KENYA NATIONAL EXAMINATION COUNCIL
REVISION MOCK EXAMS 2016
TOP NATIONAL SCHOOLS

ALLIANCE BOYS HIGH ELDORET

MATHEMATICS

PAPER 2

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ALLIANCE BOYS HIGH SCHOOL KCSE TRIAL AND PRACTICE EXAM 2016

PAPER 2

MARKING SCHEME

Answer ALL Questions in this section.

1. Find the percentage error in estimating the volume of a cone whose radius is 3.4cm and height is 8cm.(3 marks)

$V = ½ \pi r^2 h$

$R.E = \frac{0.05}{3.4} + \frac{0.05}{3.4} + \frac{0.5}{8}$

$= 0.09191$

$\% \text{ Error} = 0.09191 \times 100$

$= 9.191\%$

2. Make n the subject of the formula $P = ar^2 - s)^{1/n}$ (3 marks)

$P^n = ar^2 - s$

$n/\log P = \log (ar^2 - s)$

$n = \frac{\log (ar^2 - s)}{\log p}$

3. Solve the equation $2\cos^2 x - \sin x = 1$ for $-180^0 \leq x \leq 180^0$. (4 marks)

$2 (1-\sin^2 x) - \sin x - 1 = 0$

$2-2 \sin^2 x - \sin x - 1 = 0$

- $2\sin^2 x-\sin x+1 = 0$

$2\sin^2 x+\sin x-1 = 0$

$2y^2 + 2y - y - 1 = 0$

$2y (y+1) - 1 (y+1) = 0$

$(2y-1) (y+1) = 0$

4. When N = 1 and M = 5 when N = ½

d) Find the equation connecting M and N. (2 marks)

$M = aN + b/N^2$

$a+b = 3$

$\underline{a+8b = 10}$

$7b = 7$

$b = 1, a = 2$ Therefore $M = 2N + 1/N^2$

e) Calculate the value of M when N = 2/3 (1 mark)

$M = 2x\frac{2}{3} + \frac{1}{(2/3)^2}$

$= \frac{4}{3} + \frac{9}{4} = \frac{16 + 27}{12} = \frac{43}{12} = 3\frac{7}{12}$

5. Solve for x in the equation $½ \log_2 81 + \log^2 (x^2 - x/3) = 1$ (3 marks)

$\log_2 9 + \log_2\left(x^2 - \frac{x}{3}\right) = \log_2 2$ M1

$\log_2 9\left(x^2 - \frac{x}{3}\right) = \log_2 2$

$9x^2 - 3x - 2 = 0$ M1

$(3x+1)(3x-2) = 0$ A1

$x = -\frac{1}{3}$ or $x = \frac{2}{3}$

6. Use logarithms to evaluate $\left(\frac{34.65 \times 0.451}{4.675}\right)^{-\frac{1}{3}}$ (4mks)

$= \left(\frac{4.675}{34.65 \times 0.451}\right)^{\frac{1}{3}}$

No	log	
4.675	0.6698	M1 √logs
34.65	1.5397 +	M1 √
0.451	$\bar{1}.6542$	M1 √inv
	1.1939 4.675	
	0.6698 −	A1
	1.1939	
	$\bar{1}.4759 \times \frac{1}{3}$	

[redacted] Buma II 2014 – 121/2

$\frac{\bar{3} + 2.4759}{3} = \bar{1}.8253$

$6.688 \times 10^{-1} \leftarrow \bar{1}.8253$

$= 0.6688$ ✓

7. Table below is part of tax table for annual income for the year 2010.

Taxable income in K£4 p.a.	Rate in Kshs. Per K£
Under K£4201	2
From K£4201 but under K£8401	3
From K£8401 but under K£1261	4

In the year 2010, the tax on Oyugi's annual income was Ksh.12,000. Calculate Oyugi's annual income in K£. (3 marks)

1st 4200 = 4200 x 2 = 8,400

Income in Kf = $\frac{12000 - 8400}{3} + 4200$

= 1200 + 4200

Kf = 5400

8. (a) Expand $(1 - 2x)^6$ upto the term in x^3. (1 mark)

$= 1 - 12x + 60x^2 - 160x^3$

(b) Use the expansion to evaluate $(1.02)^6$ to 4 decimal places. (2 marks)

