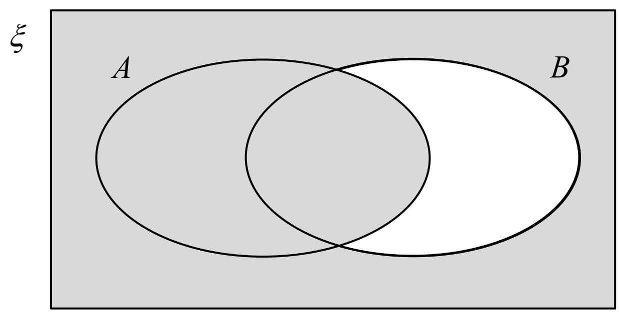
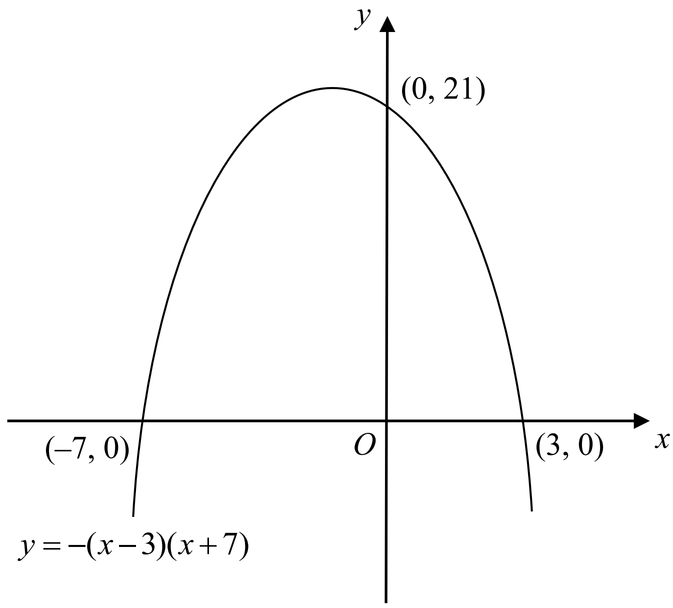
General Certificate of Education Ordinary Level 2023
Mathematics 4052/01
Syllabus 4052 Paper 1
SUGGESTED Solutions & Marking Scheme Mark Allocation
Prepared by: Jordan Tew (*@math_stuff_here*)

1		Sima \$270	B1		
		Ken \$210	B1		
					[2]
2	(a)	$x = 68.5$	B1		
		$x = 111.5$	B1		
	(b)	$77.9°$	B1		
					[3]
3	(a)	$8c^9d^6$	B1		
	(b)	$16\times25^2+9\times25^2=5^k$ $25^2(16+9)=5^k$	M1	Factorise out 25^2 s.o.i.	
		$5^k=25^3 \Rightarrow 5^k=5^6$ $k=6$	A1		
					[3]
4	(a)	Since the indices of M are **all even** or **are all factors of 2** or are **all divisible by 2**, M is a perfect square.	B1		
	(bi)	$k = 2\times7^2$	B1		
	(bii)	LCM $=2^{20}\times7^{10}\times11^{15}$	B1		
					[3]
5	(a)	The rate 0.25% should be multiplied to the respective balance of each month. Taking 3% of \$4500 is taking simple interest per annum, not compound interest.	B1	Describe how simple/compound interest works	
	(b)	Total value $=\$4500\left(1+\frac{0.25}{100}\right)^{12}$	M1		
		$=\$4636.871806$ $=\$4636.87$ (2 d.p.)	A1		
					[3]

6	(a)	$x^2-14x+b$ $=(x-7)^2-49+b$ $(x+a)^2-25$ $=x^2+2ax+a^2-25$	M1	Expand or complete the square s.o.i. or M0	
		$a=-7$	A1	or B1	
		$b=-24$		or B1	
	(b)	$x=7$	B1	FT from (a)	
					[3]
7	(a)	New Total $=118\%\times 550$	M1	o.e.	
		$=649$	A1		
	(b)	Total remainder $=\dfrac{100}{45}\times 81=180$	M1	Calculate remainder s.o.i.	
		Total postcards $=\dfrac{100}{72}\times 180$	M1	o.e.	
		$=250$	A1		
					[5]
8	(ai)	114 cm	B1		
	(aii)	Upper Quartile $=106$ minutes Lower Quartile $=125$ minutes	M1	Either one seen	
		19 minutes	A1		
	(b)	$h=121$	B1		
	(ci)	115.75 cm	B1	c.a.o.	
	(cii)	12.1 cm	B1		
					[6]
9		In France: $\$780=€\,\dfrac{780}{1.5953}=€488.9362502$	M1	Conversion	
		In Singapore: $\$1=\dfrac{€488.9362502+€1}{780}=€0.6281233977$ $\$1=€0.62$ (2 d.p.)	A1	Accept 4 d.p.	
					[2]

