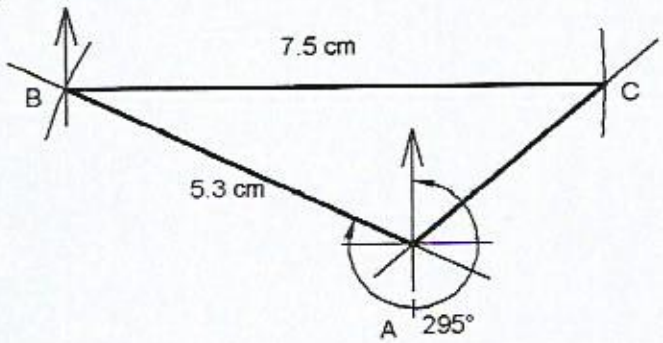
5.0 THE YEAR 2019 KCSE EXAMINATION MARKING SCHEMES

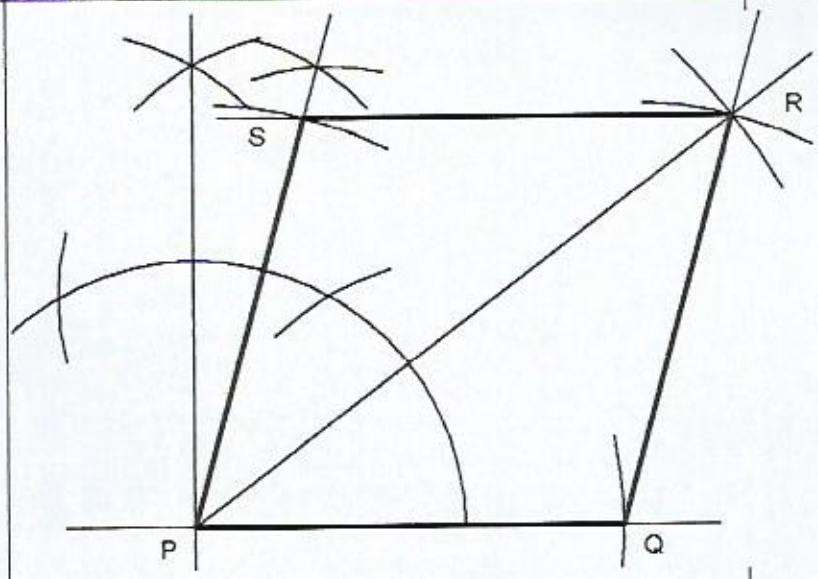
5.1 MATHEMATICS ALTERNATIVE A (121)

5.1.1 Mathematics Alternative A Paper 1 (121/1)

No.	Marking Scheme	Marks	Comments
1.	$\frac{5.4}{0.025\times3.6}=\frac{5.4\times10^4}{0.025\times3.6\times10^4}$ $=\frac{54\times1000}{25\times36}$ $=\frac{6000}{100}$ $=60$	M1 M1 A1 **3**	Removal of decimals or equivalent Simplification
2.	$1728=2^6\times3^3$ $2025=3^4\times5^2$ $\frac{\sqrt[3]{1728}}{\sqrt{2025}}=\frac{\sqrt[3]{2^6\times3^3}}{\sqrt{3^4\times5^2}}=\frac{2^2\times3}{3^2\times5}$ $=\frac{4}{15}$ or $0.2\dot{6}$	B1 B1 M1 A1 **4**	✓ removal of cube root and square root
3.	Time taken = $\left.\begin{matrix}10.15\\8.30\end{matrix}\right\}-$ 1.45 $=1$ hr 45 mins $=1.75$hrs $=1\frac{3}{4}$ Speed $=\frac{140}{1.75}$ $=80$ km/h	M1 M1 A1 **3**	Process of time difference
4.	$4(q+6)+7(q-3)=4q+24+7q-21$ $=11q+3$	M1 A1 **2**	