$= 1 - 12(-0.01) + 60(-0.01)^2 - 160(-0.01)^3$

$= 1 + 0.12 + 0.006 + 0.00016$

$= 1.1262$ (4d.p)

9. Given that OA = 2i + 5k and OB = 7i – 5j. A point T is on B such that 2AT = 3TB. Calculate the magnitude of OT to 4 significant figures. (3 marks)

$\underset{\sim}{OT} = \frac{3}{5}\underset{\sim}{OB} + \frac{2}{5}\underset{\sim}{OA}$

$= \frac{3}{5}\begin{pmatrix}7\\-5\\0\end{pmatrix} + \frac{2}{5}\begin{pmatrix}2\\0\\5\end{pmatrix}$

$= \begin{pmatrix}5\\-3\\2\end{pmatrix}$ B1

$|\underset{\sim}{OT}| = \sqrt{5^2 + -3^2 + 2^2} = 6.164$ units. M1A1

10. Find the quartile deviation for the set of data below. (2 marks)

16, 18, 10, 8, 5, 11, 4 and 7

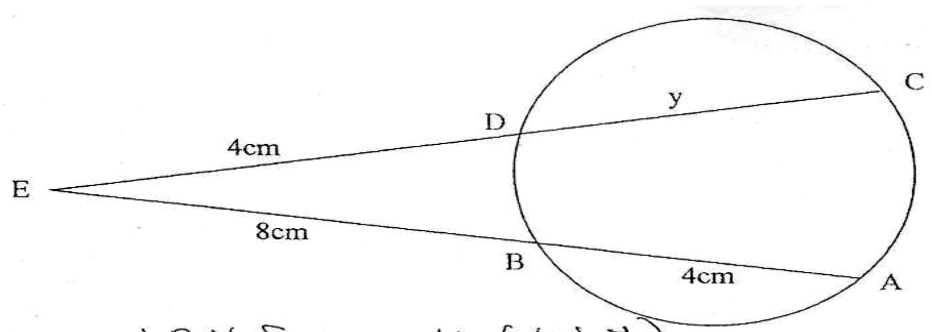
4, 5, 7, 8, 10, 11, 16, 18

$L.Q = \frac{5+7}{2} = 6$

$U.Q = \frac{11+16}{2} = 13.5$ B1

Quartile deviation $= \frac{13.5 - 6}{2} = 3.75$ B1

11. In the figure below, line AB = 4cm, BE = 8cm and DE = 4cm. Find the value of y. (2 marks)



$12 \times 8 = 4(4+y)$

$24 = 4 + y$

$y = 20$ cm.

12. Solve the following simultaneous inequalities and state all integral values for the solution.

$\frac{x-3}{3} < 1$

$3x + 1 \geq -17$ (2 marks)

$X - 3 < 3$

$X < 6$ *$3X \geq -18$*

$X \geq -6$

$-6 \leq X < 6$

- *6, - 5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5*

13. The curve $y = ax^3 - 3x^2 - 2x + 1$ has the gradient 7 when x = 1. Find the:

(i) Value of a

$\frac{dy}{dx} = 3ax^2 - 6x - 2$

$3ax^2 - bx - 2 = 7$

$3a - 6 - 2 = 7$ *at x = 1*

$3a = 15$

$a = 5$

(ii) Equation of the tangent to the curve at x = -1 (3 marks)

$\frac{dy}{dx} = 15x^2 - 6x - 2$

$x = -1$

$\frac{dy}{dx} = 15 + 6 - 2$

$= 19$

$\frac{y - {}^{-}5}{x - -1} = 19$ *at (-1, -5)*

$\frac{y+5}{x+1} = 19$

$y + 5 = 19 \times 19$

$y = 19x + 14$

$y = 19x + 14$

14. Without using a calculator, $\frac{\sqrt{252} + \sqrt{72}}{\sqrt{32} + \sqrt{28}}$, leaving the answer in the form $a\sqrt{b} + c$ where a, b and c are integers. (4 marks)

$= \frac{6\sqrt{7} + 6\sqrt{2}}{4\sqrt{2} + 2\sqrt{7}} = \frac{3\sqrt{7} + 3\sqrt{2}}{2\sqrt{2} + \sqrt{7}} \times \frac{(2\sqrt{2} - \sqrt{7})}{(2\sqrt{2} - \sqrt{7})}$

