LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

WATERBERG

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS TEST 1
MARCH 2022
MARKING GUIDELINES

MARKS : 100

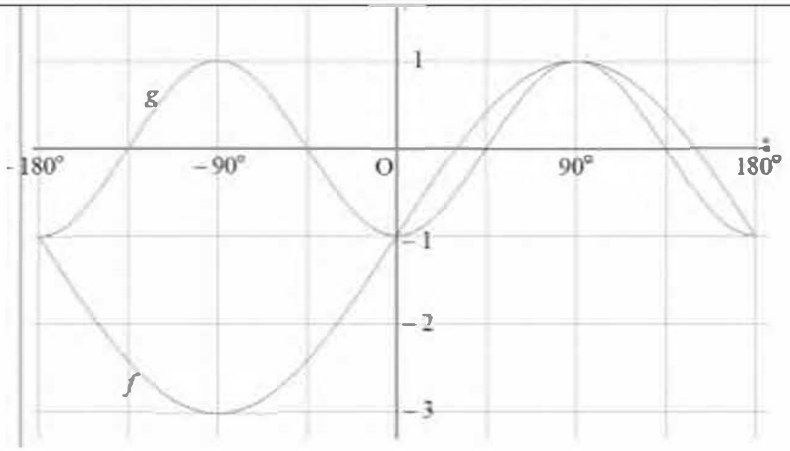
This MEMORANDUM consists of 10 pages.

	QUESTION 1	
1.1.1	73; 99	✓✓ (2)
1.1.2	9; 19; 33; 51; ... 10; 14; 18 4 4 $2a = 4$ $3a + b = 10$ $a + b + c = 9$ $a = 2$ $b = 4$ $c = 3$ $T_n = 2n^2 + 4n + 3$	✓ 2nd diff constant ✓ a ✓ b ✓
1.1.3	$T_n = 2n^2 + 4n + 3$ $= 2\left(n^2 + 2n + \frac{3}{2}\right)$ $= 2\left[n^2 + 2n + (1)^2 - (1)^2 + \frac{3}{2}\right]$ $= 2\left[(n+1)^2 + \frac{1}{2}\right]$ $= 2(n+1)^2 + 1$	✓ common factor ✓ adding special zero ✓ completed square (3)
1.2.1	$\sum_{k=1}^{\infty} 4(0{,}2)^{k-1}$ 4; $\frac{4}{5}$; $\frac{4}{25}$	✓ all three (1)
1.2.2	$r = \frac{1}{5}$ $S_\infty = \frac{a}{1-r} = \frac{4}{1-\frac{1}{5}} = 5$	✓ value of r ✓ correct sub into formula ✓ answer (3)

1.2.3	$S_\infty - S_n < 0{,}0001$ $5 - \left[\frac{4\left(1-\left(\frac{1}{5}\right)^n\right)}{1-\frac{1}{5}}\right] < 0{,}0001$ $5 - 5\left(1-\left(\frac{1}{5}\right)^n\right) < 0{,}0001$ $5 - 5 + 5.5^{-n} < 0{,}0001$ $5^{1-n} < 0{,}0001$ $1 - n < \log_5 0{,}0001$ $1 - n < -5{,}7$ $-n < -6{,}7$ $n > 6{,}7$ $n = 7$	✓ inequality ✓substitutions ✓ simplification ✓ use of logarithm ✓answer
1.3	$3 + 11 + 3 + 15 + 3 + 19 + \cdots$ 107 Sub series: $11 + 15 + 19 + \cdots + 107$ $4n + 7 = 107$ $n = 25$ $S_{25} = \frac{25}{2}[11 + 107] = 1475$ Sub series of 3s: $3 + 3 + \cdots + 3$ $S_{25} = 3 \times 25 = 75$ $S_{50} = 1475 + 75 = 1550$	✓ general term for even T ✓equating 107 ✓ n ✓ sum of even sub set ✓ answer **(5)**
		[23]

