basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

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

MATHEMATICS P2/
WISKUNDE V2

MARKING GUIDELINES/*NASIENRIGLYNE*

2019

MARKS: 150
PUNTE: 150

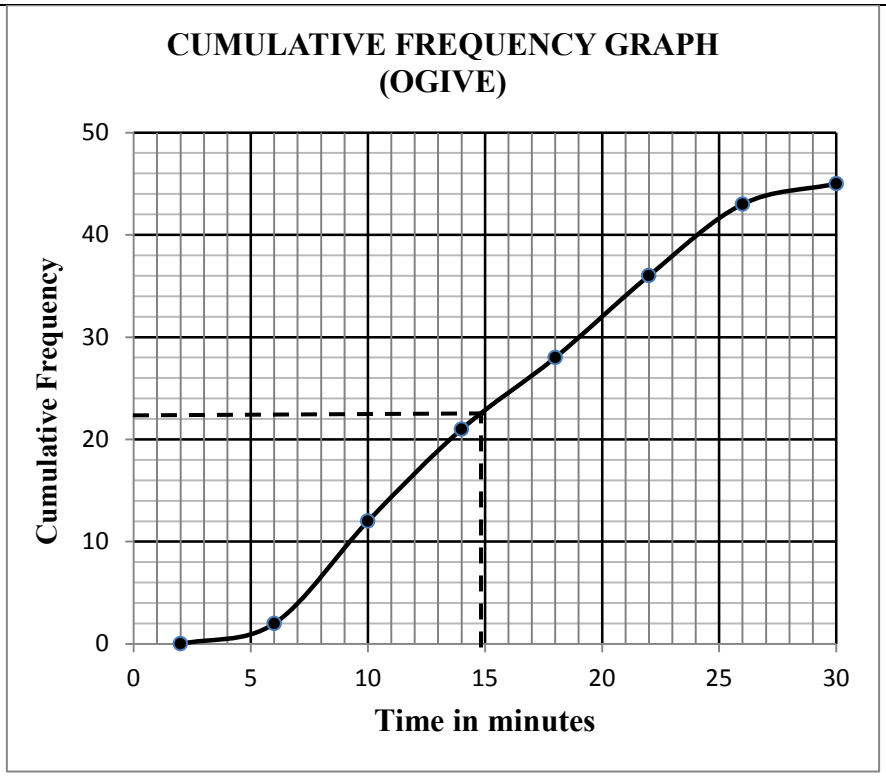
These marking guidelines consist of 20 pages.
Hierdie nasienriglyne bestaan uit 20 bladsye..

