121/1 MS
MATHEMATICS (Alt. A)
Paper 1
March 2022
MARKING SCHEME

THE KENYA NATIONAL EXAMINATIONS COUNCIL

Kenya Certificate of Secondary Education

MATHEMATICS (Alt. A)

PAPER 1

MARKING SCHEME
(CONFIDENTIAL)

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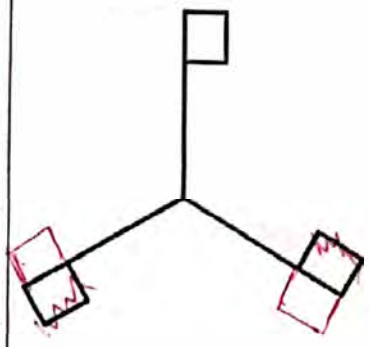
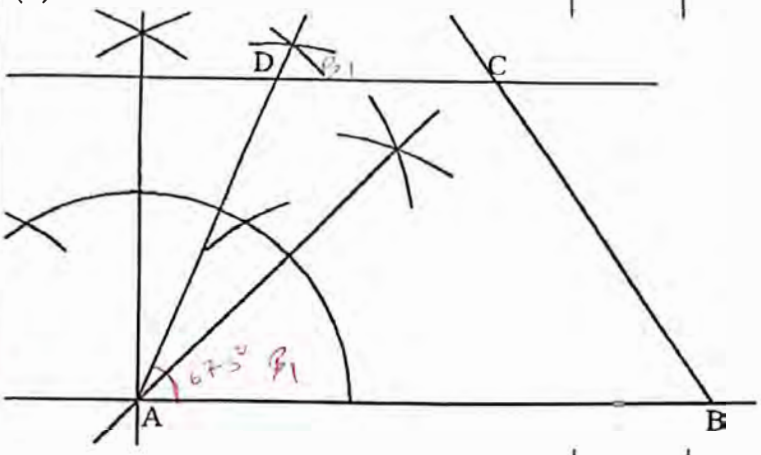
This marking scheme consists of 15 printed pages

MATHEMATICS ALT. A 121/1 PAPER 1 MARKING SCHEME

No.	Marking Scheme	Marks	Comments
1.	Num $= \frac{9}{5} \div \frac{2}{3}$ of $\frac{9}{4} - \frac{3}{10}$ $= \frac{9}{5} \div \frac{3}{2} - \frac{3}{10}$ $= \frac{9}{5} \times \frac{2}{3} - \frac{3}{10}$ $= \frac{6}{5} - \frac{3}{10}$ or $\frac{12-3}{10}$ $= \frac{9}{10}$ Den $= \frac{5}{6} + \frac{22}{39} \times \frac{13}{11}$ $= \frac{5}{6} + \frac{2}{3}$ or $\frac{5+4}{6}$ $= \frac{9}{6} = \frac{3}{2}$ Num ÷ Den $= \frac{9}{10} \div \frac{3}{2}$ $= \frac{9}{10} \times \frac{2}{3}$ $= \frac{3}{5}$	M1 M1 M1 A1 4	equivalent e.g. $\frac{12}{15}, \frac{6}{20}$ or equivalent Accept 0.6
2.	L.C.M = 5 × 6 × 7 = 210 min = 3h 30 min Time they will ring together again = 8.48 am + 3h 30 min = 12.18 pm	M1 M1 A1 3	2 × 3 × 5 × 7 Correct addition 12:18 pm | 1218 h | 12:18 h Do not allow 12:18
3.		B1 B1 B1 3	120° seen or measured ±1° 1st arm ✓ 2nd arm ✓

