NAME:……………………………………………INDEX NO………………………..

CLASS:…………………….

DATE:……………………….   Signature:…………………………………..

121/ 2
MATHEMATICS
NOVEMBER 2020
2 ½ Hours

KAPSABET BOYS HIGH SCHOOL
Kenya Certificate of Secondary Education (K.C.S.E)
MATHEMATICS ALT. A   PAPER TWO

Instructions to candidates
1. *Write your name and index number in the spaces provided above.*
2. *Sign and write the date of examination in the spaces provided above.*
3. *The paper contains two sections: **Section I** and **Section II**.*
4. *Answer **All** the questions in **section I** and **any five** questions **from Section II**.*
5. *All answers and working must be written on the question paper in the spaces provided below each question.*
6. *Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.*
7. *Marks may be given for correct working even if the answer is wrong.*
8. *Non-programmable silent electronic calculators and **KNEC** mathematical tables may be used, except unless stated otherwise.*

For Examiners use only.
Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**Total**

Section II

17	18	19	20	21	22	23	24	**Total**

Grand Total

Answer all questions from this section in the spaces provided.

1. The roots of the quadratic equation $x^2 + px = q$ are $x = -\frac{3}{7}$ and $x = 2$. Find the values of p and q. (3mks)

2. Without using a mathematical table or a calculator, evaluate leaving your answer in the form. $a\sqrt{b} + c.$, where a, b and c are constants. (3mks)

$$\frac{\sin 30° - \sin 420°}{\tan 60°}.$$

3. Two matrices **P** and **Q** are such that $P = \begin{pmatrix} k & 4 \\ 3 & 2 \end{pmatrix}$ and $Q = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$. Given that the determinant of **QP** is 44, find the value of k. (3mks)

4. Find the value of x given that $\log(x - 1) + 2 = \log(3x + 2) + \log 25$. (3mks)

5. The equation of a circle is given as $x^2 + y^2 + 4x - 2y - 4 = 0$. Determine the centre and the diameter of the circle. (3mks)

6. Using logarithms, evaluate $\left(\dfrac{93.62}{0.4892 \times 72.89}\right)^{-\frac{1}{3}}$ (4mks)

7. If $\boldsymbol{OA} = \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix}$, $\boldsymbol{OB} = \begin{pmatrix} 5 \\ 4 \\ 3 \end{pmatrix}$. P divides AB externally in the ratio 2:1. Find the coordinates of P. (3mks)

8. Kapsabet Boys' handball team scored the following goals in 6 matches; 10, 8, 14, 16, 6 and 18. Using assumed mean of 12, determine the standard deviation leaving your answer to 2 d.p. (3mks)

9. The gradient of a curve at point (x,y) is $4x - 6$. The curve has a minimum value at $5\frac{1}{2}$. Find the equation of the curve. (3mks)

10. The nth term of G.P is given by $5 \times 2^{n-2}$
        (i) Write down the first 4 terms of the G.P   (1mark)

        (ii) Calculate the sum of the first 6 terms.   (2marks)

11. (a) Expand $\left(1 - \frac{1}{2}x\right)^5$ in ascending powers of x leaving the coefficients as fractions in their simplest form.   (2mks)

    (b) Using the first three terms in the expansion in (a) above, estimate the value of $\left(\frac{19}{20}\right)^5$
                                                      (2mks)

12. A 2– digit number is made by combining any two of the digits 1, 3, 5, 7, 9 at random
        a) Write down all the possible outcomes.   (1mk)

        b) Find the probability that the number is prime.   (1mk)

