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SENIOR CERTIFICATE**

GRADE 12

MATHEMATICS (MATHS)

MARKING GUIDELINES

COMMON TEST

MARCH 2024

MARKS: 100

These marking guidelines consist of 10 pages.

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QUESTION 1

1.1.1	$8 ; 15 ; 22 ; ………..$ $a = 8; \quad d = 7; \quad n = 36$ $T_n = a + (n-1)d$ $T_{36} = 8 + (36-1)(7)$ $T_{36} = 253$	✓A substitution ✓CA answer	(2)
1.1.2	$a = 8; \quad d = 7; \quad n = 36$ $S_n = \dfrac{n}{2}\left[2a + (n-1)d\right]$ $S_{36} = \dfrac{36}{2}\left[2(8) + (36-1)(7)\right]$ $S_{36} = 4698$ **OR** $S_n = \dfrac{n}{2}(a+l)$ $S_{36} = \dfrac{36}{2}(8 + 253)$ $\quad\;\; = 4698$	✓CA substitution ✓CA answer **OR** ✓CA substitution ✓CA answer	(2)
1.1.3	$T_n = a + (n-1)d$ $T_{72} = 8 + (72-1)(7) = 505$ $T_{72-m} = 8 + (72 - m - 1)(7)$ $T_{72-m} + T_{72} = 786$ $505 + 8 + 497 - 72 - m = 786$ $-7m = -224$ $\quad m = 32$	✓CA value of T_{72} ✓CA Substitution in T_{72-m} ✓CA Simplification ✓CA value of m	(4)
1.2.1	$81 \times \dfrac{2}{3} = 54cm$ The next jump is $54cm$	✓A answer	(1)
1.2.2	$81 ; 54 ; 36 ; …….$ $a = 81; \quad r = \dfrac{2}{3}; \quad n = 9$ $T_n = ar^{n-1}$ $T_9 = 81\left(\dfrac{2}{3}\right)^8$ $\quad = \dfrac{256}{81} = 3,16\,cm$	✓A substitution ✓A answer	(2)

1.2.3	$S_\infty = \dfrac{a}{1-r}$		
	$S_\infty = \dfrac{81}{1-\dfrac{2}{3}}$	✓A substitution	
	$= 243\,cm$	✓CA value of S_∞	
	$243\,cm > 230\,cm$		
	Yes he will be able to catch the insect	✓CA conclusion	
	OR	**OR**	
	Showing that he can reach a distance > 230 through **substitution of a value of n that is ≥ 8** in the S_n formula.	✓A substitution ✓CA value of S_n ✓CA conclusion	(3)
			[14]

QUESTION 2			
2.1.1	$16 ; 0 ; -12 ; -20 ; \ldots\ldots$		
	$-16 ; -12 ; -8 ; \ldots\ldots$		
	$\qquad 4 ; \qquad 4 ; \ldots\ldots$		
	$2a = 4$	✓A value of a	
	$a = 2$		
	$-16 = 3a + b$		
	$-16 = 3(2) + b$		
	$b = -22$	✓CA value of b	
	$16 = 2 - 22 + c$	✓CA value of c	
	$c = 36$		(4)
	$T_n = 2n^2 - 22n + 36$	✓CA answer	
2.1.2	$32 ; 28 ; 24 ; 20 ; \ldots\ldots$		
	$a = 32$		
	$d = -4$		
	$T_n = a + (n-1)d$		
	$T_n = 32 + (n-1)(-4)$ **Answer only: Full marks**	✓A substitution	
	$T_n = -4n + 36$	✓CA answer	(2)
2.1.3	$2n^2 - 22n + 36 = -4n + 36$	✓CA equating	
	$2n^2 - 18n = 0$		
	$n^2 - 9n = 0$		
	$n(n - 9) = 0$	✓CA factors	
	$n = 0$ or $n = 9$		
	$n = 9$ only		
		✓CA $n = 9$ only	
	$\therefore T_{17}$ and T_{18} are the terms	✓CA answer	(4)