No.	Marking Scheme	Marks	Comments
4.	$\frac{5}{3} - 2x < 1 - \frac{2}{3}x$ $5 - 6x < 3 - 2x$ $2 < 4x$ $\frac{1}{2} < x$ $1 - \frac{2}{3}x \leq 2 - x$ $x - \frac{2}{3}x \leq 2 - 1$ $\frac{1}{3}x \leq 1$ $x \leq 3$ $\frac{1}{2} < x \leq 3$ Integral values 1, 2, 3	B1 M1 B1 A1 B1 3	$x > \frac{1}{2}$ use of equal sign = $\frac{1}{2} \leq x \leq 3$ B1 B1
5.	Let the polygon be n sided $(n-2)180 = 90 + 90 + 150(n-2)$ $180n - 360 = 180 + 150n - 300$ $30n = 360 + 180 - 300 = 240$ $n = 8$	M1 M1 A1 3	$(n-2)90$ $90+90+x(180-150)=x$ $30x=120$ $x=6$ $n=6+2=8$ M1M1A1 $30n=240$ $90+90(n-2)30=360$ M1 $(n-2)30=180$ $30n=240$ M1 $n=8$ A1
6.	Time taken by Kipsang to run 300 m $= \frac{300}{5}$ $= 60$ sec Mutungas speed $= \frac{(310 + 50)}{60}$ $= 6$ m/s	M1 M1 A1 3	$\frac{310}{5} - \frac{10}{5}$ or $62-2$ M1 or $\frac{360}{60}$ $300:5=360:x$ $\frac{300}{5}=\frac{360}{x}$ $x=6$ M1M1A1

No.	Marking Scheme	Marks	Comments
7.	$(4+2y)^2-(2y-4)^2$ $=[(4+2y)-(2y-4)][(4+2y)+(2y-4)]$ $=[4+2y-2y+4][4+2y+2y-4]$ M1 $=8\times 4y$ $=32y$ A1	M1 A1 2	$16+16y+4y^2-4y^2+16y-16$ M1 $32y$ A1
8.	Commission earned on selling Table $=\frac{8}{100}\times 4500$ (i) $=$ sh 360 (i) Chair $=\frac{5}{100}\times 2000$ (ii) $=$ sh 100 (ii) Let the no. of chairs sold $= x$ $360(x-3)+100x=3980$ M1 $460x=5060$ $x=11$ A1	M1 M1 A1 3	$360\times 4+100(x+1)=3980$ M1 $x=8$ no of chairs $=8+3=11$ M1A1 either (i) or (ii) Any of (i) and (ii) $360x+100x=3980$ M1 $x-y=3$ $460x=5060$ M1 $x=11$ A1
9.	(a) $T=\begin{pmatrix}3\\5\end{pmatrix}-\begin{pmatrix}-6\\2\end{pmatrix}=\begin{pmatrix}9\\3\end{pmatrix}$ B1 (b) $\begin{pmatrix}a\\b\end{pmatrix}=\begin{pmatrix}-4\\2\end{pmatrix}-\begin{pmatrix}9\\3\end{pmatrix}$ M1 $a=-13,\ b=-1$ $P(-13,-1)$ A1	B1 M1 A1 3	Seeing $\begin{pmatrix}9\\3\end{pmatrix}$ without working or $\begin{pmatrix}9\\3\end{pmatrix}-\begin{pmatrix}a\\b\end{pmatrix}=\begin{pmatrix}-4\\2\end{pmatrix}$ $P=(-13,-1)$ alone
10.	Distance from A to B (Using Johns Vehicle) $=\frac{12\times 2805}{110}$ M1 $=306$ km Cost of fuel that Jane would required $=\left(\frac{12.5\times 306}{100}\right)\times 110$ M1 $=$ Ksh 4207.50 A1	M1 M1 A1 3	John $\Rightarrow$ 12 litres $=2805$ 1 litre $=\frac{2805}{12}$ $=\frac{12}{2805}\times 2805$ M1M1 $=4207.50$ A1 OR $\frac{2805}{110}=25.5$ $25.5\times 12=306$ M1 $12.5\rightarrow 100$ 38.25×110 M1 $=4207.50$ A1 4207.5 (allow)

No.	Marking Scheme	Marks	Comments
11.	$2\theta - 15 + 30 = 90$ M1 $50 = 105$ $\theta = 21°$ A1	M1 A1 2	
12.	(a)  (b) DC = 3.1cm ± 0.1	B1 B1 B1 B1 4	✓ Construction of 67.5° at A and locating point D. ✓ Construction of DC//AB ✓ Trapezium ABCD
13.	Departure (from Msa) = 2.30 am = 0230h (Tue) Arrival (Mtito Andei) = 0230 + 3h12min = 0542h (Tue) M1 NB: 36hrs = 1day 12hours Departure (Mtito Andei) = 0542h (Tue) + 1day + 12 hrs = 0542h (wed) + 12hours = 1742hrs (Wed) Arrival (Nairobi) = 1742 + 5h 25min M1 = 2307 h = 11.07 pm Wednesday A1	M1 M1 A1 3	

