MARANDA HIGH SCHOOL

Kenya Certificate of Secondary Education

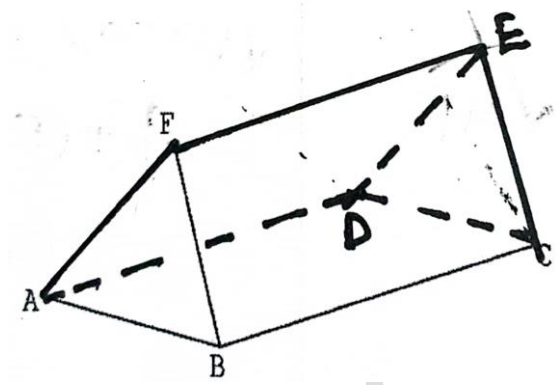
MOCK MARKING SCHEME

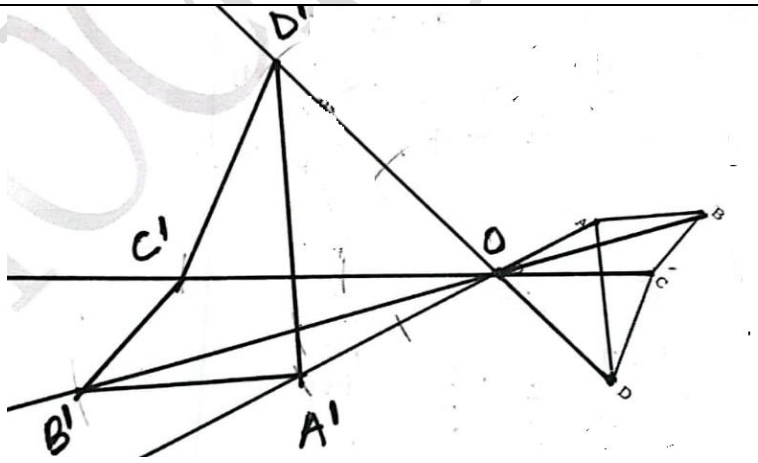
121/1 MATHEMATICS Paper 1

September 2022 – TIME $2\frac{1}{2}$ Hours

	WORKING		COMMENTS
1	$\frac{0.01}{100}$ of $\left[\frac{\frac{4+6-3}{8}}{\frac{180-5-16}{40}}\right]$ $= \frac{1}{10000}$ of $\left[\frac{\frac{7}{8}}{\frac{159}{40}}\right]$ $= 10000 \left[\frac{7}{8} \times \frac{40}{159}\right]$ $= \frac{7}{200 \times 159}$ $= \frac{7}{31800}$	M1 M1 M1 A1	√Resolving the numerator √Resolving the denominator and using its reciprocal √one operation remaing in the denominator √C.A.O
		04	
2	$M: C: A = 2x: 3x: 1.5x$ $x = \frac{65}{13}$ $x = 5$ $Mike's Age = 30 \text{ years}$ $Charles Age = 20 \text{ years}$ $Abdul's Age = 15 \text{ years}$	M1 M1 A1	$M: C: A = 4x: 6x: 3x$ √Attempt to solve for x √ Ages
		03	
3	$18 = 2 \times 3^2$ $30 = 2 \times 3 \times 5$ $54 = 2 \times 3^3$		

