



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA



SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

MATHEMATICS P2

2022

Stanmorephysics.com

MARKS: 150

TIME: 3 hours



This question paper consists of 14 pages and 1 information sheet.



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. that you have used in determining your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. An information sheet with formulae is included at the end of the question paper.
9. Write neatly and legibly.



QUESTION 1

The table below shows the mass (in kg) of the school bags of 80 learners.

MASS (in kg)	FREQUENCY
$5 < m \leq 7$	6
$7 < m \leq 9$	18
$9 < m \leq 11$	21
$11 < m \leq 13$	19
$13 < m \leq 15$	11
$15 < m \leq 17$	4
$17 < m \leq 19$	1

- 1.1 Write down the modal class of the data. (1)
- 1.2 Complete the cumulative frequency column in the table in the ANSWER BOOK. (2)
- 1.3 Draw a cumulative frequency graph (ogive) for the given data on the grid provided in the ANSWER BOOK. (3)
- 1.4 Use the graph to determine the median mass for this data. (2)
- 1.5 The international guideline for the mass of a school bag is that it should not exceed 10% of a learner's body mass.
 - 1.5.1 Calculate the estimated mean mass of the school bags. (2)
 - 1.5.2 The mean mass of this group of learners was found to be 80 kg. On average, are these school bags satisfying the international guideline with regard to mass? Motivate your answer. (2)

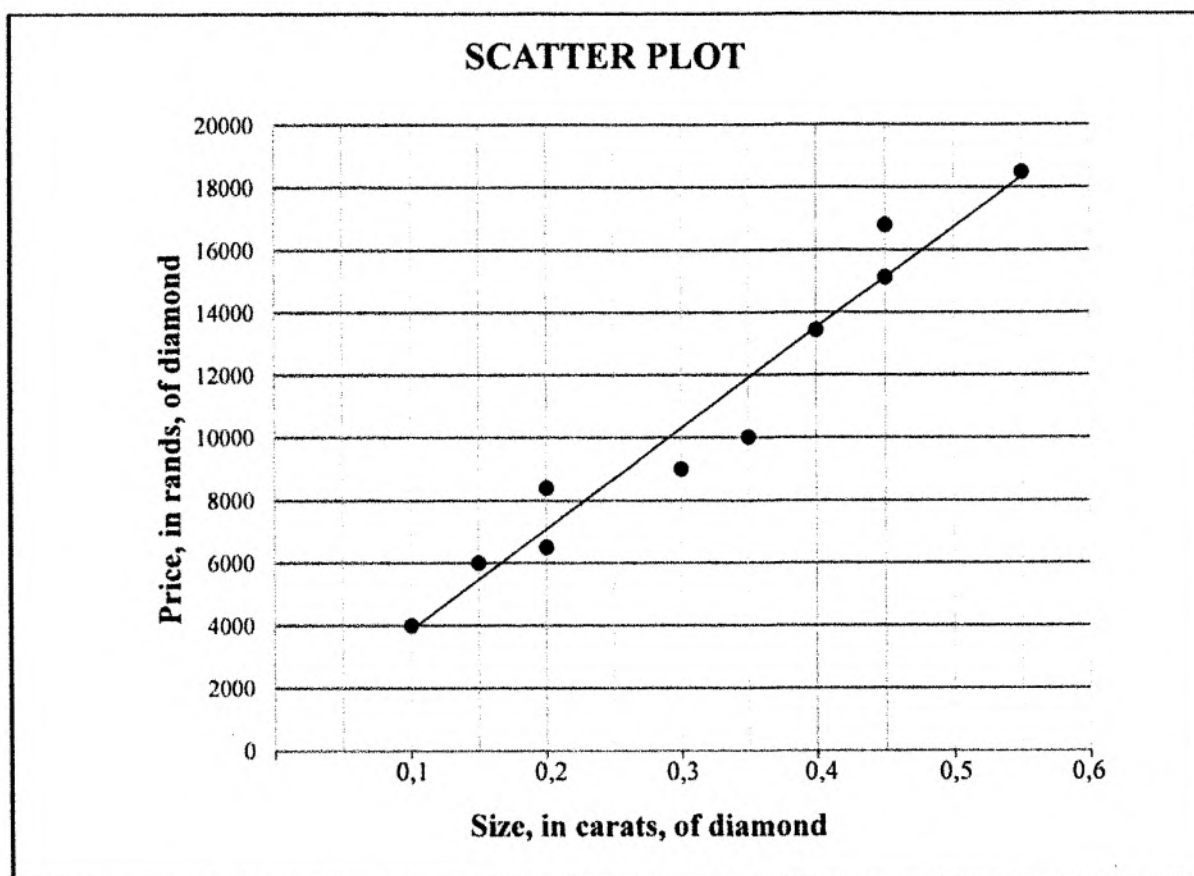
[12]



QUESTION 2

The table below shows the size (in carats) and the price (in rands) of 10 diamonds that were sold by a diamond trader. This information is also presented in the scatter plot below. The least squares regression line for the data is drawn.

Size, in carats, of diamond (x)	0,1	0,15	0,2	0,2	0,3	0,35	0,4	0,45	0,45	0,55
Price, in rands, of diamond (y)	4 000	6 000	6 500	8 400	9 000	10 000	13 440	15 120	16 800	18 480

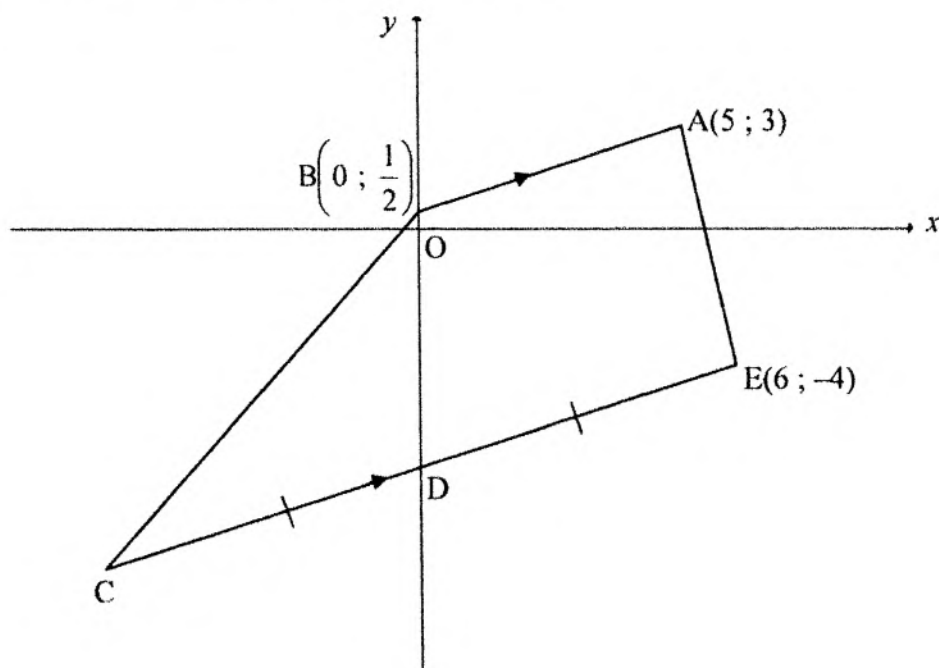


- 2.1 Determine the equation of the least squares regression line for the data. (3)
- 2.2 If the trader sold a diamond that was 0,25 carats in size, predict the selling price of this diamond in rands. (2)
- 2.3 Calculate the average price increase per 0,05 carat of the diamonds. (2)
- 2.4 It was later found that the selling price of the 0,35 carat diamond was recorded incorrectly. The correct price is R11 500. When this correction is made to the data set, the correlation between the size and price of these diamonds gets stronger. Explain the reason for this by referring to the given scatter plot. (1)

[8]

QUESTION 3

In the diagram, $A(5; 3)$, $B\left(0; \frac{1}{2}\right)$, C and $E(6; -4)$ are the vertices of a trapezium having $BA \parallel CE$. D is the y -intercept of CE and $CD = DE$.

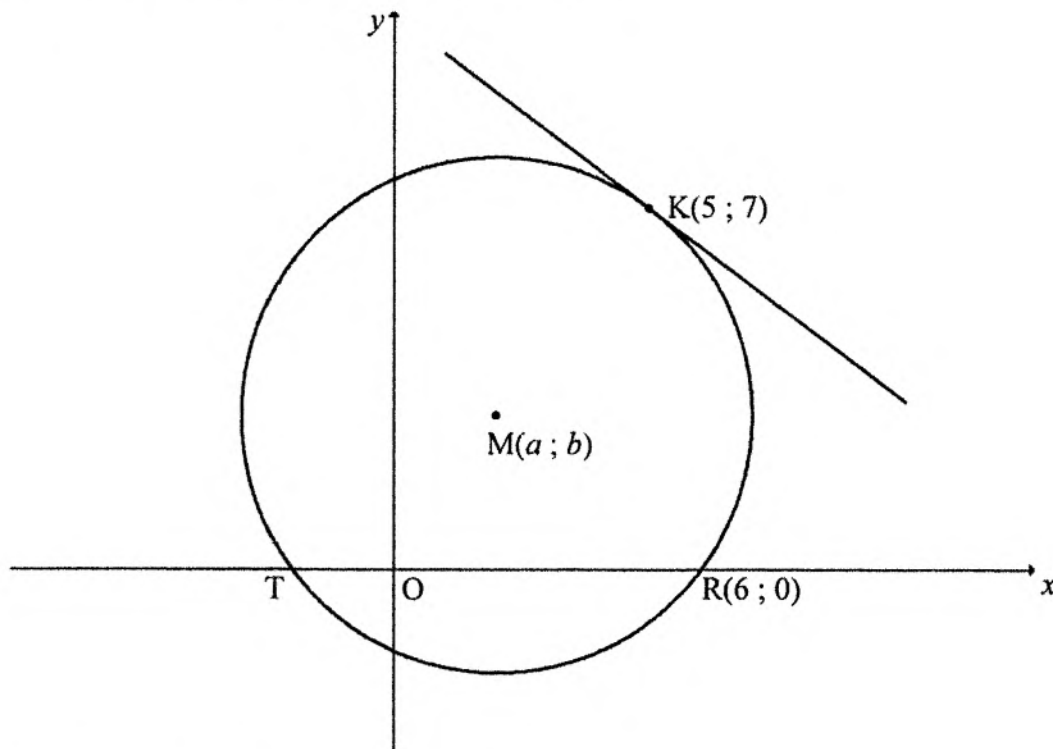


- 3.1 Calculate the gradient of AB . (2)
- 3.2 Determine the equation of CE in the form $y = mx + c$. (3)
- 3.3 Calculate the:
 - 3.3.1 Coordinates of C (3)
 - 3.3.2 Area of quadrilateral $ABCD$ (4)
- 3.4 If point K is the reflection of E in the y -axis:
 - 3.4.1 Write down the coordinates of K (2)
 - 3.4.2 Calculate the:
 - (a) Perimeter of $\triangle KEC$ (4)
 - (b) Size of $\hat{KCE}$ (3)

[21]

QUESTION 4

In the diagram, the circle centred at $M(a; b)$ is drawn. T and $R(6; 0)$ are the x -intercepts of the circle. A tangent is drawn to the circle at $K(5; 7)$.