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

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

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

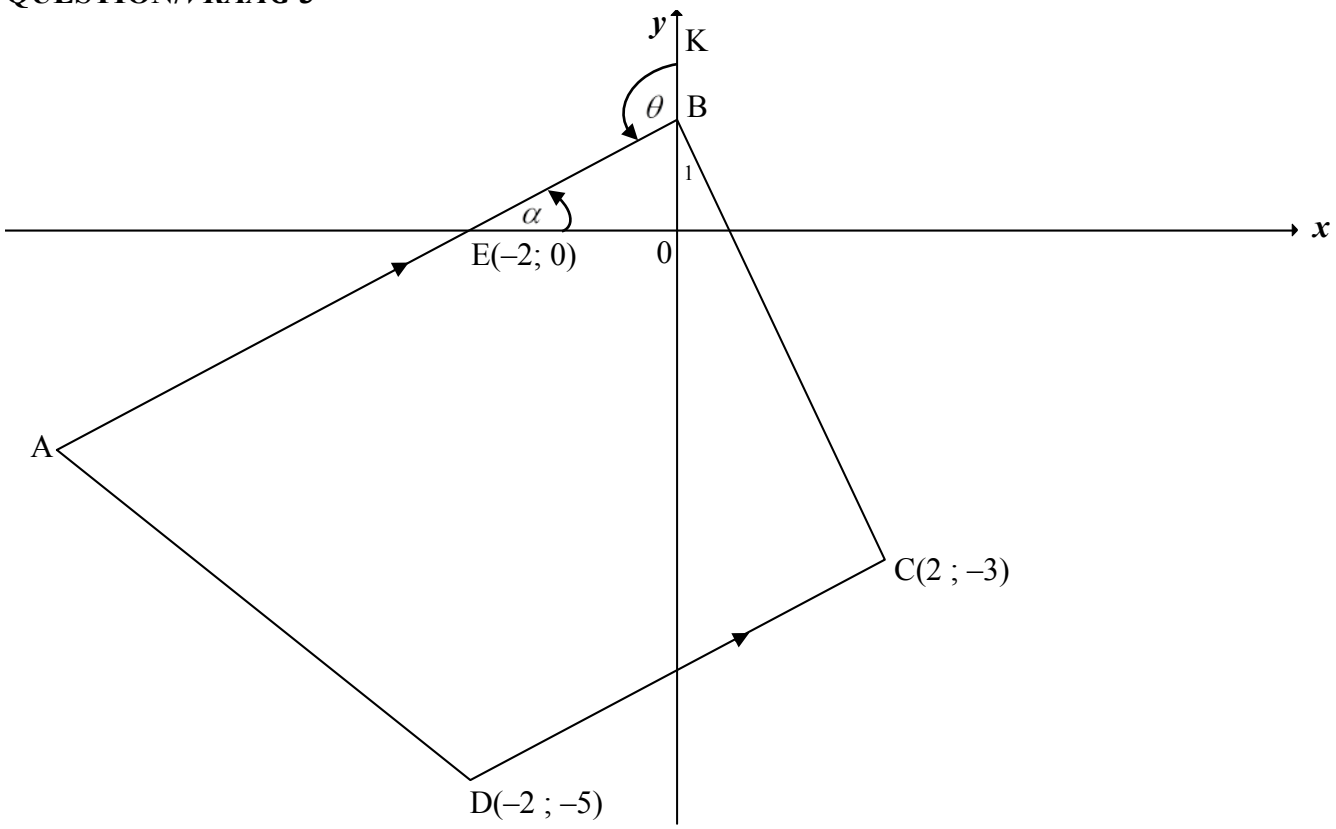
QUESTION/*VRAAG* 1

1.1	45 children	✓ answer (1)
1.2	$\bar{x} = \frac{\sum fx}{n} = \frac{(4\times 2)+(8\times 10)+(12\times 9)+(16\times 7)+(20\times 8)+(24\times 7)+(28\times 2)}{45}$ $\bar{x} = \frac{692}{45}$ OR $\bar{x} = 15{,}38$ minutes Answer only: full marks	✓ 692 ✓ answer (2)
1.3	**Time taken (*t*) (in minutes)** / **Number of children** / **Cumulative frequency** $2 < t \leq 6$ / 2 / 2 $6 < t \leq 10$ / 10 / 12 $10 < t \leq 14$ / 9 / 21 $14 < t \leq 18$ / 7 / 28 $18 < t \leq 22$ / 8 / 36 $22 < t \leq 26$ / 7 / 43 $26 < t \leq 30$ / 2 / 45	✓ first 4 cum freq correct ✓ last 3 cum freq correct (2)
1.4	**CUMULATIVE FREQUENCY GRAPH (OGIVE)**  	✓ plotting cum freq at upper limits correctly (all points) ✓ shape (smooth) ✓ grounding (2;0) (3)
1.5	On graph at the *y*-value of 22,5 or 23 Median = ± 15 minutes. Answer only: full marks	✓ graph ✓ answer (2)
		[10]