No.	Marking Scheme	Marks	Comments
5.	Area of trapezium $= \frac{1}{2}(8 + 6)h = 28$ $7h = 28$ $h = 4cm$	M1 A1 2	
6.	$\sqrt[3]{9^4} = 3^n$ $(3^2)^{\frac{4}{3}} = 3^n$ $3^{\frac{8}{3}} = 3^n$ $n = \frac{8}{3} = 2\frac{2}{3}$	M1 M1 A1 4	Base 3 (both sides)
7.	(a)  (b) $AC = 3.5cm \pm 0.1$ $AC = (35 \pm 1)km$	B1 B1 B1 B1 4	Location of B Location of C for
8.	$40 = 2\times2\times2\times5$ $250 = 2\times5\times5\times5$ $350 = 2\times5\times5\times7$ $LCM = 2\times2\times2\times5\times5\times5\times7$ $= 7000g$	M1 M1 A1 3	Allow any method of finding LCM

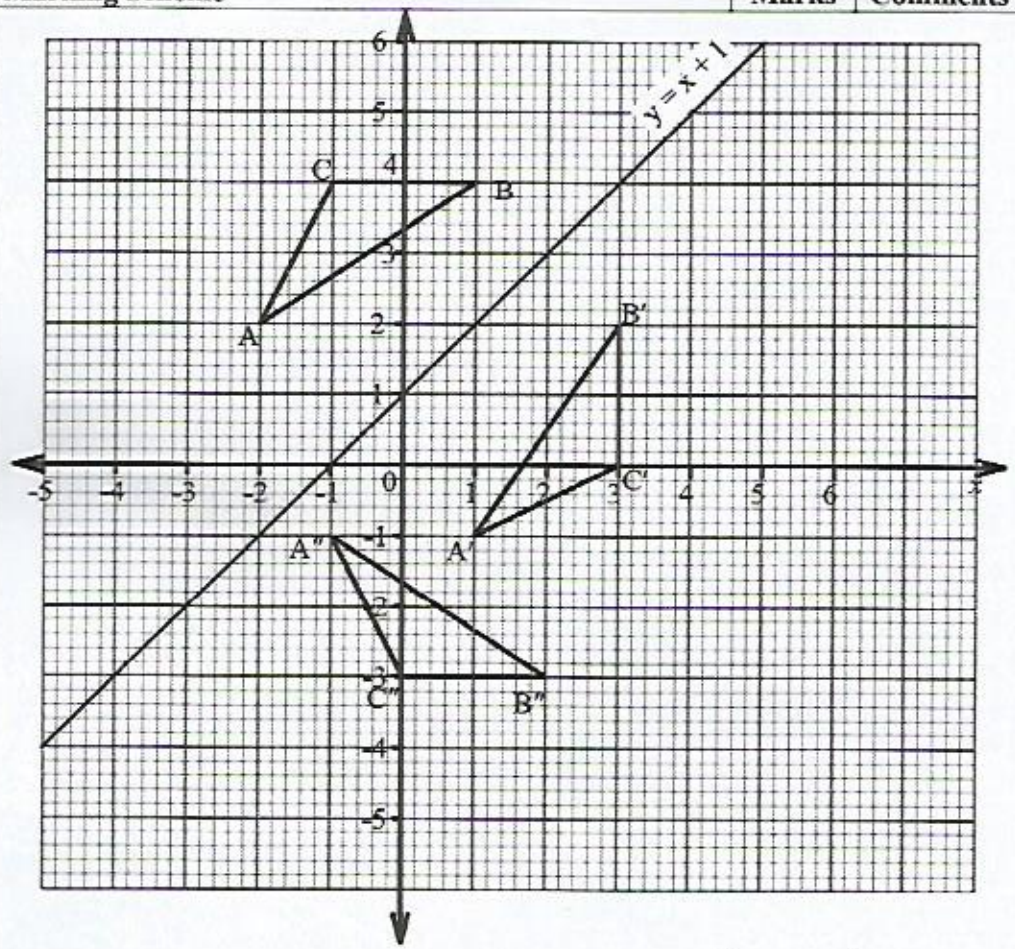
No.	Marking Scheme	Marks	Comments
9.	$\sin 2x = \cos(3x-10)$		
	$2x+(3x-10)=90$	M1	Or equivalent
	$5x=100$		
	$x=20°$	A1	
	$\tan 20° = 0.3640$	B1	
		3	
10.	\$5820 = Ksh (5820×102.10)	M1	
	= Ksh 594222		
	Balance in \$		
	$= \frac{594222-450000}{103.0}$	M1	
	$= \frac{144222}{103}$		
	= 1400 US Dollars	A1	
		3	
11.	$\underset{\sim}{a} = 3\begin{pmatrix}3\\2\end{pmatrix}-2\begin{pmatrix}2\\4\end{pmatrix}$	M1	
	$= \begin{pmatrix}9\\6\end{pmatrix}-\begin{pmatrix}4\\8\end{pmatrix}$		
	$= \begin{pmatrix}5\\-2\end{pmatrix}$	A1	
	$\lvert\underset{\sim}{a}\rvert = \sqrt{5^2+(-2)^2}$	M1	
	= 5.39	A1	
		4	