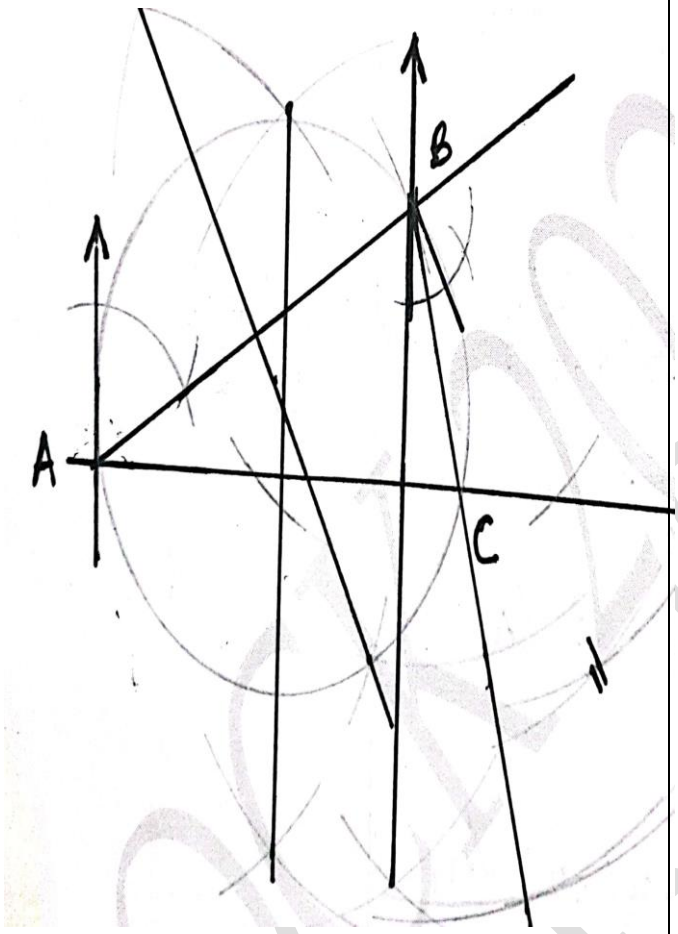
	$\text{GCD} = 2 \times 3$ $= 6$ $\text{No of rows} = \frac{18}{6} + \frac{30}{6} + \frac{54}{6}$ $= 17$	B1 M1 A1	√GCD √Expression on number of rows √C.A.O
		03	
4	$2x + 6 = x + 8$ $x = 2$ $L = 21 \text{ and } W = 10$ $A = 21 \times 10$ $= 210$	M1 M1 A1	√Attempt to solve for x √Expression for area of the rectangle √C.A.O
		03	
5	$\frac{4}{P^2} = (221 - 220)(221 + 220)$ $\frac{1}{P^2} = \frac{441}{4}$ $\frac{1}{P} = \pm\frac{21}{2}$ $P = \pm\frac{2}{21}$	M1 M1 A1	√Difference of two squares √Squareeoots. Deny if only one solution √Reciprocals
		03	
6	$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$ $= -\begin{pmatrix} x \\ 4 \end{pmatrix} + \begin{pmatrix} 5 \\ 7 \end{pmatrix}$ $= \begin{pmatrix} 5 - x \\ 3 \end{pmatrix}$ $\sqrt{(5 - x)^2 + 3^2} = 5^2$ $(5 - x)^2 = 16$ $5 - x = \pm 4$ $x = 1 \text{ or } 9$	M1 M1 A1	√Expression of vector AB √Equation of the magnitude √Both answers
		03	
7	$2k + 10 + 3k - 20 = 90°$ $k = 20°$	M1 A1	√Expression √C.A.O

		02	
8	$\sqrt{-2x-6} = 3+x$ $-2x-6 = x^2+6x+9$ $x^2+8x+15=0$ $x = \frac{-8 \pm \sqrt{64-60}}{2}$ $x = \frac{-8 \pm 2}{2}$ $x = -5 \text{ or } -3$	M1 M1 A1	√Squareroots on both sides √Factorization/resolving of the discriminant √Roots
		03	
9		B1 B1 B1	√ Drawing of Sides AF, FE and EC √ Drawing of Sides AD, DE and DC √ Labeling of the solid
		03	
10	$\text{M.P} = \frac{1440 \times 100}{90}$ $= 1600$ $\text{S.P} = \frac{1440 \times 100}{120}$ $= 1200$ $\text{Profit} = 1600 - 1200$ $= 400$	M1 M1 A1	√ Expression for the Marked Price √ Expression for the Selling Price √Profit
		03	
11	$\text{BD} = \sqrt{10^2+10^2}$ $= 11.662$ $\sin \text{CDB} = \frac{5}{11.662}$ $= 28.209°$	M1 M1 A1	√ Use of Pythagorean √Use of any trigonometric ratios C.A.O