QUESTION/*VRAAG* 2

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

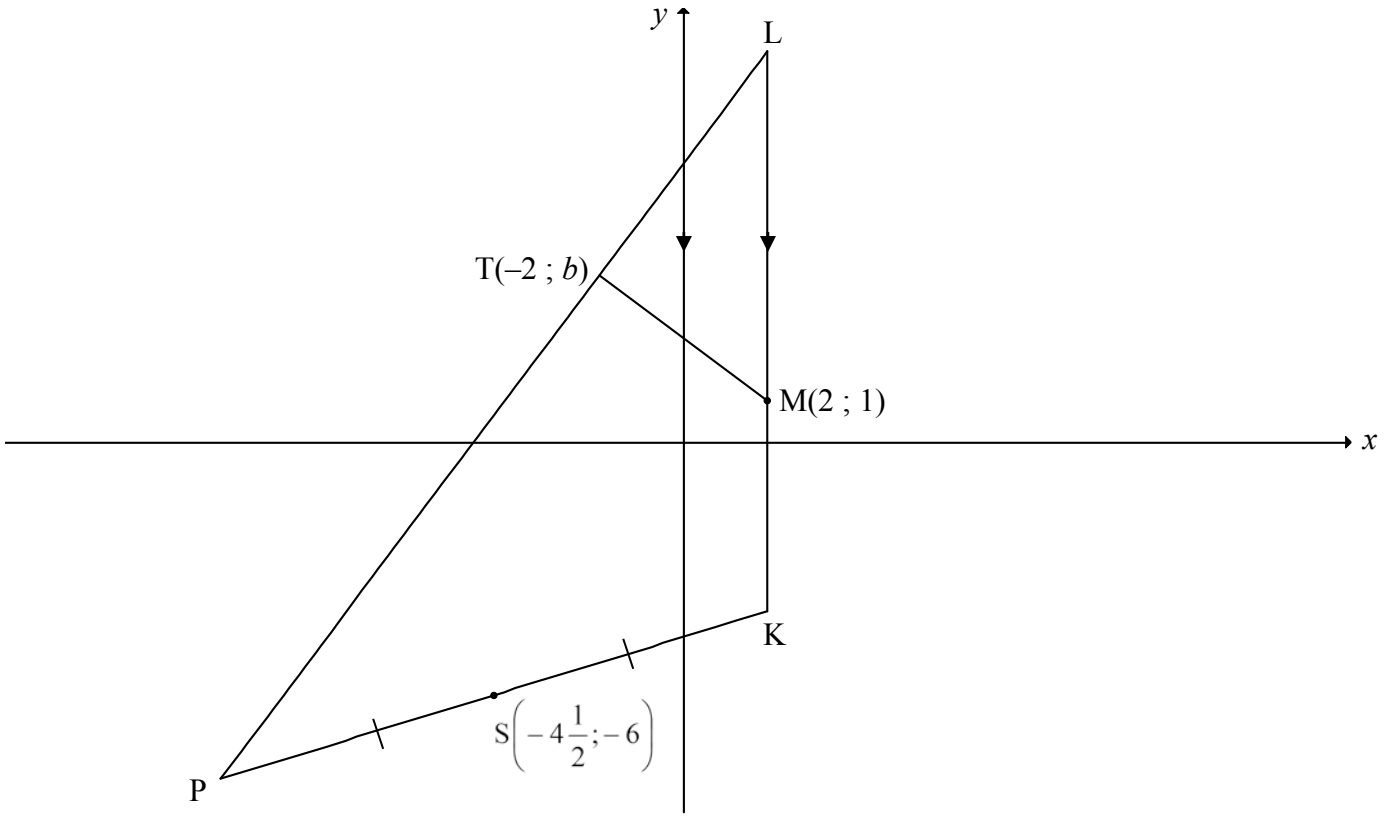
QUESTION/*VRAAG* 3



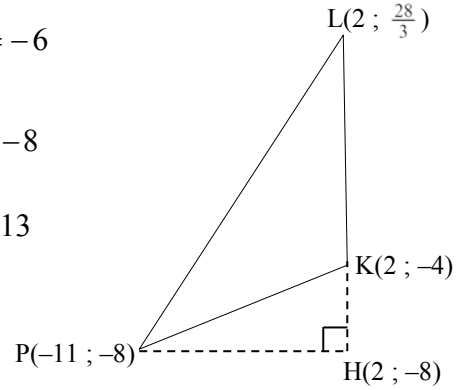
3.1.1	Midpoint of EC: $=\left(\frac{-2+2}{2}\ ;\ \frac{0+(-3)}{2}\right)=\left(0\ ;\ \frac{-3}{2}\right)$	✓ x value ✓ y value (2)
3.1.2	$m_{DC}=\frac{-3-(-5)}{2-(-2)}$ OR $\frac{-5-(-3)}{-2-2}$ $=\frac{2}{4}=\frac{1}{2}$ Answer only: full marks	✓ substitution ✓ answer (2)
3.1.3	$m_{AB}=\frac{1}{2}$ [AB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