No.	Marking Scheme	Marks	Comments
14.	V.S.F $= \frac{7}{8} : 1$ $= 7 : 8$ L.S.F $= \sqrt[3]{7} : 2$ M1 Let the height of frustum $= x$ $\frac{12 - x}{12} = \frac{\sqrt[3]{7}}{2} = \frac{1.913}{2}$ M1 $24 - 2x = 22.956$ $2x = 1.044$ $x = 0.522$ cm A1	M1 M1 A1 3	1 item. V.S.F = 2:7 $\frac{2}{\sqrt[3]{7}} = \frac{12}{y}$ M1 $y = 11.48$ frust = 12 − 11.48 M1 = 0.52 A1.
15.	$8^{x+1} - 2^{3x-1} = 120$ $(2^3)^{x+1} - 2^{3x-1} = 120$ $2^{3x+3} - 2^{3x-1} = 120$ $2^{3x} \times 2^3 - \frac{2^{3x}}{2} = 120$ M1 $2^{3x}\left(2^3 - \frac{1}{2}\right) = 120$ $2^{3x} = 120 \times \frac{2}{15} = 16 = 2^4$ M1 $3x = 4$ M1 $x = 1\frac{1}{3}$ A1	M1 ~~M1~~ M1 M1 A1 4	$2^{3x} \cdot 2^3 - 2^{3x} \cdot 2^{-1} = 120$ M1 $2^{3x} = 2^4$ M1 $3x = 4$ M1 $x = 1\frac{1}{3}$ A1 Add/sub of indices reversed. accept 1·3 or 1·333... don't accept 4/3 / x decimals

$2 \times 2^{3x} - 2^{3x} = 120$ M1
$16 \times 2^{3x} - 2^{3x} = 240$
$15 \times 2^{3x} = 2400$
$2^{3x} = 16$
$2^{3x} = 2^4$ M1
$3x = 4$ M1
$x = 1\frac{1}{3}$ A1

$2^{3x} \cdot 2^3 - 2^{3x} \cdot 2^{-1} = 120 - 8$
$2^{3x} \cdot 2^3 - 2^{3x} \cdot 2^{-1} = 2^7 - 2^3$
$2^{3x+3} = 2^7$
$3x + 3 = 7$
$x = 1\frac{1}{3}$

Can only compare when we have 0 or ÷

No.	Marking Scheme	Marks	Comments
16.	(a) $\frac{dy}{dx} = 6x^2 - 6x - 12$ B1	B1	
	(b) At $x = 1$		
	$\frac{dy}{dx} = 6\times1 - 6\times1 - 12 = -12$ M1	M1	
	$m_1 \times -12 = -1$		
	$m_1 = \frac{1}{12}$		
	$\frac{y+1}{x-1} = \frac{1}{12}$ M1	M1	$y = mx + c$ $-1 = \frac{1}{12}\times1 + c$ M1
	$12(y+1) = x - 1$		
	$y + 1 = \frac{1}{12}x - \frac{1}{12}$		
	$y = \frac{1}{12}x - 1\frac{1}{12}$ A1	A1	$-\frac{13}{12}$ (allow) $y = \frac{1}{12}x - 1.083$ Ao.
		4	