		03	
12	$\log 0.045 = \log(3^2 \times 5 \times 10^{-3})$ $= 2\log 3 + \log 5 + \log 10^{-3}$ $= 2 \times 0.4771 + 0.6990 + \bar{3}$ $= \bar{2}.6532$	M1 M1 A1	$\log(3^2 \times 5 \times 10^{-3})$ $= 2\log 3 + \log 5 - 3\log 10$ $= 2 \times 0.4771 + 0.6990 - 3$ $= -1.3468$
		03	
13	The distance covered by the car by 9: 30am $= 1.5x$ km Remaining distance $= 810 - 1.5x$ $\frac{810 - 1.5x}{x + 84} = 1.5$ $810 - 1.5x = 1.5x + 126$ $x = 228$	M1 M1 M1 A1	√ Expression of the remaining distance to be covered √ Equation of expressions of time √ $1620 - 3x = 3x + 252$ √ C.A.O
		04	
14	$< OAC = < OCA = 70°$ and $< OAB = 10°$ $< CAB = 70° + 10°$ $= 80°$	B1 M1 A1	√ Angles √ Expression for $< CAB$ √ C.A.O
		03	
15	<table><tr><td>x</td><td>-1.5</td><td>-0.5</td><td>0.5</td><td>1.5</td><td>2.5</td><td>3.5</td></tr><tr><td>y</td><td>10.75</td><td>8.75</td><td>12.75</td><td>22.75</td><td>38.75</td><td>60.75</td></tr></table> $A = 1(10.75 + 8.75 + 12.75 + 22.75 + 38.75 + 60.75)$ $= 154.5$	B1 B1 M1 A1	√ x values √ y values √Substitution into the formula √C.A.O
		04	
16		B1 B1 B1	√ Location of A^{I} and B^{I} √ Location of C^{I} and D^{I} √ Completion of the image A^{I} B^{I} C^{I} D^{I}

		03	
17	a) $3y = -2x - 6$ $y = -\frac{2}{3}x - 2$ $m_1 = -\frac{2}{3}$ b) $-\frac{2}{3} \times m_2 = -1$ $m_2 = 1.5$ $\frac{y-2}{x-7} = 1.5$ $y = 1.5x - 8.5$ c) At Q $-\frac{2}{3}x - 2 = 1.5x - 8.5$ $x = 3$ $y = -\frac{2}{3} \times 3 - 2$ $= -4$ hence the co $-$ ordinates of is $Q(3, -4)$ d) $m_3 = -\frac{2}{3}$ $\frac{y-2}{x-7} = -\frac{2}{3}$ $2x + 3y = 20$ e) y intercept is $6\frac{2}{3}$ and x intercept is 10	B1 B1 M1 A1 M1 M1 A1 M1 A1 B1	√Gradient. Deny 0.6667 √ Gradient. Accept $\frac{3}{2}$ seen √Attempt to get equation of the line √ Equation. Accept $y = 1\frac{1}{2}x - 8\frac{1}{2}$ √Attempt to get x ordianate of Q √Attempt to get y ordianate of Q √Coordianates of Q √Attempt to get equation of the line √ Equation √ Intercepts
		10	
18	a) i) $\frac{90000}{x}$ ii) $\frac{90000}{x-50}$ b) $\frac{90000}{x-50} - \frac{90000}{x} = 600$ $600x^2 - 30{,}000x - 45{,}000{,}000 = 0$	B1 B1 M1 M1	√ Expression √ Expression √ Equation √ Quadratic Equation in the form $ax^2 + bx + c = 0$

	$x = \frac{50 \pm \sqrt{2500 + 300{,}000}}{2}$ $= \frac{50 \pm 550}{2}$ $= 300 \text{ or } -250$ $\therefore x = 300$ c) Original contribution $= \frac{900{,}000}{300}$ $= 3000$ $\% \text{ Change} = \frac{600}{3000} \times 100\%$ $= 20\%$ d) Remaining students=250 Boys contributions=130×3600 $= 468{,}000$	M1 A1 M1 A1 M1 A1	√ Resolution of the discriminant/Factorisation √ Discrimination of the roots √Expression for each students contribution √Percentage √Expression of boys contribution √CAO
		10	
19	a) $\frac{1}{2}AB = 3.5^2 - x^2$ also $\frac{1}{2}AB = 4.2^2 - (6-x)^2$ hence $3.5^2 - x^2 = 4.2^2 - (6-x)^2$ $12x = 36 + 3.5^2 - 4.2^2$ $\therefore x = 2.551\text{cm}$ b) $\cos < \frac{1}{2}A01B = \frac{2.551}{3.5}$ $\therefore < A01B = 86°$ $\cos < \frac{1}{2}A02B = \frac{3.449}{4.2}$ $\therefore < A02B = 70°$ c) Area of $O1AO2B = \frac{1}{2}3.5^2\sin 86° + \frac{1}{2}4.2^2\sin 70°$ $= 14.40$ d) Area of the shaded region $= 14.40 - \frac{86°}{360°} \times 3.142 \times 3.5^2$ $= 5.8$	M1 M1 A1 M1 A1 B1 M1 A1 M1 A1	√Expressions AB √Equation of the perpendicular height √C.A.O √Attempt to get AO1B √AO1B √AO2B √Attempt to get Area of O1AO2B √C.A.O √Attempt to get Area of the shaded √C.A.O
		10	

