \frac{CD^2}{3}$ $3DC^2 = 12r^2 - CD^2$ $4CD^2 = 12r^2$ $DC = \sqrt{3}r$	✓ AC ito r ✓ trig ratio ✓ simplification ✓ all 3 $\angle$s = 60° (4) ✓ $\frac{\sqrt{3}r}{3r}=\frac{DB}{CD}$ ✓ $\frac{1}{\sqrt{3}} = \tan x$ ✓ $x = 30°$ ✓ all 3 $\angle$s = 60° (4) ✓ $BD = \frac{CD}{\sqrt{3}}$ ✓ $DC = \sqrt{3}r$

	$EC^2 = EA^2 + AC^2$ $= 3r^2 + 9r^2$ $EC = 2\sqrt{3}r$ $\therefore$ ED = EC – DC $= \sqrt{3}r$ $\therefore$ ED = EA = AD $\therefore$ ΔADE is equilateral/*is gelyksydig*	✓ $EC = 2\sqrt{3}r$ ✓ ED = EA = AD (4) **[20]**

TOTAL/*TOTAAL*: 150