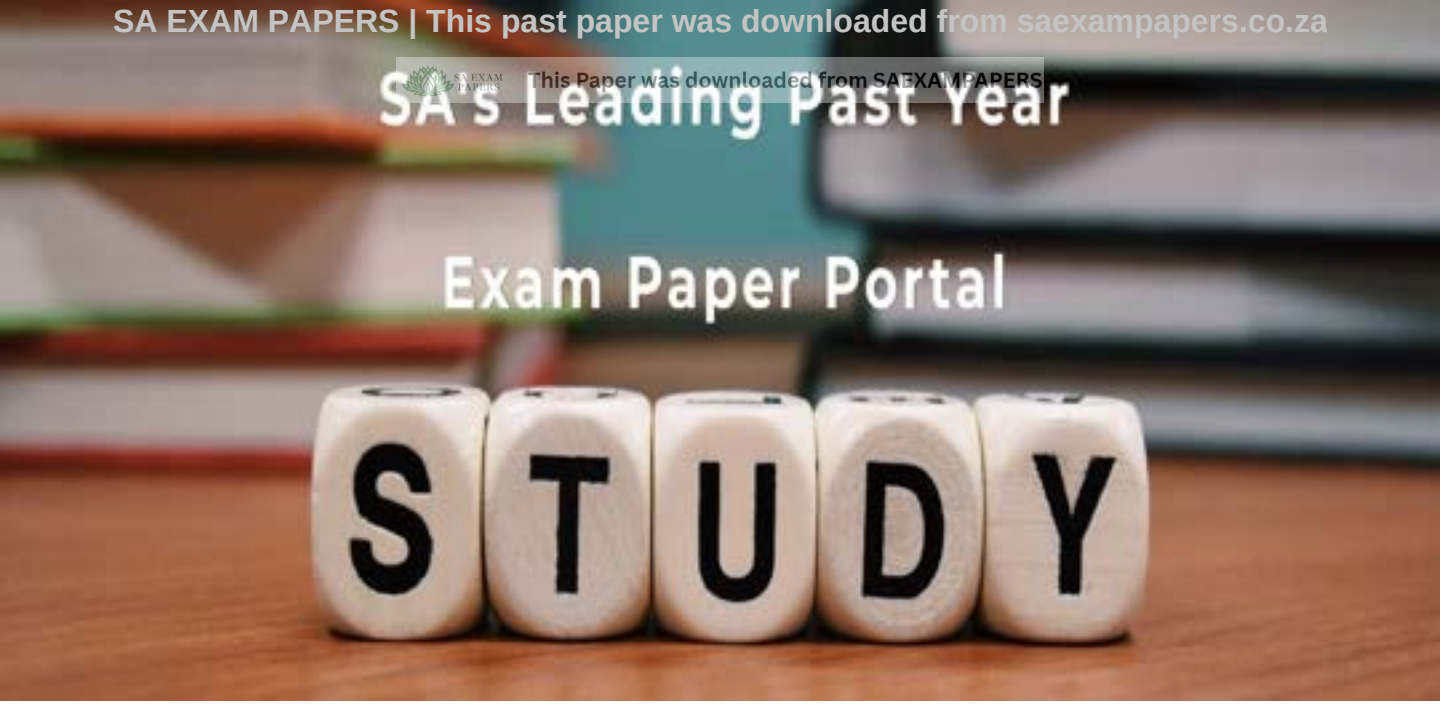


LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL SENIOR CERTIFICATE

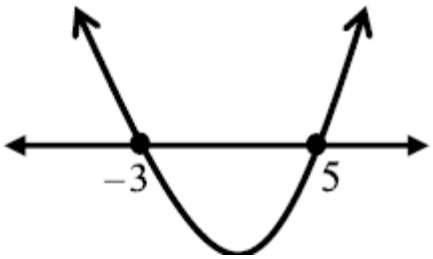
GRADE 12

MATHEMATICS
TEST NO 1
MARKING GUIDELINE

MARKS: 100

This marking guideline consists of 8 pages.

QUESTION 1

1.1.1	$x=-3$ or $x=2$	✓ $x=-3$ ✓ $x=2$ **(2)**
1.1.2	$(x+3)(x-5)\geq 0$ CV: $x=-3$ or $x=5$   $x\leq -3$ or $x\geq 5$ **OR** $x\in(-\infty;-3]$ or $x\in[5;\infty)$	✓ critical values ✓ $x\leq 3$ ✓ $x\geq 5$ **(3)**
1.2.1	$x\leq -5, x\in\mathbb{R}$	✓✓ answer **(2)**
1.2.2	$x+3=\sqrt{x+5}$ $(x+3)^2=\left(\sqrt{x+5}\right)^2$ $x^2+6x+9=x+5$ $x^2+5x+4=0$ $(x+1)(x+4)=0$ $x=-1$ or $x\neq -4$	✓ isolating surd ✓ square both sides ✓ standard form ✓ selection **(4)**
		[11]

