FORM 4 MATHEMATICS PAPER 1
MARKING SCHEME

S/N	Working	Marks
1.	Numerator. $\frac{3}{4} + \frac{9}{7} \div \frac{3}{7} \times \frac{7}{3}$ $\frac{3}{4} + \frac{9}{7} \times 1$ $\frac{3}{4} + \frac{9}{7} = \frac{21+27}{28}$ $= \frac{48}{28}$ $= \frac{12}{7}$	M1
	Denominator $\frac{2}{3}\left(\frac{9}{7} - \frac{3}{8}\right) = \frac{2}{3}\left(\frac{72-21}{56}\right)$ $= \frac{2}{3} \times \frac{51}{56}$ $= \frac{17}{28}$	M1
	$\frac{\text{Num}}{\text{Den}} = \frac{12}{7} \div \frac{17}{28} = \frac{12}{7} \times \frac{28}{17}$ $= 2\frac{14}{17}$.	A1
2	Numerator. $3x^2 - xy - 2y^2$ $3x^2 - 3xy + 2xy - 2y^2$ $3x(x-y) + 2y(x-y)$ $(3x+2y)(x-y)$ ✓	M1
	Denominator $2(9x^2 - 4y^2) = 2(3x+2y)(3x-2y)$ Difference of two squares.	M1
	$\frac{(3x+2y)(x-y)}{2(3x+2y)(3x-2y)} = \frac{x-y}{6x-4y}$	A1

S/N	Working	MKS
3.	sh. 12000 ⟶ 100% SP ⟶ 90% $SP = \frac{12000 \times 90}{100}$ $= sh.\ 10,800$ ✓	M1
	sh. 10 800 ⟶ 108% BP ⟶ 100% $BP = \frac{10\,800 \times 100}{108}$ ✓ ✓ $= sh.\ 10000$	M1 A1
4.	L.C.M	
	2 | 30 56 60 2 | 15 28 30 3 | 15 14 15 5 | 5 14 5 5 | 1 7 1 1	
	$L.C.M = 2^2 \times 3 \times 5^2$ $= 300\ min$	1
	Time in hrs $= \frac{300}{60}$ $= 5\ hrs.$	1
	7:18 a.m 5:00 12:18 P.M	1
5.		

Class limits	f	cf
20.5 – 30.5	2	2
30.5 – 40.5	4	6
40.5 – 50.5	11	17
50.5 – 60.5	5	22
60.5 – 70.5	3	25
	$N = 25$	

Position of K median $= \frac{25}{2} = 12.5^{th}$ M1

$Median = 40.5 + \left(\frac{12.5 - 6}{11}\right) \times 10$ M1

$= 40.5 + \left(\frac{6.5}{11} \times 10\right)$

$= 40.5 + 5.91$

$= 46.4$ A1

Q	Working	MKS
6.	$r = h$.	
	$2\pi r^2 + 2\pi rh = 154\ cm^2$	M 1
	$2\pi r^2 + 2\pi r(r) = 154$	
	$4\pi r^2 = 154$	
	$4\left(\frac{22}{7}\right)r^2 = 154$	
	$r = \sqrt{\frac{154 \times 7}{88}} = 3.5\ cm.$	M 1
	Diameter $= 2 \times 3.5$	
	$= 7\ cm.$	A 1
7.	$(x - 50) + (2x + 20) = 180^\circ$	
	$3x - 30 = 180^\circ$	
	$3x = 210^\circ$	M 1
	$x = 70^\circ$	
	Exterior Angle $= 70 - 50^\circ$	
	$= 20^\circ$.	M 1
	Number of sides $= \frac{360^\circ}{20} = 18$ sides.	A 1
8.	$6x + 2 < 3x + 11$	
	$3x < 9$	
	$x < 3$ ✓	M 1
	$3x + 11 \leq 27x - 1$	
	$\frac{-24x}{-24} \leq \frac{-12}{-24}$	
	$x \geq \frac{1}{2}$ ✓	M 1
	$\frac{1}{2} \leq x < 3$ Integral values 1, 2	A 1