20	a) Scale Diagram  	B1 B1 B1	√Scale used √ Location of B from A √Loction of C from both A and B
	b) 3.0 ± 0.1 cm 60 ± 2 km	B1 B1	√Radius in cm √Radius in km
	c) Radius 3.2 ± 0.1 cm A $= \frac{22}{7} \times 64^2$ $= 12873.142857142 \text{ km}^2$	B1 B1	√Construction of the circumcircle √Area of the circle
	d) Area $= 12873.142857142 - \frac{1}{2} \times 120 \times 60$ $= 9273.142857142$ Money spen $= \frac{9273.142857142 \times 10^6 \times 5000}{10^4}$ $=$ Kshs. 4,636,571,429	M1 M1 A1	√Expression of area outside triangle √Expression of the money spent √Amount
		10	

21	a) $h = 7 + \sqrt{25^2 - 7^2}$ $= 31\text{cm}$ b) $V = \frac{1}{3} \times \frac{22}{7} \times 7^2 \times 24 + \frac{2}{3} \times \frac{22}{7} \times 7^3$ $= 1950\frac{2}{3}$ c) S.A= $2 \times \frac{22}{7} \times 7^2 + \frac{22}{7} \times 7 \times 2$ $= 858$ d) $m = 12.5 \times 1950\frac{2}{3}$ $= 24383\frac{1}{3}\text{g}$	M1 A1 M1 M1 A1 M1 M1 A1 M1 A1	√Expression of height 7+24 √C.A.O √Expression of vol. of the hemisphere √Expression of vol. of the cone √C.A.O √Expression of curved S.A of the h/s √Expression of curved S.A of cone √C.A.O √Expression of the mass √C.A.O
		10	
22	a) i. $\overrightarrow{AB} = -\underset{\sim}{a} + \underset{\sim}{b}$ ii. $\overrightarrow{CD} = \frac{1}{3}\underset{\sim}{a} - 3\underset{\sim}{b}$ b) $\overrightarrow{CM} = k\left(\frac{1}{3}\underset{\sim}{a} - 3\underset{\sim}{b}\right)$ $\overrightarrow{AM} = h\left(-\underset{\sim}{a} + \underset{\sim}{b}\right)$ $\overrightarrow{AM} = -\underset{\sim}{a} + 3\underset{\sim}{b} + k\left(\frac{1}{3}\underset{\sim}{a} - 3\underset{\sim}{b}\right)$ $\therefore \overrightarrow{AM} = (-1 + \frac{1}{3}k)\underset{\sim}{a} + (3 - 3k)\underset{\sim}{b}$ $\therefore -h\underset{\sim}{a} + h\underset{\sim}{b} = (-1 + \frac{1}{3}k)\underset{\sim}{a} + (3 - 3k)\underset{\sim}{b}$ Comparing the coefecients: $-1 + \frac{1}{3}k = -h$ $3 - 3k = h$ Hence $-1 + \frac{1}{3}k = -3 + 3k$ $k = \frac{3}{4}$ and $h = \frac{3}{4}$	B1 B1 B1 M1 M1 A1	√ vector AB √ vector CD √ Expression of vector AM √ Equation of the expressions of vector AM or any other √ Formation of the simultaneous equations in k and h √ Attempt to solve for either k or h √ C.A.O for both k and h

	c) $\overrightarrow{OM} = -\underset{\sim}{a} + 3\underset{\sim}{b} + \frac{3}{4}\left(\frac{1}{3}\underset{\sim}{a} - 3\underset{\sim}{b}\right)$ $= \frac{1}{4}\underset{\sim}{a} + \frac{3}{4}\underset{\sim}{b}$ $\overrightarrow{MN} = \frac{3}{4}\underset{\sim}{a} - \frac{3}{4}\underset{\sim}{b} - \frac{1}{2}\underset{\sim}{a} + \frac{3}{2}\underset{\sim}{b}$ $= \frac{1}{4}\underset{\sim}{a} + \frac{3}{4}\underset{\sim}{b}$ $\therefore \overrightarrow{OM} = \overrightarrow{MN}$ hence $\overrightarrow{OM}$ is parallel $\overrightarrow{MN}$. Given $\overrightarrow{OM}$ is parallel $\overrightarrow{MN}$ and they share a common point M then points O, M and N are collinear	B1 B1 B1	√ Expression of vector OM √ Expression of vector MN √ Conclusion
		10	
23	a) $S(2) = 2^3 - 6 \times 2^2 + 9 \times 2 + 50$ $= 52$ b) $v = 3t^2 - 12t + 9$ $v = 3 \times 4^2 - 12 \times 4 + 9$ $= 9$ c) $a = 6t - 12$ when $t = 5$ $a = 6 \times 5 - 12$ $a = 18$ d) At rest $v = 0$ $v = 3t^2 - 12t + 9 = 0$ $t = 1s$ or $3s$ e) $S(3rd) = (3^3 - 6 \times 3^2 + 9 \times 3 + 50) - (2^3 - 6 \times 2^2 + 9 \times 2 + 50)$ $= -2m$	M1 A1 M1 A1 M1 A1 M1 A1 M1 A1	√ Substitution √ CA.O √Differentiation to get expression for v √ CA.O √Differentiation to get expression for a √ CA.O √v=0 √C.A.O √ Substitution √ CA.O
		10	
24			