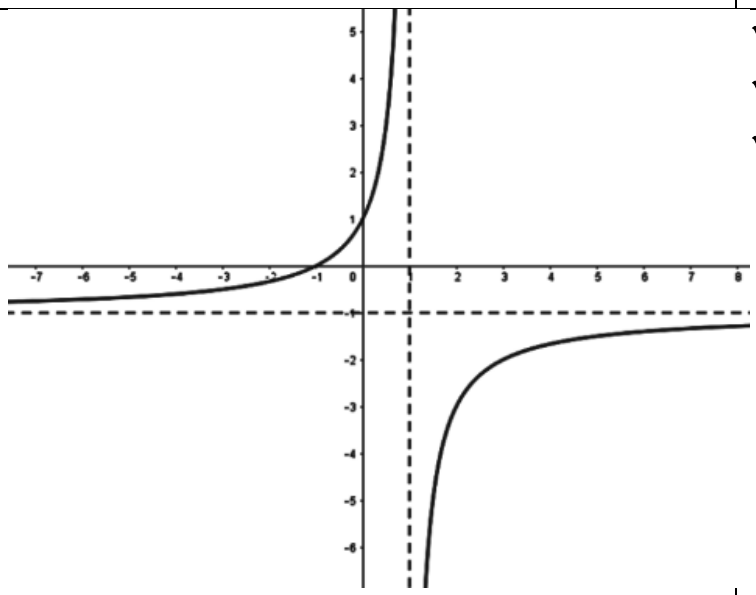
QUESTION 2

2.1.1	$r=\frac{T_3}{T_2}=\frac{6x}{12}$ $=\frac{x}{2}$	✓ answer **(1)**
2.1.2	$x=4\Rightarrow a=6$ & $r=2$ $S_{10}=\frac{a\left(r^n-1\right)}{r-1}$ $=\frac{6\left(2^{10}-1\right)}{2-1}$ $=6138$	✓ values of a and r ✓ substitution ✓ answer **(3)**
2.2.1	$S_{15}=-(15)^2+8(15)$ $=-105$	✓ substitution ✓ answer **(2)**
2.2.2	$T_{15}=S_{15}-S_{14}$ $=-105-(-84)=-21$	✓ method ✓ answer **(2)**
2.2.3	$T_1=S_1=7$ $S_2=-(2)^2+8(2)=12$ OR $\therefore T_2=5$ $\Rightarrow d=-2$ $T_n=a+(n-1)d$ $7+(n-1)(-2)=-169$ $7-2n+2=-169$ $-2n=-178$ $n=89$ **OR** $S_n-S_{n-1}=T_n$ $-n^2+8n-\left[-(n-1)^2+8(n-1)\right]=-169$ $-n^2+8n-\left[-n^2+2n-1+8n-8\right]=-169$ $-n^2+8n+n^2-10n+9=-169$ $-2n=-178$ $n=89$	$a+14d=-21$ $7+14d=-21$ $14d=-28$ $d=-2$ ✓ $T_5=5$ **or** $14d=-28$ ✓ $d=-2$ ✓ substitution ✓ answer ✓ formula ✓ substitution ✓ simplification ✓ answer **(4)**
		[12]

QUESTION 3

3.1.1	$T_1 = (x-1)$ $T_2 = (x-1)^2$ $\therefore r = x-1$ for convergence: $-1 < r < 1$ $-1 < x-1 < 1$ $\therefore 0 < r < 2$	✓ $-1 < r < 1$ ✓ answer **(2)**
3.1.2	When: $x = \frac{2}{3}$ $k = \left(\frac{2}{3}-1\right) + \left(\frac{2}{3}-1\right)^2 + \left(\frac{2}{3}-1\right)^3 + \ldots$ $k = \left(-\frac{1}{3}\right) + \left(\frac{1}{9}\right) + \left(-\frac{1}{27}\right) + \ldots$ $\therefore a = -\frac{1}{3}$ and $r = -\frac{1}{3}$ $\therefore S_\infty = \frac{a}{1-r}$ $= \frac{-\frac{1}{3}}{1-\left(-\frac{1}{3}\right)}$ $= -\frac{1}{4}$	✓ substitution ✓ values of a and r ✓ substituting into S_∞ formula ✓ answer **(4)**
3.2	$a = 70$ and $T_{11} = 50$ $\therefore 70 + 10d = 50$ $10d = -20$ $\therefore d = -2$ $70 + (n-1)(-2) = 58$ $70 - 2n + 2 = 58$ $-2n = -14$ $n = 7$ $\therefore$ 7th horizontal support has a length of 58 cm	✓ $70 + 10d = 50$ ✓ $d = -2$ ✓ $70 + (n-1)(-2) = 58$ ✓ $-2n = -14$ ✓ answer **(5)**
		[11]