2.2	$T_1 = -54;\quad T_2 = 162;\quad T_3 = -486$			
	$a = -54;\quad r = -3;\quad n = 7$		✓A $\;a = -54$	
	$S_n = \dfrac{a\left(r^n - 1\right)}{r - 1}$		✓A $\;r = -3$	
	$S_7 = \dfrac{-54\left((-3)^7 - 1\right)}{-3 - 1}$	**Answer only:** **Full marks**	✓CA substitution	
	$= -29\,538$		✓CA answer	(4)
				[14]
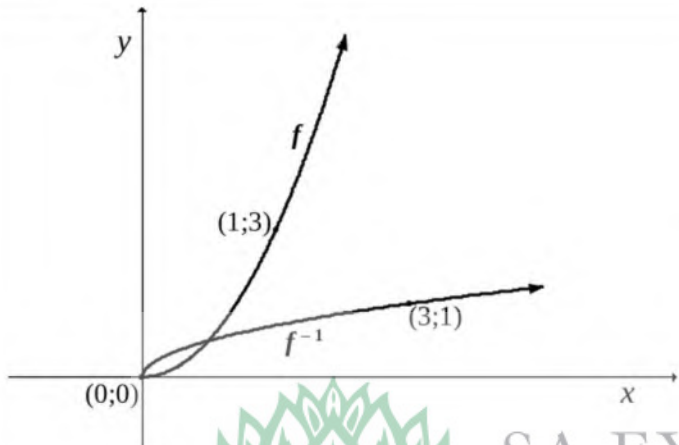
QUESTION 3				
3.1	$x = -2$		✓A answer	
	$y = 1$		✓A answer	(2)
3.2	$0 = \dfrac{3}{x+2} + 1$		✓A substituting $y = 0$	
	$-1 = \dfrac{3}{x+2}$			
	$-x - 2 = 3$			
	$x = -5$		✓ A value of x	
	$A(-5\,;\,0)$			(2)
3.3	$y = \dfrac{3}{0+2} + 1$		✓A substituting $x = 0$	
	$y = \dfrac{5}{2}$		✓ A value of y	
	$B\left(0\,;\,\dfrac{5}{2}\right)$	**Answer only:** **Full marks**		(2)
3.4	$g(x) = \dfrac{3}{-x+2} + 1 + 2$		✓A $\;-x$	
	$g(x) = \dfrac{-3}{x-2} + 3$		✓A answer	
	OR		**OR**	
	$g(x) = \dfrac{3}{-x+2} + 3$	**Answer only:** **Full marks**	✓A✓A answer	(2)
3.5	$y = x + c$		✓A substituting $(2;3)$	
	$3 = 2 + c \quad \text{subst}(2;3)$		✓CA answer	
	$c = 1$			(2)
				[10]

QUESTION 4

4.1	$y = mx + 5$ B(0 ; 5): y-intercept OB = 5 units OA = OB AB = 5 − 2 = 3 units A(0 ; 3) $f(x) = -x^2 + 2x + 3$ $p = 3$	✓A 5 − 2	(1)
4.2	$x = \dfrac{-b}{2a}$ $x = \dfrac{-2}{2(-1)}$ $= 1$ $y = -(1)^2 + 2(1) + 3 = 4$ F(1; 4) **OR** $f(x) = -\left[x^2 - 2x - 3\right]$ $f(x) = -\left[(x^2 - 2x + 1) - 3 - 1\right]$ $f(x) = -\left[(x-1)^2 - 4\right]$ $f(x) = -(x-1)^2 + 4$ F(1; 4)	✓A substitution ✓CA value of x ✓CA value of y **OR** ✓A completing the square ✓CA value of x ✓CA value of y	(3)
4.3	$f(x) = -x^2 + 2x + 3$ $0 = x^2 - 2x - 3$ $0 = (x-3)(x+1)$ $x = 3$ or -1 C(3 ; 0)	✓A equating to 0 ✓A factors ✓CA answer	(3)
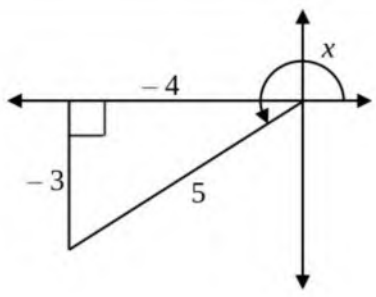
4.4	C(3 ; 0)		✓CA OD = 10 units	
	CD = 7 units			
	OD = 7 + 3 = 10 units			
	D(10 ; 0)			
	$y = mx + 5$ **or**	$m = \dfrac{y_2 - y_1}{x_2 - x_1}$	✓CA substituting D(10 ; 0) in $y = mx + 5$ **OR** substituting in gradient formula	
	$0 = 10m + 5$	$= \dfrac{0 - 10}{5 - 0}$		
	$m = -\dfrac{1}{2}$	$= -\dfrac{1}{2}$	✓CA value of m	
	$y = -\dfrac{1}{2}x + 5$ **or**	$C\hat{D}E = 180° - \angle$ of incl of DE		
	At E: $x = 3$	$= 26,57°$		
	$\therefore y = -\dfrac{1}{2}(3) + 5 = \dfrac{7}{2}$	$CE = CD \times \tan 26,57°$	✓CA substituting $x = 3$ in $y = -\dfrac{1}{2}x + 5$ **OR** ✓CA $CE = CD \times \tan 26,57°$	(5)
	$\therefore CE = \dfrac{7}{2} - 0 = \dfrac{7}{2}$ units	$= 7 \times \tan 26,57° = \dfrac{7}{2}$	✓CA answer	
				[12]