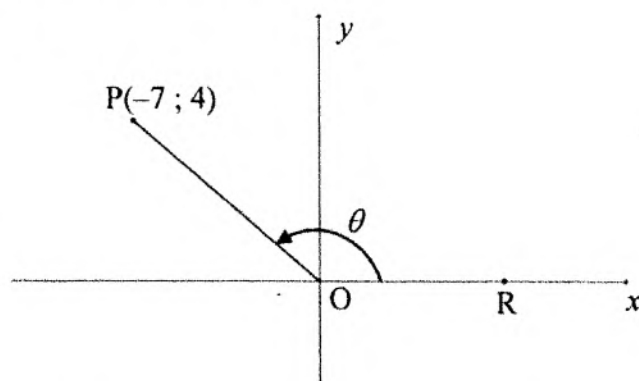


- 4.1 M is a point on the line $y = x + 1$.
- 4.1.1 Write b in terms of a . (1)
- 4.1.2 Calculate the coordinates of M . (5)
- 4.2 If the coordinates of M are $(2; 3)$, calculate the length of:
- 4.2.1 The radius of the circle (2)
- 4.2.2 TR (2)
- 4.3 Determine the equation of the tangent to the circle at K . Write your answer in the form $y = mx + c$. (5)
- 4.4 A horizontal line is drawn as a tangent to the circle M at the point $N(c; d)$, where $d < 0$.
- 4.4.1 Write down the coordinates of N . (2)
- 4.4.2 Determine the equation of the circle centred at N and passing through T . Write your answer in the form $(x - a)^2 + (y - b)^2 = r^2$. (3)

[20]

QUESTION 5

- 5.1 In the diagram below, $P(-7; 4)$ is a point in the Cartesian plane. R is a point on the positive x -axis such that obtuse $\hat{POR} = \theta$.



Calculate, **without using a calculator**, the:

- 5.1.1 Length OP (2)
- 5.1.2 Value of:
- (a) $\tan \theta$ (1)
- (b) $\cos(\theta - 180^\circ)$ (2)
- 5.2 Determine the general solution of: $\sin x \cos x + \sin x = 3 \cos^2 x + 3 \cos x$ (7)
- 5.3 Given the identity: $\frac{\sin 3x}{1 - \cos 3x} = \frac{1 + \cos 3x}{\sin 3x}$
- 5.3.1 Prove the identity given above. (3)
- 5.3.2 Determine the values of x , in the interval $x \in [0^\circ; 60^\circ]$, for which the identity will be undefined. (3)

[18]



QUESTION 6

- 6.1 Without using a calculator, simplify the following expression to a single trigonometric term:

$$\frac{\sin 10^\circ}{\cos 440^\circ} + \tan(360^\circ - \theta) \cdot \sin 2\theta \quad (6)$$

- 6.2 Given: $\sin(60^\circ + 2x) + \sin(60^\circ - 2x)$

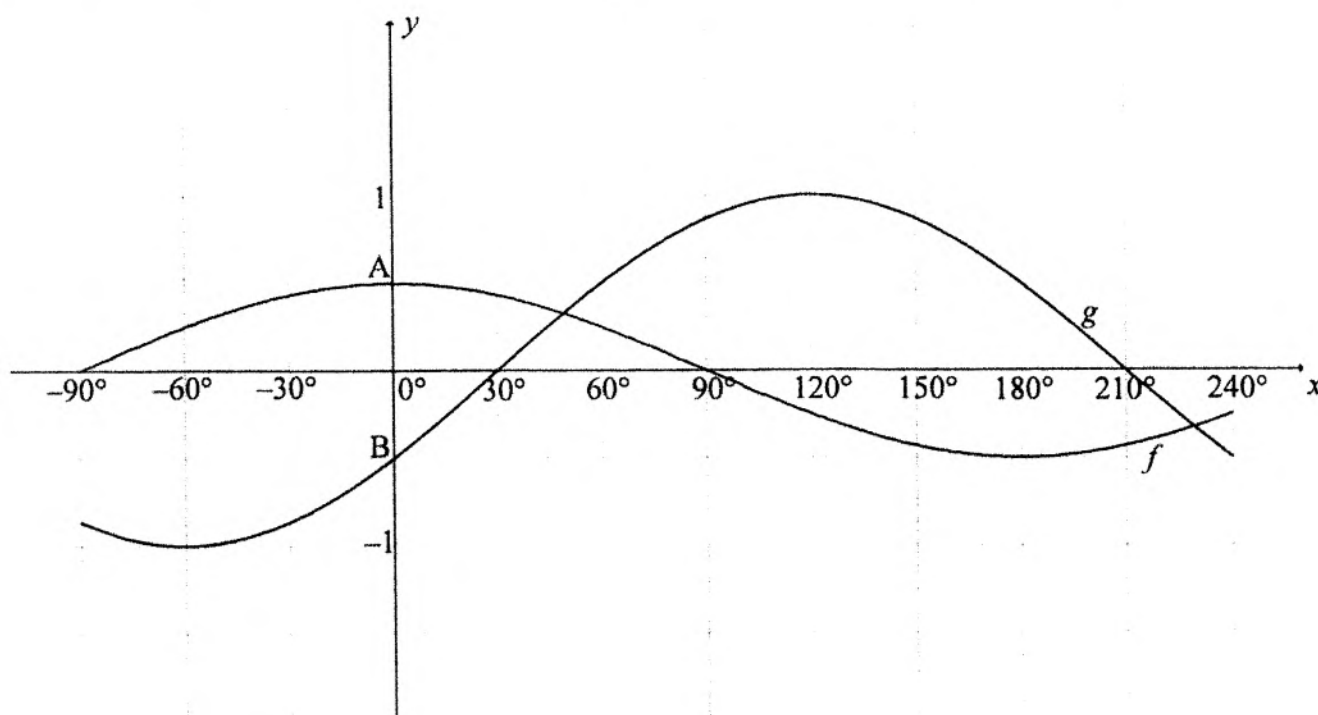
6.2.1 Calculate the value of k if $\sin(60^\circ + 2x) + \sin(60^\circ - 2x) = k \cos 2x$. (3)

6.2.2 If $\cos x = \sqrt{t}$, without using a calculator, determine the value of $\tan 60^\circ [\sin(60^\circ + 2x) + \sin(60^\circ - 2x)]$ in terms of t . (3)

[12]

QUESTION 7

In the diagram below, the graphs of $f(x) = \frac{1}{2} \cos x$ and $g(x) = \sin(x - 30^\circ)$ are drawn for the interval $x \in [-90^\circ; 240^\circ]$. A and B are the y-intercepts of f and g respectively.



7.1 Determine the length of AB. (2)

7.2 Write down the range of $3f(x) + 2$. (2)

7.3 Read off from the graphs a value of x for which $g(x) - f(x) = \frac{\sqrt{3}}{2}$. (2)

7.4 For which values of x , in the interval $x \in [-90^\circ; 240^\circ]$, will:

7.4.1 $f(x) \cdot g(x) > 0$ (2)

7.4.2 $g'(x - 5^\circ) > 0$ (2)

[10]

QUESTION 8

FIGURE I shows a ramp leading to the entrance of a building. B, C and D lie on the same horizontal plane. The perpendicular height (AC) of the ramp is 0,5 m and the angle of elevation from B to A is 15° . The entrance of the building (AE) is 0,915 m wide.

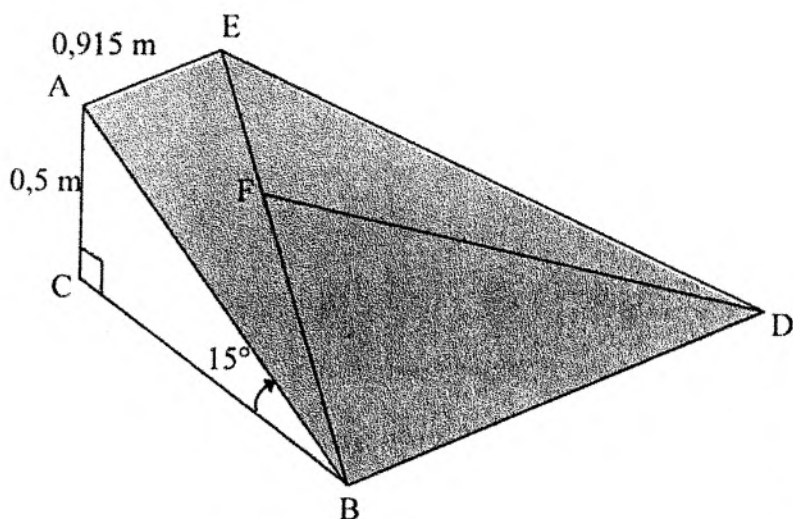


FIGURE I

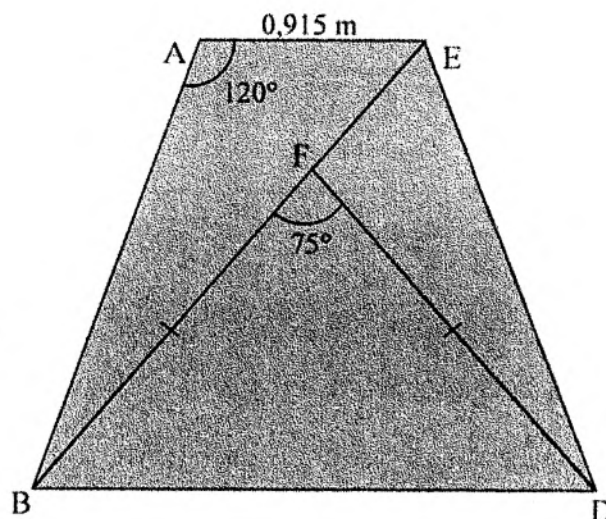


FIGURE II (top view)

8.1 Calculate the length of AB. (2)

8.2 Figure II shows the top view of the ramp. The area of the top of the ramp is divided into three triangles, as shown in the diagram.

If $\hat{BAE} = 120^\circ$, calculate the length of BE. (3)

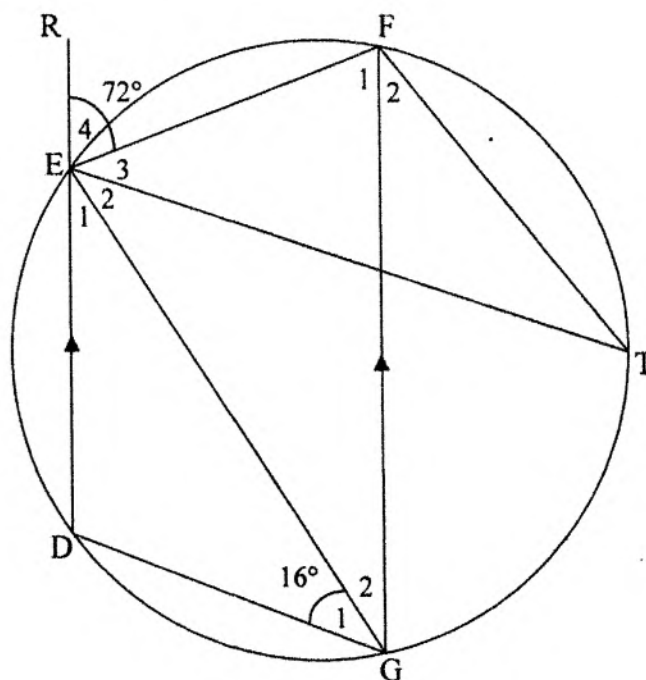
8.3 Calculate the area of $\triangle BFD$ if $\hat{BFD} = 75^\circ$, $BF = FD$ and $BF = \frac{5}{7}BE$. (3)

[8]



QUESTION 9

- 9.1 In the diagram, DEFG is a cyclic quadrilateral with $DE \parallel GF$. DE is produced to R. T is another point on the circle. EG, FT and ET are drawn. $\hat{E}_4 = 72^\circ$ and $\hat{G}_1 = 16^\circ$.



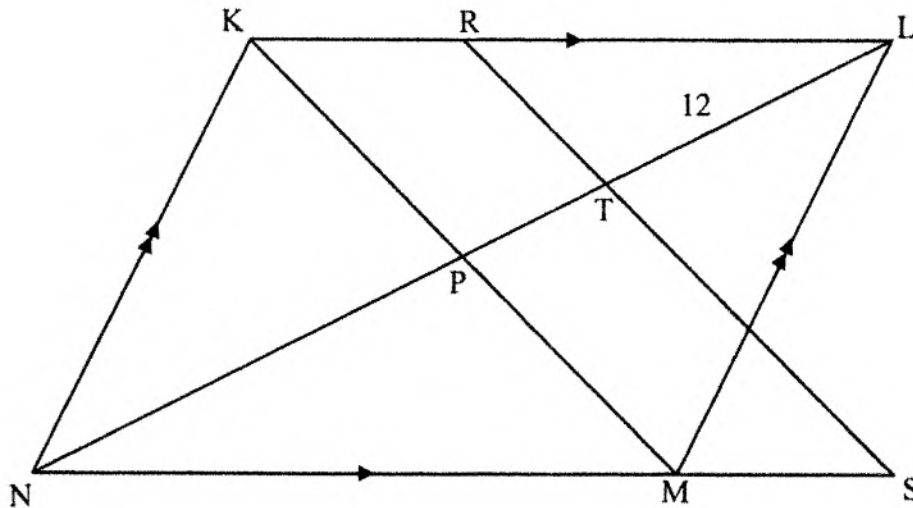
Determine, with reasons, the size of the following angles:

9.1.1 $\hat{DGF}$ (2)

9.1.2 $\hat{T}$ (2)

9.1.3 $\hat{GEF}$ (2)

- 9.2 In the diagram, the diagonals of parallelogram KLMN intersect at P. NM is produced to S. R is a point on KL and RS cuts PL at T. $NM : MS = 4 : 1$, $NL = 32$ units and $TL = 12$ units.



