KAPSABET HIGH SCHOOL

121/2 **(*Kenya Certificate of Secondary Education*)** **Paper 2**

INTERNAL MOCK EXAM

MATHEMATICS

ALT A

Dec. 2020– 2 ½ Hours

MARKING SCHEME

Instructions to candidates

(a) Write your name, admission number and stream in the spaces provided above.
(b) Sign and write the date of examination in the spaces provided above.
*(c) This paper consists of **two** sections: **Section I** and **Section II.***
*(d) Answer **all** the questions in **Section I** and only **five** questions from **Section II**.*
*(e) **Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question.***
(f) Marks may be given for correct working even if the answer is wrong.
*(g) **Non-programmable** silent electronic calculators **and** KNEC Mathematical tables may be used, except where stated otherwise.*
*(h) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***
*(i) Candidates should answer the questions in **English***

Q	WORKING	MKS	COMMENTS
1	$(7x+3)(x-2)=0$ $7x^2-11x-6=0$ $x^2-\frac{11}{7}x=\frac{6}{7}$ $\therefore p=-\frac{11}{7}\ and\ q=\frac{6}{7}$	M1 A1 B1	 For both values stated
2	$\frac{\frac{1}{2}-\frac{\sqrt{3}}{2}}{\sqrt{3}}$ $\frac{\left(\frac{1}{2}-\frac{\sqrt{3}}{2}\right)\times 2\sqrt{3}}{\left(\sqrt{3}\right)\times 2\sqrt{3}}$ $\frac{\sqrt{3}-3}{6}$ $=\frac{1}{6}\sqrt{3}-\frac{1}{2}$	 M1 M1 A1	
3	$\begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix}\begin{pmatrix}k & 4\\ 3 & 2\end{pmatrix}=\begin{pmatrix}k+6 & 8\\ 3k+12 & 20\end{pmatrix}$ $Det=20k+120-24k-96$ $-4k+24=44$ $\therefore k=-5$	M1 M1 A1	
4	$\log(x-1)+\log 100=\log(3x+2)+\log 25$ $\log 100(x-1)=\log 25(3x+2)$ $100(x-1)=25(3x+2)$ $4(x-1)=3x+2$ $x=6$	 M1 M1 A1	
5	$x^2+4x+\mathbf{4}+y^2-2y+\mathbf{1}=4+\mathbf{4}+\mathbf{1}$ $(x+2)^2+(y-1)^2=9$ $Hence\ centre\ is\ (-2,1)$ $radius\ is\ 3$ $\Longrightarrow diameter\ is\ 6$	M1 A1 B1	 For both centre and diameter

6	<table><tr><td>Number</td><td>Log</td></tr><tr><td>0.4892</td><td>$\bar{1}.6895$</td></tr><tr><td>72.89</td><td>$1.8626+$</td></tr><tr><td></td><td>1.5521</td></tr><tr><td>93.62</td><td>$1.9714-$</td></tr><tr><td></td><td>$\bar{1}.5807$</td></tr></table> $\bar{1}.5807 \times \frac{1}{3} = \bar{1}.8602$ $10^{-1} \times 7.249$ $= 0.7248$	M1 M1 M1 A1	All logs correct Correct addition and subtraction Correct division by 3
7	$Using\ the\ ratio\ theorem$ $OP = -1\begin{pmatrix}3\\2\\1\end{pmatrix} + 2\begin{pmatrix}5\\4\\3\end{pmatrix}$ $= \begin{pmatrix}-3\\-2\\-1\end{pmatrix} + \begin{pmatrix}10\\8\\6\end{pmatrix} = \begin{pmatrix}7\\6\\5\end{pmatrix}$ $\therefore P\ (7,6,5)$	M1 A1 B1	Accept alternative
8	<table><tr><td>X</td><td>10</td><td>8</td><td>14</td><td>16</td><td>6</td><td>18</td></tr><tr><td>$d = x - 12$</td><td>-2</td><td>-4</td><td>2</td><td>4</td><td>-6</td><td>6</td></tr><tr><td>d^2</td><td>4</td><td>16</td><td>4</td><td>16</td><td>36</td><td>36</td></tr></table> $s.d = \sqrt{\frac{\sum d^2}{N}}$ $= \sqrt{\frac{4+16+4+16+16}{6}}$ $= \sqrt{\frac{112}{6}}$ $= 4.32$	M1 M1 A1	C.A.O