No.	Marking Scheme	Marks	Comments
12.			
		B1	Construction of 75°
		B1	✓ Locating point R
		B1	Complete Rhombus
	$PR = (9.5 \pm 0.1)cm$	B1	
		4	
13.	$2x-1 \leq 3x+4$		
	$-5 \leq x$	B1	
	$3x+4 < 7-x$		
	$4x < 3$		
	$x < \frac{3}{4}$	B1	
	$-5 \leq x < \frac{3}{4}$	B1	
		3	

No.	Marking Scheme	Marks	Comments
14.	$\begin{pmatrix}2 & 3\\4 & 4\end{pmatrix}\begin{pmatrix}x & 1\\2 & 3\end{pmatrix}=\begin{pmatrix}2x+6 & 11\\4x+8 & 16\end{pmatrix}$	M1	
	$\begin{vmatrix}2x+6 & 11\\4x+8 & 16\end{vmatrix}=0$		
	$16(2x+6)-11(4x+8)=0$	M1	
	$32x+96-44x-88=0$		
	$32x-44x=88-96$		
	$-12x=-8$		
	$x=\frac{2}{3}=0.\dot{6}$	A1	
		3	
15.	$\left.\begin{matrix}A+B=50\\60A+56B=2872\end{matrix}\right\}$	M1	Alt
	$60A+56(50-A)=2872$	M1	
	$4A = 2872-2800$		
	$4A = 72$		
	$A = 18$	A1	
		3	
16.	Time taken = 5 hours 40 min 3 hours 15 min 40 min 9 hours 35min	M1	Or equivalent
	Arrival time = 08.15 + 9 hrs 35 min	M1	
	= 1750 hours	A1	
		3	

No.	Marking Scheme	Marks	Comments
17.	(a) Volume of water required $= 2.4 \times 2 \times (1.5 - 0.45)\,m^3$ $= 2.4 \times 2 \times 1.05\,m^2$	M1	Or equivalent
	Amount of water in litres $= 2.4 \times 2 \times 1.05$ x 1000 litres	M1	
	$= 5040$ litres	A1	
	(b) (i) Amount of water let in by 3h is $= 10 \times 3 \times 60 = 1800$ litres Amount of water drawn from the tank in 2h is $= 4 \times 120 = 480$ litres Total amount of water in tank after 3h $= 2160 + 1800 - 480$	M1	
	$= 3480$ litres	A1	
	Height of water in tank is $= \frac{3480}{1000 \times 2 \times 2.4}$	M1	
	$= 0.725m$	A1	
	(b)(ii) Height of water to be filled $= 1.5 - 0.725 = 0.775m$	M1	
	Time in hours taken to fill the tank is $= 3h + \left(\frac{2.4 \times 2 \times 0.775 \times 1000}{6 \times 60}\right)h$	M1	
	$= 3h + 10\frac{1}{3}h$		
	$= 13\frac{1}{3}h$ (or 13h 20min)	A1	
		10	

