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Department:
Basic Education
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**SENIOR CERTIFICATE EXAMINATIONS/
SENIORSERTIFIKAAT-EKSAMEN
NATIONAL SENIOR CERTIFICATE EXAMINATIONS/
NASIONALE SENIORSERTIFIKAAT-EKSAMEN**

MATHEMATICS P2/WISKUNDE V2

MARKING GUIDELINES/NASIENRIGLYNE

2022

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

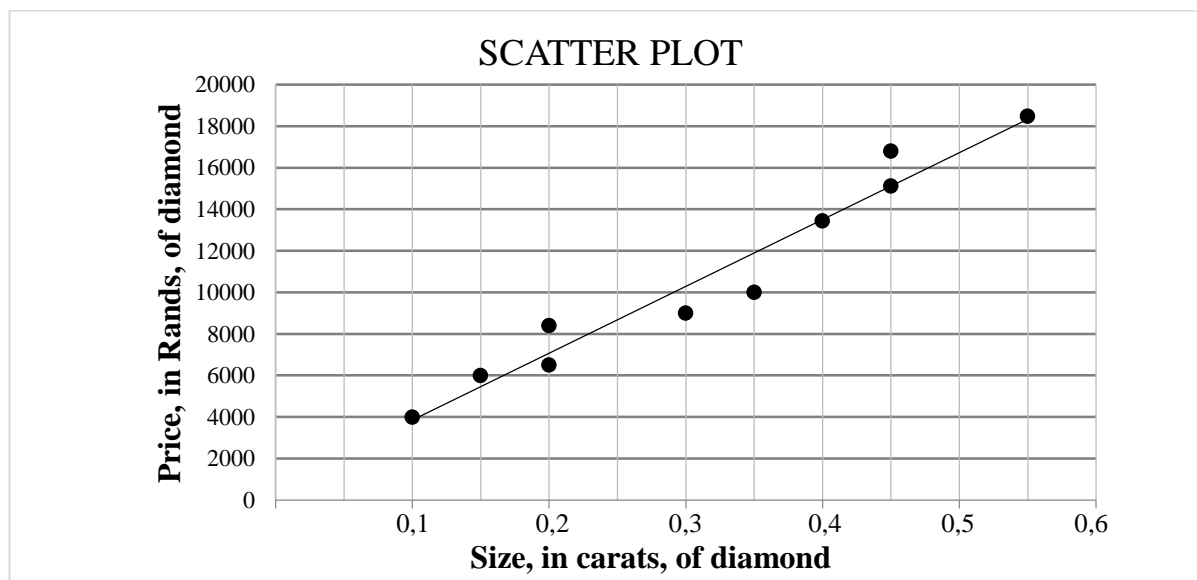
QUESTION/VRAAG 1

1.1	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	✓ adding ✓ 80 (2)
Mass (in kg)	Frequency	Cumulative frequency																								
$5 < m \leq 7$	6	6																								
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$13 < m \leq 15$	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	$\bar{x} = \frac{(6 \times 6 + 18 \times 8 + 21 \times 10 + 19 \times 12 + 11 \times 14 + 4 \times 16 + 1 \times 18)}{80}$ $= \frac{854}{80}$ $= 10,68$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only 2/2</div>	✓ 854 ✓ answer (2)																								
1.5.2	Learners' bags are heavier than the stipulated international guideline. Estimated mean = 10,68 kg 10% of 80 kg = 8 kg 10,68 kg > 8 kg	✓ answer ✓ 8 kg (2)																								

	<p>OR/ OF</p> <p>Learners' bags are heavier than the stipulated international guideline.</p> $\text{Estimated mean} = \frac{10,68}{80} \times 100$ $= 13,35\%$ $13,35\% > 10\%$	<p>✓ answer</p> <p>✓ 13,35%</p> <p>(2)</p>
[12]		