QUESTION 4

4.1	$x=1$ $y=-1$	✓ $x=1$ ✓ $y=-1$ **(2)**
4.2	y-intercept: $y=-1$ x-intercept: $0=\frac{-2}{x-1}-1$ $x=-1$	✓ y-intercept ✓ equating to 0 ✓ x-intercept **(3)**
4..3		✓ asymptotes ✓ intercepts ✓ shape **(3)**
4.4	$-1=(-1)(1)+c$ $c=0$ $y=-x$	✓ gradient ✓ answer **(2)**
		[10]

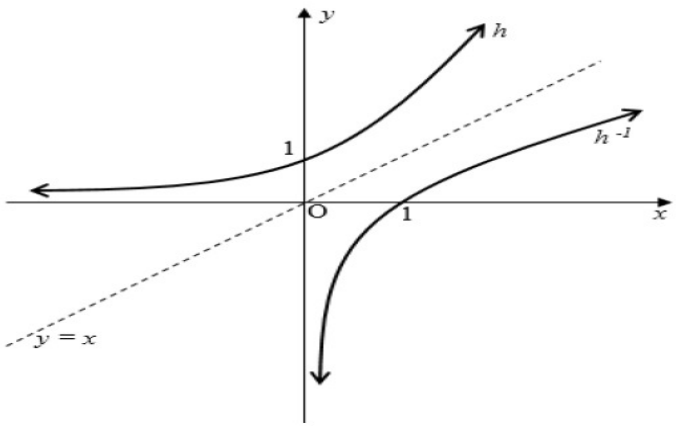
QUESTION 5

5.1.	$g(x)=-3x+20$ $g(3)=-3(3)+20=11$ $\therefore k=11$	✓ subst. $x=3$ ✓ $k=11$ **(2)**
5.2	$y\geq -11$ OR	✓✓ answer **(2)**

	$x \in [-11;\infty)$	
5.3	$y = a(x-3)^2 + 11$ subst. $(6;2)$ $2 = a(6-3)^2 + 11$ $-9 = 9a$ $a = -1$ $y = -1(x-3)^2 + 11$ $y = -(x^2 - 6x + 9) + 11$ $y = -x^2 + 6x + 2$ $\therefore\ a = -1; b = 6$ and $c = 2$ OR $f'(3) = 0$ $f'(x) = 2ax + b$ $f'(3) = 6a + b = 0$ $b = -6a ...(1)$ $f(3) = 11$ $11 = 9a + 3b + c ...(2)$ subst (1) in (2) $11 = 9a - 18a + c$ $9a + 11 = c ...(3)$ $f(6) = 2$ $2 = 36a + 6b + c ...(4)$ subst (1) and 3 in (4) $2 = 36a + 6(-6a) + 11 + 9a$ $2 = 11 + 9a$ $-9 = 9a$ $a = -1$ subst in (1): $b = -6(-1) = 6$ subst in (3): $11 + 9(-1) = c$ $c = 2$	✓ $y = a(x-3)^2 + 11$ ✓ subst. $(6;2)$ ✓ $a = -1$ ✓ $x^2 - 6x + 9$ ✓ $y = -x^2 + 6x + 2$ ✓ answer ✓ $b = -6a$ ✓ $11 = 9a + 3b + c$ ✓ $11 + 9a = c$ ✓ $2 = 36a + 6b + c$ ✓ $a = -1$ ✓ $b = 6$ and $c = 2$ **(6)**
5.4	$3 < x < 6$	✓ critical values

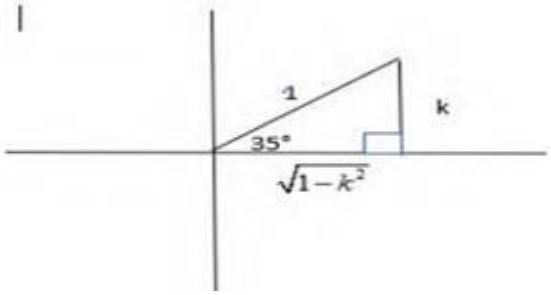
	OR $x \in (3;6)$	✓ inequalities **(2)**
		[12]