No.	Marking Scheme	Marks	Comments
18.	(a) Gradient $= \frac{7-3}{5-3}$ $= 2$	M1	
	Equation of L_1 $\frac{y-3}{x-3} = 2$ $y = 2x - 3$	M1 A1	Or equivalent
	(b) (i) Gradient of L_2 $= -\frac{1}{2}$	B1	
	Equation of L_2 $\frac{y-3}{x+2} = -\frac{1}{2}$ $y - 3 = -\frac{1}{2}x - 1$ $y = -\frac{1}{2}x + 2$	M1 A1	Or equivalent
	(b)(ii) When y=0 $-\frac{1}{2}x + 2 = 0$ $x = 4$ The x intercept of L_2 is 4	B1	
	(c) At point of intersection of L_1 and L_2 $2x - 3 = -\frac{1}{2}x + 2$ $2\frac{1}{2}x = 5$ $x = 2$ When $x = 2$, $y = 2(2) - 3 = 1$ Point of intersection is (2,1)	M1 M1 A1	
		10	

No.	Marking Scheme	Marks	Comments
19.			
	(a) (i) ΔABC correctly drawn	B1	
	(ii) Line $y = x + 1$	P1 L1	✓Line drawn
	(iii) Triangle A′B′C′		
	Identifying coordinates of vertices of Δ A′B′C′	B1	
	Δ A′B′C′ correctly drawn	B1	
	(b) Correct rotation of -90°	B1	
	Correct vertices of Δ A″B″C″	B1	
	Δ A″B″C″ correctly drawn	B1	
	(c) (i) Oppositely Congruent	B1	
	(ii) Directly Congruent	B1	
		10	

No.	Marking Scheme	Marks	Comments
20.	(a)		
	$\frac{AB}{8} = \frac{10}{20}$	M1	
	$AB = \frac{1}{2} \times 8$		
	$= 4\ cm$	A1	
	(b) (i) $AC = \sqrt{16+16}$ cm	M1	
	$= \sqrt{32}$ cm		
	$= 5.66$ cm	A1	
	(ii) $\perp$ height of pyramid		
	$= \sqrt{10^2 - \left(\frac{1}{2} \times 5.66\right)^2} = \sqrt{\left(10^2 - 2.83^2\right)}$	M1	
	$= 9.59\ cm$	A1	
	(c) Volume of VABCD		
	$= \frac{1}{3} \times 4 \times 4 \times 9.59$	M1	
	$= 51.15\ cm^3$		
	Volume of VEFGH		
	$= \frac{1}{3} \times 8 \times 8 \times (2 \times 9.59)$	M1	$2 \times 9.59 = 19.18$
	$= 409.17$		
	Volume of frustum ABCDEFGH		
	$= 409.17 - 51.15$	M1	
	$= 358.02 cm^3$	A1	
		10	

No.	Marking Scheme	Marks	Comments
21.	(a) $2+8+10+6+2+x=40$ $x=12$	B1	
	(b) Modal class = 180 – 189	B1	
	(c) (i) Mean		

Height	Mid pt	Freq	fx
150 - 159	154.5	2	309
160 - 169	164.5	8	1316
170 - 179	174.5	10	1745
180 - 189	184.5	12	2214
190 - 199	194.5	6	1167
200 - 209	204.5	2	409
		40	**7160**

	M1	for midpoint x
	M1	for fx
Mean height $= \frac{7160}{40}$ $= 179$	M1 A1	
(i) Median		

U.C.B	159.5	169.5	179.5	189.5	199.5	209.5
C.F	2	10	20	32	38	40

	B1	From table or implied
	B1	
Median Height = height of 20^{th} athlete $=179.5$	M1 A1	$Median = 169.5 - \left(\frac{\frac{40}{2} - 10}{10}\right)10$ $= 179.5$
	10	