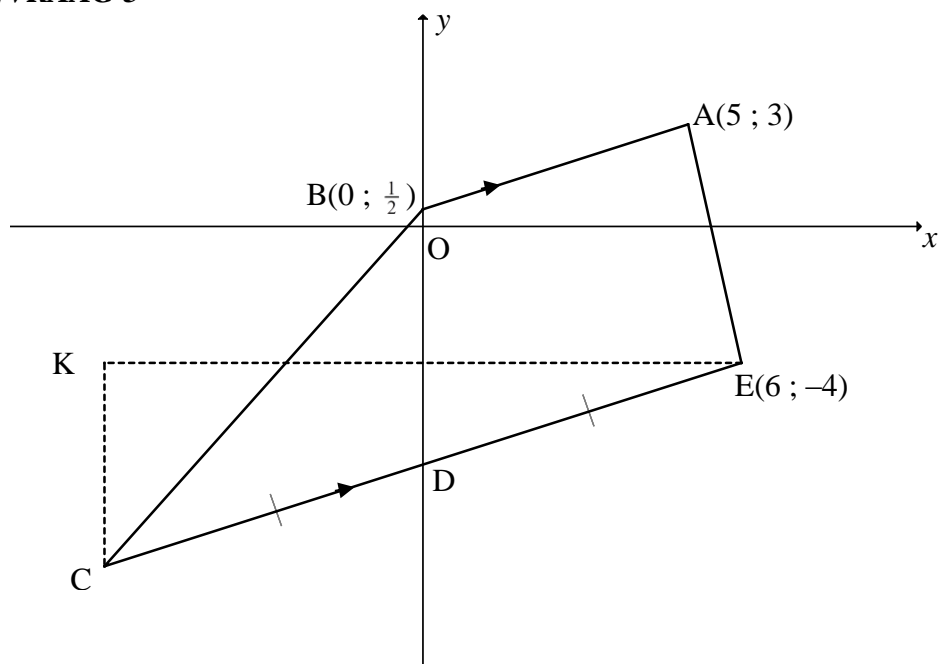
QUESTION/VRAAG 2

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 <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only 3/3</div>	(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 ✓ ✓ answer	(2) (2)
2.3	Average price increase $= R \frac{32189,26}{20}$ per 0,05 carat $= R1\,609,46$ per 0,05 carat OR/OF Average price increase $= 0,05 \times 32\,189,26$ $= R1\,609,46$ per 0,05 carat OR/OF at 0,3: $\hat{y} = R10\,291,16$ \therefore Average price increase $= 10\,291,16 - 8\,681,70$ $= R1\,609,46$ per 0,05 carat <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only 2/2</div>	✓ divide gradient by 20 ✓ answer ✓ multiply gradient by 0,05 ✓ answer ✓ Estimated price of a 0,3 carat diamond ✓ answer	(2) (2) (2)
2.4	The point (0,35 ; 11500) is closer to the least squares regression line.	✓ reason	(1)
[8]			