15. A mixture contains two powders P and Q with masses in the ration 3: 11. If the mixture costs sh.670 per kg and powder P costs sh.560 per kg, find the cost of a kg of powder Q. (3 marks)

$\frac{3 \times 560 + 11Q}{3 + 11} = 670$

$1680 + 11Q = 670 \times 14$

$11Q = 7700$

$Q =$ *kshs.700*

16. Find the radius and the centre of a circle whose equation is

$3x^2 + 3y^2 + 18y = 12x - 9 = 0$ (3 marks)

$x^2 + y^2 + 6y - 4x - 3 = 0$

$x^2 - 4x + y^2 + 6y = 3$

$x^2 - 4x + 4 + y^2 + 6y + 9 = 3 + 4 + 9$

$(x - 2) + (y + 3)^2 = 16$

Centre (2, -3)

$R2 = 16$

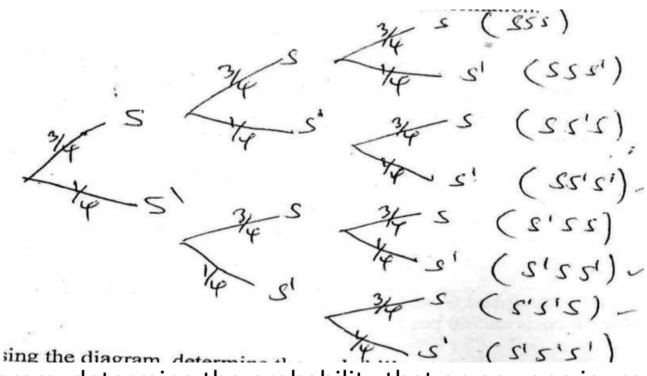
$R = 4$ *units*

SECTION 11 (50 Marks)

Answer any five questions from this Section.

17. In driving to work, Buma has to pass through three sets of traffic lights. The probability that he will have to stop at any of the lights is ¾

a) Draw a tree diagram to represent the above information. (2 marks)



(b) Using the diagram, determine the probability that on any one journey, he will have to stop at:

i) All the three sets. (2 marks)

$\frac{3}{4} \times \frac{3}{4} \times \frac{3}{4}$

$= \frac{27}{64}$

ii) Only one of the sets (2 marks)

$(\frac{3}{4} \times \frac{1}{4} \times \frac{1}{4}) + (\frac{1}{4} \times \frac{3}{4} \times \frac{1}{4}) + (\frac{1}{4} + \frac{1}{4} + \frac{3}{4})$

$= \frac{9}{64}$

iii) Only two of the sets (2 marks)

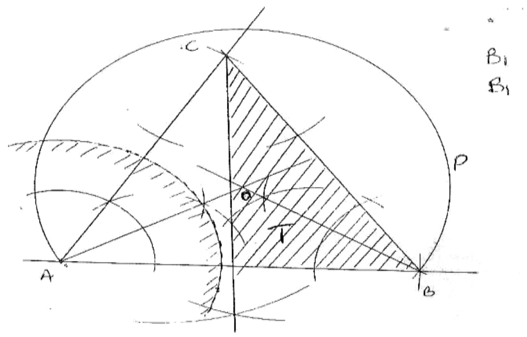
$(\frac{3}{4} \times \frac{3}{4} \times \frac{1}{4}) + (\frac{3}{4} \times \frac{1}{4} \times \frac{3}{4}) + (\frac{1}{4} \times \frac{3}{4} \times \frac{3}{4})$

$= \frac{27}{64}$

iv) None of the sets. (2 marks)

$\frac{1}{4} \times \frac{1}{4} \times \frac{1}{4} \qquad = \frac{1}{64}$

18. (a) Using a ruler and pair of compasses only, construct triangle ABC in which AB = 9cm, AC = 8cm and angle BAC = 60^0. (2 marks)



(b) On the same side of AB as C, draw the locus of a point such that angle APB = 60^0 (3 marks)

(a) A region T is within the triangle ABC such that AT > 4cm and angle ACT ≥ angle BCT. Show the region T by shading it. (5 marks)