No.	Marking Scheme	Marks	Comments
17.	(a) No. of tins $= \frac{60}{10} \times \frac{30}{10} \times \frac{30}{15}$ M1 $= 6 \times 3 \times 2$ $= 36$ A1	M1 A1	a) $\frac{60}{10} \times \frac{30}{10} \times \frac{30}{15} = 4 \times 3 \times 3$ M1 $= 36$ A1
	(b) Mass of tin and jam $= 990\,g + 300\,g$ M1 $= 1290\,g$	M1	(allow : kg) b) $560 + (36 \times 300) + (36 \times 990)$ M1 M1
	Mass of carton full jam tins $= (560 + 1290 \times 36)\,g$ M1 $= 47000\,g$ $= 47\,kg$	M1	$= \frac{600}{47}$ M1 $= 12$ cartons A1
	Let N be the number of cartons carried by pick up $47N \leq 600$ M1 $N \leq 12.76$ Max N = 12 A1	M1 A1	$47N = 600$
	(c) Retailers S.P $= \text{Ksh}(110 \times 36)$ M1 $= \text{Sh } 3960$ per carton Retailers profit $= \text{Ksh}(3960 - 2880)$ M1 $= \text{sh } 1080$ Retailers % profit $= \frac{1080}{2880} \times 100$ M1 $= 37.5\%$ A1	M1 M1 M1 A1	Alternative c) S.P $= 2880/12 = 3456$ S.P $= 3960 \times 12 = 47520$ M1 % $= \frac{47520 - 3456}{3456} \times 100$ M1 M1 $= 37.5\%$ A1 S.P $\frac{2880}{36} =$ M1 $= 80$ profit $= 110 - 80$ M1 % profit $= \frac{30}{80} \times 100\%$ $= 37.5\%$ follow through
		10	
18.	(a)		

No.	Marking Scheme	Marks	Comments
18.	Area of equilateral triangle		
	$= \frac{1}{2} \times 10 \times 10 \times \sin 60$ M1	M1	
	$= 43.30$ sq units A1	A1	CAO
	(b) Volume of triangular prism VABC		
	$= \frac{1}{3} \times 43.30 \times 15$ M1	M1	
	$= 216.5 \text{ cm}^3$ A1	A1	
	(c) (i) h = Height of cone		
	$\frac{1}{3} \times \frac{22}{7} \times 3.5^2 \times h = 216.5$ M1	M1	
	$h = \left(\frac{3 \times 7 \times 216.5}{22 \times 3.5^2}\right)$		
	$= 16.87 \text{ cm}$ A1	A1	
	(ii) Let l = slant height of cone		
	$l = \sqrt{(3.5^2 + 16.87^2)}$ M1	M1	
	$= \sqrt{296.8}$		
	$= 17.23 \text{ cm}$ A1	A1	
	Surface area of cone		
	$= \frac{22}{7} \times 3.5^2 + \frac{22}{7} \times 3.5 \times 17.23$ M1	M1	
	$= 38.5 + 189.53$		
	$= 228.03 \text{ cm}^2$ A1	A1	
		10	

No.	Marking Scheme	Marks	Comments
19.	(a) $25x + 35y = 13500$ or $5x + 7y = 2700$ B1	B1	
	$21x + 38y = 12200$ B1	B1	
	(b) $\begin{pmatrix} 5 & 7 \\ 21 & 38 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2700 \\ 12200 \end{pmatrix}$		
	Determinant of coefficient matrix		
	$= 5\times 38 - 7\times 21$		
	$= 43$		
	Inverse of coefficient matrix		
	$= \frac{1}{43}\begin{pmatrix} 38 & -7 \\ -21 & 5 \end{pmatrix}$ M1	M1	for inverse
	$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{43}\begin{pmatrix} 38 & -7 \\ -21 & 5 \end{pmatrix}\begin{pmatrix} 2700 \\ 12200 \end{pmatrix}$ M1	M1	pre multiplying by inverse
	$= \frac{1}{43}\begin{pmatrix} 38\times 2700 + -7\times 12200 \\ -21\times 2700 + 5\times 12200 \end{pmatrix}$ M1	M1	Attempting to solve
	$= \frac{1}{43}\begin{pmatrix} 17200 \\ 4300 \end{pmatrix}$		
	$= \begin{pmatrix} 400 \\ 100 \end{pmatrix}$ M1	M1	Simplifying
	Textbook = sh.400 Exercise book sh.100 A1 (both)	A1	For both
	(c) Amount spent by Kasuku school		
	$= 25\times\frac{95}{100}\times 400 + 35\times\frac{105}{100}\times 100$ M1	M1	
	= Ksh 13175		
	Difference		
	= 13500 − 13175 M1	M1	
	= Ksh 325 A1	A1	
		10	