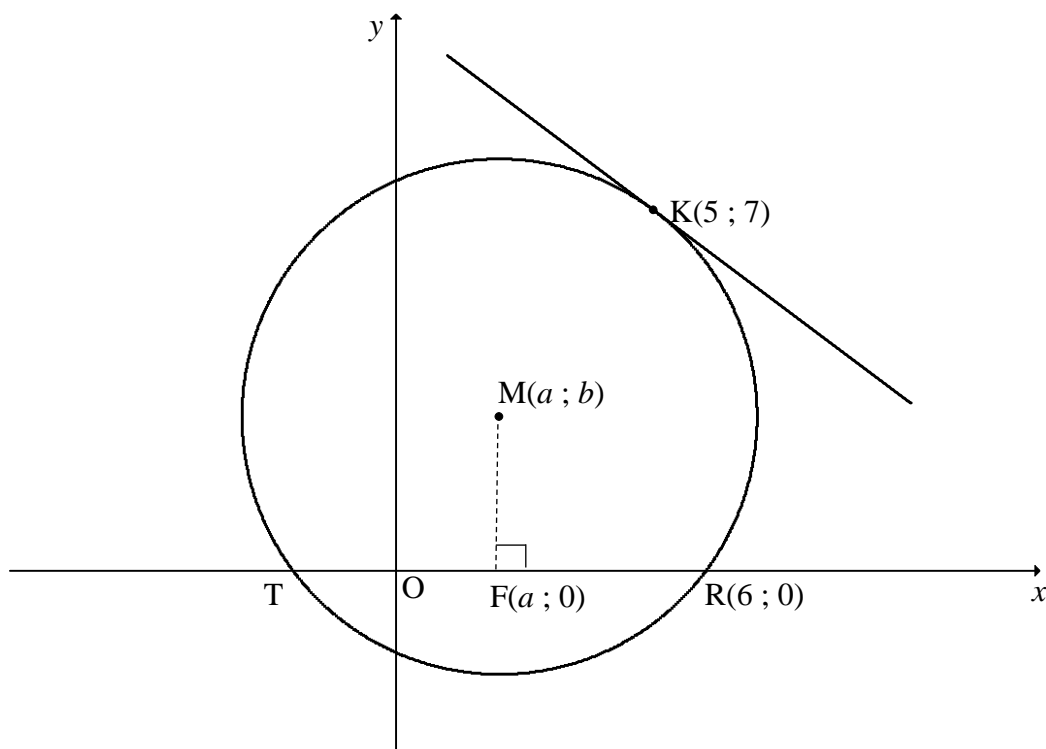
QUESTION/VRAAG 3



3.1	$m_{AB} = \frac{3 - \frac{1}{2}}{5 - 0}$ $m_{AB} = \frac{1}{2}$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only 2/2</div>	✓ substitution ✓ answer (2)
3.2	$m_{CE} = m_{BA} = \frac{1}{2}$ $-4 = \frac{1}{2}(6) + c \quad \text{OR/OF} \quad y - (-4) = \frac{1}{2}(x - 6)$ $c = -7$ $y = \frac{1}{2}x - 7$	✓ gradient ✓ substitution of E ✓ answer (3)
3.3.1	$\frac{x_C + 6}{2} = 0 \qquad \frac{y_C + (-4)}{2} = -7$ $x_C = -6 \qquad y_C = -10$ $C(-6; -10)$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only 3/3</div>	✓ D(0; -7) ✓ $x_C = -6$ ✓ $y_C = -10$ (3)
3.3.2	$\text{Area } \triangle BCD = \frac{1}{2}(7,5)(6)$ $= 22,5$ $\text{Area } \triangle ABD = \frac{1}{2}(7,5)(5)$ $= 18,75$ $\text{Area ABCD} = 22,5 + 18,75 = 41,25 \text{ units}^2$	✓ subst of correct base and height into the area formula ✓ area $\triangle BCD = 22,5$ ✓ area $\triangle ABD = 18,75$ ✓ answer (4)

3.4.1	$K(-6; -4)$	$\checkmark x_K = -6$ $\checkmark y_K = -4$ (2)
3.4.2a	<p>KC = 6 units; KE = 12 units;</p> $CE = \sqrt{(6)^2 + (12)^2} \quad [\text{Pythagoras}]$ $CE = \sqrt{180} = 6\sqrt{5} = 13,42$ <p>Perimeter $\Delta KEC = 6 + 12 + \sqrt{180}$</p> $= 31,42 \text{ units}$	\checkmark KC = 6 units \checkmark KE = 12 units \checkmark CE \checkmark answer (4)
3.4.2b	<p>$\tan \hat{KCE} = \frac{KE}{KC} = \frac{12}{6} = 2$</p> <p>$\hat{KCE} = 63,43^\circ$</p> <p>OR/OF</p> <p>$\sin \hat{KCE} = \frac{KE}{CE} = \frac{12}{\sqrt{180}} = \frac{2\sqrt{5}}{5}$</p> <p>$\hat{KCE} = 63,43^\circ$</p> <p>OR/OF</p> <p>$m_{CE} = \frac{1}{2}$</p> <p>$\tan \theta = \frac{1}{2}$</p> <p>$\theta = 26,57^\circ$</p> <p>$\hat{KCE} = 90^\circ - 26,57^\circ$</p> <p>$\hat{KCE} = 63,43^\circ$</p> <p>OR/OF</p> <p>$KE^2 = KC^2 + CE^2 - 2(KC)(CE)\cos \hat{KCE}$</p> <p>$(12)^2 = (6)^2 + (\sqrt{180})^2 - 2(6)(\sqrt{180})(\cos \hat{KCE})$</p> <p>$\cos \hat{KCE} = \frac{\sqrt{5}}{5}$</p> <p>$\hat{KCE} = 63,43^\circ$</p>	\checkmark trig ratio $\checkmark \tan \hat{KCE} = 2$ \checkmark answer (3) \checkmark trig ratio $\checkmark \sin \hat{KCE} = \frac{12}{\sqrt{180}}$ \checkmark answer (3) $\checkmark \tan \theta = \frac{1}{2}$ $\checkmark \theta = 26,57^\circ$ \checkmark answer (3) \checkmark substitution into cosine rule \checkmark trig ratio \checkmark answer (3)
		[21]