19. Three consecutive terms in a geometric progression are 3^{2x1}, 9^x and 81 respectively.

a) Calculate the value of x. (3 marks)

$$\frac{3^{2x}}{3^{2x}+1} = \frac{34}{3^{2x}}$$

$$3^{4x} = 3^{2x} + 5$$

$$4x = 2x + 5$$

$$x = 2.5$$

b) Find the common ratio of the series. (2 marks)

$$r = \frac{3^4}{3^{2(5/2)}}$$

$$= \frac{34}{35}$$

$$= 3^{-1} \qquad = 1/3$$

c) Calculate the sum of the first 10 terms of the series. (2 marks)

$$S_{10} = \frac{3^6\left(1-\left(\frac{1}{3}\right)^{10}\right)}{1-\frac{1}{3}}$$

$$= 1093\tfrac{13}{27} \quad \text{or} \quad 1093.48$$

d) Given that the fifth and the seventh terms of this G.P form the first two consecutive terms of an arithmetic sequence, Calculate the sum of the first 20 terms of the arithmetic sequence. (3 marks)

$T_5 = ar^{n-1} = 3^6\left(\frac{1}{3}\right)^4 = 3^6 \cdot \frac{1}{3^4} = 3^2 = 9$ (3mrks)

$T_7 = ar^{n-1} = 3^6\left(\frac{1}{3}\right)^6 = \frac{3^6}{3^6} = 1$

9, 1 — — — — ✓ B1

$d = -8$

$S_{20} = \frac{20}{2}\left(2 \times 9 + (20-1) \times -8\right)$ M1

$= 10\left(18 + 19 \times -8\right)$ A1

e) Sketch the curve of $y = x^2 - 4$ (2 marks)

$x^2 - 4 = 0$

$(x+2)(x-2) = 0$

$x = 2$ or $x = -2$ B1

$x = 0,\ y = -4$

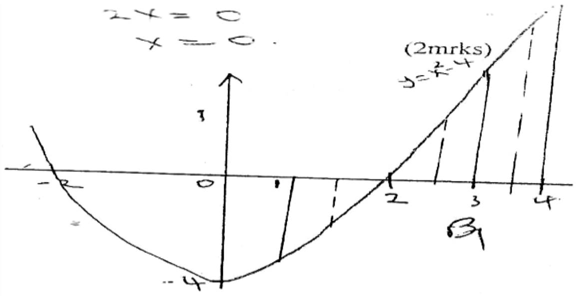
$(2, 0), (-2, 0)$ and $(0, -4)$

At turning point $\frac{dy}{dx} = 0$

$\frac{dy}{dx} = 2x$

$2x = 0$

$x = 0$.



e) Calculate the area bounded by the curve $y = x^2 - 4$, the x – axis, the lines $x = 1$ and $x = 4$ by using the trapexoidal rule with 6 equal strips. (3 marks)

x	1	1.5	2	2.5	3	3.5	4
y	-3	-1.75	0	2.25	5	8.25	12

$\text{Area} = \frac{1}{2} \times 0.5 \left[(3+12) + 2(1.75 + 0 + 2.25 + 5 + 8.25)\right]$ M1

$= \frac{1}{4}\left[15 + 2(17.25)\right]$

$= 12.375 \text{ units}^2$

A1

F) Calculate the exact area in (6) above using the method of integration. (4 marks)

$\text{Area} = \int_1^2 (x^2 - 4)\,dx + \int_2^4 (x^2 - 4)\,dx$ M1

$= \left[\frac{1}{3}x^3 - 4x\right]_1^2 + \left[\frac{1}{3}x^3 - 4x\right]_2^4$

$= \left[\left(\frac{8}{3} - 8\right) - \left(\frac{1}{3} - 4\right)\right] + \left[\left(\frac{64}{3} - 16\right) - \left(\frac{8}{3} - 8\right)\right]$

$= \frac{4}{3} + \frac{32}{3}$ M1

$= \frac{36}{3}$

$= 12 \text{ units}^2$ M1

d) Find the percentage error in the area in (b) above. (1 mark)

% error = $\frac{12.375 - 12}{12} \times 100$

= *3.125*

21. A and B are two points on the latitude 40^0N. The two points lie on the longitudes 20^0 W and 100^0 E respectively.

a) Calculate:

The distance from A to B along a parallel of latitude. (3 marks)