QUESTION 5		
5.1	$f : y = 3x^2$	✓A swapping x and y
	$f^{-1} : x = 3y^2$	
	$y^2 = \dfrac{1}{3}x$	
	$y = \pm\sqrt{\dfrac{1}{3}x}$	✓A $\pm\sqrt{\dfrac{1}{3}x}$
	$y = \sqrt{\dfrac{1}{3}x}$; $y \geq 0$	✓A answer $y = \sqrt{\dfrac{1}{3}x}$ (3)
5.2		✓A ✓A shape of each graph
		✓A coordinates of any two points on f
		✓A coordinates of any two points on f^{-1}
		(4)

5.3	$3x^2 = \sqrt{\dfrac{1}{3}x}$		$\checkmark$CA equating	
	$\left(3x^2\right)^2 = \left(\sqrt{\dfrac{1}{3}x}\right)^2$		$\checkmark$CA squaring both sides	
	$9x^4 = \dfrac{1}{3}x$			
	$27x^4 - x = 0$			
	$x(27x^3 - 1) = 0$			
	$x(3x-1)(9x^2 + 3x + 1) = 0$ **or** $x=0$ or $27x^3 = 1$			
	$x = 0$ or $x = \dfrac{1}{3}$ $x = 0$ $x = \dfrac{1}{3}$		$\checkmark$A $\ x = 0$ $\checkmark$CA $\ x = \dfrac{1}{3}$	
	OR		**OR**	
	$x = \sqrt{\dfrac{1}{3}x}$		$\checkmark$CA equating	
	$x^2 = \left(\sqrt{\dfrac{1}{3}x}\right)^2$		$\checkmark$CA squaring both sides	
	$x^2 = \dfrac{1}{3}x$			
	$3x^2 = x$			
	$3x^2 - x = 0$			
	$x(3x-1) = 0$			
	$x = 0$ or $x = \dfrac{1}{3}$		$\checkmark$A $\ x = 0$ $\checkmark$CA $\ x = \dfrac{1}{3}$	
	OR		**OR**	
	$3x^2 = x$		$\checkmark$A equating	
	$3x^2 - x = 0$			
	$x(3x-1) = 0$		$\checkmark$A factors	
	$x = 0$ or $x = \dfrac{1}{3}$		$\checkmark$A $\ x = 0$ $\checkmark$CA $\ x = \dfrac{1}{3}$	(4)
				[11]