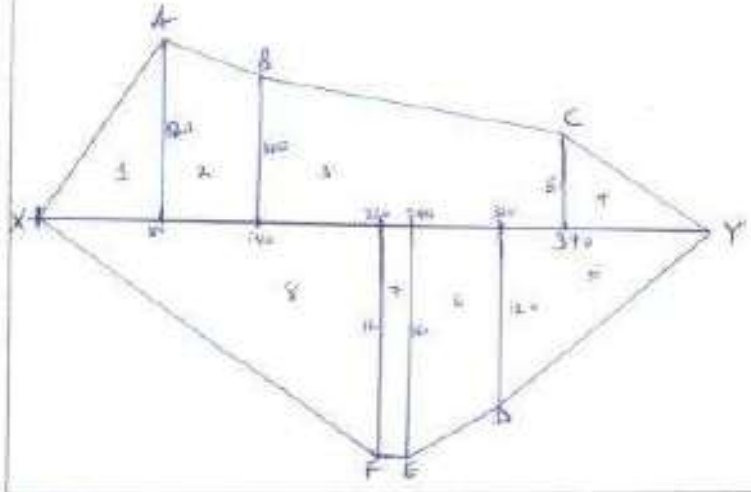
S/N	Working	MKs.
9.	$\frac{1}{2}x + 2y = -3$	
	$2y = -\frac{1}{2}x - 3$	
	$y = -\frac{1}{4}x - \frac{3}{2}$ gradient(M) $= -\frac{1}{4}$	M1
	$M_1 \times M_2 = -1$	
	$-\frac{1}{4} \times M_2 = -1 \Rightarrow M_2 = 4$	M1
	Equation of perpendicular.	
	$\frac{y-1}{x-2} = 4$	
	$y - 1 = 4x - 8$	
	$y = 4x - 7$	A1
10	$9^x + 2 \times 3^{2x} = 243$	
	$3^{2x} + 2 \times 3^{2x} = 243$	M1
	Let $3^{2x} = y$	
	$y + 2y = 243$	
	$3y = 243$	
	$\Rightarrow y = 81$	M1
	$3^{2x} = 3^4$	
	$\Rightarrow 2x = 4$	
	$x = 2$	A1
11	$\vec{OA} = \begin{pmatrix} 2 \\ -3 \\ 4 \end{pmatrix}$ $\vec{OB} = \begin{pmatrix} -2 \\ -1 \\ 2 \end{pmatrix}$ $\vec{AB} = \vec{OB} - \vec{OA}$	
	$= \begin{pmatrix} -2 \\ -1 \\ 2 \end{pmatrix} - \begin{pmatrix} 2 \\ -3 \\ 4 \end{pmatrix} = \begin{pmatrix} -4 \\ 2 \\ -2 \end{pmatrix}$	M1
	Length of AB $= \sqrt{(-4)^2 + 2^2 + (-2)^2}$	M1
	$= \sqrt{24}$	M1
	$= 4.90$ units.	A1

S/N	Working	Mks
12.	Amount in Kshs. $= 9600 \times 125.3$	
	$=$ Kshs. $1,202,880$	M1
	After the Commission $= 1202,880 \times \frac{95}{100}$	
	$=$ Sh. $1,142,736$	M1
	Amount in US\$ $= \frac{1,142\,736}{63.5} = 17\,996$	A1
13.	$(2x-10)+60^\circ = 90^\circ$ Complementary angles.	M1
	$2x + 50 = 90$	
	$2x = 40^\circ$	M1
	$\Rightarrow x = 20^\circ$	A1
14.	 $(3x-2)(3x+1) = 28$	
	$9x^2 + 3x - 6x - 2 = 28$	
	$9x^2 - 3x - 30 = 0$	M1
	$3x^2 - x - 10 = 0$	
	$3x^2 - 6x + 5x - 10 = 0$	
	$3x(x-2) + 5(x-2) = 0$	
	$(3x+5)(x-2) = 0$	
	Either $3x + 5 = 0 \Rightarrow x = -\frac{5}{3}$ N/A	
	OR $x - 2 = 0 \Rightarrow x = 2.$	M1
	Length $= 3(2) + 1 = 7$ cm	A1