Longitude difference = 20 + 100 = 120^0

Distance between A and B = $\frac{120}{360} \times 2 \times \frac{22}{7} \times 6370\ Cs40^0$

$= \frac{120}{360} \times 2 \times \frac{22}{7} \times 6370 \times 0.7660$

= 10223.5KM

OR $\quad AB = 120x\ 60\ x\ Cs\ 40^0 = 5515.2nm$

(i) The shortest distance from A to B along a great circle. (4 marks)

$AB = 2r \sin 60^0$ $\quad\quad Q = 83.120$

$= 2 R \cos 40^0 \sin 60^0$

$AB = 2R \sin ½ Q$

$2R \sin ½ Q = 2 R \cos 40^0 \sin 60^0$ $\quad\quad = \frac{83.12}{360} \times 2 \times \frac{22}{7} \times 637$

$\sin ½ Q = \cos 400 \sin 60^0$

$= 9245KM$

$= 0.7660 \times 0.8660$ $\quad\quad$ OR $= 83.12 \times 60$

$= 0.6634$ $\quad\quad = 4987.2mm$

$½ Q = 41.56$

b) Two planes P and Q left A for B at 400 knots and 600 knots respectively. If P flew along the great circle and B along parallel latitude, which one arrived earlier and by how long. Give your answer to the nearest minute (Take R = 6370 km and π = 22/7). (3 marks)

Time taken by A $= \frac{4987.2}{400}$

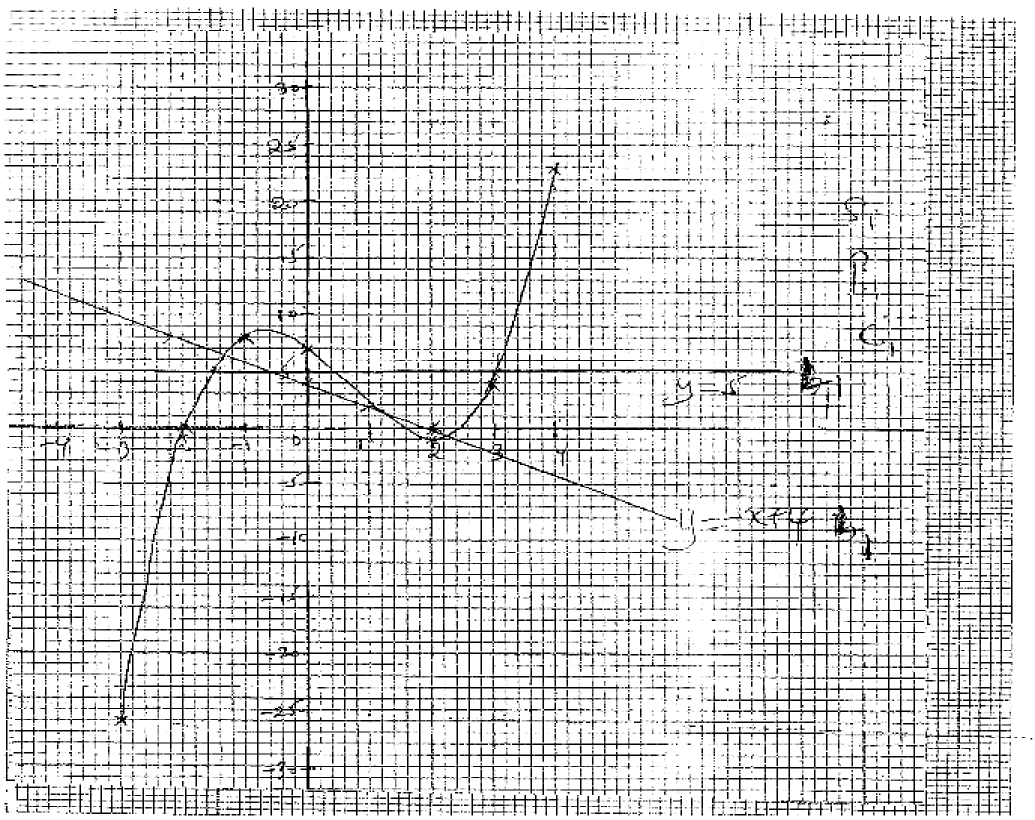
$= 12.47$ hrs

" B $= \frac{5515.2}{600} = 9.19$ hrs

22. (a) Complete the table below for the equation $y = x^3 - 2x^2 - 4x + 7$. (2 marks)

x	-3	-2	-1	0	1	2	3	4
y	-26	-1	8	7	8	-2	8	23

(b) Using the scale 1cm to represent 1 unit on the x – axis and 1 unit to represent 5 units on the y – axis, draw the graph of $y = x^3 - 2x^2 - 4x + 7$. (3 marks)



c) Use your graph to estimate the roots of the equation

$x^3 - 2x^2 - 4x + 7 = 0$ (1 mark)