	QUESTION 2	
2.1	$$\frac{\cos(-\theta).\tan(180°-\theta).\cos(90°-\theta)}{\sin(180°-\theta).\sin(540°+\theta)}$$ $$=\frac{\cos\theta\,(-\tan\theta)\sin\theta}{\sin\theta\,(-\sin\theta)}$$ $$=\frac{\cos\theta}{\sin\theta}.\frac{\sin\theta}{\cos\theta}$$ $$=1$$	✓ $\cos\theta$ ✓ $-\tan\theta$ ✓ $\sin\theta$ ✓ $\sin\theta$ ✓ $-\sin\theta$ ✓ $\tan\theta=\frac{\sin\theta}{\cos\theta}$ ✓ 1 (7)
2.2	$\sin(A+B)=\cos[90°-(A+B)]$ $=\cos[(90°-A)-B]$ $=\cos(90°-A)\cos B+\sin(90°-A)\sin B$ $=\sin A\cos B+\cos A\sin B$	✓ co-fun ✓ $\sin A$ ✓ $\cos A$ (3)
2.3.1	$5\cos A+3=0$ $\cos A=-\frac{3}{5}$ $5^2=(-3)^2+y^2$ $y=\pm4$ $\therefore y=4$ $\sin A=\frac{4}{5}$	✓ theorem of Pythagoras ✓ value of y ✓ answer (3)
2.3.2	$$\sin 2A=2\sin A\cos A$$ $$=2\left(\frac{4}{5}\right)\left(-\frac{3}{5}\right)=-\frac{24}{25}$$	✓ expansion ✓ correct sub ✓ answer (3)

2.4	$RHS = \frac{1-\cos 2x-\sin x}{\sin 2x-\cos x}$ $= \frac{1-(1-2\sin^2 x)-\sin x}{2\sin x\cos x-\cos x}$ $= \frac{2\sin^2 x-\sin x}{2\sin x\cos x-\cos x}$ $= \frac{\sin x\,(2\sin x-1)}{\cos x\,(2\sin x-1)}$ $= \tan x = RHS$	✓ $1-2\sin^2 x$ ✓ $2\sin x\cos x$ ✓ take $\sin x$ as a common factor ✓ take $\cos x$ as a common factor ✓ $\tan x$ (5)
		[21]

	QUESTION 3	
3.1	$4\sin x + 2\cos 2x = 2$ $2\sin x + 1 - 2\sin^2 x = 1$ $2\sin x\,(1 - \sin x) = 0$ $\sin x = 0 \ \ or \ \ \sin x = 1$ $x = 180°k \quad x = 90° + 360°k, k\epsilon\mathbb{Z}$	✓ $1 - 2\sin^2 x$ ✓ factors ✓ $\sin x = 0 \ \ or \ \ \sin x = 1$ ✓ $x = 180°k$ ✓ $x = 90° + 360°k$ ✓ $k\epsilon\mathbb{Z}$ (6)
3.2.1		✓ turning point $(-90°; -3)$ ✓ turning point $(90°; 1)$ ✓ shape (3)
3.2.2	$-90° < x < 0°$	✓ boundaries ✓notation (if boundary correct) (2)
3.2.3	$f(x) = g(x)$ $\therefore -180°; 0°; 90°; 180°$ $f(x + 30°) = g(x + 30°)$ $\therefore -30°; 60°; 150°$	✓ ✓ any ONE correct ✓ OTHER two (2)
		[13]

	QUESTION 4	
4.1	$\tan\alpha = \frac{AP}{AB}$ $AP = AB\tan\alpha$	✓ trig ratio ✓ answer (2)
4.2	$\frac{AB}{\sin\beta} = \frac{BC}{\sin(180° - (\theta+\beta))}$ $AB = \frac{BC\sin\beta}{\sin(\theta+\beta)} = \frac{20sin\,\beta}{\sin(\theta+\beta)}$ $AP = \frac{20sin\,\beta}{\sin(\theta+\beta)}.\tan\alpha$ $= \frac{20sin\,\beta.\tan\alpha}{\sin(\theta+\beta)}$	✓sine rule ✓ AB ✓ substitution of AB on AP (3)
4.3	$AP = \frac{20sin\,\beta.\tan\alpha}{\sin 2\beta}$ $= \frac{20sin\,\beta.\tan\alpha}{2\sin\beta\cos\beta} = \frac{10\tan\alpha}{\cos\beta}$	✓ $\sin 2\beta$ ✓ $2\sin\beta\cos\beta$ ✓ answer (3)
		[8]