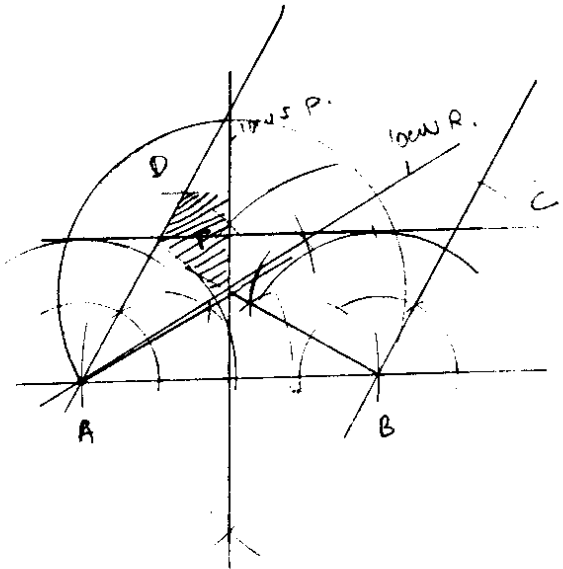
9	$\frac{dy}{dx} = 4x - 6$ $at\ minimum\ 4x - 6 = 0$ $\therefore x = 1.5$ $the\ minimum\ point\ is\ thus\ (1.5, 5.5)$ $y = 2x^2 - 6x + c$ $at\ (1.5, 5.5), c = 10$ $Hence, y = 2x^2 - 6x + 10$	B1 M1 A1	
10	$(a) 5 \times 5^{-1}, 5 \times 5^0, 5 \times 5^1, 5 \times 5^2$ $2.5, 5, 10, 20$ $(b) S_6 = \frac{2.5(2^6 - 1)}{2 - 1}$ $= 157.5$	B1 M1 A1	
11	$(a) 1 - 5\left(\frac{1}{2}x\right) + 10\left(\frac{1}{2}x\right)^2 - 10\left(\frac{1}{2}x\right)^3 + 5\left(\frac{1}{2}x\right)^4 - \left(\frac{1}{2}x\right)^5$ $1 - \frac{5}{2}x + \frac{5}{2}x^2 - \frac{5}{4}x^3 + \frac{5}{16}x^4 - \frac{1}{32}x^5$ $(b) 1 - \frac{5}{2}(0.1) + \frac{5}{2}(0.1)^2 - \frac{5}{4}(0.1)^3$ $1 - 0.25 + 0.025 - 0.00125$ $= 0.77375$	M1 A1 M1 A1	
12	(a) (b) $P(prime) = \frac{11}{20}$	B1 B1	

	1	3	5	7	9
1		**13**	**15**	**17**	**19**
3	**31**		**35**	**37**	**39**
5	**51**	**53**		**57**	**59**
7	**71**	**73**	**75**		**79**
9	**91**	**93**	**95**	**97**	