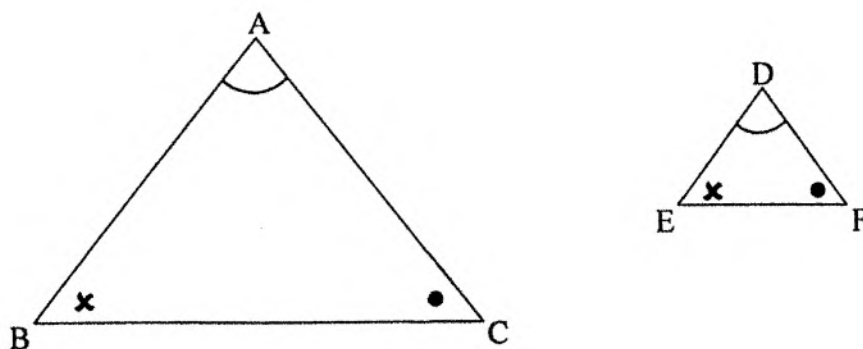
- 9.2.1 Determine, with reasons, the value of the ratio $NP : PT$ in simplest form. (4)
- 9.2.2 Prove, with reasons, that $KM \parallel RS$. (2)
- 9.2.3 If $NM = 21$ units, determine, with reasons, the length of RL . (4)

[16]



QUESTION 10

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

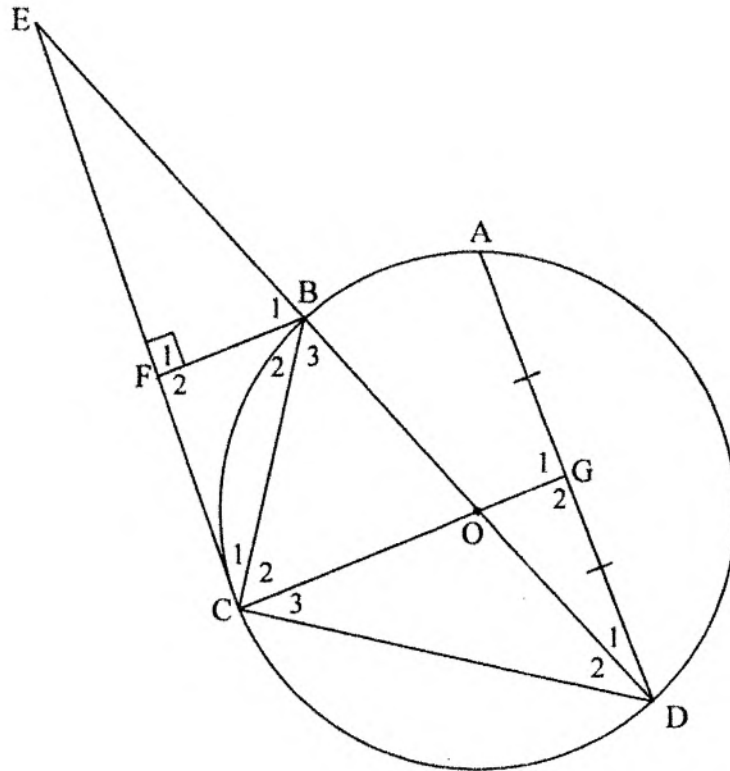


Use the diagram in the ANSWER BOOK to prove the theorem which states that if two triangles are equiangular, then the corresponding sides are in proportion,

i.e. $\frac{AB}{DE} = \frac{AC}{DF}$.

(6)

- 10.2 In the diagram, O is the centre of a circle passing through A , B , C and D . EC is a tangent to the circle at C . Diameter DB produced meets tangent EC at E . F is a point on EC such that $BF \perp EC$. Radius CO produced bisects AD at G . BC and CD are drawn.



10.2.1 Prove, with reasons, that:

(a) $FB \parallel CG$ (3)

(b) $\triangle FCB \parallel \triangle CDB$ (5)

10.2.2 Give a reason why $\hat{G}_1 = 90^\circ$. (1)

10.2.3 Prove, with reasons, that $CD^2 = CG \cdot DB$. (5)

10.2.4 Hence, prove that $DB = CG + FB$. (5)

[25]

TOTAL: 150



INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta$$

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

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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



E A 5 2 2 E F 2 E 0 0 0 0 0 2

Department
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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*) 2022

CENTRE NUMBER SENTRUMNOMMER						
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[illegible]

DATE DATUM	
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BOOK NUMBER BOEKNUMMER		OF VAN		BOOKS BOEKE
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SUBJECT CODE VAKKODE					
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PAPER NUMBER VRAESTELNOMMER	2
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SUBJECT NAME VAKNAAM	MATHEMATICS/ <i>WISKUNDE</i>
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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 THE NEXT PAGE
LEES INSTRUCTIES OP VOLGENDE BLADSV

This answer book consists of 23 pages./Hierdie antwoordeboek bestaan uit 23 bladsye.



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

QUESTION/VRAAG 1

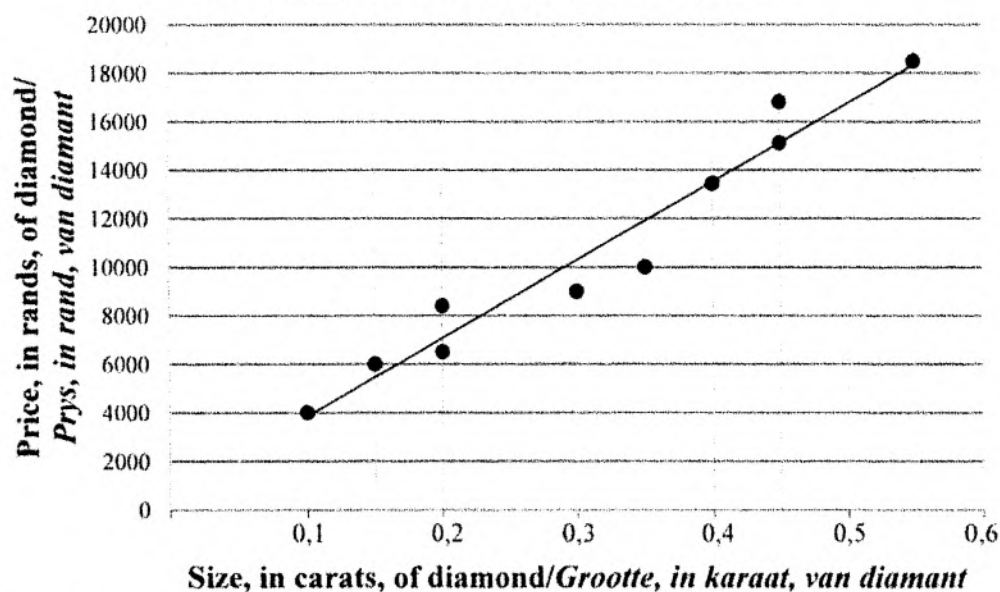
	Solution/Oplissing	Marks Punte																								
1.1		(1)																								
1.2	<table border="1"> <thead> <tr> <th>MASS (in kg)/ MASSA (in kg)</th><th>FREQUENCY/ FREKWENSIE</th><th>CUMULATIVE FREQUENCY/ KUMULATIEWE FREKWENSIE</th></tr> </thead> <tbody> <tr> <td>$5 < m \leq 7$</td><td>6</td><td></td></tr> <tr> <td>$7 < m \leq 9$</td><td>18</td><td></td></tr> <tr> <td>$9 < m \leq 11$</td><td>21</td><td></td></tr> <tr> <td>$11 < m \leq 13$</td><td>19</td><td></td></tr> <tr> <td>$13 < m \leq 15$</td><td>11</td><td></td></tr> <tr> <td>$15 < m \leq 17$</td><td>4</td><td></td></tr> <tr> <td>$17 < m \leq 19$</td><td>1</td><td></td></tr> </tbody> </table>	MASS (in kg)/ MASSA (in kg)	FREQUENCY/ FREKWENSIE	CUMULATIVE FREQUENCY/ KUMULATIEWE FREKWENSIE	$5 < m \leq 7$	6		$7 < m \leq 9$	18		$9 < m \leq 11$	21		$11 < m \leq 13$	19		$13 < m \leq 15$	11		$15 < m \leq 17$	4		$17 < m \leq 19$	1		(2)
MASS (in kg)/ MASSA (in kg)	FREQUENCY/ FREKWENSIE	CUMULATIVE FREQUENCY/ KUMULATIEWE FREKWENSIE																								
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$13 < m \leq 15$	11																									
$15 < m \leq 17$	4																									
$17 < m \leq 19$	1																									
1.3	Ogive/Ogief	(3)																								

	Solution/Oplissing	Marks Punte
1.4		(2)
1.5.1		(2)
1.5.2		(2)
		[12]

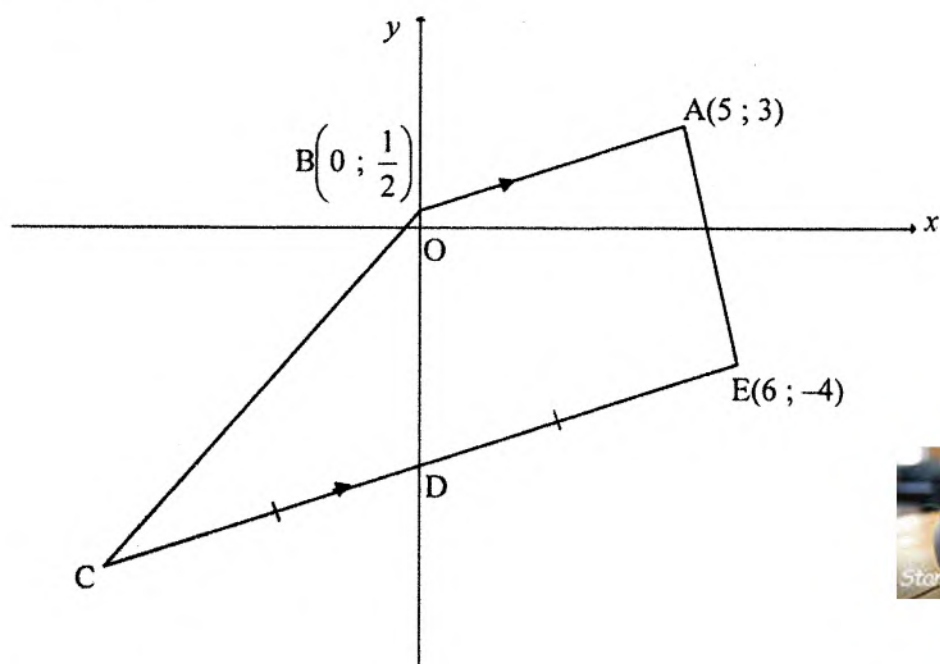
QUESTION/VRAAG 2

Size, in carats, of diamond (x)/ Grootte, in karaat, van diamant (x)	0,1	0,15	0,2	0,2	0,3	0,35	0,4	0,45	0,45	0,55
Price, in rands, of diamond (y)/ Prys, in rand, van diamant (y)	4 000	6 000	6 500	8 400	9 000	10 000	13 440	15 120	16 800	18 480