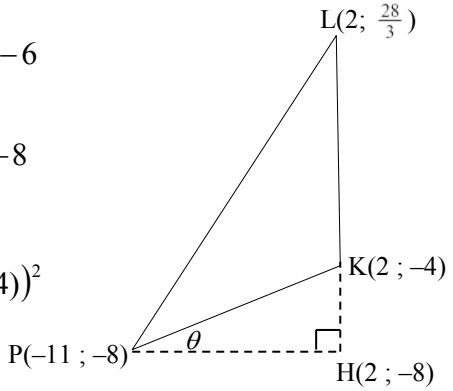
3.2	B(0 ; 1) $m_{BC}=\frac{1-(-3)}{0-2}$ **OR** $m_{BC}=\frac{(-3)-1}{2-0}$ $=-2$ $=-2$ $m_{AB}\times m_{BC}=\frac{1}{2}\times -2$ $=-1$ $\therefore AB\perp BC$	✓ coordinates of B ✓ $m_{BC}=-2$ ✓ product of gradients = –1 (3)
3.3.1	$A\hat{B}C=90°$ $\therefore$ EC is diameter [converse: $\angle$ in semi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

QUESTION/*VRAAG* 4



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

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

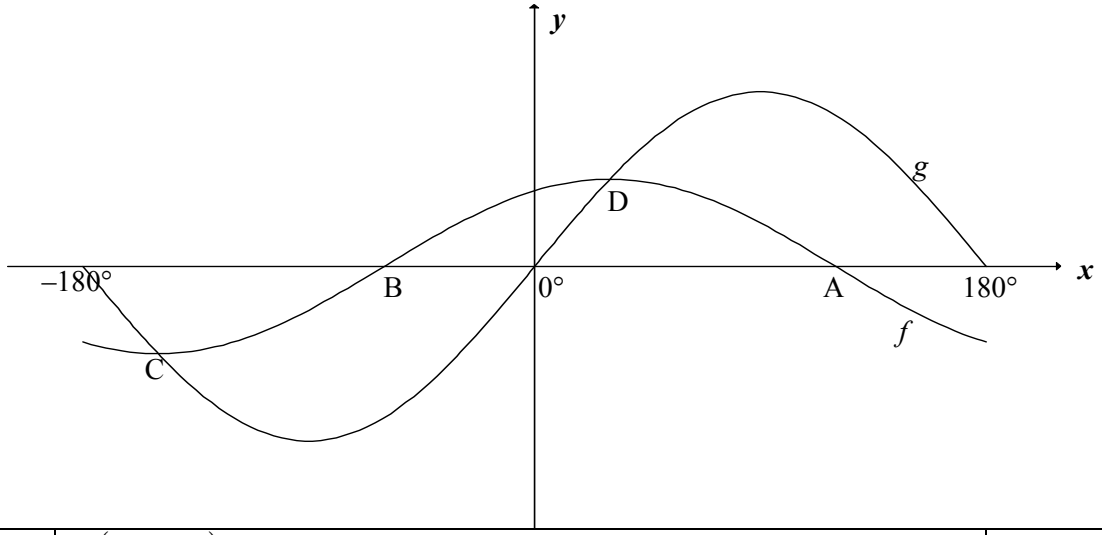
4.2.3	**OR** $y_L = \frac{4}{3}(2) + \frac{20}{3} = \frac{28}{3}$ $L\left(2\ ;\ \frac{28}{3}\right)$ and $K(2\ ;-4)$: $LK = \frac{28}{3} - (-4) = \frac{40}{3}$ Coordinates of P: $\frac{x+2}{2} = -4\frac{1}{2}$ and $\frac{y-4}{2} = -6$ $\therefore\ x = -11 \qquad y = -8$ $\therefore P(-11;-8)$ $PK^2 =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