13	$Max = (3.25 + 5.5) - 1.95$ $= 6.8$ $Min = (3.15 + 4.5) - 2.05$ $= 5.6$ $Actual = (3.2 + 5) - 2.0$ $= 6.2$ $Absolute\ error = \frac{6.8 - 5.6}{2} = 0.6$ $\%\ error = \frac{0.6}{6.2} \times 100\%$ $= 9.677\%$	B1 M1 A1	For both max and min.
14	$A = \frac{kB}{\sqrt{C}}$ $A_O = k$ $A_1 = \frac{0.948k}{\sqrt{1.44}} = 0.79k$ $\%\ decrease = \frac{k - 0.79k}{k} \times 100\%$ $= 21\%$	 M1 M1 A1	
15	$(u - y) = \frac{p}{t + \frac{1}{r}}$ $t + \frac{1}{r} = \frac{p}{u - y}$ $\frac{1}{r} = \frac{p}{u - y} - t$ $\frac{1}{r} = \frac{p - ut + yt}{u - y}$ $r = \frac{u - y}{p - ut + yt}$	 M1 M1 A1	
16	(a)$\cos\theta = \frac{2}{4}$ $\theta = 60°$ (b)$\tan\theta = \frac{\sqrt{12}}{3}$ $\theta = 49.12°$	M1 A1 M1 A1	Accept alternatives

17	(a) (i) $58000 + 8200 + 6000$ $Ksh\ 72200$ (ii)$11180 \times 0.1 = 1118$ $10534 \times 0.15 = 1580.1$ $10534 \times 0.2 = 2106.8$ $10534 \times 0.25 = 2633.5$ $29418 \times 0.3 = 8825.4$ $\boldsymbol{Ksh\ 16263.8}$ $Net\ tax = \mathbf{16263.8 - 1280}$ $= \boldsymbol{Ksh\ 14983.8}$ (b)$\frac{5}{100} \times 58000 = 2900$ $\frac{30}{100} \times 2900 = 870$ $Net\ Salary = 72200 + 2900 - (14983.8 + 870)$ $= Ksh\ 59246.2$	M1 A1 M1 M1 M1 M1 A1 M1 M1 A1	First 3 slabs correct Last 2 slabs corct Correct addition
18		B1	

18. (a)Using a ruler and a pair of compasses only, construct a parallelogram ABCD such that $AB = 7cm, BC = 5cm$ and $\angle ABC = 120°$. (3mks)



(b)Construct the following loci on the same diagram above

i. P is such that $AP = BP$. (1mk)

ii. R is such that it is equidistant from DA and BA. (1mk)

iii. Q is such that $AQ = 3.5\ cm$. (1mk)

(c) A region T is such that $AT \leq BT, \angle DAT \leq \angle BAT$ and $AT \geq 3.5\ cm$. By shading, show the region T. (1mks)

(d) Locate point S such that $\angle ASB = 60°$ and the area of triangle ASB is 11.2 cm^2. Hence measure the shortest distance from S to C (3mks)

= 2·7cm.

19 (a) 61 B1

Class	f	x	fx	cf
42-46	3	44	132	3
47-51	4	49	196	7
52-56	10	54	540	17
57-61	12	59	708	29
62-66	8	64	512	37
67-71	3	69	207	40
	$\sum f = 40$		$\sum fx = 2295$	

