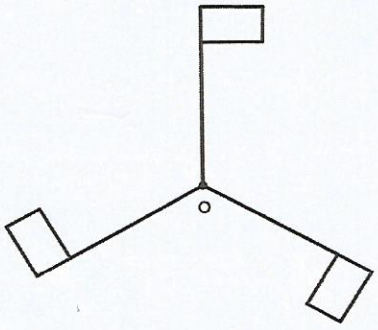
5.0 THE YEAR 2021 KCSE EXAMINATION MARKING SCHEMES

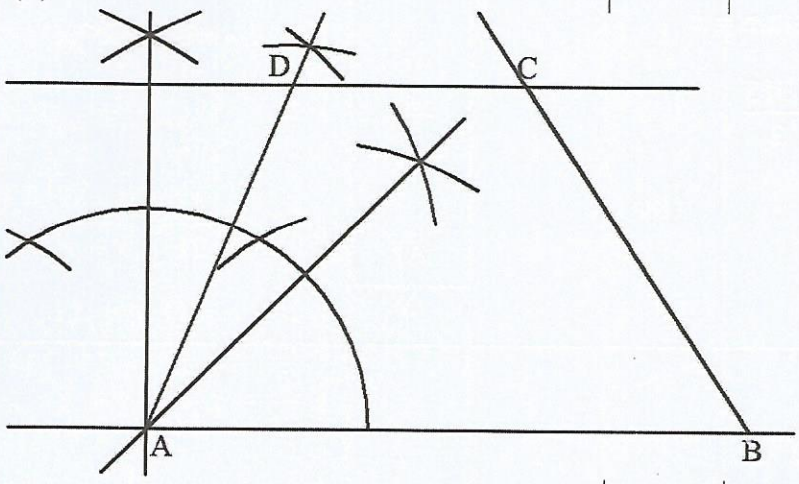
5.1 MATHEMATICS ALTERNATIVE A (121)

5.1.1 Mathematics Alt A Paper 1 (121/1)

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 $\frac{12-3}{10}$ $= \frac{9}{10}$	M1	or equivalent
	Den $= \frac{5}{6} + \frac{22}{39} \times \frac{13}{11}$ $= \frac{5}{6} + \frac{2}{3}$ or $\frac{5+4}{6}$ $= \frac{9}{6} = \frac{3}{2}$	M1	or equivalent
	Num ÷ Den $= \frac{9}{10} \div \frac{3}{2}$ $= \frac{9}{10} \times \frac{2}{3}$ $= \frac{3}{5}$	M1 A1	
		4	
2.	L.C.M $= 5 \times 6 \times 7$ $= 210$ min $= 3$h 30 min Time they will ring together again $= 8.48$ am $+ 3$h 30 min $= 12.18$ pm	M1 M1 A1	Accept 1218h, 12:18h, 12:18pm
		3	
3.		B1 B1 B1	120° seen or measured 1st arm ✓ 2nd arm ✓
		3	

No.	Marking Scheme	Marks	Comments
4.	$\frac{5}{3} - 2x < 1 - \frac{2}{3}x$ $5 - 6x < 3 - 2x$ $2 < 4x$ $\frac{1}{2} < x$ .....(i) $1 - \frac{2}{3}x \leq 2 - x$ $x - \frac{2}{3}x \leq 2 - 1$ $\frac{1}{3}x \leq 1$ $x \leq 3$ .....(ii) $\frac{1}{2} < x \leq 3$ Integral values 1, 2, 3	B1 B1 B1 **3**	
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**	
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**	

No.	Marking Scheme	Marks	Comments
7.	$(4+2y)^2-(2y-4)^2$ $=16+16y+4y^2-(4y^2-16y+16)$ $=16+16y+4y^2-4y^2+16y-16$ $=32y$	M1 A1 **2**	
8.	Commission earned on selling Table $=\frac{8}{100}\times 4500$ (i) $=$ sh 360 Chair $=\frac{5}{100}\times 2000$ (ii) $=$ sh 100 Let the no. of chairs sold $=x$ $360(x-3)+100x=3980$ $460x=5060$ $x=11$	M1 M1 A1 **3**	Either (i) or (ii)
9.	(a) $T=\begin{pmatrix}3\\5\end{pmatrix}-\begin{pmatrix}-6\\2\end{pmatrix}=\begin{pmatrix}9\\3\end{pmatrix}$ (b) $\begin{pmatrix}a\\b\end{pmatrix}=\begin{pmatrix}-4\\2\end{pmatrix}-\begin{pmatrix}9\\3\end{pmatrix}$ $a=-13,\ b=-1$ $P(-13,-1)$	B1 M1 A1 **3**	
10.	Distance from A to B (Using Johns Vehicle) $=\frac{12\times 2805}{110}$ $=306$ km Cost of fuel that Jane would requires $=\left(\frac{12.5\times 306}{100}\right)\times 110$ $=$ Ksh 4207.50	M1 M1 A1 **3**	

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

No.	Marking Scheme	Marks	Comments
14.	V.S.F $= \frac{7}{8} : 1$ $= 7 : 8$ L.S.F $= \sqrt[3]{7} : 2$ Let the height of frustum $= x$ $\frac{12 - x}{12} = \frac{\sqrt[3]{7}}{2} = \frac{1.913}{2}$ $24 - 2x = 22.956$ $2x = 1.044$ $x = 0.522$ cm	M1 M1 A1 3	
15.	$8^{x+1} - 2^{3x-1} = 120$ $\left(2^3\right)^{x+1} - 2^{3x-1} = 120$ $2^{3x+3} - 2^{3x-1} = 120$ $2^{3x} \times 2^3 - \frac{2^{3x}}{2} = 120$ $2^{3x}\left(2^3 - \frac{1}{2}\right) = 120$ $2^{3x} = 120 \times \frac{2}{15} = 16 = 2^4$ $3x = 4$ $x = 1\frac{1}{3}$	M1 M1 M1 A1 4	

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

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

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

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

No.	Marking Scheme	Marks	Comments
20.	(a)(i) $AC^2 = 8^2 + 6^2 - 2\times8\times6\times\cos 70$	M1	
	$= 67.17$		
	$AC = 8.2$ cm	A1	
	(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	
	(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	
	(b) Area of quadrilateral		
	$= \frac{1}{2}\times8\times6\times\sin 70 + \frac{1}{2}\times9.7^2\times\sin 50$	M1M1	
	$= 22.55 + 36.04$	A1	
	$= 58.6$ cm^2	**10**	

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

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

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

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	
	$= -1$	A1	
	(ii) $\frac{dy}{dx} = x^2 - x - 2$	M1	
	At $x = -2$		
	$\frac{dy}{dx} = 4 + 2 - 2$	M1	
	$= 4$		
	Equation of tangent to the curve at $x = -2$		
	$\frac{y-(-1)}{x-(-2)} = 4$	M1	
	$y + 1 = 4x + 8$		
	$y = 4x + 7$	A1	
	(b) $\frac{dy}{dx} = x^2 - x - 2 = 0$ at turning point	M1	
	$(x+1)(x-2) = 0$	M1	
	$x = 1$ *or* $x = 2$		
	Coordinates of the turning points		
	$\left(-1, \frac{5}{6}\right)$ and $\left(2, -3\frac{2}{3}\right)$	A1B1	
		10	