13. Find the percentage error in evaluating $(a + b) - c$, if $a = 3.2\ cm, b = 5cm\ and\ c = 2.0cm$, leaving your answer to the nearest 4 s.f   (3mks)
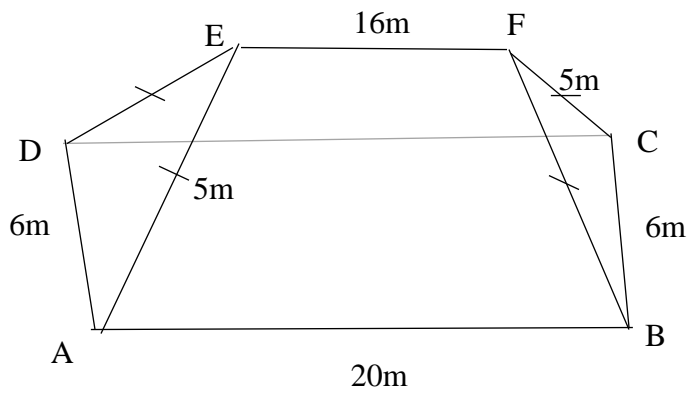
14. Three quantities A, B and C are such that A varies directly as B and inversely as the square root of C. Find the percentage decrease in A if B decreases by 5.2% and C increases by 44%.   (3mks)

15. Write r in terms of u, y, p and t   (3mks)

$$u = y + \cfrac{p}{t + \cfrac{1}{r}}$$

16. Using the diagram below, find the angle;

(a) Plane BFC makes with ABCD   (2mks)

(b) Plane ABFE makes with ABCD   (2mks)

17. The table below shows monthly income tax rates for a certain year.

Monthly taxable income in Ksh.	Tax rate (%) in each shilling
0 – 11180	10
11181 – 21714	15
21715 – 32248	20
32249 – 42782	25
Above 42782	30

Mr Tundu earned a salary of Ksh 58 000, a house allowance of Ksh. 8 200 and a commuter allowance of Ksh. 6 000. He gets a monthly personal relief of Ksh. 1280.

    a. Calculate

        i.   Mr Tundu's monthly taxable income in Ksh.   (2mks)

        ii.   The tax payable by Mr Tundu in that month.   (5mks)

    b. The following month that year, Tundu's basic salary was raised by 5%. Determine his net salary for that month.   (3mks)

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)

19. The marks scored by 40 students in a mathematics class were shown in the table below:

Marks	42 - 46	47 - 51	52 - 56	57 - 61	62 - 66	67 - 71
Number of students	3	4	10	12	8	3

(a)State the upper class limit of the modal class (1mks)

(b)Estimate the mean mark (3mks)

(c) If the pass mark is 55%, how many students passed? (3mks)

(d) Find the range of marks scored by the middle 50% of the students. (3mks)

20. A plane leaves an airport X $(41.5°\ N, 36.4°\ W)$ at 9.00 a.m. and flies due North to airport Y on latitude $53.2°$ N.

(a)Calculate the distance covered by the plane in km. (3mks)