B1

$$(b) Mean = \frac{2295}{40}$$

M1

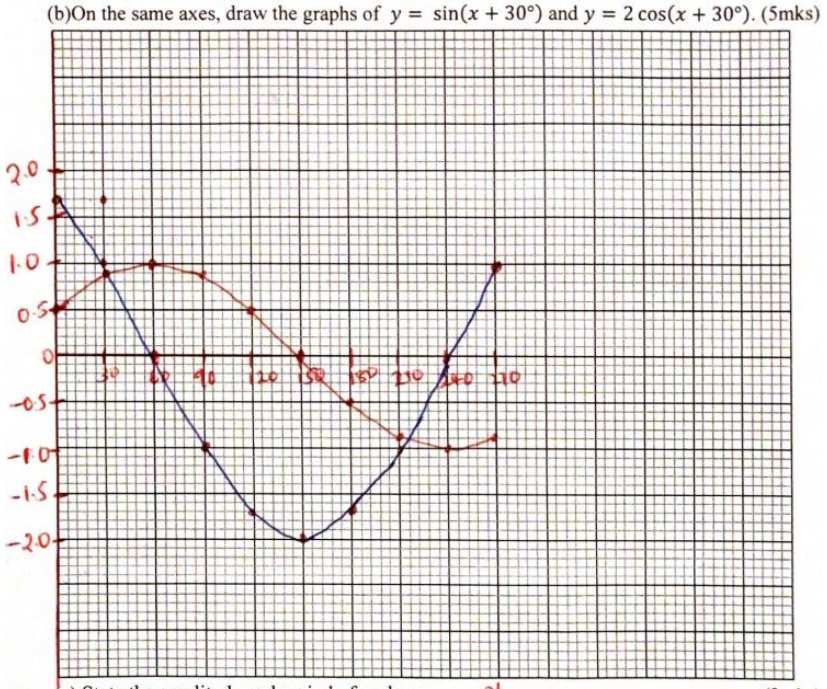
$$= 57.375$$

A1

	$(c) 55 = 51 + \left(\frac{N-7}{10}\right) \times 5$ $N = 14$ $Therefore\ those\ who\ passed\ are\ (40-14)+1$ $= 27$ $(d) Q1 = 51.5 + \left(\frac{10-7}{10}\right) \times 5 = 53$ $Q3 = 61.5 + \left(\frac{30-29}{8}\right) \times 5 = 62.125 \cong 62$ $Range\ is\ between\ 53\ marks\ and\ 62\ marks$ $53 \leq Marks \leq 62$	M1 A1 B1 M1 M1 A1	
20	$(a) 2 - 41.5 = 11.7°$ $Dist = \frac{11.7}{360} \times 2 \times \frac{22}{7} \times 6370$ $= 1301.3\ Km$ $(b) i. \frac{\theta}{360} \times 2 \times \frac{22}{7} \times 6370 \cos 53.2 = 2500$ $\theta = 37.5°$ $Longitude = 37.5 - 36.4 = 1.1°$ $\therefore Z\ (53.2°N\ ,\ 1.1°E)$ $ii. Time = \frac{1301.3}{500} + \frac{1}{2} + \frac{2500}{500}$ $= 8\ hours\ 6\ minutes$	B1 M1 A1 M1 A1 B1 M1 A1	

	$37.5 \times 4 = 150\ minutes \approx 2\ hours\ 30\ minutes$ $\therefore 9.00 + 2\ hr\ 30\ min + 8\ hrs\ 6\ \text{min}$ $= 7.36\ p.m$	M1 A1	
21	21. (a) Complete the table below to 2 dp. (2mks) (b)On the same axes, draw the graphs of $y = \sin(x + 30°)$ and $y = 2\cos(x + 30°)$. (5mks) (c) State the amplitude and period of each wave. (2mks) (d)Use the graph to solve the equation $2\cos(x + 30°) = \sin(x + 30°)$. (1mk) 216 and 32°.		

$x°$	0	30	60	90	120	150	180	210	240	270
$\sin(x + 30°)$	0.50	0.87	1	0.866	0.5	0	-0.50	-0.87	-1	-0.87
$2\cos(x + 30°)$	1.73	1	0	-1	-1.73	-2	-1.73	-1	0	1



Period	360	360
Amplitude	1	2

22	(a)$\boldsymbol{OS} = \frac{2}{7}p + \frac{5}{7}q$ $\boldsymbol{OR} = -q + \frac{1}{4}q$ (b)$OT = k\left(\frac{2}{7}p + \frac{5}{7}q\right)$ $\frac{2}{7}kp + \frac{5}{7}kq$ (c)i.$OT = \frac{1}{4}p + h\left(q - \frac{1}{4}p\right)$ $\frac{1}{4}p + hq - \frac{1}{4}hp$ ii. $\frac{2}{7}kp + \frac{5}{7}kq = \frac{1}{4}p + hq - \frac{1}{4}hp$ $\frac{2}{7}k = \frac{1}{4} - \frac{1}{4}h \implies 8k = 7 - 7h \ldots\ldots(i)$ $\frac{5}{7}k = h \ldots\ldots(ii)$ $k = \frac{7}{13}\ and\ h = \frac{5}{13}$ (d)$15: -8$	M1 A1 B1 B1 M1 A1 M1 M1 A1 B1	
23	(a) x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 y | -2 | -1.5 | 0 | 2.5 | 6 | 10.5 | 16 | 22.5 | 30 (b)$A = \frac{1}{2} \times 1\{(2 + 30) + 2(1.5 + 0 + 2.5 + 6 + 10.5 + 16 + 22.5)\}$ $= 75$ (c)$A = 2(1.5 + 2.5 + 10.5 + 22.5)$ $= 74$	B1 M1 A1 M1 A1	