S/N	Working	Mks.
15.	(a) V.S.f = Ratio of Mass	
	$= \frac{324g}{768}$	
	$V.Sf = \frac{27}{64}$	M1
	$L.S.f = \sqrt[3]{\frac{27}{64}}$	
	$= \frac{3}{4}$	M1
	$\frac{h}{20} = \frac{3}{4} \Rightarrow h = 20 \times \frac{3}{4}$	
	$= 15cm$	A1
	(b) $A.S.f = (l.s.f)^2$	
	$= \left(\frac{3}{4}\right)^2$	
	$= \frac{9}{16}$.	M1
	$\frac{A}{40} = \frac{9}{16} \Rightarrow h = 40 \times \frac{9}{16}$	
	$= 22.5cm^2$	A1
16.	$3p + 5b = 130$ ------(i)	
	$2p + 3b = 80$ ------(ii)	M1
	$6p + 10b = 260$	
	$6p + 9b = 240$	
	$1b = 20$	A1
	$3p + 5(20) = 130$	
	$3p = 30$	1 Pen = Sh. 10
	$p = 10$	1 Book = Sh. 20 A1

S/N	Working	MKs.
17.	(a) $\text{Time} = \frac{d}{s}$ $= \frac{300\text{km}}{80\text{km/h}}$ $= 3\frac{3}{8}\text{hrs}$ Time arrived: 7:00 a.m + 3:45 = 10:45 a.m	M1 A1
	(b) Distance travelled by the bus for 45min $D = s \times t$ $= 80\text{km/h} \times \frac{3}{4}\text{hrs}$ $= 60\text{km}$ Remaining distance $= 300 - 60 = 240\text{km}$ ✓ Relative speed $= 80\text{km/h} + 120\text{km/h} = 200\text{km/h}$ Time taken t meet $= \frac{240\text{km}}{200\text{km/h}} = 1\text{hr } 12\text{min}$ The time they met = 7:45 a.m + 1:12 = 9:57 a.m	M1 M1 A1
	(c) Distance travelled by the car t meet: $D = 120\text{km/h} \times 1\frac{1}{5}\text{hrs}$ $= 144\text{km}$ ✓ Distance to NRB $= 300 - 144 = 156\text{km}$ ✓	M1 A1
	(d) Time taken by the car t arrive NRB. $t = \frac{240\text{km}}{120\text{km/h}} = 2\text{hr } 30\text{min}$. 7:45 + 2:30 = 10:15 a.m Remaining distance $= 80\text{km/h} \times \frac{1}{2}$ $= 40\text{km}$	

18 (a) 1 cm rep. 40m.



(b)

Area 1 $= \frac{1}{2} \times 80 \times 120 = 4800\,m^2$

Area 2 $= \frac{1}{2} \times 60 \times (120 + 100) = 6600\,m^2$

Area 3 $= \frac{1}{2} \times 200 \times (100 + 60) = 16000\,m^2$

Area 4 $= \frac{1}{2} \times 60 \times 60 = 1800\,m^2$

Area 5 $= \frac{1}{2} \times 100 \times 120 = 6000\,m^2$

Area 6 $= \frac{1}{2} \times 60 \times (160 + 120) = 8400\,m^2$

Area 7 $= 160 \times 20 = 3200\,m^2$

Area 8 $= \frac{1}{2} \times 160 \times 220 = 17600\,m^2$

Total Area. $= 64400\,m^2$.

Area in ha $= \frac{64400}{10000} = 6.44\,ha.$

(c) Total Cost $= 6.44\,ha \times 80000$

$= 515200/=$

19(a) Monthly taxable income = 21 750 + 15000 + 8000

= Ksh. 44 750 A1

Annual taxable income = 44750 × 12

= Ksh. 537,000 A1

(b)

Income		Tax (Ksh)
116 600	× 10/100	= 11 660
109 000	× 15/100	= 16 350
109 440	× 20/100	= 21 888
109 440	× 25/100	= 27 360
92 520	× 30/100	= 27 756

Total tax payable P.m = Ksh. 105 014 ✓

Tax due = Tax payable − Personal Relief P.m

= Sh 105 014 − (1056 × 12)

= Sh 105 014 − 12 672

= Sh. 92 342

(c) Tax P.M = $\frac{92\,342}{12}$ = Sh 7695.17

Net income = Gross income − All deductions

= 44 750 − (7695.17 + 200 + 4500)