(b) After stopping for 30 minutes to refuel at Y, the plane then flies due East to airport Z, 2500 km from Y. Find the:
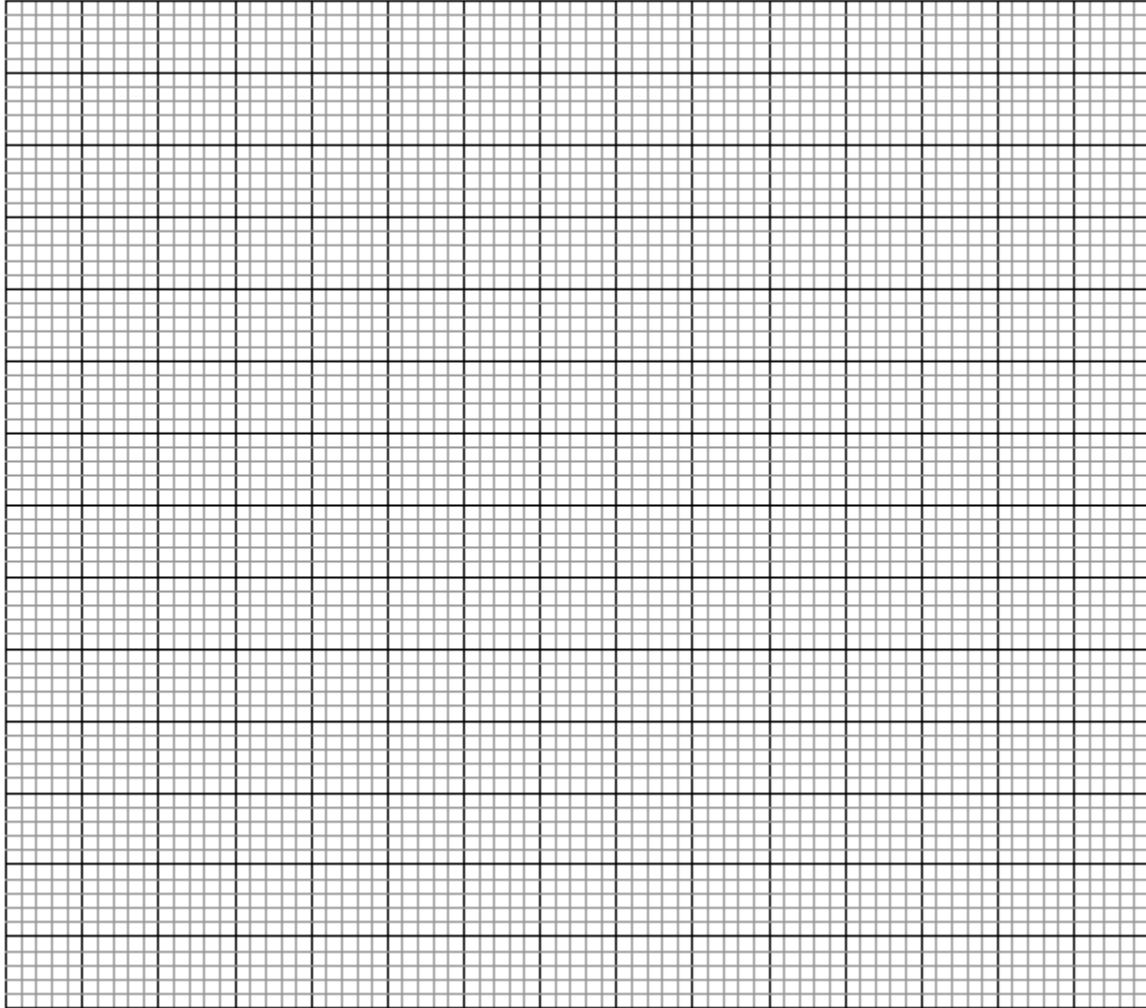
   i.   Position of Z (3mks)

   ii.   Time the plane lands at Z, if its speed is 500km/h. (4mks)
        (take $\pi = \frac{22}{7}$ and the radius of the earth $R = 6370\ km$)

21. (a) Complete the table below to 2 dp.   (2mks)

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

(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)

22. Triangle OPQ is such that $OP = p$ and $OQ = q.$ Point R divides OP in the ratio $1:3$ and point S divides PQ in the ratio $5:2.$ OS and RQ meet at T.

    (a) Express **OS** and **QR** in terms of **p** and **q.**   (3 mks)

    (b) Given that $OT = kOS$, express **OT** in terms of k, **p** and **q.**   (1mk)

    (c)

       (i)   Given also that $RT = hRQ$, express **OT** in terms of h, **p** and **q.**

                                                        (2mks)

       (ii)   Find the values of h and k.   (3mks)

       (iii)   In what ratio does O divide TS?   (1mk)