No.	Marking Scheme	Marks	Comments
22.	(a) Let $\angle BDC = \theta$ $\frac{\sin\theta}{5} = \frac{\sin 30^\circ}{4}$	M1	Follow thro Question
	$\sin\theta = \frac{5\times\sin 30}{4} = 0.625$	A1	
	Acute $\theta = 38.68^\circ$ Obtuse $\theta = 141.32^\circ$	B1	
	(b) Length AD Angle $ABD = 180 - 38.68\times 2$ $= 102.64$	M1	
	$AD^2 = 4^2+4^2-2\times4\times4\cos 102.64$ $= 39$	M1	
	$AD = 6.24m$	A1	
	(c) Length of DC $\angle DBC = 180-(30+141.32)$ $= 8.68^\circ$		
	Using sine rule $\frac{\sin 8.68}{DC} = \frac{\sin 30}{4}$ $\Rightarrow$ $DC = 8\sin 8.68$ $= 1.21m$	M1 A1	
	(d) Area of ABC $= \frac{1}{2}\times4\times5\sin(8.68+102.64)$	M1	$8.68^\circ+102.64^\circ = 111.32^\circ$
	$= 9.32m^2$	A1	
		10	

No.	Marking Scheme	Marks	Comments

23. (a)

x	0	200	400	600	800	1000	1200	
Ordinates along AB	200	240	280	300	280	240	200	B1
Ordinates along CD	400	500	580	600	580*	580	640	B1

For ordinates along CD
At $x = 800$, accept
$580 \leq y \leq 590$

(b) Area of piece of land ABCD using trapezium rule

Area under curve AB

$= \frac{1}{2} \times 200\{(200+200)+2(240+280+300+280+240)\}$ M1

Use of differences

$= \frac{1}{2} \times 200[(200+440)+2(260+300\times3+340)]$ M1M1

$= 100(400+2680)$

$= 308\,000\ \text{m}^2$

Area under curve CD

$= \frac{1}{2} \times 200\{(400+640)+2(500+580+600+580+580)\}$ M1

$= 100\,(1040+5680)$

$= 672\,000$

Area of land ABCD

$= 672000 - 308000$

$= 364000\ \text{m}^2$ A1

$= \frac{364000}{10000}\ \text{ha}$

$= 36.4\ \text{ha}$ B1

(c) (c) Area using mid ordinate Rule:

$= 400\{(500+600+580)-(240+300+240)\}$ B1 M1 Mid ordinates

$= 400\times900$

$= 360000\,\text{m}^2$ A1

$= \frac{360000}{10000}$

$= 36\,\text{ha}$ B1

10

No.	Marking Scheme	Marks	Comments
24.	(a)(i) $y = x^3 + x^2 - x - 1$ $\frac{dy}{dx} = 3x^2 + 2x - 1$ $3x^2 + 2x - 1 = 0$ at stationary point. $(x + 1)(3x - 1) = 0$ $x = -1$ or $\frac{1}{3}$ $(-1, 0)$ and $\left(\frac{1}{3}, -1\frac{5}{27}\right)$ (a)(ii) Nature of stationary points $\frac{d^2y}{dx^2} = 6x + 2$ *At* $x = -1$ $\frac{d^2y}{dx^2} = -6 + 2$ $= -4$ (Negative) $x = -1$ is a maximum point. *At* $x = \frac{1}{3}$, $\frac{d^2y}{dx^2} = \frac{6}{3} + 2$ $= 4$ *At* $x = \frac{1}{3}$ *is a minimum point*	M1 M1 A1 B1 B1	

No.	Marking Scheme	Marks	Comments
	(b) (i) at $x=1$ $y=0$ At $x=1$ $\frac{dy}{dx} = 3(1)+2(1)-1 = 4$ Equation of tangent $\frac{y-0}{x-1} = 4$ $y = 4x-4$ (b) (ii) Let gradient of normal = m_2 $m_2 \times 4 = -1$ $m_2 = -\frac{1}{4}$ $\frac{y-0}{x-1} = -\frac{1}{4}$ $y = -\frac{1}{4}x + \frac{1}{4}$	B1 M1 A1 M1 A1 **10**	