QUESTION 6

6.1	$h(x) = a^x$ $\frac{1}{2} = a^{-1}$ $\therefore a = 2$	✓ substitution ✓ answer **(2)**
6.2	$y = 2^x$ $x = 2^y$ $\therefore h^{-1}(x) : y = \log_2 x$	✓ swop x and y ✓ answer **(2)**
6.3		✓ y-intercept for h ✓ shape of h ✓ x-intercept for h^{-1} ✓ shape of h^{-1} **(4)**
6.4	$x > 0; x \in \mathbb{R}$	✓ answer **(1)**
6.5	$x > 2; x \in \mathbb{R}$ **OR** $\log_2 x > 1$ algebraically $\therefore x > 2$	✓ answer ✓ answer **(1)**
6.6.1	$t(x) = \left(\frac{1}{2}\right)^x - 1$ $= 2^{-x} - 1$ $\Rightarrow$ reflection about the $y-$axis shift of 1 unit down	✓ reflection ✓ shift **(2)**

6.6.2	$y=-1$	✓ answer **(1)**
		[13]

QUESTION 7

7.1.1	$r^2=x^2+y^2$ $(1)^2=x^2+(k)^2$ $x=1-k^2$ $x=\pm\sqrt{1-k^2}$	✓ x
		
	$\cos 55^\circ=\cos(90^\circ-35^\circ)$ $=\sin 35^\circ$ $=k$ **OR** $\cos 55^\circ=k$	✓ $\cos(90^\circ-35^\circ)$ ✓ answer ✓✓ answer **(3)**
7.1.2	$\sin 70^\circ=\sin 2(35^\circ)$ $=2\sin 35^\circ.\cos 35^\circ$ $=2.k.\sqrt{1-k^2}$	✓ double angle ✓ k ✓$\sqrt{1-k^2}$ **(3)**
7.1.3	$\cos 80^\circ=\cos(45^\circ+35^\circ)$ $=\cos 45^\circ.\cos 35^\circ-\sin 45^\circ.\sin 35^\circ$ $=\frac{\sqrt{2}}{2}.\sqrt{1-k^2}-\frac{\sqrt{2}}{2}.k$ $=\frac{\sqrt{2}}{2}\left(\sqrt{1-k^2}-.k\right)$ **OR**	✓ $\cos(45^\circ+35^\circ)$ ✓ expansion ✓ answer **(3)**

	$= \dfrac{\sqrt{2-2k^2}-\sqrt{2}k}{2}$	
7.2	$(\sin x-\cos x)^2 = \left(\dfrac{3}{4}\right)^2$ $\sin^2 x-2\sin x\cos x+\cos^2 x = \dfrac{9}{16}$ $1-2\sin x\cos x = \dfrac{9}{16}$ $2\sin x\cos x = \dfrac{7}{16}$ $\therefore \sin 2x = \dfrac{7}{16}$	✓ squaring both sides ✓ expanding LHS ✓ using identity ✓ answer **(4)**
7.3	$\dfrac{\tan(180^\circ+x).\cos(360^\circ-x)}{\sin(x-180^\circ)\cos(90^\circ+x)+\cos(720^\circ+x).\cos(-x)}$ $= \dfrac{\tan x.\cos x}{-\sin x.(-\sin x)+\cos x.\cos x}$ $= \dfrac{\frac{\sin x}{\cos x}.\cos x}{\sin^2 x+\cos x^2}$ $= \sin x$	✓ both $\tan x$ and $\cos x$ ✓ both $-\sin x$ and $-\sin x$ ✓ both $\cos x$ and $\cos x$ ✓ $\dfrac{\sin x}{\cos x}$ ✓ $\sin^2 x+\cos^2 x=1$ ✓ answer **(6)**
7.4	LHS: $= \dfrac{\cos 2x+\cos^2 x+3\sin^2 x}{2-2\sin^2 x}$ $= \dfrac{\cos^2 x-\sin^2 x+\cos^2 x+3\sin^2 x}{2(1-\sin^2 x)}$ $= \dfrac{2\cos^2 x+2\sin^2 x}{2\cos^2 x}$ $= \dfrac{2(1)}{2\cos^2 x}$ $= \dfrac{1}{\cos^2 x}$ $\therefore$ LHS = RHS	✓ $\cos^2 x-\sin^2 x$ ✓ $2(1-\sin^2 x)$ ✓ $2\cos^2 x+2\sin^2 x$ ✓ $\cos^2 x$ ✓ answer **(5)**

7.5	$2\sin x\cos x-\cos^2 x=0$ $\cos x(2\sin x-\cos x)=0$ $\cos x=0$ or $2\sin x=\cos x$ $\cos x=0$ or $\tan x=\frac{1}{2}$ $x=90^0+360^0.k$ or $x=270^0+360^0.k$ or $x=26,57^0+180^0.k;k\in\mathbb{Z}$	✓ factors ✓ $\cos=0$ ✓ $\tan x=\frac{1}{2}$ ✓ $x=90^0+360^0.k$ ✓ $x=270^0+360^0.k$ ✓ $x=26,57^0+180^0.k$ ✓ $k\in\mathbb{Z}$ **(7)**
		[31]

TOTAL: 100