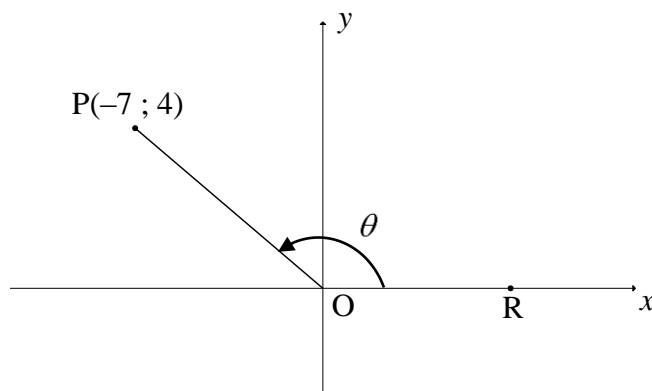
QUESTION/VRAAG 4



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 / solving simultaneously \checkmark substitution $b = a + 1$ $\checkmark 12a = 24$ $\checkmark a = 2$ $\checkmark b = 3$ (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)

Answer only 2/2

4.2.2	<p>T(-2 ; 0) TR = 8 units [line from centre \perp to chord]</p> <p>OR/OF</p> <p>M(2 ; 3) F(a ; 0) FR = 4 units TR = 8 units [line from centre \perp to chord]</p> <p>OR/OF</p> <p>$(x-2)^2 + (0-3)^2 = 25$ $x^2 - 4x + 4 + 9 = 25$ $x^2 - 4x - 12 = 0$ $(x-6)(x+2) = 0$ $x = 6$ or $x = -2$ TR = 8 units</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only 2/2</div>	<p>✓ T(-2 ; 0) ✓ answer (2)</p> <p>✓ 4 units ✓ answer (2)</p> <p>✓ x values ✓ answer (2)</p>
4.3	<p>$m_{\text{radius}} = \frac{7-3}{5-2}$ $m_{\text{radius}} = \frac{4}{3}$ $m_{\text{tangent}} = -\frac{3}{4}$</p> <p>$7 = -\frac{3}{4}(5) + c$ OR/OF $y - 7 = -\frac{3}{4}(x - 5)$ $c = \frac{43}{4}$ $y = -\frac{3}{4}x + \frac{43}{4}$ $y = -\frac{3}{4}x + \frac{43}{4}$</p>	<p>✓ substitution ✓ $m_{\text{radius}} = \frac{4}{3}$ ✓ $m_{\text{tangent}} = -\frac{3}{4}$ ✓ substitution ✓ answer (5)</p>
4.4.1	N(2 ; -2)	<p>✓ $x_N = 2$ ✓ $y_N = -2$ (2)</p>
4.4.2	<p>$(-2-2)^2 + (0+2)^2 = r^2$ $r^2 = 20$ $(x-2)^2 + (y+2)^2 = 20$</p>	<p>✓ substitution ✓ $r^2 = 20$ ✓ answer (3)</p>
		[20]