QUESTION/*VRAAG* 5

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

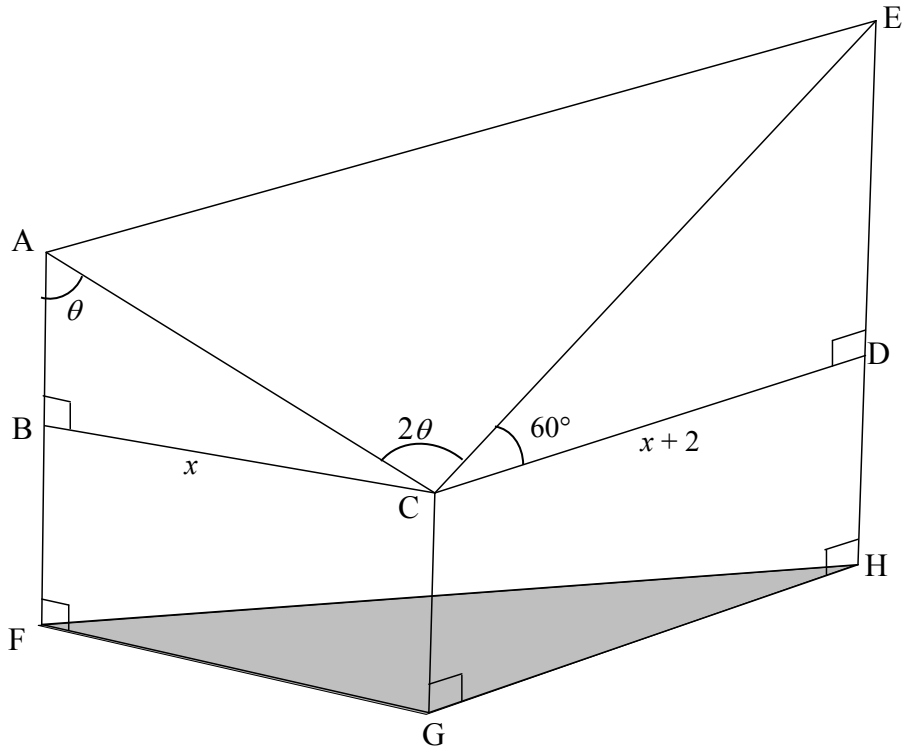
QUESTION/*VRAAG* 6

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



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

QUESTION/*VRAAG* 7

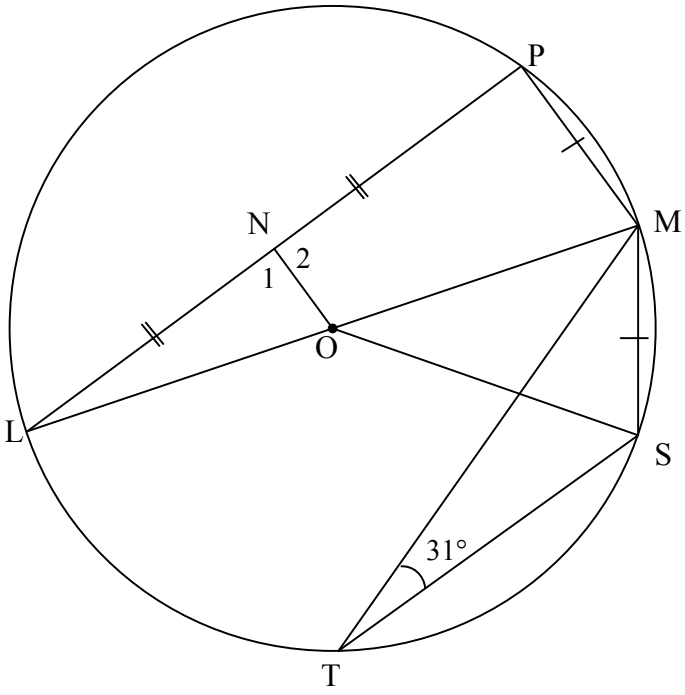


7.1.1	$\sin\theta = \frac{x}{AC}$ **OR** $\frac{\sin\theta}{x} = \frac{\sin 90°}{AC}$ $AC = \frac{x}{\sin\theta}$ $AC = \frac{x}{\sin\theta}$	✓ trig ratio ✓ simplification (2)
7.1.2	$\cos 60° = \frac{x+2}{CE}$ **OR** $\frac{\sin 30}{x+2} = \frac{\sin 90°}{CE}$ $CE = \frac{x+2}{\cos 60°}$ $CE = \frac{x+2}{\sin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