10		Gradient $=\dfrac{q-3}{p-(-2)}$	M1	o.e.	
		$\dfrac{q-3}{p+2}=\dfrac{1}{3}$ $3q-9=p+2$ $p=3q-11$	A1		
					[2]
11		$\dfrac{3a(3a+1)-2(4a-1)}{(4a-1)(3a+1)}$	M1	Common denominator	
		$=\dfrac{9a^2+3a-8a+2}{(4a-1)(3a+1)}$ $=\dfrac{9a^2-5a+2}{(4a-1)(3a+1)}$	M1		
					[2]
10	(ai)	$xy\left(x^2+y^2\right)$	B1		
	(aii)	$15cd-10ce+12d^2-8de$ $=5c(3d-2e)+4d(3d-2e)$	M1	Grouping or M0	
		$=(5c+4d)(3d-2e)$	A1	or B1B1	
	(b)	$10x^2+15ax-4ax-6a^2$	M1		
		$=10x^2+11ax-6a^2$	A1		
					[5]
13		$\dfrac{7+n}{25+n}=\dfrac{3}{5}$	M1	Form equation	
		$35+5n=75+3n$ $2n=40$ $n=20$	A1		
					[2]

14		Since D is equidistant from A, B and C, $AD = BD = CD$. Let angle $CBD = x$.			
		Angle $BCD = x$ (base angles of an isos. triangle) Angle $BDC = 180° - 2x$ (angles sum of triangle)	M1		
		Angle $ADB = 2x$ (adj. angles on a straight line) Angle $ABD = 90° - 2x$ (base angles of an isos. triangle)	A1		
		Hence, angle $ABC = 90° - x + x$ (shown)	AG		
		<u>Alternatively:</u>			
		Since D is equidistant from A, B and C, AD, BD and CD can be taken as three radii of a circle, centre D, where $AD = BD = CD$.	M1	Attempt to link points to a circle	
		Since $AD = CD$, AC is the diameter of the circle. Also, B lies on the circumference of the circle. Thus, by right angle in semicircle property, angle ABC is a right angle.	A1 AG	Mention diameter or semicircle with reason given	
					[2]
15		$(2n-1)^2 - 2(n-5)(2n-1)$ $= 4n^2 - 4n + 1 - 2\left(2n^2 - 10n - n + 5\right)$	M2	M1 for each correct expansion	
		$= 4n^2 - 4n + 1 - 4n^2 + 22n - 10$ $= 18n - 19 = 3(6n-3)$	A1	Factorise out 3 o.e.	
		Since 3 is a factor of the expression, it is a multiple of 3 for all integer values of n.	AG	Must conclude	
					[3]
16		Since the ratio of the volumes are $1^3 : 3^3 = 1:27$, it is misleading as it is supposed to be tripled.	B1	Compare volumes o.e.	
					[1]
17	(a)		B1		
	(b)	$(C \cap D) \cup (C \cup D)'$	B1	o.e.	
					[2]

18	(a)	By similar triangles, $\frac{h}{20}=\frac{r}{10}\Rightarrow h=2r$ $d=20-h=20-2r$ (Shown)	B1 AG		
	(b)	$\frac{1}{3}\pi(10)^2(20)-\frac{1}{3}\pi r^2h=\frac{1}{3}\pi r^2h$	M1	Form equation	
		$2000\pi=2\pi r^2(2r)$ $r^3=500$ $r=\sqrt[3]{500}=7.93700526$	M1	Find r o.e.	
		$d=20-2\sqrt[3]{500}=4.12598948=4.13$ (3 s.f.)	A1		
					[4]
19			B2	B1 for coordinates on x and y-axis B1 for shape and scale drawn	
					[2]
20		$\frac{(3x+4)(x-4)}{(2x+1+x+3)(2x+1-x-3)}$	M2	M1 for each factorisation s.o.i.	
		$=\frac{(3x+4)(x-4)}{(3x+4)(x-2)}$ $=\frac{x-4}{x-2}$	A1		
					[3]

