456/2
MATHEMATICS
Paper 2
JULY, 2014
$2\frac{1}{2}$ *hours*

JJEB

JINJA JOINT EXAMINATIONS BOARD

Uganda Certificate of Education

MOCK EXAMINATIONS – JULY, 2014

MATHEMATICS

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

Answer **ALL** *questions in Section* **A** *and* ***not more than*** **FIVE** *from section* **B**.

Any additional question(s) answered will not be marked.
All necessary calculations must be shown and should be done on the same page as the rest of the answer.

Mathematical tables and graph papers are provided.

Silent, non-programmable scientific calculators may be used.

SECTION A (40 MARKS)
Attempt all questions.

1. Express 0.52777....as a fraction in its lowest term.

2. Given that $\underset{\sim}{a} = \begin{pmatrix} 10 \\ -14 \end{pmatrix}$, $\underset{\sim}{b} = \begin{pmatrix} -4 \\ 5 \end{pmatrix}$ and $\underset{\sim}{p} = \underset{\sim}{a} - 2\underset{\sim}{b}$,

   (i) The value of $\underset{\sim}{p}$

   (ii) The length of $\underset{\sim}{p}$.

3. Two points P(2,5) and Q(4,3) are in a plane find the

   (a) Coordinates of R, the midpoint of $\overline{PQ}$

   (b) Gradient of the line perpendicular to line PQ

4. A car travelled at an average speed of 85km h^{-1} for 5 hours and then it further travelled at an average speed of 69 km h^{-1} for 3 hours.
   Find the average speed of the car for the whole journey.

5. If $f(x) = \frac{3}{x^2-5x+6}$
   Find the values of x for which the function is meaningless.

6. Shillings 3,600,000 was shared among six sons, three daughters and one mother in the ratio 4:5:3 respectively. Find how much each daughter got.

7. Simplify $2\log_{10} 5 - \log_{10} 0.1 + \log_{10} 4$

8. Use logarithm tables only to evaluate $\sqrt[3]{49 \times 0.001464}$

9. Find the L.C/M and H.C.F of 78 and 42.

10. Maido bought a printing machine at shs 7,000,000. The depreciation rate of the machine is 14.0% per annum. Calculate the value of the machine after 2 years.

SECTION B (60 MARKS)
Attempt any five questions only

11. (a) Evaluate $\dfrac{(5\frac{1}{4})^2-(4\frac{1}{5})^2}{(4\frac{1}{2})^2} \div 1\frac{2}{5}$ (6 marks)

(b) Solve the equation

$$log_{10}(x+1) + log_{10}(x-2) = log_{10}10$$ (6 marks)

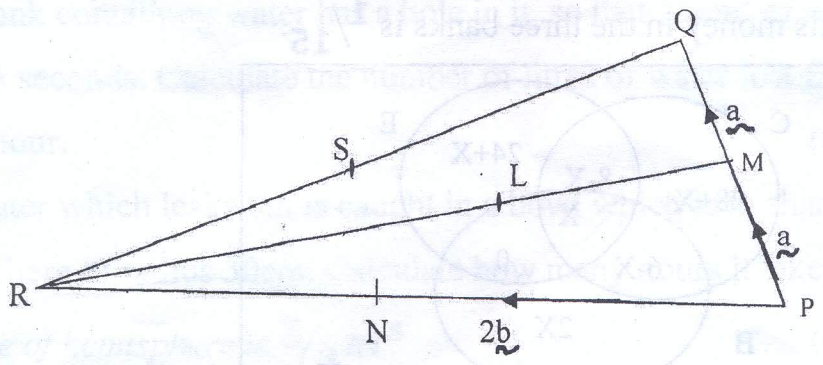
12. A line passing through the point M (5,4) is parallel to a line passing through the points T (4,6) and R(2,2). Find the;

(a) Equation of the line through M and parallel to line TR. (6 marks)

(b) Co-ordinates of the point of intersection of the line in (a) and the line

$y = -x + 6$. (6 marks)

13. In the figure below, PQ = 2$\boldsymbol{a}$ and PN = 2NR = 2b. M and S are the mid-points of $\overline{PQ}$ and $\overline{QR}$ respectively. ~~angle~~ L is a point on $\overline{MR}$ such that $2\overline{ML} = \overline{LR}$



(a) Express the following vectors in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$

(i) MR

(ii) ML

(iii) QL

(b) Show that P, L and S are collinear.