SCATTER PLOT / SPREIDIAGRAM



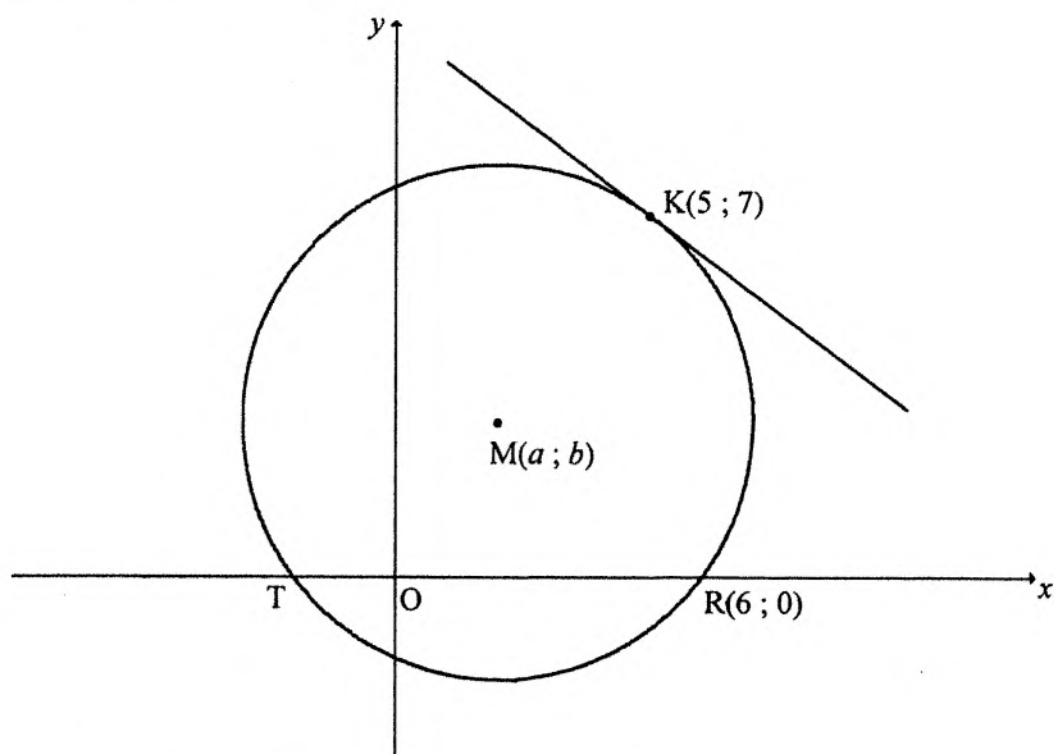
	Solution/Oplissing	Marks Punte
2.1		(3)
2.2		(2)
2.3		(2)
2.4		(1)
		[8]



	Solution/<i>Oplossing</i>	Marks <i>Punte</i>
3.1		(2)
3.2		(3)
3.3.1		(3)

	Solution/Oplissing	Marks Punte
3.3.2		(4)
3.4.1		(2)
3.4.2(a)		(4)
3.4.2(b)		(3)
		[21]

QUESTION/VRAAG 4

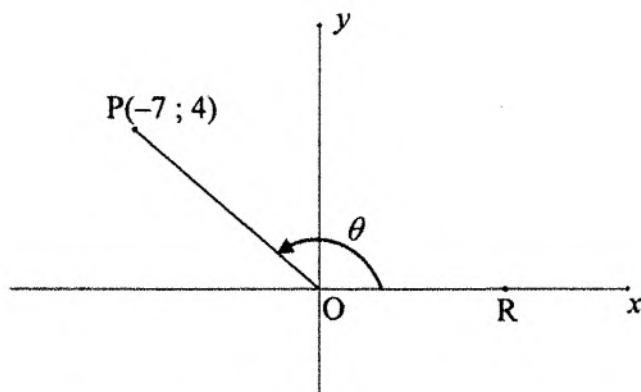


	Solution/Oplissing	Marks Punte
4.1.1		(1)
4.1.2		(5)

	Solution/Oplissing	Marks Punte
4.2.1		(2)
4.2.2		(2)
4.3		(5)
4.4.1		(2)
4.4.2		(3)
		[20]

QUESTION/VRAAG 5

5.1



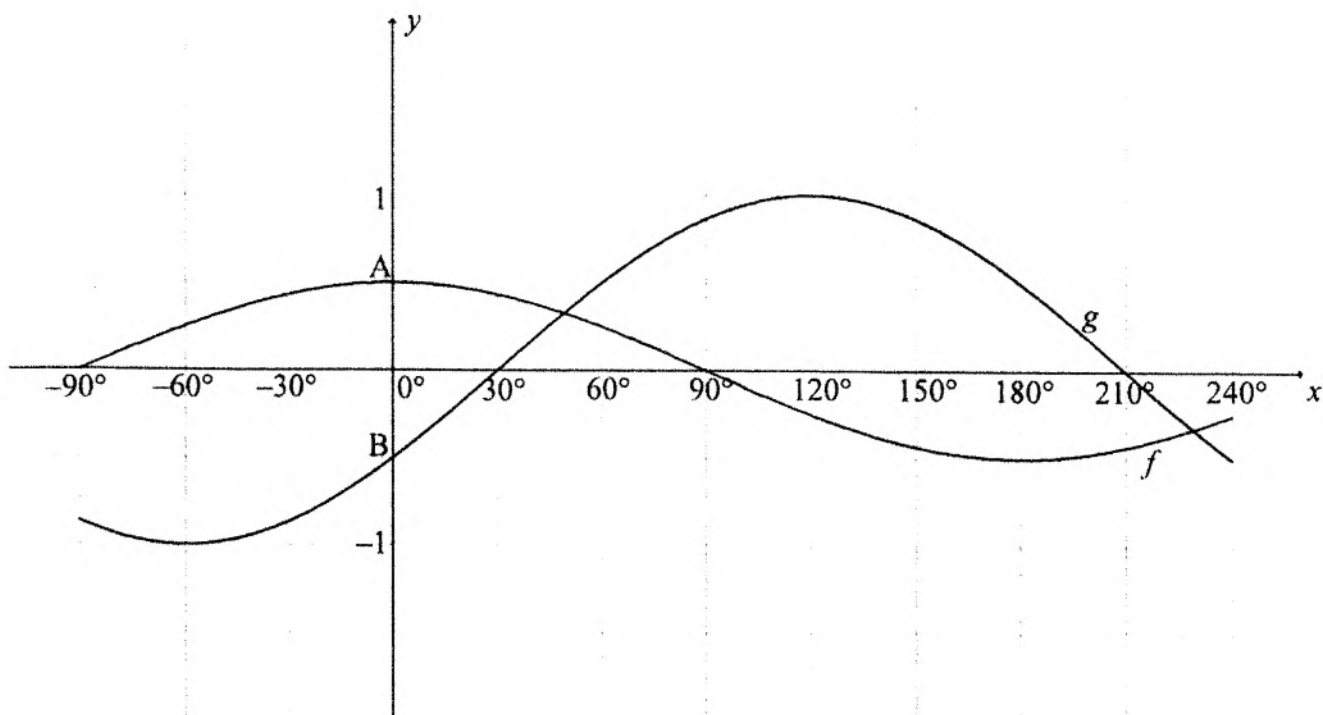
	Solution/Oplossing	Marks Punte
5.1.1		(2)
5.1.2(a)		(1)
5.1.2(b)		(2)
5.2		(7)

	Solution/Oplissing	Marks Punte
5.3.1		
		(3)
5.3.2		
		(3)
		[18]

QUESTION/VRAAG 6

	Solution/Oplissing	Marks Punte
6.1		
		(6)
6.2.1		
		(3)
6.2.2		
		(3)
		[12]

QUESTION/VRAAG 7



	Solution/Oplissing	Marks Punte
7.1		(2)
7.2		(2)
7.3		(2)
7.4.1		(2)
7.4.2		(2)
		[10]

QUESTION/VRAG 8

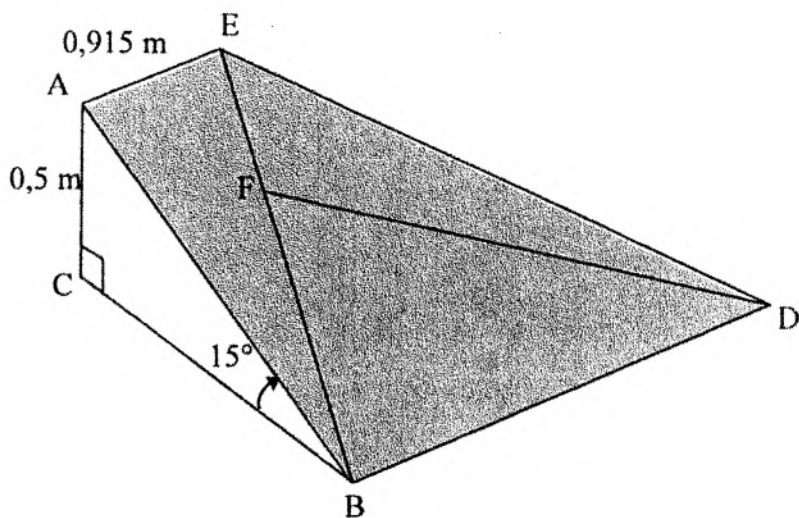


FIGURE I/FIGUUR I

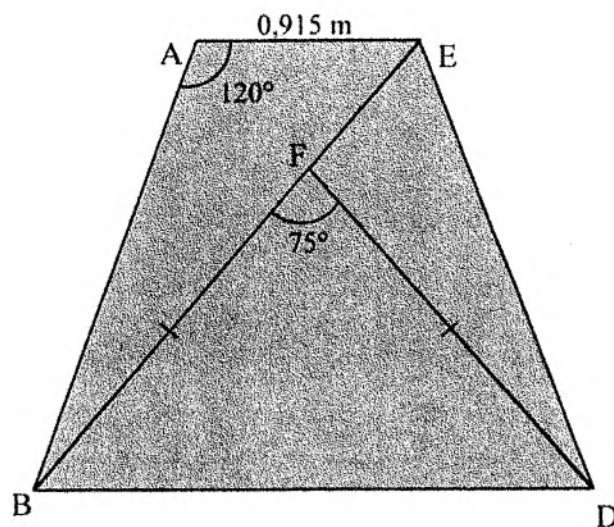


FIGURE II (top view)/FIGUUR II (boaansig)

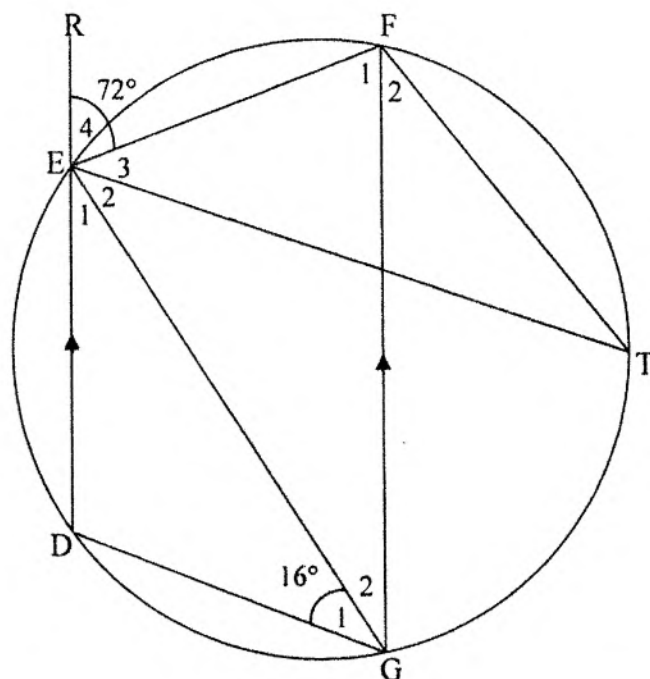
	Solution/Oplissing	Marks Punte
8.1		
		(2)
8.2		
		(3)
8.3		
		(3)
		[8]