No.	Marking Scheme	Marks	Comments
20.	(a)(i) $AC^2 = 8^2 + 6^2 - 2\times 8\times 6\times \cos 70$ M1 $= 67.17$ $AC = 8.2$ cm A1	M1 A1	follow through
	(ii) Length DC $\frac{1}{2}$ of AC $= \frac{1}{2}$ of 8.2 cm $= 4.1$ cm $\sin 25 = \frac{4.1}{DC}$ M1 $DC = \frac{4.1}{\sin 25}$ $= 9.7$ cm A1	M1 A1	$\frac{8.2}{\sin 65} = \frac{DC}{\sin 65}$ $\sin 65 = \frac{4.1}{DC}$
	(iii) Angle BAD $\frac{8.2}{\sin 70} = \frac{6}{\sin BAC}$ M1 $\sin BAC = \frac{6\times \sin 70}{8.2}$ $BAC = \sin^{-1} 0.6876$ $BAC = 43.44$ Base angles of triangle DAC $= \frac{180-50}{2}$ $= 65°$ $\angle BAD = 65 + 43.44$ M1 $= 108.4°$ A1	M1 M1 A1	FT
	(b) Area of quadrilateral $= \frac{1}{2}\times 8\times 6\times \sin 70 + \frac{1}{2}\times 9.7^2\times \sin 50$ M1M1 $= 22.55 + 36.04$ $= 58.6$ cm^2 A1	M1M1 A1 **10**	$\frac{1}{2}\times 8\times 8.2\sin 43.44°$ Quadrilateral triangles

No.	Marking Scheme	Marks	Comments
21.	(a) $(x-4)^2 = (x-8)(2x+7)$		
	$x^2 - 8x + 16 = 2x^2 + 7x - 16x - 56$ M1	M1	
	$x^2 - x - 72 = 0$ M1	M1	
	$(x-9)(x+8) = 0$ M1	M1	
	$x = 9$ or $x = -8$ A1	A1	
	(b)		
	Time taken by John $= \frac{6}{2x-3}$ (i)	B1	For any (i) or (ii)
	Time taken by Peter $= \frac{2.4}{x}$ (ii)		
	$\frac{6}{2x-3} - \frac{2.4}{x} = \frac{16}{60} = \frac{4}{15}$ M1	M1	
	$6(15x) - 2.4 \times 15 \times (2x-3) = 4x(2x-3)$		
	$90x - 72x + 108 = 8x^2 - 12x$	M1	
	$8x^2 - 30x - 108 = 0$ or $4x^2 - 15x - 54 = 0$ M1		
	$x = \frac{15 \pm \sqrt{(225 - 4 \times 4 \times -54)}}{8}$		
	$x = \frac{15 \pm 33}{8}$ M1	M1	
	$x = 6$ or $x = -2.25$		
	$x = 6$ A1	A1	
	Time taken by John $= \frac{6}{2x-3} = \frac{6}{2 \times 6 - 3}$		
	$= \frac{6}{9}\text{h} = \frac{2}{3}\text{h}$		
	$= 40$ min B1	B1	
		10	

No.	Marking Scheme	Marks	Comments
22.	(a)(i) $\mathbf{AB} = \begin{pmatrix} -8 \\ 2 \end{pmatrix} - \begin{pmatrix} -4 \\ 6 \end{pmatrix}$ M1	M1	
	$= \begin{pmatrix} -4 \\ -4 \end{pmatrix}$ A1	A1	
	(ii) $\mathrm{M}\left(\frac{-4 + -8}{2}, \frac{6 + 2}{2}\right) = \mathrm{M}(-6, 4)$ B1	B1	
	$\mathrm{N}(-2, 3)$ B1	B1	
	(iii) $\mathbf{NM} = \begin{pmatrix} -6 \\ 4 \end{pmatrix} - \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ M1	M1	
	$= \begin{pmatrix} -4 \\ 1 \end{pmatrix}$		
	$\lvert\mathbf{NM}\rvert = \sqrt{(-4)^2 + 1^2} = \sqrt{17}$ M1	M1	
	$\lvert\mathbf{NM}\rvert = 4.123$ A1	A1	
	(b) $\mathbf{CA} = \begin{pmatrix} -4 \\ 6 \end{pmatrix} - \begin{pmatrix} \div 2 \\ a \end{pmatrix} = \begin{pmatrix} -6 \\ 6 - a \end{pmatrix}$		
	$\begin{pmatrix} -6 \\ 6 - a \end{pmatrix} = k\begin{pmatrix} -8 \\ 2 \end{pmatrix}$ M1		
	$k = \frac{3}{4}$ as $\frac{4}{3}$		
	$6 - a = \frac{1}{2} \times 2$ M1	M1	
	$a = 4\frac{1}{2}$ as 4.5 A1	A1	
		10	