14. Amega and Okurut have shares in a company. Amega contributed ug. Shs 400,000,000 as his share capital. Okurut contributed ug shs 600,000,000 as his share capital. In one year the company made a gross profit of ug shs 200,000,000. The company expenses that year were electricity 12,000,000, salaries and wages 55,000,000 and transport 13,000,000. The net profit was shared in proportion to their share capitals.

(a) Find the;

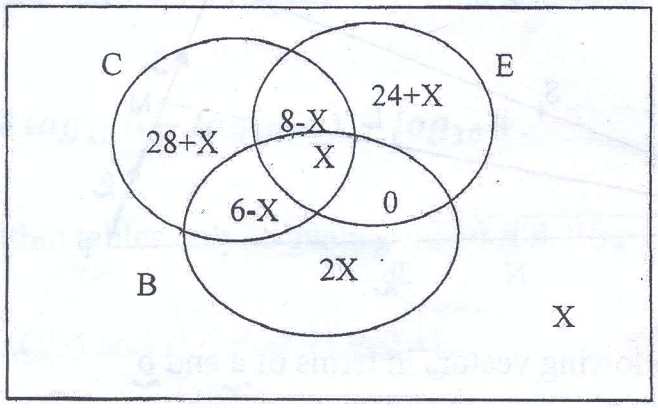
(i) Total expenditure for the company

(ii) Percentage of the company's expenses to the net profit. (6 marks)

(b) Calculate how much money each share holder got that year if 10% of this amount went to URA as income tax. (6 marks)

15. The venn diagram shows how teachers in Hoima town save their money in different Banks, Centenary(C), Equity(E) and Barclays(B)

The District Education Officer says that the probability that a teacher does not save any of his money in the three banks is $\frac{1}{15}$.



Using the information above, Determine ;

(i) The number of teachers who save in all the three banks.

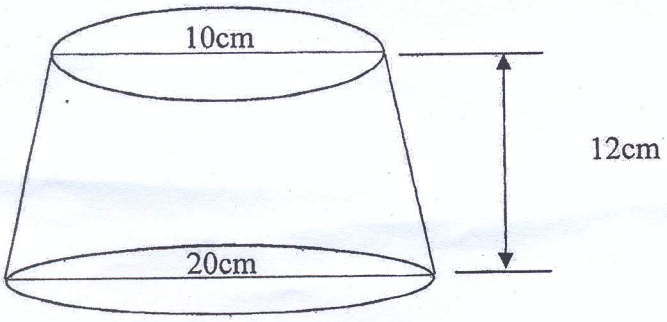
(ii) The total number of teachers in Hoima town.

(iii) Which one of this banks is very popular with the teachers.

(iv) The probability that a teacher picked at random saves in at least two banks.

(v) The ratio in its simplest form of the number of teachers saving in Barclays only to that of Equity only. (12 marks)

16. The lampshade shown below has a height of 12cm. It's upper and lower diameters are 10cm and 20cm respectively.



Calculate the area of the material required to cover the curved outer surface of the lampshade. (12 marks)

(use $\pi = 3.142$)

17. (a) A tank containing water has a hole in it, so that $15cm^3$ of water leak out every 5 seconds. Calculate the number of litres of water lost from the tank every hour. (6 marks)

The water which leaks out is caught in a bowl which is in shape of a hemisphere of radius 30cm. Calculate how many hours it takes to fill the bowl.

Volume of hemisphere is $^2/_3 \pi r^3$ (6 marks)

 End

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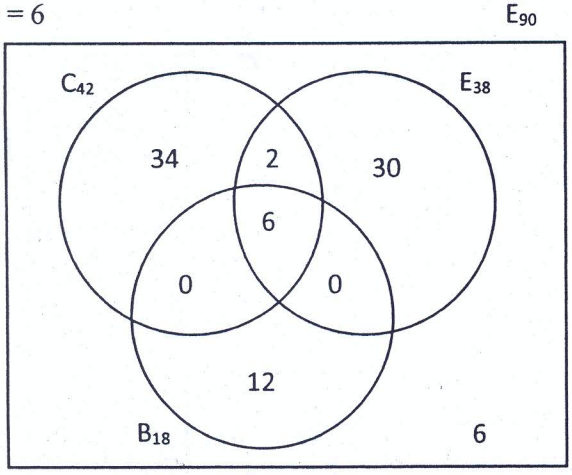
M. GUIDE 456/2 2014