Height (cm)	Mid-point x	Frequency f	fx

138-142	140	3	420
143-147	**145**	8	**1160**
148-152	**150**	12	**1800**
153-157	**155**	20	**3100**
158-162	160	30	4800
163-167	**165**	14	**2310**
168-172	**170**	7	**1190**
173-177	**175**	4	**700**
178-182	180	2	360
		$\sum f = 100$	$\sum fx = 15840$

B1 √Midpoints

B1 √First 3fx

B1 Last 3fx

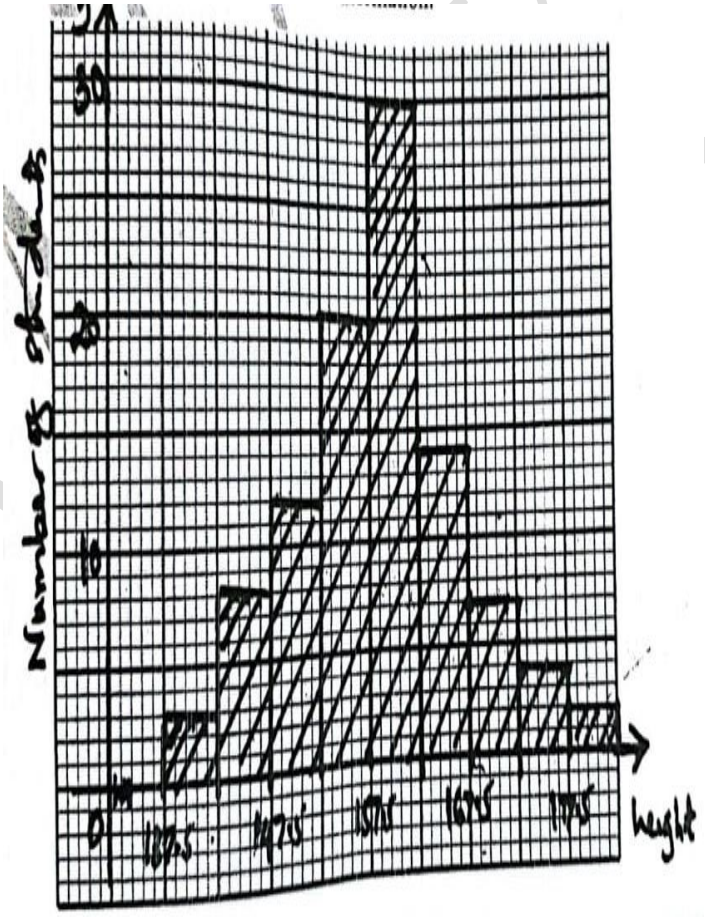
M1 √Substitution

A1 √C.A.0

b) $\overline{X} = \frac{15840}{100}$

$= 158.4$ cm

c)



B1 √First 4 bars with scale

B1 √Last 5 bars

d)

Height (cm)	Area	Cumulative Area
138-142	15	15
143-147	40	55
148-152	60	115
153-157	100	215
158-162	150	365
163-167	70	435
168-172	35	470
173-177	20	490
178-182	10	500

B1 √Table

$\frac{1}{2}$ cumulative Area $= 250$

hence the median class is $138 - 162$

$30x = 250 - 215$

$x = 1\frac{1}{6}$

M1 √ Attempt to solve for the width of the strip

$\text{Median} = 157.5 + 1\frac{1}{6}$

$= 158\frac{2}{3}$

A1 √C.A.O

10