QUESTION/VRAAG 5

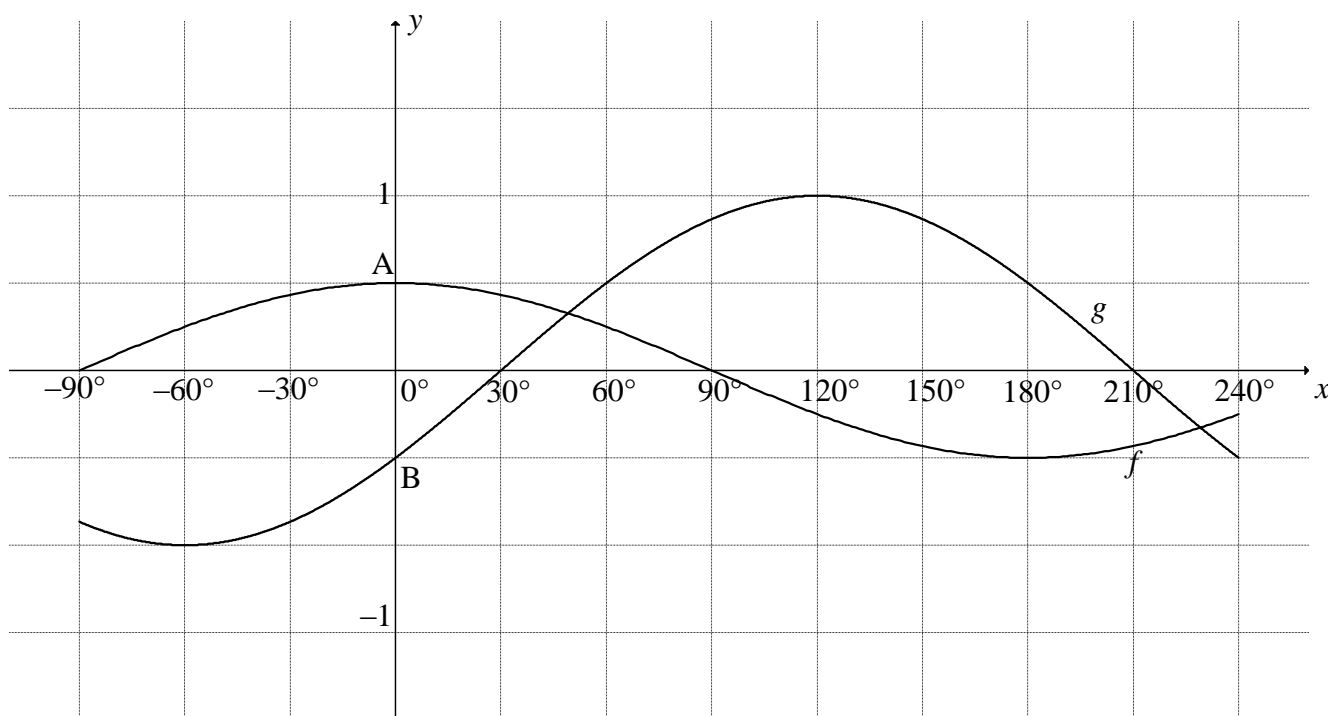
5.1.1	$OP = \sqrt{(-7)^2 + (4)^2}$ $= \sqrt{65}$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only 2/2</div>	✓ substitution ✓ answer (2)
5.1.2(a)	$\tan \theta = \frac{4}{-7}$	✓ answer (1)
5.1.2(b)	$\cos(\theta - 180^\circ) = -\cos \theta$ $= \frac{7}{\sqrt{65}}$	✓ reduction ✓ answer (2)
5.2	$\sin x \cos x + \sin x = 3\cos^2 x + 3\cos x$ $\sin x \cos x + \sin x - 3\cos^2 x - 3\cos x = 0$ $\sin x(\cos x + 1) - 3\cos x(\cos x + 1) = 0$ $(\cos x + 1)(\sin x - 3\cos x) = 0$ $\cos x = -1 \quad \text{or} \quad \sin x = 3\cos x$ $\tan x = 3$ $x = 180^\circ + k.360^\circ \quad \text{or} \quad x = 71,57^\circ + k.180^\circ ; k \in \mathbb{Z}$ <p>OR/OF</p> $\sin x \cos x + \sin x = 3\cos^2 x + 3\cos x$ $\sin x \cos x + \sin x - 3\cos^2 x - 3\cos x = 0$ $\sin x(\cos x + 1) - 3\cos x(\cos x + 1) = 0$ $(\cos x + 1)(\sin x - 3\cos x) = 0$ $\cos x = -1 \quad \text{or} \quad \sin x = 3\cos x$ $\tan x = 3$ $x = 180^\circ + k.360^\circ \quad \text{or} \quad x = 71,57^\circ + k.360^\circ \quad \text{or}$ $x = 251,57^\circ + k.360^\circ ; k \in \mathbb{Z}$	✓ RHS = 0 ✓ grouping ✓ factors ✓ both equations ✓ $x = 180^\circ$ ✓ $x = 71,57^\circ$ ✓ $+ k.180^\circ ; k \in \mathbb{Z}$ (7)
		✓ RHS = 0 ✓ grouping ✓ factors ✓ both equations ✓ $x = 180^\circ$ ✓ $x = 71,57^\circ$ and $251,57^\circ$ ✓ $+ k.360^\circ ; k \in \mathbb{Z}$ (7)