$y = x^3 - 2x^3 - 4x + 7$

$\underline{0 = x^3 – 2x^2 – 4x+7}$

$y = 0$

$x= -2, x = 1.5, x = 2.5$

(d) By drawing appropriate straight lines, use your graph to solve the equations.

(i) $x^3 – 2x^2 – 4x + 2 = 0$ (2 marks)

$y = 5$

$x = -1.5, x = 0.5, x = 3.1$

ii) $x^3 – 2x^2 – 3x + 3 = 0$ (2 marks)

$y = x^3- 2x^2 – 4x + 7$

$\underline{0 = x^3 – 2x^3 – 3x + 3}$

$y = -x + 4$

$x = -1.3, x = 1.2, x = 2.2$

23. The cash price of a laptop was Kshs.60,500. On hire purchase terms, a deposit of Ksh.8,000 was paid followed by 11 monthly installments of Kshs.6000 each.

a) Calculate:

((i) The cost of a laptop on hire purchase terms. (2 marks)

= Kshs (8000 + 11 x 6000)

= Kshs.74,000

(ii) The percentage increase of hire purchase price compared to the cash price. (2 marks)

$\% \text{ increase} = \frac{74000 – 60500}{60500} \times 100$

$= 22.31$

b) An institution was offered a 5% discount when purchasing 25 such laptops on cash terms. Calculate the amount of money paid by the institution. (2 marks)

= 60500 x 25 x 0.95

= kshs.1,436,875

c) Two other institutions X and Y, bought 25 such laptops each. Institution Y bought the laptops on cash terms with no discount by securing a loan form a bank. The bank charged 12% p.a compound interest for two years. Calculate how much more money institution Y paid than institution X. (4 marks)

Institution X: Ksh .74000x25

= kshs.1850000

Institution Y: $Kshs.60500x25x\ (1 + 1/100)^2$

= kshs.1897280

Difference = kshs (1897280 – 1850000)

= kshs.47280

24. A manager wishes to hire two types of machine. He considers the following facts.

Machine type	Number of men operators	Floors space	Hourly profit
A	4	2	4
B	3	3	8

He has a maximum of $24m^2$ of floor space and a maximum of 36 men available. In addition he is not allowed to hire more machines of type B than of type A.

a) If he hires x machines of type A and y machines of type B, write down all the inequalities that satisfy the above conditions. (3 marks)

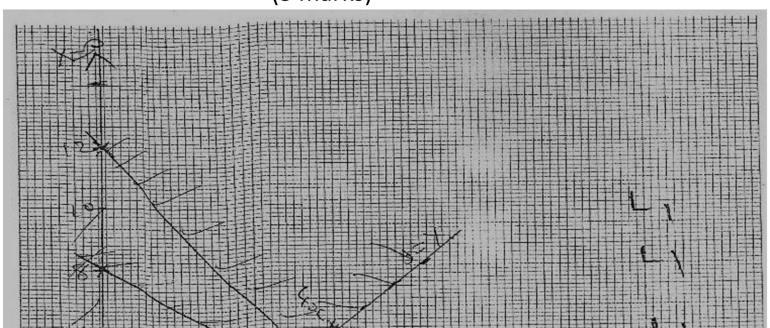
(1) $2x+3y = 24$

(2) $4x + 3y \leq 36$

(3) $Y<x$

b) On the grid provided, draw the inequalities in part (a), above and shade the unwanted region.

(3 marks)



c) Draw a search line and use it to determine the number of machines of each type that should the manager choose to give the maximum profit. (4 marks)

$4x + 8y = p$

$x = 6$

$y = 4$

$P = 4 \times 6 + 8 \times 4$

$= \text{kshs.}56$