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

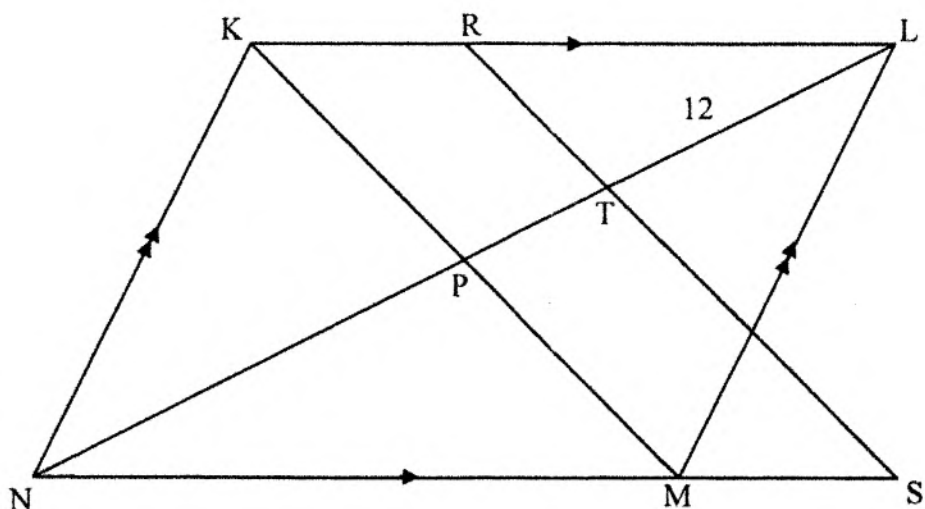
QUESTION/VRAAG 9

9.1



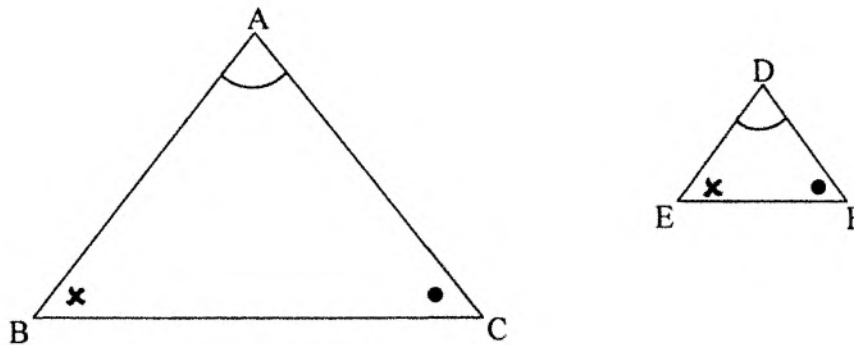
	Solution/Oplossing	Marks Punte
9.1.1		
		(2)
9.1.2		
		(2)
9.1.3		
		(2)

9.2

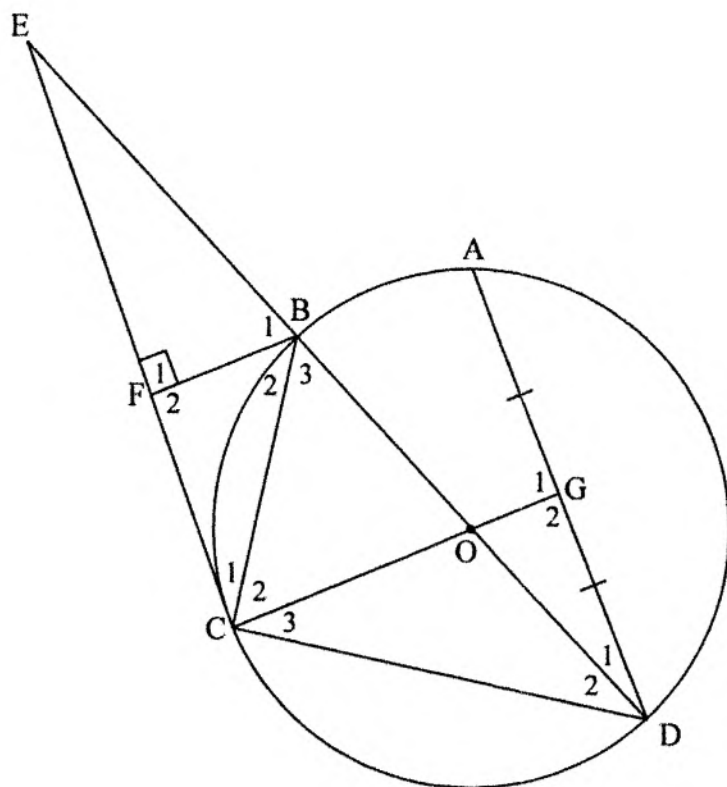


	Solution/Oplissing	Marks Punte
9.2.1		
		(4)
9.2.2		
		(2)
9.2.3		
		(4)
		[16]

10.1

[illegible]

10.2



	Solution/Oplissing	Marks Punte
10.2.1(a)		

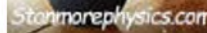
(3)

	Solution/Oplossing	Marks Punte
10.2.1(b)		(5)
10.2.2		(1)
10.2.3		(5)
10.2.4		(5)
		[25]

	Additional space/Bykomende ruimte	Marks Punte

[illegible]

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Additional space/*Bykomende ruimte*

	Marks	Punte
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Abstract



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

2022

Stanmorephysics.com

**MARKS: 150
PUNTE: 150**

**These marking guidelines consist of 18 pages./
Hierdie nasienriglyne bestaan uit 18 bladsye.**

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

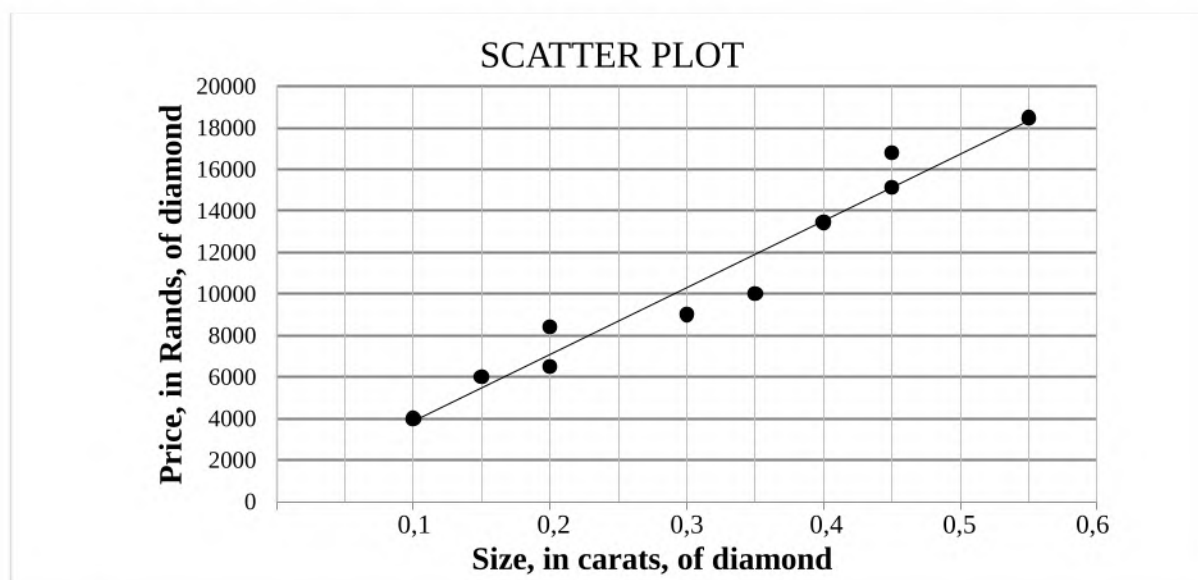


1.1	Modal class: $9 < m \leq 11$	✓ answer (1)																								
1.2	<table border="1"> <thead> <tr> <th>Mass (in kg)</th><th>Frequency</th><th>Cumulative frequency</th></tr> </thead> <tbody> <tr> <td>$5 < m \leq 7$</td><td>6</td><td>6</td></tr> <tr> <td>$7 < m \leq 9$</td><td>18</td><td>24</td></tr> <tr> <td>$9 < m \leq 11$</td><td>21</td><td>45</td></tr> <tr> <td>$11 < m \leq 13$</td><td>19</td><td>64</td></tr> <tr> <td>$13 < m \leq 15$</td><td>11</td><td>75</td></tr> <tr> <td>$15 < m \leq 17$</td><td>4</td><td>79</td></tr> <tr> <td>$17 < m \leq 19$</td><td>1</td><td>80</td></tr> </tbody> </table>	Mass (in kg)	Frequency	Cumulative frequency	$5 < m \leq 7$	6	6	$7 < m \leq 9$	18	24	$9 < m \leq 11$	21	45	$11 < m \leq 13$	19	64	$13 < m \leq 15$	11	75	$15 < m \leq 17$	4	79	$17 < m \leq 19$	1	80	✓✓ Cumulative frequency column (2)
Mass (in kg)	Frequency	Cumulative frequency																								
$5 < m \leq 7$	6	6																								
$7 < m \leq 9$	18	24																								
$9 < m \leq 11$	21	45																								
$11 < m \leq 13$	19	64																								
$13 < m \leq 15$	11	75																								
$15 < m \leq 17$	4	79																								
$17 < m \leq 19$	1	80																								
1.3		✓ grounding (5 ; 0) ✓ points ✓ shape (3)																								
1.4	Median mass: 10,5 kg	✓✓ answer (2)																								
1.5.1	$\bar{x} = \frac{(6 \times 6 + 18 \times 8 + 21 \times 10 + 19 \times 12 + 11 \times 14 + 4 \times 16 + 18 \times 18)}{80}$ $= 10,68$	✓ 854 ✓ answer (2)																								
1.5.2	Estimated mean = 10,68 kg 10% of 80 kg = 8 kg 10,68 kg > 8 kg Learners' bags are heavier than the stipulated international guideline.	✓ 10,68 kg > 8 kg ✓ answer (2)																								

[12]

QUESTION/VRAAG 2

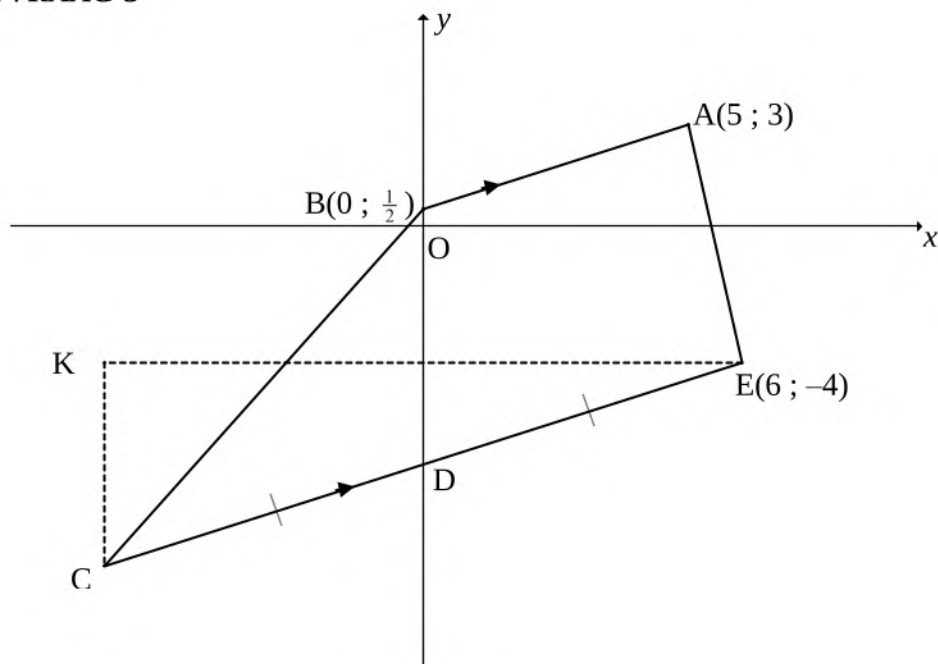
Size, in carats, of diamond (x)	0,1	0,15	0,2	0,2	0,3	0,35	0,4	0,45	0,45	0,55
Price, in rands, of diamond (y)	4 000	6 000	6 500	8 400	9 000	10 000	13 440	15 120	16 800	18 480