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

QUESTION/VRAAG 6

6.1	$\frac{\sin 10^\circ}{\cos 440^\circ} + \tan(360^\circ - \theta) \cdot \sin 2\theta$ $= \frac{\cos 80^\circ}{\cos 80^\circ} - \tan \theta (2 \sin \theta \cos \theta)$ $= 1 - \frac{\sin \theta}{\cos \theta} (2 \sin \theta \cos \theta)$ $= 1 - 2 \sin^2 \theta$ $= \cos 2\theta$	✓ $-\tan \theta$ ✓ $\cos 80^\circ$ ✓ co-ratio ✓ double angle ✓ quotient identity ✓ answer (6)
6.2.1	$\sin(60^\circ + 2x) + \sin(60^\circ - 2x) = k \cos 2x$ $(\sin 60^\circ \cos 2x + \cos 60^\circ \sin 2x) + (\sin 60^\circ \cos 2x - \cos 60^\circ \sin 2x) = k \cos 2x$ $2 \sin 60^\circ \cos 2x = k \cos 2x$ $2 \left(\frac{\sqrt{3}}{2} \right) \cos 2x = k \cos 2x$ $\therefore k = \sqrt{3}$	✓ both expansions correct ✓ special \angle s ✓ answer (3)
6.2.2	$\tan 60^\circ [\sin(60^\circ + 2x) + \sin(60^\circ - 2x)]$ $= \tan 60^\circ [k \cos 2x]$ $= \sqrt{3} (\sqrt{3} \cos 2x)$ $= 3(2 \cos^2 x - 1)$ $= 3(2(\sqrt{t})^2 - 1)$ $= 6(\sqrt{t})^2 - 3$ $= 6t - 3$	✓ special \angle ✓ double \angle s ✓ answer i.t.o t (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 <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only 2/2</div>
7.2	Range of $f: y \in \left[-\frac{1}{2}; \frac{1}{2}\right]$ Range of $3f(x) + 2: y \in \left[\frac{1}{2}; 3\frac{1}{2}\right]$ OR/OF $\frac{1}{2} \leq y \leq 3\frac{1}{2}$	✓ critical values ✓ answer
7.3	$x = 90^\circ$	✓✓ $x = 90^\circ$
7.4.1	$x \in (30^\circ; 90^\circ) \cup (210^\circ; 240^\circ]$ OR/OF $30^\circ < x < 90^\circ \text{ or } 210^\circ < x \leq 240^\circ$	✓ $x \in (30^\circ; 90^\circ)$ ✓ $(210^\circ; 240^\circ]$ ✓ $30^\circ < x < 90^\circ$ ✓ $210^\circ < x \leq 240^\circ$
7.4.2	$x \in (-55^\circ; 125^\circ)$ OR/OF $-55^\circ < x < 125^\circ$	✓ critical values ✓ answer ✓ critical values ✓ answer

[10]