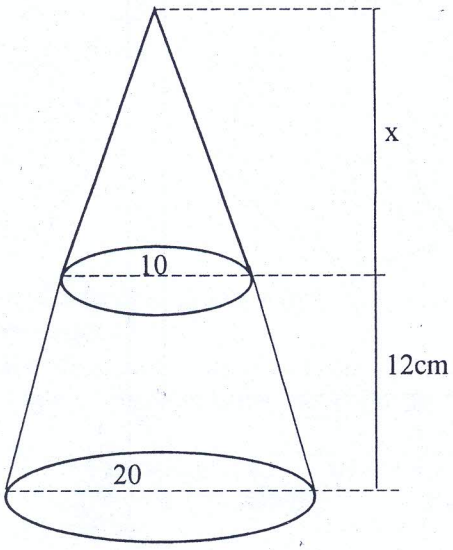
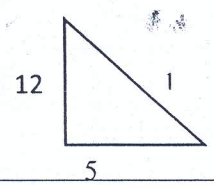
Question	Solution	Marks	Comment
1.	Let r = 0.52777 … 1000r = 527.777 … 100r = 52.777 … - 900 r = 475 $r = \frac{475}{900}$ $= \frac{95}{180}$ $= \frac{19}{36}$	M1 M1 A1 A1	
2.	$\check{P} = \check{a} - 2\check{b}$ $= \begin{pmatrix} 10 \\ -14 \end{pmatrix} - 2\begin{pmatrix} -4 \\ 5 \end{pmatrix}$ $= \begin{pmatrix} 10 \\ -14 \end{pmatrix} + \begin{pmatrix} 8 \\ -10 \end{pmatrix}$ $= \begin{pmatrix} 18 \\ -24 \end{pmatrix}$ $\lvert\tilde{P}\rvert = \sqrt{18^2 + (-24)^2}$ $= \sqrt{324 - 576}$ $= \sqrt{900}$ = 30	M1 A1 M1 A1	
3.	Coordinates of R are $\left(\frac{2+4}{2}, \quad \frac{5+3}{2}\right)$ (3, 4) Gradient of PQ is $\frac{5-3}{2-4} = \frac{2}{2} = -1$ Gradients of its perpendicular is + 1.	M1 A1 B1 B1	
4.	Distance I = 85 × 5 = 425 km Distance II = 69 × 3 = 207 km Average speed = $\frac{425+207}{5+3}$ $= \frac{632}{8}$ = 79 kmh^{-1}	M1 M1 M1 A1	
5.	F(x) is meaning less when $X^2 - 5x + 6 = 0$ $X^2 - 3x - 2x + 6 = 0$ $X(x-3) - 2(x-3) = 0$ $(x-3)(x-2) = 0$ $X - 3 = 0$ or $x - 2 = 0$ $X = 3$ $X = 2$	B1 M1 A1,A1 for each	
6.	Total ratio is 4 + 5 + 3 = 12 Three daughters got $\frac{5}{12} \times 3{,}600{,}000$ 5 × 300, 000 1, 500, 000	M1 A1	