= 44 750 − 12 395.17

= 32 354.83 /=

20 (a) $\frac{y-3}{x-(-1)} = -\frac{1}{2}$ M1

$2y - 6 = -x - 1$

$2y = -x + 5$

$y = -\frac{1}{2}x + \frac{5}{2}$ (Any form of Equation is acceptable) A1

(b) Gradient of $L_2 = \frac{5-(-3)}{4-1}$

$= \frac{8}{3}$ A1

(c) Equation of L_2

$\frac{y-(-3)}{x-1} = \frac{8}{3}$

$3y + 9 = 8x - 8$

$3y = 8x - 17$

$y = \frac{8}{3}x - \frac{17}{3}$ (Accept Any other form of the equation)

(d) $M_1 \times \frac{8}{3} = -1$

$M = -\frac{3}{8}$

$\frac{y-5}{x} = -\frac{3}{8}$

$8y - 40 = -3x$

$8y = -3x + 40$

$y = -\frac{3}{8}x + 5$

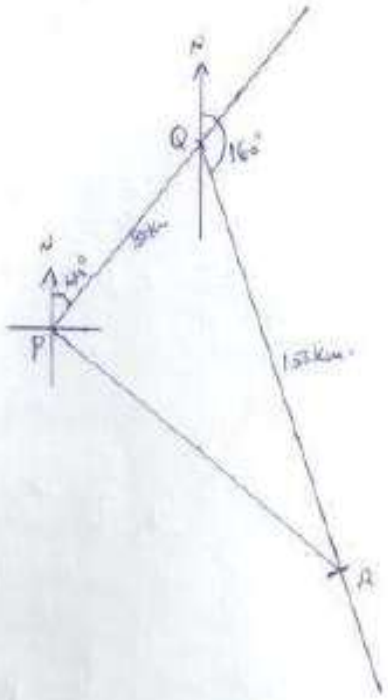
(d) $\frac{y-5}{x-4} = -\frac{1}{2}$

$2y - 10 = -x + 4$

$2y = -x + 14$

$y = -\frac{1}{2}x + 7$

21. 1cm rep 20km.



B1 mark for each correctly plotted point.

(a) Distance PR = 6.5 x 20
= 130 ± 1 Km.

(c) $t = \frac{d}{s}$

$= \frac{120\,Km}{25\,Km/h}$

$= \underline{5hr\ 12min}$

(d) S is the Centre of the circumcircle

22. (a) $a^2 = b^2 + c^2 - 2bc\cos A^\circ$

$a^2 = 6^2 + 8^2 - 2(6)(8)\cos 52^\circ$ M1

$a^2 = 100 - 61.71$ m1

$a = \sqrt{38.29}$

$= 6.19\text{cm}$ A1

(b) $\frac{b}{\sin B^\circ} = \frac{a}{\sin A^\circ}$

$\frac{6}{\sin B} = \frac{6.19}{\sin 52^\circ}$ M1

$\sin B^\circ = \frac{6 \times \sin 52^\circ}{6.19}$ M1

$B^\circ = \sin^{-1} 0.7426$

$= 47.95^\circ$ A1

(c) $a^2 = 7^2 + c^2 - 2(7)(c)\cos A^\circ$ M1

$2.82^2 = 85 - 84\cos A^\circ$

$\cos A^\circ = \frac{85 - 2.82^2}{84}$ M1

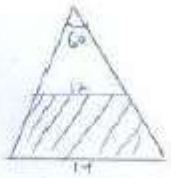
$A = \cos^{-1} 0.9172$

$= 23.48^\circ$ A1

(d) Area of $\Delta ACD = \frac{1}{2} \times 6 \times 7 \times \sin 23.48$ M1

$= 8.37\text{cm}^2$ A1

24 (a)



Area of shaded R $= \left(\frac{1}{2} \times 14^2 \times \sin 60\right) - \left(\frac{1}{2} \times 12^2 \times \sin 60\right)$ 2