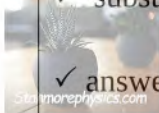


2.1	$a = 634,382\dots$ $b = 32\,189,263\dots$ $\hat{y} = 634,38 + 32189,26x$	✓ a ✓ b ✓ equation (3)
2.2	$\hat{y} = 634,38 + 32189,26(0,25)$ $= R8\,681,70$ OR/OF $\hat{y} = R8\,681,70$ (if using calculator)	✓ substitution ✓ answer (2) ✓ ✓ answer (2)
2.3	$\text{Average price increase} = R \frac{32189,26}{20} \text{ per } 0,05 \text{ carat}$ $= R1\,609,46 \text{ per } 0,05 \text{ carat}$ OR/OF $\text{Average price increase} = 0,05 \times 32\,189,26$ $= R1\,609,46 \text{ per } 0,05 \text{ carat}$ OR/OF at 0,3: $\hat{y} = R10\,291,16$ $\therefore \text{Average price increase} = 10\,291,16 - 8\,681,70$ $= R1\,609,46 \text{ per } 0,05 \text{ carat}$	✓ divide gradient by 20 ✓ answer (2) ✓ multiply gradient by 0,05 ✓ answer (2) ✓ Estimated price of a 0,3 carat diamond ✓ answer (2)
2.4	The point (0,35 ; 11500) is closer to the least squares regression line.	✓ reason (1)

[8]

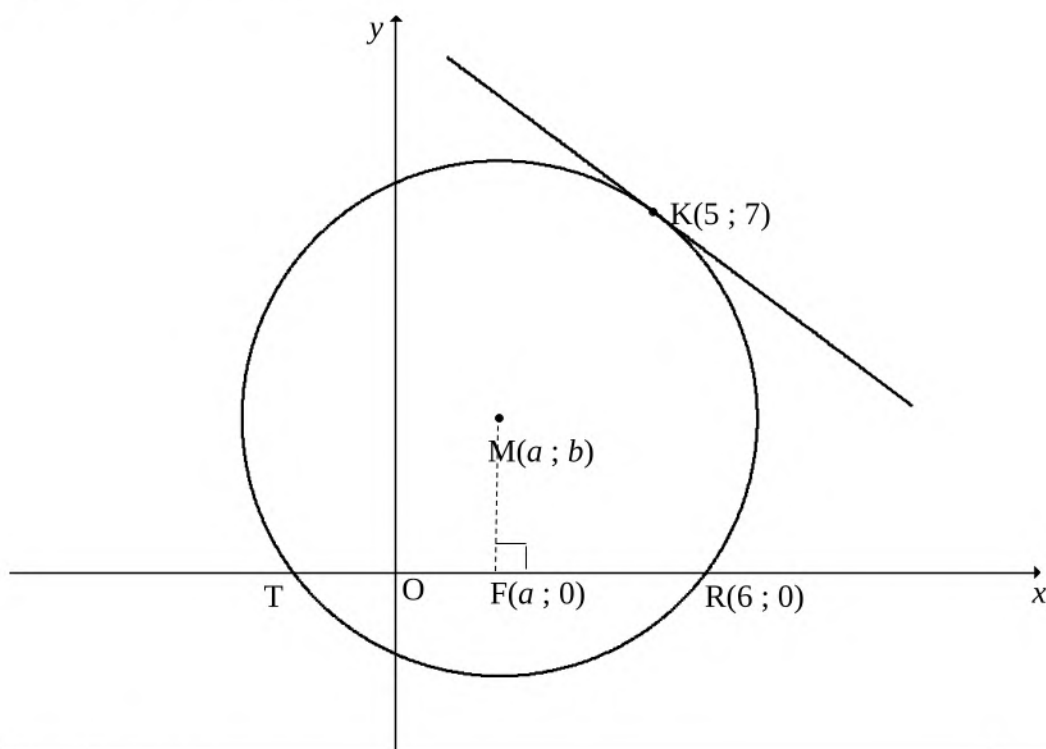
QUESTION/VRAAG 3



3.1	$m_{AB} = \frac{3 - \frac{1}{2}}{5 - 0}$ $m_{AB} = \frac{1}{2}$	✓ substitution ✓ answer  (2)
3.2	$m_{CE} = m_{BA} = \frac{1}{2}$ $-4 = \frac{1}{2}(6) + c \quad \text{OR/OR} \quad y - (-4) = \frac{1}{2}(x - 6)$ $c = -7$ $y = \frac{1}{2}x - 7$ $y = \frac{1}{2}x - 7$	✓ gradient ✓ substitution of E ✓ answer (3)
3.3.1	$D(0; -7)$ $\frac{x_C + 6}{2} = 0$ $x_C = -6$ $C(-6; -10)$ $\frac{y_C + (-4)}{2} = -7$ $y_C = -10$	✓ substitution ✓ $x_C = -6$ ✓ $y_C = -10$ (3)
3.3.2	$\text{Area } \triangle BCD = \frac{1}{2}(7,5)(6)$ $= 22,5$ $\text{Area } \triangle ABD = \frac{1}{2}(7,5)(5)$ $= 18,75$ $\text{Area } ABCD = 22,5 + 18,75 = 41,25 \text{ units}^2$ 	✓ area $\triangle BCD = 22,5$ ✓ area $\triangle PSQ = 18,75$ ✓ method ✓ answer (4)

3.4.1	$K(-6; -4)$ 	$\checkmark x_K = -6$ $\checkmark y_K = -4$ (2)
3.4.2a	$KC = 6 \text{ units}; KE = 12 \text{ units};$ $CE = \sqrt{(6)^2 + (12)^2} \quad \text{Pythagoras}$ $CE = \sqrt{180}$ $\text{Perimeter } \triangle KEC = 6 + 12 + \sqrt{180}$ $= 31,42 \text{ units}$	$\checkmark KC = 6 \text{ units}$ $\checkmark KE = 12 \text{ units}$ $\checkmark CE = \sqrt{180}$ $\checkmark \text{ answer}$ (4)
3.4.2b	$\tan \hat{KCE} = \frac{KE}{KC} = \frac{12}{6} = 2$ $\hat{KCE} = 63,43^\circ$ OR/OF $\sin \hat{KCE} = \frac{KE}{CE} = \frac{12}{\sqrt{180}} = \frac{2\sqrt{5}}{5}$  $\hat{KCE} = 63,43^\circ$ OR/OF $KE^2 = KC^2 + CE^2 - 2(KC)(CE)\cos \hat{KCE}$ $(12)^2 = (6)^2 + (\sqrt{180})^2 - 2(6)(\sqrt{180})(\cos \hat{KCE})$ $\cos \hat{KCE} = \frac{\sqrt{5}}{5}$ $\hat{KCE} = 63,43^\circ$	$\checkmark \text{ trig ratio}$ $\checkmark \text{ gradient of } 2$ $\checkmark \text{ answer}$ (3) $\checkmark \text{ trig ratio}$ $\checkmark \sin \hat{KCE} = \frac{12}{\sqrt{180}}$ $\checkmark \text{ answer}$ (3) $\checkmark \text{ substitution into cosine rule}$ $\checkmark \text{ trig ratio}$ $\checkmark \text{ answer}$ (3)
		[21]

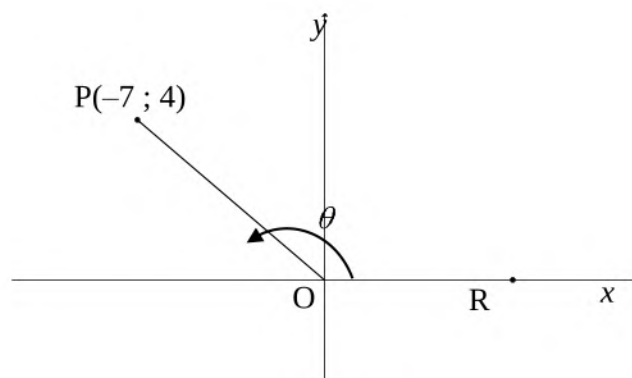
QUESTION/VRAAG 4



4.1.1	$y = x + 1$ $b = a + 1$	$\checkmark b = a + 1$ (1)
4.1.2	$MR^2 = MK^2$ $(a - 6)^2 + (b - 0)^2 = (a - 5)^2 + (b - 7)^2$ $(a - 6)^2 + (a + 1)^2 = (a - 5)^2 + (a + 1 - 7)^2$ $a^2 + 2a + 1 = a^2 - 10a + 25$ $12a = 24$ $a = 2$ $b = 3$ $\therefore M(2; 3)$	$\checkmark$ equating radii $\checkmark$ substitution $\checkmark 12a = 24$ $\checkmark a = 2$ $\checkmark b = 3$ (5)
4.2.1	$(6 - 2)^2 + (0 - 3)^2 = r^2$ $r = 5$ OR/OF $(2 - 5)^2 + (3 - 7)^2 = r^2$ $r = 5$	$\checkmark$ substitution R and M $\checkmark r = 5$ (2) $\checkmark$ substitution K and M $\checkmark r = 5$ (2)
4.2.2	$M(2; 3)$ $F(a; 0)$ $FR = 4$ units $TR = 8$ units [line from centre $\perp$ to chord] OR/OF	$\checkmark 4$ units $\checkmark$ answer (2)

	$(x-2)^2 + (0-3)^2 = 25$ $x^2 - 4x + 4 + 9 = 25$ $x^2 - 4x - 12 = 0$ $(x-6)(x+2) = 0$ $x = 6 \quad \text{or} \quad x = -2$ $\text{TR} = 8 \text{ units}$	✓ x values ✓ answer (2)
4.3	$m_{\text{radius}} = \frac{7-3}{5-2}$ $m_{\text{radius}} = \frac{4}{3}$ $m_{\text{tangent}} = -\frac{3}{4}$ $7 = -\frac{3}{4}(5) + c$ $c = \frac{43}{4}$ $y = -\frac{3}{4}x + \frac{43}{4}$ 	✓ substitution ✓ $m_{\text{radius}} = \frac{4}{3}$ ✓ $m_{\text{tangent}} = -\frac{3}{4}$ ✓ substitution ✓ answer (5)
4.4.1	N(2 ; -2)	✓ $x_N = 2$ ✓ $y_N = -2$ (2)
4.4.2	$(-2-2)^2 + (0+2)^2 = r^2$ $r^2 = 20$ $(x-2)^2 + (y+2)^2 = 20$	✓ substitution ✓ $r^2 = 20$ ✓ answer (3)
		[20]

QUESTION/VRAAG 5



5.1.1	$OP = \sqrt{(-7)^2 + (4)^2}$ $= \sqrt{65}$	✓ substitution ✓ answer (2)
5.1.2(a)	$\tan \theta = \frac{4}{-7}$	✓ answer (1)
5.1.2(b)	$\cos(\theta - 180^\circ) = -\cos \theta$ $= \frac{7}{\sqrt{65}}$	✓ reduction ✓ answer (2)
5.2	$\sin x \cos x + \sin x = 3\cos^2 x + 3\cos x$ $\sin x \cos x + \sin x - 3\cos^2 x - 3\cos x = 0$ $\sin x(\cos x + 1) - 3\cos x(\cos x + 1) = 0$ $(\cos x + 1)(\sin x - 3\cos x) = 0$ $\cos x = -1 \quad \text{or} \quad \sin x = 3\cos x$ $\tan x = 3$ $x = 180^\circ + k.360^\circ \quad \text{or} \quad x = 71,57^\circ + k.180^\circ ; k \in \mathbb{Z}$ OR/OF $\sin x \cos x + \sin x = 3\cos^2 x + 3\cos x$ $\sin x \cos x + \sin x - 3\cos^2 x - 3\cos x = 0$ $\sin x(\cos x + 1) - 3\cos x(\cos x + 1) = 0$ $(\cos x + 1)(\sin x - 3\cos x) = 0$ $\cos x = -1 \quad \text{or} \quad \sin x = 3\cos x$ $\tan x = 3$ $x = 180^\circ + k.360^\circ \quad \text{or} \quad x = 71,57^\circ + k.360^\circ \quad \text{or}$ $x = 251,57^\circ + k.360^\circ ; k \in \mathbb{Z}$	✓ RHS = 0 ✓ grouping ✓ factors ✓ both equations ✓ $x = 180^\circ$ ✓ $x = 71,57^\circ$ ✓ $+k.180^\circ ; k \in \mathbb{Z}$ (7)