QUESTION 6

6.1.1	$r^2 = (-4)^2 + (-3)^2 = 25$ $\therefore r = 5$ $\therefore \sin x = \dfrac{-3}{5}$	✓ A sketch ✓ A $r = 5$ ✓ CA answer	(3)
6.1.2	$2 - \sin 2x$ $= 2 - 2 \sin x \cos x$ $= 2 - 2\left(\dfrac{-3}{5}\right)\left(\dfrac{-4}{5}\right)$ $= 2 - \dfrac{24}{25}$ $= \dfrac{26}{25}$	✓ A expansion ✓ CA substitution ✓ CA answer	(3)
6.1.3	$\cos^2(90° - x) - 1$ $= \sin^2 x - 1$ $= \left(\dfrac{-3}{5}\right)^2 - 1$ $= \dfrac{9}{25} - 1$ $= \dfrac{-16}{25}$	✓ A $\sin^2 x$ ✓ CA substitution ✓ CA answer	(3)
6.2	$\dfrac{-1 + \cos(180° - \theta)\,.\,\sin(\theta - 90°)}{\cos(-\theta)\,.\,\sin(90° + \theta)\,.\,\tan^2(540° + \theta)}$ $= \dfrac{-1 + (-\cos\theta)\,.\,-\cos\theta}{\cos\theta\,.\,\cos\theta\,.\,\tan^2(540° - 360° + \theta)}$ $= \dfrac{\cos^2\theta - 1}{\cos\theta\,.\,\tan^2(180° + \theta)}$ $= \dfrac{-(1 - \cos^2\theta)}{\cos^2\theta\,.\,\tan^2\theta}$ $= \dfrac{-\sin^2\theta}{\cos^2\theta\,.\,\dfrac{\sin^2\theta}{\cos^2\theta}}$ $= -1$	In numerator: ✓ A $-\cos\theta$, ✓ A $-\cos\theta$ In denominator: ✓ A $\cos\theta$, ✓ A $\cos\theta$ ✓ A $\tan^2\theta$ ✓ CA $-\sin^2\theta$ ✓ CA answer after simplification	(7)
			[16]

QUESTION 7

7.1.1	$\sin(A+B)$ $= \cos\left[90° - (A+B)\right]$ $= \cos(90° - A - B)$ $= \cos\left[(90° - A) - B\right]$ $= \cos(90° - A).\cos B + \sin(90° - A).\sin B$ $= \sin A.\cos B + \cos A.\sin B$	✓ A co-ratio ✓ A re-arrangement ✓ A expansion	(3)
7.1.2	$\sin(2x + 50°) - \sin15°\cos48° = \sin48°\cos15°$ $\sin(2x + 50°) = \sin48°\cos15° + \sin15°\cos48°$ $\sin(2x + 50°) = \sin63°$ $2x + 50° = 63° + k.360°$ OR $2x + 50° = 180° - 63° + k.360°$ $2x = 13° + k.360°$ $\qquad 2x = 67° + k.360°$ $x = 6{,}5° + k.180°, k \in Z$ $\quad x = 33{,}5° + k.180°, k \in Z$	✓A using compound angle identity ✓ A both solutions ✓CA $x = 6{,}5° + k.180°$ ✓CA $x = 33{,}5° + k.180°$ $k \in Z$: penalty of 1 if not written at least once	(4)
7.2.1	$\dfrac{4\sin x \cos x}{2\sin^2 x - 1}$ $= \dfrac{2(2\sin x \cos x)}{-(1 - 2\sin^2 x)}$ $= \dfrac{2\sin 2x}{-\cos 2x}$ $= -2\tan 2x$	 ✓ A $2\sin 2x$ ✓ A $-\cos x$ ✓ CA answer	(3)
7.2.2	$2\sin^2 x - 1 = 0$ $\sin x = \pm \dfrac{1}{\sqrt{2}}$ $x = -45°$ or $x = 45°$	 ✓ A $\pm \dfrac{1}{\sqrt{2}}$ ✓ CA $-45°$; CA ✓ $45°$	(3)
7.2.3	$\dfrac{4\sin 15° \cos 15°}{2\sin^2 15° - 1}$ $= -2\tan 30°$ $= -2\left(\dfrac{1}{\sqrt{3}}\right)$ $= \dfrac{-2}{\sqrt{3}}$ or $\dfrac{-2\sqrt{3}}{3}$	 ✓ A $-2\tan 30°$ ✓ A answer	(2)
			[15]

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QUESTION 8

8.1	$m = -\dfrac{1}{2}$ $n = 30°$	✓ A $m = -\dfrac{1}{2}$ ✓ A $n = 30°$	(2)
8.2	amplitude of $f = 1$	✓ A answer	(1)
8.3	period of $h = 180°$	✓ A answer	(1)
8.4	$60° \leq x \leq 150°$	✓ ✓ A A answer	(2)
8.5	translation of $60°$ to the left; and reflection in the x-axis	✓ A translation of $60°$ to the left ✓ A reflection in the x-axis	(2)
			[8]

GRAND TOTAL: 100