	QUESTION 5	
5.1	Twice the angle subtended by the same arc at circumference	✓ (1)
5.2.1	$M\hat{L}O = 90°$ rad ⊥ tan $\hat{O}_2 = 90° - \hat{M} = 64°$ sum of $< s$ in a Δ	✓ S/R ✓ S/R (2)
5.2.2	$\hat{P} = \frac{\hat{O}_2}{2} = 32° <$ at centre $= 2 \times <$ at circum $\hat{L}_2 = \hat{P} = 32° < s$ opp = sides	✓ S ✓R ✓ S/R (3)
5.2.3	$\hat{L}_5 = \hat{P} = 32°$ tan- chord theorem	✓ S ✓ R (2)
5.2.4	$M\hat{L}P = 90°$ $<$ in a $\frac{1}{2}\odot$ $\hat{Q}_1 = 90° - \hat{P} = 58°$ sum of $< s$ in a Δ	✓ S/R ✓ S/R (2)
5.2.5	$\hat{N} = \hat{P} = 32° < s$ in the same seg	✓ S/R (1)
		[11]

	QUESTION 6	
6.1	$R\hat{P}V = R\hat{Q}P = 70°$ tan-chord theorem $\hat{P}_2 = 180° - R\hat{Q}P - Q\hat{R}P = 54°$ sum of $< s$ in a Δ $R\hat{S}T = \hat{P}_2 = 54°$ $< s$ in the same seg	✓ S ✓ R ✓ S/R ✓ S ✓R (5)
6.2	$\hat{Q}_1 = \hat{R}_1 = 37°$ $< s$ in the same seg $Q\hat{R}S = 93° \neq 90$ ∴ QS is not a diameter, it does not subtend an angle of 90° at circumference	✓ S ✓R ✓ S ✓ R (4)
6.3	$\hat{Q}_1 = 37°$ given $\hat{S} = 54°$ proven $\hat{Q}_1 \neq \hat{S}$ ∴ QP is not parallel to RS, alt $< s$ are $\neq$	✓ S ✓ R (2)
		[11]

	QUESTION 7	
7.1	$\hat{R}_2 = \hat{Q}_2$ tan-chord theorem $\hat{S}_2 = \hat{R}_2$ alt $< s$; QS $\|$ RE $\hat{Q}_2 = \hat{S}_2$ both $= \hat{R}_2$ $QR = RS$ sides opp $= < s$	✓ S ✓ R ✓ S/R ✓ R (4)
7.2	In ΔRST and in Δ PQT $\hat{T}$ is common $\hat{S}_3 = P\hat{Q}R$ ext < of a cyclic quad $S\hat{R}T = \hat{P}$ ext < of a cyclic quad / sum of $< s$ in a Δ ∴ ΔRST ||| Δ PQT <<<	✓ S ✓ S ✓ R ✓ S (4)
7.3.1	$\frac{RS}{PQ} = \frac{RT}{PT}$ similar Δs $\frac{PQ}{PT} = \frac{RS}{RT}$ $QR = RS$ proven $\frac{PQ}{PT} = \frac{QR}{RT}$ $\frac{QR}{TR} = \frac{SE}{ET}$ a line drawn $\|$ line side of a Δ $\frac{PQ}{PT} = \frac{SE}{ET}$ both $= \frac{QR}{RT}$	✓ S ✓R ✓ S ✓S ✓ R (5)
		[13]
	TOTAL	**100**