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

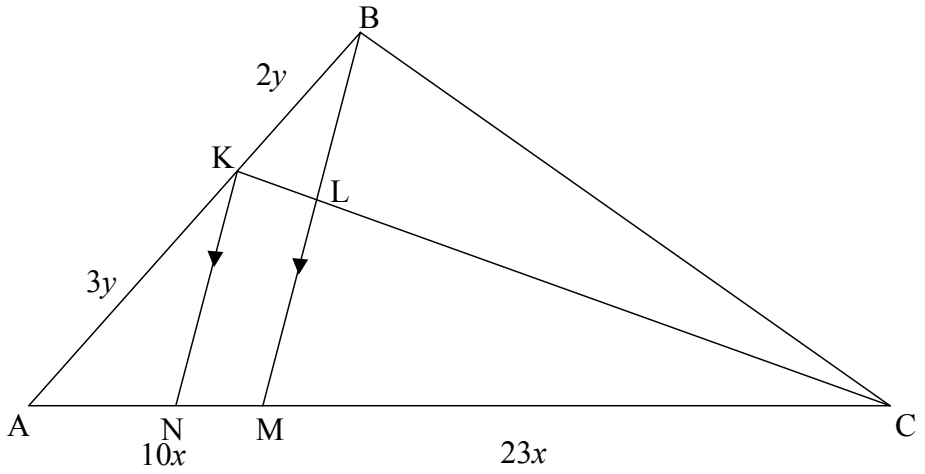
QUESTION/*VRAAG* 8

8.1



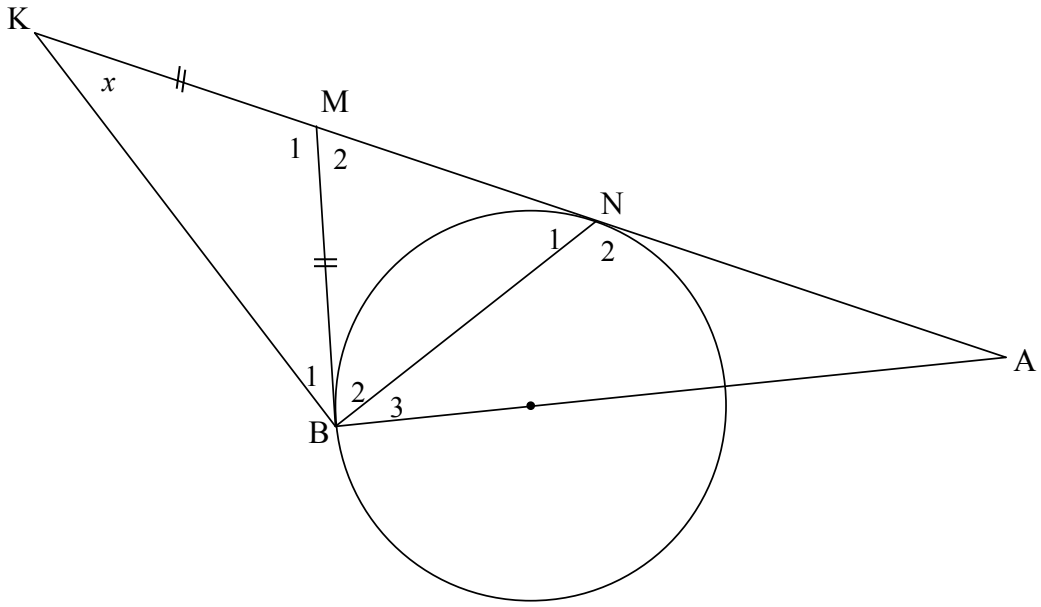
8.1.1(a)	$M\hat{O}S = 62°$ [∠ at centre = 2× ∠ at circumf/*middelpts∠ =2omtreks∠*]	✓ S ✓ R (2)
8.1.1(b)	$\hat{L} = 31°$ [equal chords; equal ∠s /= *koorde; = ∠e*]	✓ S ✓ R (2)
8.1.2	LN = NP and LO = OM $\therefore$ ON = $\frac{1}{2}$PM [midpoint theorem/*middelpuntstelling*] $\therefore$ ON = $\frac{1}{2}$MS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