$= 84.87 - 62.35$ 1

$= 22.52 cm^2$ 1

Total Area of shaded R $= 22.52 \times 6$ 1

$= 135.12 cm^2$

(b) Volume = Area of Cross-section x length

$= 135.12 cm^2 \times 20 cm$ 1

$= 2702.4 cm^3$ 1

(c) Mass = density x Volume

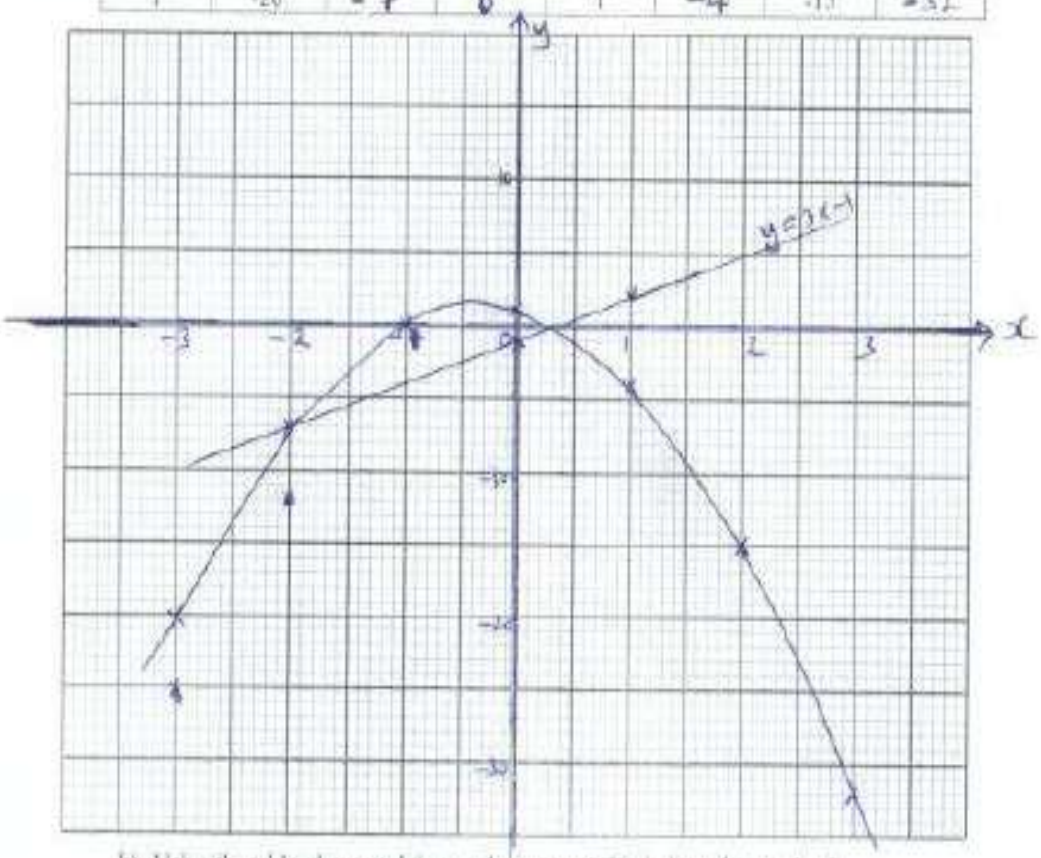
$= 3.5 g/cm^3 \times 2702.4 cm^3$

$= 9458.4 g$.

$= 9.458 kg$

2) Complete the table for the function $y = 1 - 2x - 3x^3$ in the range $-3 \leq x \leq 3$ (2 mks)

X	-3	-2	-1	0	1	2	3
$-3x^3$	-27	-12	-3	0	-3	-12	-27
$-2x$	6	4	2	0	-2	-4	-6
1	1	1	1	1	1	1	1
Y	-20	-7	0	1	-4	-15	-32



b) Using the table above and the graph paper provided, draw the graph of $y = 1 - 2x - 3x^3$ (4 mks)

c) Use the graph in (b) above to solve

i) $1 - 2x - 3x^3 = 0$ (2 mks)

Roots $x = -1$ or $x = 0.2$

ii) $2 - 5x - 3x^3 = 0$ (2 mks)

$y = 1 - 2x - 3x^3$

$0 = 2 - 5x - 3x$

$y = -1 + 3x$

Roots $x = -2$ or $x = 0.3$.