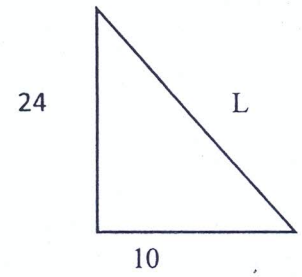
	Each daughter got $\frac{1500,000}{3}$ = shs. 500, 000	M1 A1	
7.	$2\log_{10} 5 - \log_{10} 0.1 + \log_{10} 4$ $\log_{10} 5^2 + \log_{10} 4 - \log_{10} 0.1$ $\log_{10}(\frac{25\times4}{0.1})$ $= \log_{10} \frac{25\times4\times10}{1}$ $= \log_{10} 1000$ $= \log_{10} 10^3$ $= 3\log_{10}10$ $= 3$	M1M1 M1 A1	
8.	No s.d log 49 4.9×10^1 1.6902 + 0.001464 1.464×10^{-3} $\bar{3}$.1655 $= \bar{2}.8557$ $= \bar{3} + 1.8557$ $\sqrt[3]{49\times0.001464}$ = Antilog $\bar{1}.6192$ = 41.61	B1 M1 M1 A1	Reading logs
9.	2 | 78 | 42 3 | 39 | 21 7 | 13 | 71 13 | 13 | 1 L.C.M = $2\times3\times7\times13$ = 546 H.C.F = 2×3 = 6	M1M1 A1 A1	
10.	$\frac{86}{100}\times\frac{86}{100}\times 7\,000,000$ $86\times86\times700$ = 5,177,200 Or $7,000,000\left(1-\frac{14}{100}\right)^2$ $7,000,000\times0.86^2$ = 5,177,200	M1M1M1 A1 M1M1 M1 A1	
11. (a)	$\frac{(5\frac{1}{4})^2-(4\frac{1}{5})^2}{(4\frac{1}{2})^2} \div 1\frac{2}{5}$ $\frac{(\frac{21}{4})^2-(\frac{21}{5})^2}{(\frac{9}{2})^2} \div \frac{7}{5}$ $\frac{(\frac{21}{4}+\frac{21}{5})(\frac{21}{4}-\frac{21}{5})}{(\frac{9}{2})^2} \div \frac{7}{5}$	 M1 M1	

	$\frac{(\frac{105+84}{20})(\frac{105-84}{20})}{\frac{81}{4}} \div \frac{7}{5}$ $((\frac{189}{20})(\frac{21}{20}) \div \frac{81}{4}) \div \frac{7}{5}$ $(\frac{189}{20})(\frac{21}{20}) \times \frac{4}{81}) \times \frac{5}{7}$ $(\frac{21}{4})(\frac{3}{20}) \times \frac{4}{9}$ $= \frac{7}{20}$	M1 M1 M1 A1	
(b)	$Log_{10}(x+1) + log_{10}(x-2) = log_{10}10$ $Log_{10}(x+1)(x-2) = log_{10}10$ $(x+1)(x-2) = 10$ $X^2 - x - 2 = 10$ $X^2 - x - 12 = 0$ $(x-4)(x+3) = 0$ $X - 4 = 0$ or $x + 3 = 0$ $X = 4$ or $X = -3$	 M1 M1 M1 M1 A1A1	
12. (a)	Gradient of line TR $\frac{6-2}{4-2} = \frac{4}{2} = 2$ Equation of line through (5,4) with gradient 2 is $\frac{y-4}{x-5} = 2$ $y - 4 = 2x - 10$ $y = 2x - 6$	 M1A1 M1 M1 M1A1	
(b)	To find the coordinates, we solve $y = 2x - 6$ and $y = -x + 6$ simultaneously $2x - 6 = -x + 6$ $3x = 12$ $x = 4$ $y = 2(4) - 6$ $y = 2$ Coordinates are (4, 2)	 M1 M1 A1 M1 A1 B1	
13. (a)	(i) $MR = MP + PR$ $= -\tilde{a} + 2\tilde{b}$ $-a+2b$ Or $= 2\tilde{b} - \tilde{a}$ $2b-a$ (ii) $ML = \frac{1}{2} LR$ $= \frac{1}{3} MR$ $= \frac{1}{3}(2\tilde{b} - \tilde{a})$ $\frac{2b-a}{3}$	M1 A1 M1 A1	