8.2



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

QUESTION/*VRAAG* 9

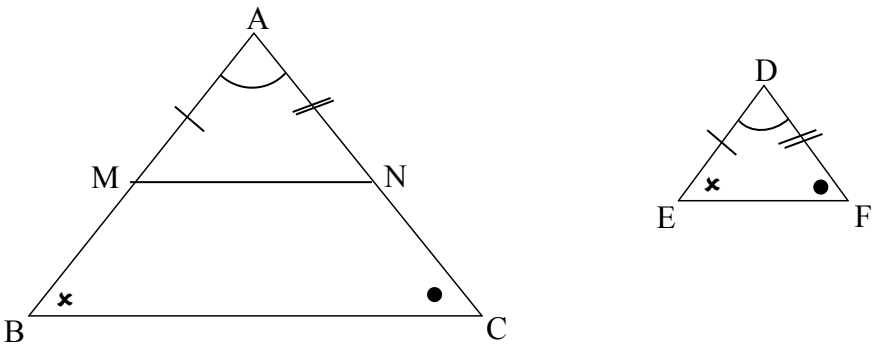


9.1	$\hat{B}_1 = x$ [$\angle$'s opp = sides/*$\angle$e teenoor = sye*] $\hat{M}_2 = 2x$ [ext $\angle$ of Δ] **OR** $\hat{M}_1 = 180° - 2x$ [$\angle$s of Δ] BM = MN [2 tans from a common point/*raaklyne vanuit dieselfde punt*] $\hat{N}_1 = \frac{180° - 2x}{2} = 90° - x$ [$\angle$'s opp = sides/*$\angle$e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

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

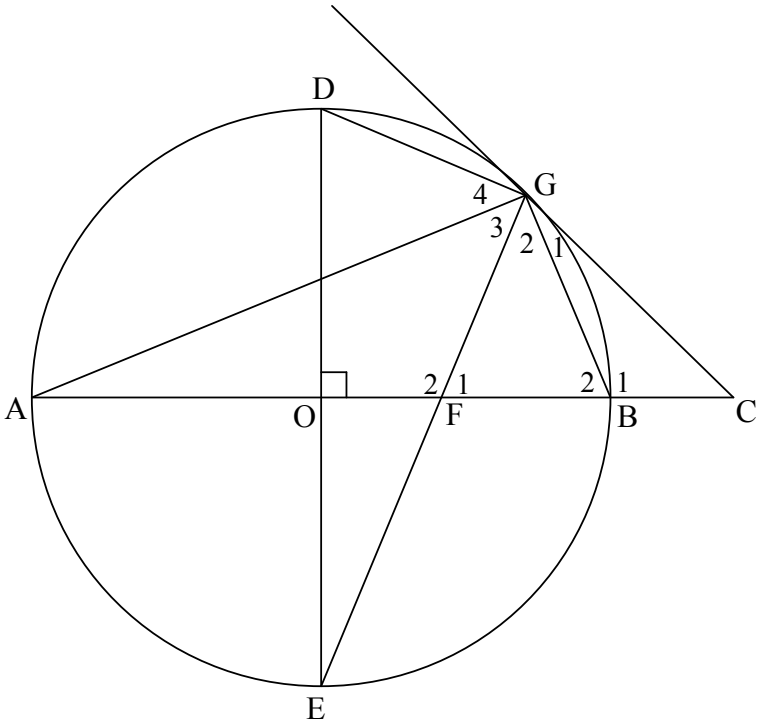
QUESTION/*VRAAG* 10

10.1



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

10.2



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

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

	TOTAL/*TOTAAL*:	**150**