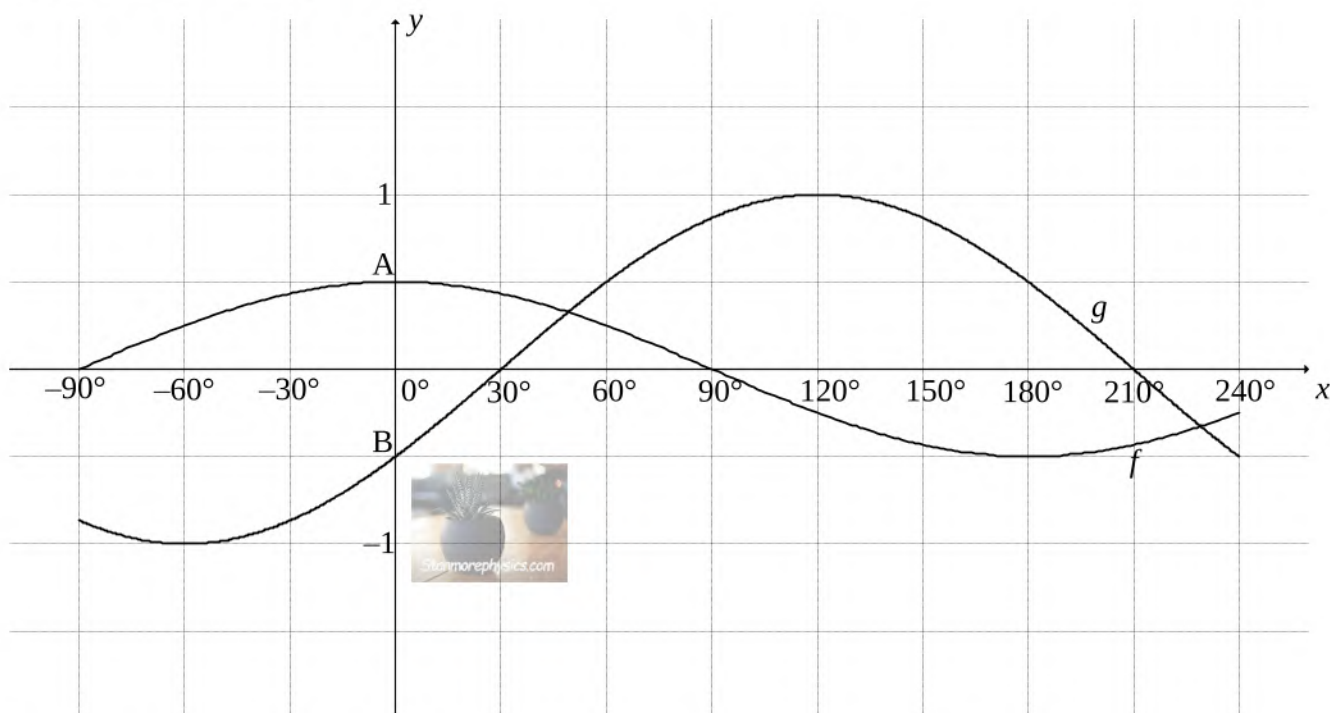


5.3.1	$\begin{aligned} \text{LHS} &= \frac{\sin 3x}{1 - \cos 3x} \times \frac{1 + \cos 3x}{1 + \cos 3x} \\ &= \frac{(\sin 3x)(1 + \cos 3x)}{(1 - \cos 3x)(1 + \cos 3x)} \\ &= \frac{(\sin 3x)(1 + \cos 3x)}{1 - \cos^2 3x} \\ &= \frac{(\sin 3x)(1 + \cos 3x)}{\sin^2 3x} \\ &= \frac{1 + \cos 3x}{\sin 3x} \\ &= \text{RHS} \end{aligned}$ OR/OF $\begin{aligned} \text{LHS} &= \frac{\sin 3x}{1 - \cos 3x} \times \frac{\sin 3x}{\sin 3x} \\ &= \frac{\sin^2 3x}{\sin 3x(1 - \cos 3x)} \\ &= \frac{1 - \cos^2 3x}{\sin 3x(1 - \cos 3x)} \\ &= \frac{(1 - \cos 3x)(1 + \cos 3x)}{\sin 3x(1 - \cos 3x)} \\ &= \frac{1 + \cos 3x}{\sin 3x} \\ &= \text{RHS} \end{aligned}$	✓ multiply by “1” ✓ product ✓ square identity (3) ✓ multiply by “1” ✓ square identity ✓ factors (3)
5.3.2	undefined when $\sin 3x = 0$ or $1 - \cos 3x = 0$ $3x = 0^\circ$ or $3x = 180^\circ$ or $3x = 0^\circ$ or $3x = 360^\circ$ $x = 0^\circ$ or $x = 60^\circ$	✓ $\sin 3x = 0$ or $1 - \cos 3x = 0$ ✓ ✓ answers (3)
[18]		

QUESTION/VRAAG 6

6.1	$\frac{\sin 10^\circ}{\cos 440^\circ} + \tan(360^\circ - \theta) \cdot \sin 2\theta$ $= \frac{\cos 80^\circ}{\cos 80^\circ} - \tan \theta (2 \sin \theta \cos \theta)$ $= 1 - \frac{\sin \theta}{\cos \theta} (2 \sin \theta \cos \theta)$ $= 1 - 2 \sin^2 \theta$ $= \cos 2\theta$	✓ co-ratio ✓ reduction ✓ reduction ✓ double angle ✓ quotient identity ✓ answer (6)
6.2.1	$\sin(60^\circ + 2x) + \sin(60^\circ - 2x) = k \cos 2x$ $(\sin 60^\circ \cos 2x + \cos 60^\circ \sin 2x) + (\sin 60^\circ \cos 2x - \cos 60^\circ \sin 2x) = k \cos 2x$ $2 \sin 60^\circ \cos 2x = k \cos 2x$ $2 \left(\frac{\sqrt{3}}{2} \right) \cos 2x = k \cos 2x$ $\therefore k = \sqrt{3}$	✓ expansion ✓ special $\angle$ s ✓ answer (3)
6.2.2	$\tan 60^\circ [\sin(60^\circ + 2x) + \sin(60^\circ - 2x)]$ $= \tan 60^\circ [k \cos 2x]$ $= \sqrt{3} (\sqrt{3} \cos 2x)$ $= 3(2 \cos^2 x - 1)$ $= 6 \cos^2 x - 3$ $= 6(\sqrt{t})^2 - 3$ $= 6t - 3$	 ✓ simplification ✓ compound $\angle$ s ✓ $= 6(\sqrt{t})^2 - 3$ or $= 6t - 3$ (3)
[12]		

QUESTION/VRAAG 7



7.1	$A\left(0; \frac{1}{2}\right) \quad B\left(0; -\frac{1}{2}\right)$ $AB = \frac{1}{2} - \left(-\frac{1}{2}\right)$ $= 1 \text{ unit}$	✓ y-values ✓ answer (2)
7.2	Range of $f: y \in \left[-\frac{1}{2}; \frac{1}{2}\right]$ Range of $3f(x) + 2: y \in \left[\frac{1}{2}; 3\frac{1}{2}\right]$	✓✓ answer (2)
7.3	$x = 90^\circ$	✓✓ $x = 90^\circ$ (2)
7.4.1	$x \in (30^\circ; 90^\circ) \cup (210^\circ; 240^\circ]$ OR/OF $30^\circ < x < 90^\circ \text{ or } 210^\circ < x \leq 240^\circ$	✓ $x \in (30^\circ; 90^\circ)$ ✓ $(210^\circ; 240^\circ]$ (2) ✓ $30^\circ < x < 90^\circ$ ✓ $210^\circ < x \leq 240^\circ$ (2)
7.4.2	$x \in (-55^\circ; 125^\circ)$ OR/OF $-55^\circ < x < 125^\circ$	✓✓ $x \in (-55^\circ; 125^\circ)$ (2) ✓✓ $-55^\circ < x < 125^\circ$ (2)
		[10]

QUESTION/VRAAG 8

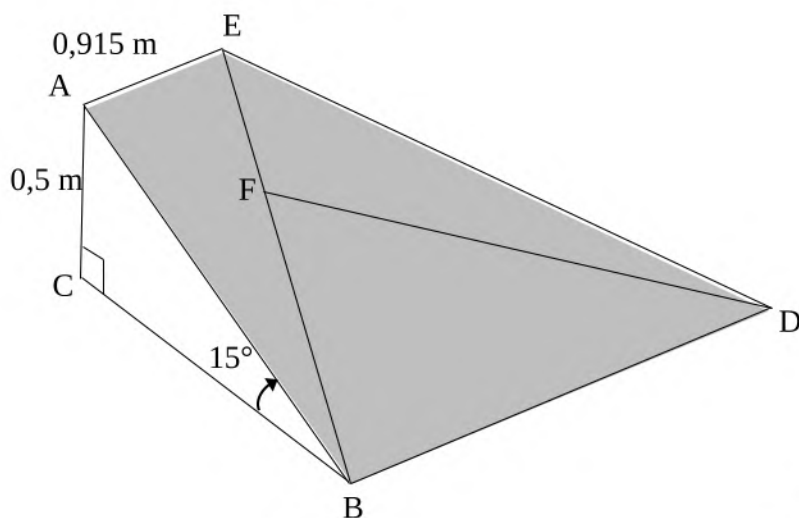


FIGURE I

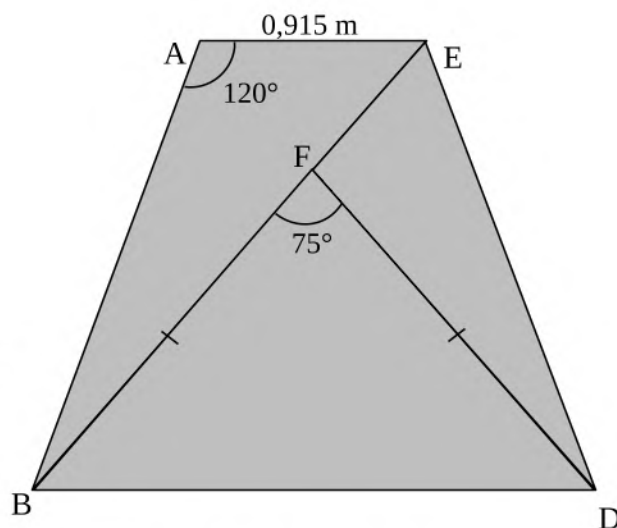
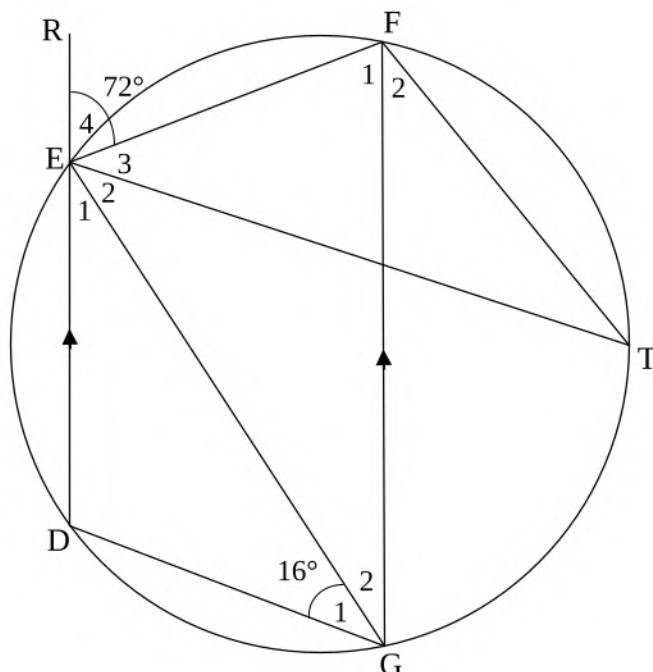