	(iii) $QL = QM + ML$ $= -\tilde{a} + \frac{1}{3}(2\tilde{b} - \tilde{a})$ $= \frac{-3\tilde{a}+2\tilde{b}-\tilde{a}}{3}$ $= \frac{2\tilde{b}-4\tilde{a}}{3}$ Or $= \frac{2}{3}(\tilde{b} - 2\tilde{a})$	M1 A1	
(b)	$PL = PM + ML$ $= \tilde{a} + \frac{1}{3}(2\tilde{b} - \tilde{a})$ $= \frac{3\tilde{a}+2\tilde{b}-\tilde{a}}{3}$ $= \frac{2\tilde{a}+2\tilde{b}}{3}$ $= \frac{2}{3}(\tilde{a} + \tilde{b})$ $LS = LQ + QS$ $= LQ + \frac{1}{2}(QP + PR)$ $= \frac{2}{3}(2\tilde{a} - \tilde{b}) + \frac{1}{2}(2\tilde{b} - 2\tilde{a})$ $= \frac{4(2\tilde{a}-\tilde{b})+3(2\tilde{b}-2\tilde{a})}{6}$ $= \frac{8\tilde{a}-4\tilde{b}+6\tilde{b}-6\tilde{a}}{6}$ $= \frac{2\tilde{a}+2\tilde{b}}{6}$ $= \frac{1}{3}(\tilde{a} + \tilde{b})$ Since $\widetilde{PL}$ and $\widetilde{LS}$ have vector $(\tilde{a} + \tilde{b})$ in common, then they are parallel. And since L is the common point then they lie on one straight line implication is they are collinear.	M1 A1 M1 A1 B1 A1	
		12	
14. (a)	(i) Total expenditure = 12,000,000 + 55,000,000 + 13,000,000 Shs, 80,000,000 (ii) Net Profit = 200,000,000 – 80,000,000 Shs, 120,000,000 $\frac{80,000,000}{120,000,000} \times 100\%$ 66.667% $\cong$ 66.7%	M1 A1 M1 A1 M1 A1	
(b)	Share ratio Amega : Okurut 400,000,000 : 600,000,000 2 : 3	 M1 A1	

	Amega got $\frac{2}{5} \times 120{,}000{,}000 \times \frac{90}{100}$ Shs, 43,200,000 Okurut got $\frac{3}{5} \times 120{,}000{,}000 \times \frac{90}{100}$ Shs. 64,800,000	M1 A1 M1 A1 12	
15.	Total number of teachers is $28 + x + 24 + x + 2x + 8 - x + 6 - x + x + x$ $= 66 + 4x$ $\frac{x}{66+4x} = \frac{1}{15}$ $15x = 66 + 4x$ $11x = 66$ $x = 6$  (i) n (c n E n B) = 6 (ii) n(∈) = 66 + 4 × 6 = 90 (iii) Centenary bank (iv) $\frac{2+6}{90}$ $\frac{8}{90}$ or $\frac{4}{45}$ (v) 12 : 30 2 : 5	M1 A1 M1 M1 A1 B1 B1 B1 M1 A1 M1 A1	
16.			

	(i) n (c n E n B) = 6 (ii) n(∈) = 66 + 4 × 6 = 90 (iii) Centenary bank (iv) $\frac{2+6}{90}$ $\frac{8}{90}$ or $\frac{4}{45}$ (v) 12 : 30 2 : 5	B1 B1 B1 M1 A1 M1 A1	
16.	 $\frac{10}{20} = \frac{x}{12+x}$ $\frac{1}{2} = \frac{x}{12+x}$ 2x = 12 + x X = 12 	B1 Sketch M1 M1 A1	

	$l = \sqrt{5^2 + 12^2}$ $= \sqrt{169}$ $l = 13$  $L = \sqrt{24^2 + 10^2}$ $= \sqrt{676}$ $L = 26$ Area of curve surface $= 3.142 \times 10 \times 26 - 3.142 \times 5 \times 13$ $= 816.92 - 204.23$ $= 612.69\ cm^2$	M1 A1 M1 A1 M1M1 M1 A1	
		12	
17. (a)	In 5 secs → 15 cm^2 leaks out In 1 sec → $\frac{15}{3}$ = $5cm^3$ leaks out 3 cm³ In 1 hour $5 \times 60 \times 60\ cm^3$ 3 × 60 × 6 = 18,000 cm^3 leaks out 10,800 cm³ Number of litres = $\frac{18000}{1000}$ = 18 litres 10.8 litres	M1 A1 M1 A1 M1 A1	
(b)	Volume of hemisphere = $\frac{2}{3} \times \frac{22}{7} \times 30 \times 30 \times 30$ $= 56571.42\ cm^3$ Volume in litres to fill = $\frac{56571.42}{1000}$ = 56.57142 ≈ 56.57 lites	M1 A1 M1 A1	