21	(a)	$\mathbf{T}=\begin{pmatrix}103.2+3x & 402.3 & 77\\ 129+2x & 383 & 88.9\end{pmatrix}$	B2	B1 for any 3 correct elements B1 for all correct	
	(b)	$103.2+3x=129+2x+5.6$	M1	Form equation	
		$x=31.4$	A1		
	(c)	$\mathbf{B}=\begin{pmatrix}1.60\\ 2.80\end{pmatrix}$	B1	c.a.o.	
					[5]
22	(a)	$3x(4x-y)=2x(3x+2y)$ $12x^2-3xy=6x^2+4xy$	M1	Expand	
		$7xy=6x^2$ $y=\frac{6x}{7}$	A1		
	(b)	$2(3x+4x-y)+16=2(2x+3x+2y)$ $14x-2y+16=10x+4y$ $6y-4x=16$	M1	Find equation o.e.	
		$6\left(\frac{6x}{7}\right)-4x=16$	M1	Substitute	
		$\frac{8x}{7}=16$ $x=14$	A1		
					[5]

23	(a)	304°	B1		
	(b)	Using cosine rule, $AC=\sqrt{63^2+95^2-2(63)(95)\cos 64°}$	M2	Deduct M1 for any wrong value used	
		$AC=88.01532465=88.0$ m (3 s.f.)	A1	c.a.o.	
	(c)	Using sine rule, $\frac{\sin\angle BAC}{95}=\frac{\sin 64°}{88.01532465}$ $\angle BAC=\sin^{-1}\left(\frac{95\sin 64°}{88.01532465}\right)=75.95846268°$	M1		
		Bearing $=360°-(180°-60°)-75.95846268°$	M1	$180°-60°$ s.o.i.	
		$=164.0415373°=164.0°$ (1 d.p.)	A1	c.a.o.	
					[7]
24	(a)	$I=\frac{k}{D^2}$ (k is a constant)			
		When $D=150$, $I=1370$. $1370=\frac{k}{150^2}\Rightarrow k=3.0825\times 10^7$	M1	Find constant	
		When $D=228$, $I=\frac{3.0825\times 10^7}{228^2}$ $=592.9709141=593$ (3 s.f.)	A1		
	(b)	The Sun's radiation would be quartered.	B1	'Quartered' o.e.	
					[3]
25	(a)	3, 8, 13	B2	B1 for any two B1 for all correct	
	(b)	$5n-2$	A1		
					[3]

26		By Pythagoras' Theorem, $AH=\sqrt{8^2+6^2}=10$ cm		M1	s.o.i.	
		$AF^2=8^2+12^2=208$		M1		
		$AG=\sqrt{208+6^2}=\sqrt{244}=15.62049935$ cm		M1		
		Shortest length $=17-15.62049935$ $=1.379500648=1.38$ cm (3 s.f.)		A1		
						[4]
27	(a)	$\overrightarrow{NM}=\mathbf{a}-\mathbf{b}$ $\overrightarrow{NP}=\frac{2}{5}(\mathbf{a}-\mathbf{b})$	$\overrightarrow{MN}=\mathbf{b}-\mathbf{a}$ $\overrightarrow{MP}=\frac{3}{5}(\mathbf{b}-\mathbf{a})$	M1	Find $\overrightarrow{NP}$ or $\overrightarrow{MP}$	
		$\overrightarrow{OP}=\mathbf{b}+\frac{2}{5}\mathbf{a}-\frac{2}{5}\mathbf{b}$ $\overrightarrow{OP}=\frac{2}{5}\mathbf{a}+\frac{3}{5}\mathbf{b}$ $=\frac{1}{5}(2\mathbf{a}+3\mathbf{b})$ (Shown)	$\overrightarrow{OP}=\mathbf{a}+\frac{3}{5}\mathbf{b}-\frac{3}{5}\mathbf{a}$ $\overrightarrow{OP}=\frac{2}{5}\mathbf{a}+\frac{3}{5}\mathbf{b}$ $=\frac{1}{5}(2\mathbf{a}+3\mathbf{b})$ (Shown)	A1 AG		
	(b)	$\overrightarrow{OQ}=\mathbf{a}+\frac{1}{5}\mathbf{a}+\frac{9}{5}\mathbf{b}$		M1		
		$=\frac{6}{5}\mathbf{a}+\frac{9}{5}\mathbf{b}$ $=3\left(\frac{2}{5}\mathbf{a}+\frac{3}{5}\mathbf{b}\right)=3\overrightarrow{OP}$		A1		
		Since $\overrightarrow{OQ}=3\overrightarrow{OP}$, OQ is a scalar multiple of OP, with common point O. Thus O, P and Q lie on a straight line.		A1	Must state common point	
						[5]

END OF MARKING SCHEME