FIGURE II (top view)

8.1	$\frac{0,5}{AB} = \sin 15^\circ$ $AB = 1,93 \text{ m}$	✓ trig ratio ✓ answer (2)
8.2	$BE^2 = AB^2 + AE^2 - 2(AB)(AE)\cos \hat{BAE}$ $BE^2 = (1,93)^2 + (0,915)^2 - 2(1,93)(0,915)(\cos 120^\circ)$ $BE = 2,52 \text{ m}$	✓ correct use of cosine rule ✓ substitution ✓ answer (3)
8.3	$BF = FD = \frac{5}{7}(2,52) = 1,80 \text{ m}$ $\text{Area } \triangle BFD = \frac{1}{2}(BF)(FD)\sin \hat{BFD}$ $= \frac{1}{2}(1,8)(1,8)(\sin 75^\circ)$ $= 1,56 \text{ m}^2$	✓ BF  ✓ correct use of area rule ✓ answer (3)
[8]		

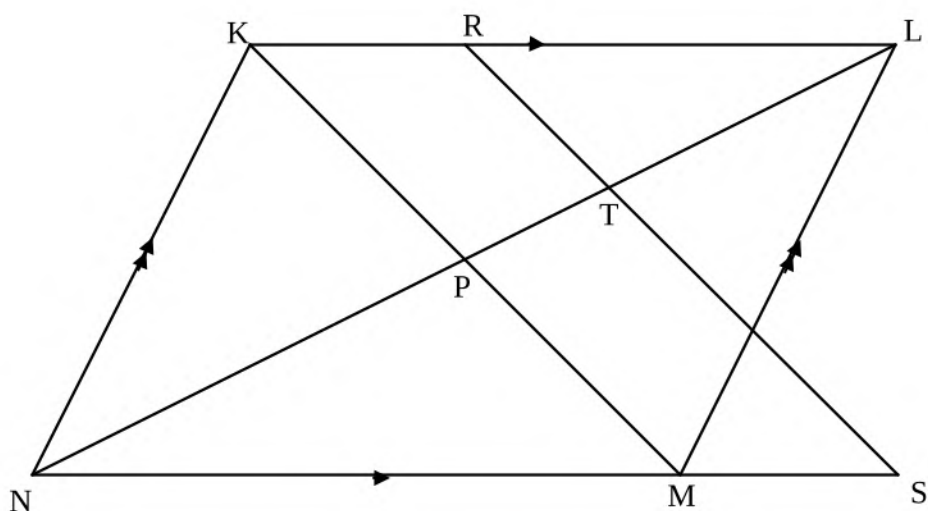
QUESTION/VRAAG 9

9.1



9.1.1	$\hat{DGF} = \hat{E}_4 = 72^\circ$ [ext $\angle$ of cyclic quad/ buite $\angle$ v kvh]	✓ S ✓ R (2)
9.1.2	$\hat{G}_2 = 72^\circ - 16^\circ = 56^\circ$ $\hat{T} = \hat{G}_2 = 56^\circ$ [$\angle$ s in the same seg/ $\angle$ e in dies. $\odot$ segment]	✓ S ✓ S / R (2)
9.1.3	$\hat{F}_1 = \hat{E}_4 = 72^\circ$ [alt $\angle$ s; DE $\parallel$ GF / verw. $\angle$ e; DE $\parallel$ GF] $\therefore \hat{GEF} = 52^\circ$ [sum of $\angle$ s in Δ / $\angle$ e van Δ] OR/OF $\hat{E}_1 = 56^\circ$ [alt $\angle$ s; DE $\parallel$ GF / verw. $\angle$ e; DE $\parallel$ GF] $\therefore \hat{GEF} = 52^\circ$ [$\angle$ s on a str. line/ $\angle$ e op 'n reguitlyn]	✓ S / R ✓ S / R (2) ✓ S / R ✓ S / R (2)

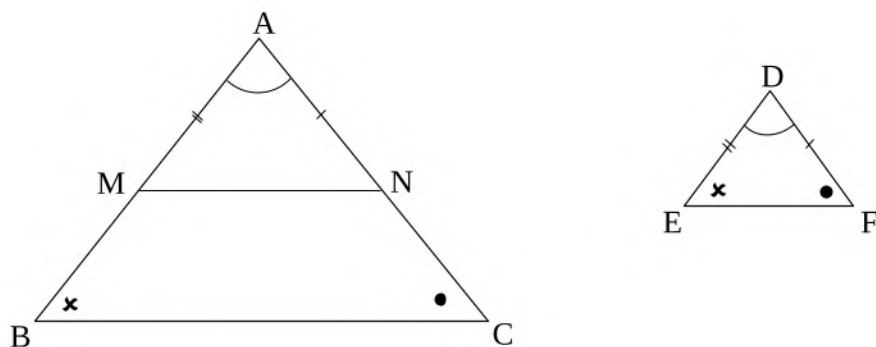
9.2



9.2.1	$NP = PL = 16$ [diag of $\parallel m$ / hoeklyne van $\parallel m$] $PT = 4$ $NP : PT = 16 : 4$ $= 4 : 1$	✓ S ✓ R ✓ S ✓ answer (4)
9.2.2	$NM : MS = 4 : 1$ $NP : PT = NM : MS$ $KM \parallel RS$ [line divides two sides of Δ in prop / Lyn verdeel 2 sye v Δ eweredig] OR/OF [converse prop theorem / omgekeerde lyn $\parallel$ een sy v Δ]	✓ S ✓ R (2)
9.2.3	$\frac{RL}{KL} = \frac{TL}{LP}$ [prop theorem; $KM \parallel MS$ OR line $\parallel$ one side of Δ / Lyn $\parallel$ een sy v Δ] $RL = \frac{12 \times 21}{16}$ $= 15,75$	✓ S ✓ R ✓ S ✓ answer (4)
[16]		

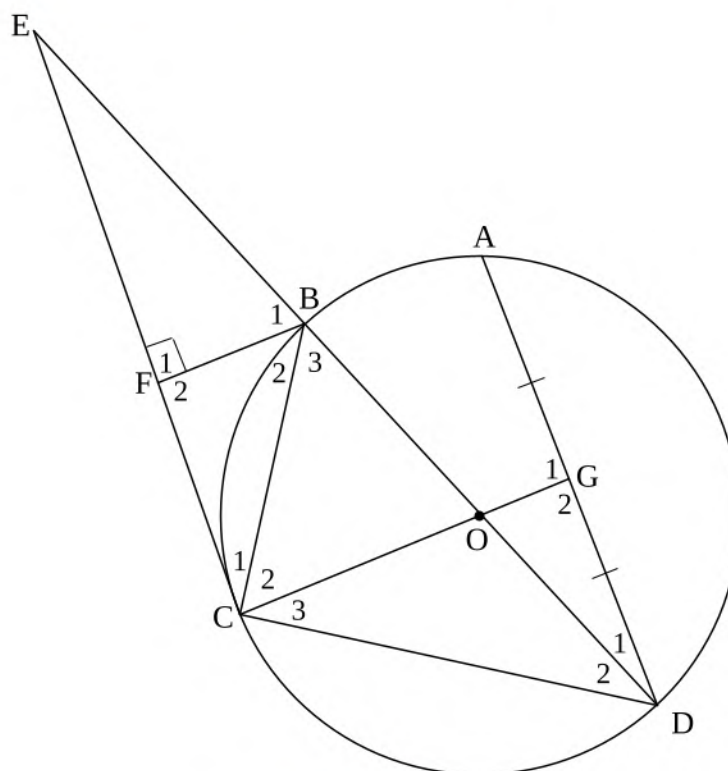
QUESTION/VRAAG 10

10.1



10.1	Constr: Let M and N lie on AB and AC respectively such that $AM = DE$ and $AN = DF$. Draw MN. Proof: In $\triangle AMN$ and $\triangle DEF$ $AM = DE$ [Constr / Konstruksie] $AN = DF$ [Constr / Konstruksie] $\hat{A} = \hat{D}$ [Given / Gegee] $\therefore \triangle AMN \cong \triangle DEF$ [s, $\angle$, s] $\therefore \hat{AMN} = \hat{E} = \hat{B}$ $MN \parallel BC$ [corresp $\angle$'s are equal/ ooreenk. $\angle$ e gelyk] $\frac{AB}{AM} = \frac{AC}{AN}$ [line $\parallel$ one side of $\triangle$ OR/OF prop theorem; $MN \parallel BC$ / Lyn $\parallel$ een sy v $\triangle$] $\therefore \frac{AB}{DE} = \frac{AC}{DF}$ [AM=DE and AN=DF]	✓Constr ✓S ✓R ✓S /R ✓S ✓R (6)
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10.2



10.2.1(a)	$\hat{F}\hat{C}O = 90^\circ$ [tan $\perp$ radius / <i>raaklyn $\perp$ radius</i>] $\hat{E}\hat{F}B = 90^\circ$ [BF $\perp$ EC] $\therefore \hat{F}\hat{C}O = \hat{E}\hat{F}B = 90^\circ$ FB $\parallel$ CG [corresp $\angle$ s = / <i>ooreenk. $\angle$ gelyk</i>]	✓ S / R ✓ S ✓ R (3)
10.2.1(b)	In $\triangle FCB$ and $\triangle CDB$ $\hat{F}_2 = 90^\circ$ [BF $\perp$ EC] $\hat{B}\hat{C}D = 90^\circ$ [$\angle$ in semi-circle / $\angle \frac{1}{2} \odot$] $\therefore \hat{F}_2 = \hat{B}\hat{C}D = 90^\circ$ $\hat{C}_1 = \hat{D}_2$ [tan chord theorem / $\angle$ <i>tussen rkl en koord</i>] $\hat{B}_2 = \hat{B}_3$ [sum of $\angle$ s in $\triangle$ / $\angle$ <i>e van $\triangle$</i>] $\therefore \triangle FCB \parallel \triangle CDB$ OR/OF In $\triangle FCB$ and $\triangle CDB$ $\hat{F}_2 = 90^\circ$ [BF $\perp$ EC] $\hat{B}\hat{C}D = 90^\circ$ [$\angle$ in semi-circle / $\angle \frac{1}{2} \odot$] $\therefore \hat{F}_2 = \hat{B}\hat{C}D = 90^\circ$ $\hat{C}_1 = \hat{D}_2$ [tan chord theorem / $\angle$ <i>tussen rkl en koord</i>] $\therefore \triangle FCB \parallel \triangle CDB$ [$\angle, \angle, \angle$]	✓ S / R ✓ S ✓ S ✓ R ✓ S ✓ S / R ✓ S ✓ S ✓ R ✓ R (5)

10.2.2	$\hat{G}_1 = 90^\circ$ [line from centre to midpt of chord / midpt. $\odot$; midpt. koord]	✓ R (1)
10.2.3	In $\triangle GCD$ and $\triangle CDB$ $\hat{G}_2 = \hat{B}\hat{C}\hat{D} = 90^\circ$ $\hat{C}_3 = \hat{D}_2$ [∠s opp equal sides / ∠e teenoor gelyke sye] $\hat{G}\hat{D}\hat{C} = \hat{B}$ [sum of ∠s in $\triangle$ / ∠e van $\triangle$] $\therefore \triangle GCD \parallel \triangle CDB$ [∠, ∠, ∠] $\therefore \frac{CD}{DB} = \frac{CG}{CD}$ [∆s] $\therefore CD^2 = CG \cdot DB$	✓ identifying $\triangle$ s ✓ S ✓ S / R ✓ S OR ✓ R ✓ S (5)
10.2.4	$\frac{BC}{DB} = \frac{FB}{BC}$ [$\triangle FCB \parallel \triangle CDB$] $\therefore BC^2 = DB \cdot FB$ $CD^2 + BC^2 = CG \cdot DB + DB \cdot FB$ $DB^2 = DB(CG + FB)$ $DB = CG + FB$	✓ S / R ✓ S ✓ sum ✓ LHS ✓ RHS (5)
		[25]

TOTAL/TOTAAL: 150