QUESTION/VRAAG 8

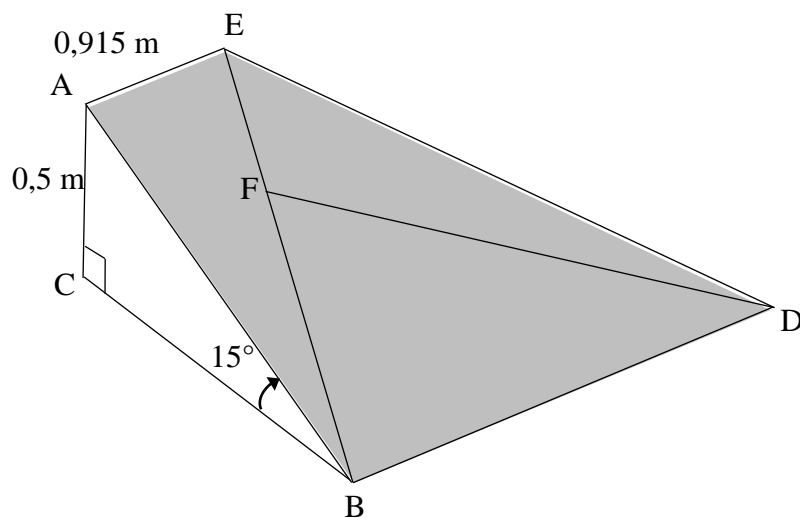


FIGURE I

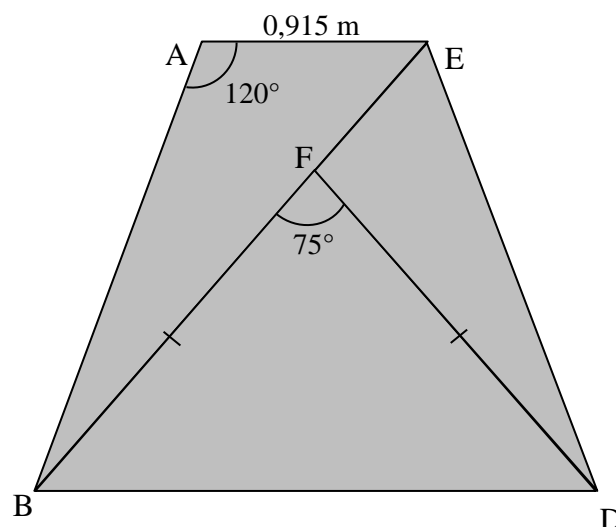


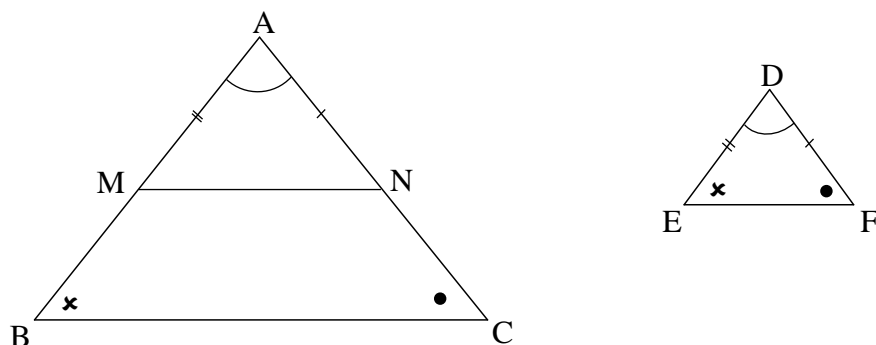
FIGURE II (top view)

8.1	$\frac{0,5}{AB} = \sin 15^\circ$ $AB = \frac{0,5}{\sin 15^\circ}$ $AB = 1,93 \text{ m}$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only 2/2</div>	✓ trig ratio ✓ answer <div style="text-align: right;">(2)</div>
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 <div style="text-align: right;">(3)</div>
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 substitution into the area rule ✓ answer <div style="text-align: right;">(3)</div>
[8]		

	OR / OF $NM : MS = 4 : 1$ $KR = MS = 5,25$ [opp side of \parallel^m / teenoorst. sye van \parallel^m] $KL = NM = 21$ $RL + 5,25 = 21$ $RL = 15,75$	✓ S ✓ R ✓ S ✓ answer (4)
[16]		

QUESTION/VRAAG 10

10.1



10.1	<p>Constr: Let M and N lie on AB and AC respectively such that $AM = DE$ and $AN = DF$. Draw MN.</p> <p>Proof: In $\triangle AMN$ and $\triangle DEF$</p> <p>$AM = DE$ [Constr / Konstruksie] $AN = DF$ [Constr / Konstruksie] $\hat{A} = \hat{D}$ [Given / Gegee] $\therefore \triangle AMN \equiv \triangle DEF$ [s, \angle, s] $\therefore \hat{A}MN = \hat{E} = \hat{B}$ $MN \parallel BC$ [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 $AN=DF$]</p>	<p>✓Constr</p> <p>✓S ✓R</p> <p>✓S /R</p> <p>✓S ✓R</p> <p>(6)</p>
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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] $\hat{G}\hat{D}\hat{C} = \hat{B}_3$ [sum of ∠s in \triangle / ∠e van \triangle] $\therefore \triangle GCD \parallel \triangle CDB$ [∠, ∠, ∠] $\therefore \frac{CD}{DB} = \frac{CG}{CD}$ [\triangle 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 ✓ $DB^2 = CD^2 + BC^2$ (5)
		[25]

TOTAL/TOTAAL: 150