23. Using the equation of the curve $y = \frac{1}{2}x^2 - 2 \ for \ 0 \le x \le 8$

    a) Complete the table below.   (1mks)

x	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6.0	6.5
y												

    b) Using trapezium rule with 8 strips, determine the area bounded by the curve, the lines $x = 0, \ x = 8 \ and \ the \ x - axis$.   (2mks)
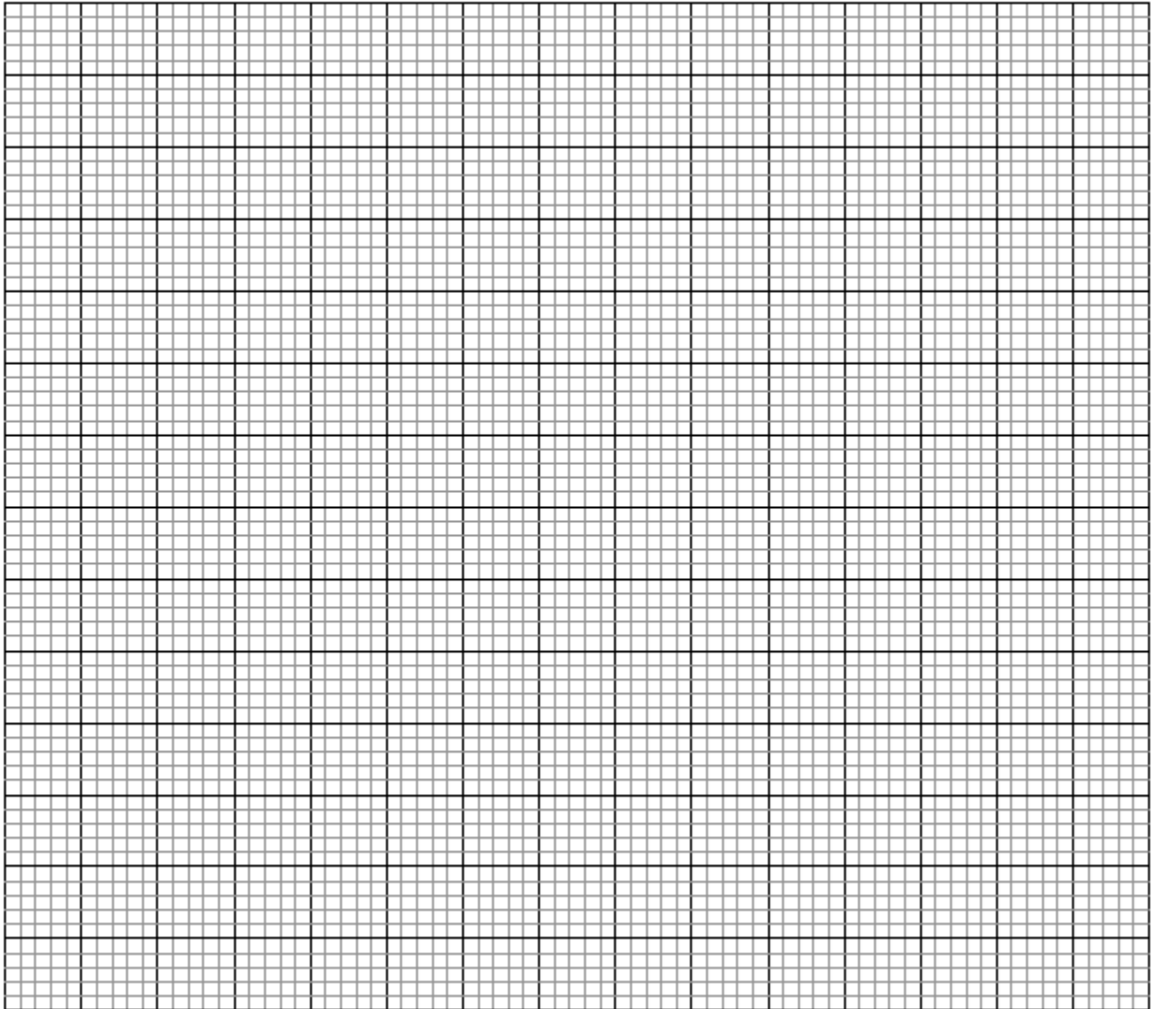
    c) Find the area in (b) above using the mid-ordinate rule with 4 strips   (2mks)

    d) Find the exact area by integration   (3mks)

    e) What is the percentage error in using the mid-ordinate rules?   (2mks)

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)

   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)

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

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