$\sqrt{(-2-6)^2 + (3-4)^2}$ M1M1
$= \sqrt{17}$
$= 4.123$ A1.
OR
$-6 : -8$
$6 - a : 2$
$\frac{6-a}{2} = \frac{-6}{-8}$ M1M1
$-48 + 8a = -12$
$a = 4.5$ A1

CA // OB : equal gradient
$OB = -\frac{1}{4}$
$-\frac{1}{4} = \frac{a-6}{2-4}$ M1M1
$a = 4.5$ A1

No.	Marking Scheme	Marks	Comments
23.	(a)		

	Tally	Frequency	Mid-point (x)	xf	CF
40 – 44	////	4	42	168	4
45 – 49	### //	7	47	329	11
50 – 54	### ///	8	52	416	19
55 – 59	### /	6	57	342	25
60 – 64	### //	7	62	434	32
65 – 69	///	3	67	201	35
70 – 74	##	5	72	360	40
		$\sum f = 40$		2250	

B1	√ class interval
B1	√ frequency
B1	√ Mid-points
B1	√ xf

(b) Modal classes

50 – 54

B1

(c) (i)

$$\bar{x} = \frac{2250}{40}$$

M1

$$= 56.25 \text{ kg}$$

A1

(ii) Median student $= 20^{th}$

B1 √ CF

Mass of 20th student

$$= 54.5 + \frac{5}{6} \times 1$$

M1

$$= 55\frac{1}{3} \text{ kg}$$

A1

M1	$54.5 + \frac{(20-19)}{6} 5$ (allow)
A1	Accept 55.5 ≈ 55.33

Only class with is equal.

$$\frac{M - 54.5}{59.5 - 54.5} = \frac{20 - 19}{25 - 19}$$ M1

$$\left(\frac{M - 54.5}{5} = \frac{1}{6}\right)$$ M1

$6M - 327 = 5$

$M = 55.33$ A1

10

No.	Marking Scheme	Marks	Comments
24.	(a)(i) When $x = -2$		
	$y = \frac{1}{3}\times(-2)^3 - \frac{1}{2}\times(-2)^2 - 2\times(-2) - \frac{1}{3}$ M1	M1	Substitution
	$= -1$ A1	A1	
	(ii) $\frac{dy}{dx} = x^2 - x - 2$ M1	M1	Correct gradient function
	At $x = -2$		
	$\frac{dy}{dx} = 4 + 2 - 2$ M1	M1	$(-2)^2 - (-2) - 2$
	$= 4$		
	Equation of tangent to the curve at $x = -2$		
	$\frac{y-(-1)}{x-(-2)} = 4$ M1	M1	$-1 = 4(-2) + c$ M1
	$y + 1 = 4x + 8$		
	$y = 4x + 7$ A1	A1	$y - 4x = 7$ / $y - 4x - 7 = 0$ / $-\frac{4}{7}x + \frac{y}{7} = 1$
	(b) $\frac{dy}{dx} = x^2 - x - 2 = 0$ at turning point M1	M1	
	$(x+1)(x-2) = 0$ M1	M1	
	$x = -1$ *or* $x = 2$ A1		
	Coordinates of the turning points	A1	
	$\left(-1, \frac{5}{6}\right)$ and $\left(2, -3\frac{2}{3}\right)$ A1 C.A.O	A1B1	Don't $\left(-\frac{11}{3}\right)$ ~~decimal~~ or improper fraction is allowed.
		10	