	(d) $\left[\frac{x^3}{6}-2x\right]_0^2+\left[\frac{x^3}{6}-2x\right]_2^8$ $\left(\frac{8}{6}-4\right)-0+\left(\frac{512}{6}-16\right)-\left(\frac{8}{6}-4\right)$ $-2\frac{2}{3}+69\frac{1}{3}-2\frac{2}{3}$ $69\frac{1}{3}$ (e) $\left(\frac{74-69\frac{1}{3}}{69\frac{1}{3}}\right)\times 100\%$ 6.731%	M1 M1 A1 \ M1 A1	

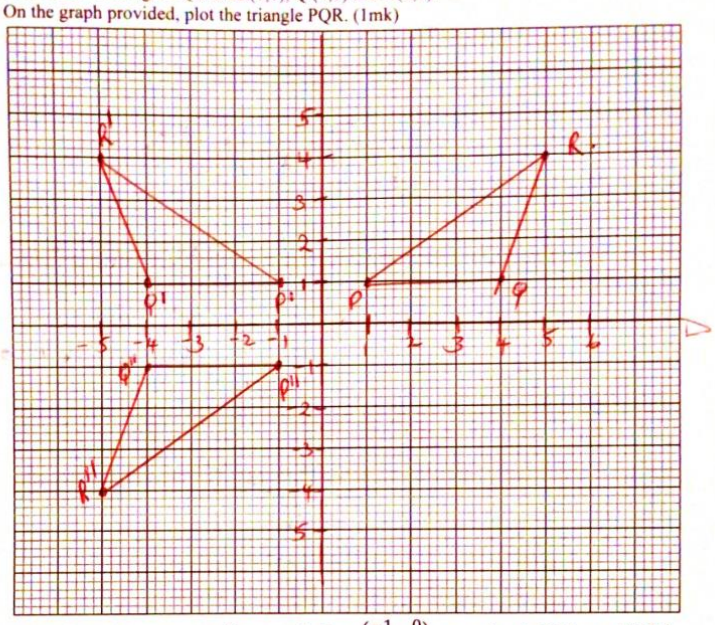
24

$\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 4 & 5 \\ 1 & 1 & 4 \end{pmatrix} = \begin{pmatrix} -1 & -4 & -5 \\ 1 & 1 & 4 \end{pmatrix}$

$\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} -1 & -4 & -5 \\ 1 & 1 & 4 \end{pmatrix} = \begin{pmatrix} -1 & -4 & -5 \\ -1 & -1 & -4 \end{pmatrix}$

24. The vertices of a triangle PQR are P(1,1), Q (4,1) and R(5,4).

a) On the graph provided, plot the triangle PQR. (1mk)



b) A transformation represented by a matrix $T = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ maps triangle PQR onto $P^IQ^IR^I$. Draw and state the coordinates of $P^IQ^IR^I$. (3mks)

P'(-1,1) Q'(-4,1) R'(-5,4).

c) Another transformation $U = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ maps $P^IQ^IR^I$ onto $P^{II}Q^{II}R^{II}$. Draw and state the coordinates of $P^{II}Q^{II}R^{II}$. (3mks)

P''(-1,-1) Q''(-4,-1) R''(-5,-4).

d) Describe a single transformation that maps PQR onto $P^{II}Q^{II}R^{II}$ and find its matrix. (3mks)

- Enlargement Scale factor −1 about the origin or
- It is a rotation of ±180° about the origin.

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Its matrix is

$\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$.