END OF TERM 1 EXAMS

MATHEMATICS
FORM FOUR
PAPER 2
TIME: 2 ½ HOURS

NAME……………………………………………………ADM NO:……………………

SIGN…………………………………………………. INDEX NO:…………………

SECTION 1 (50MARKS)
Answer all the questions in this section in the spaces provided.

1. The length and width of a rectangular window pane measured to the nearest millimeter are 8.6cm and 5.3 respectively.
    Find to four significant figures, the percentage error in the area of the window pane.   (3mks)
    (Answer to 4 significant figures)

2. Without using a calculator or mathematical tables, express $\underline{\text{Cos } 30^0}$ in surd form and simplify leaving
    $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ Tan $45^0 + \sqrt{3}$
    your answer in the form $a + b \sqrt{c}$ where a, b and c are rational numbers.   (3mks)

3. In the figure below, **O** is the centre of the circle which passes through the points **T,C** and **D**. Line **TC** is parallel to **OD** and line **ATB** is a tangent to the circle at **T.** Angle **DOC** = 38^0. Calculate the size of angle **CTB** (3mks)
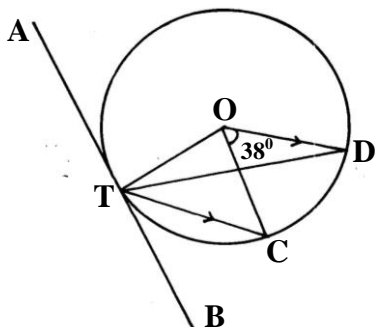
4. A coffee dealer mixes two brands of coffee, *x* and *y,* to obtain 40kg of the mixture worth Ksh. 65 per kg. If brand *x* is valued at Ksh. 70 per kg and brand *y* at ks.55 per kg. Calculate the ratio, in its simplest form, in which the brands *x* and *y* are mixed. (2mks)

5. Find the radius and the coordinate of the centre of the circle whose equation is
$$2x^2 + 2y^2 - 6x + 10y + 9 = 0$$ (3mks)

6 a) Expand $(1 + ¼ x)^4$ (2mks)

b)   Use your expansion in (a) above to evaluate $(0.975)^4$ to 4 significant figures.   (2mks)

7.   When Ksh. 60,000 was invested in a certain bank for 8years it earned a simple interest of Ksh. 14,400. Find the amount that must have been invested in the same bank at the same rate for 5years to earn a simple interest of Ksh. 12,000   (3mks)

8.   Given that $P = \dfrac{2q - r}{q + 3r}$, express **q** in terms of **p** and **r**   (3mks)

9.   If $\vec{OA} = 3\underset{\sim}{\mathbf{i}} + 2\mathbf{j} - 4\underset{\sim}{\mathbf{k}}$ and $\vec{OB} = 4\mathbf{i} + 5\mathbf{j} - 2\underset{\sim}{\mathbf{k}}$, **P** divides **AB** in the ratio 3:-2. Determine the modulus of **OP** leaving your answer to 1 decimal place. Given that **O** is the origin.   (3mks)

10.   Solve for x in $2 + \log_7 (3x-4) = \log_7 98$ (3mks)

11. A carpenter wishes to make, a ladder with 18 cross-pieces. The cross pieces are to diminish uniformly in lengths from 65cm at the bottom to 31cm at the top. Calculate the length in cm, of the eighth cross-piece from the bottom.   (3mks)

12. A quantity **P** varies partly as **Q** and partly as the square root of **Q,** given that **P**=30 when **Q**=9, and **P**=14 when **Q**=16. Find **P** when **Q**=36.   (3mks)

13.   Seven people can build five huts in 30 days. Find the number of people, working at the same rate that will build 9 similar huts in 27days.   (3mks)

14. (a) **A** and **B** are two points on earth's surface and on latitude 40^0 N. The two points are on the longitude 50^0W and 130^0E respectively. Calculate the distance from **A** to **B** along a parallel of latitude in kilometers. (2mks)

b) The shortest distance from **A** to **B** along a great circle in kilometres
(Take $\pi = \frac{22}{7}$ and radius of the earth = 6370km) (2mks)

15. Find the inverse of the matrix $\begin{pmatrix} 3 & 1 \\ 2 & -1 \end{pmatrix}$ hence find the coordinates of the point
Of intersection of the line $3x + y = 4$ and $2x - y = 1$ (3mks)

16. Evaluate $\int_{-2}^{3} \frac{(1 - x^2)\, dx}{(1 + x)}$ (4mks)

17.   The following are marks scored by form four student in Mathematics test.

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Frequency	2	6	10	16	24	20	12	8	2

Using an assumed mean of 54.5, calculate the
    a)   Mean mark   (4mks)

    b)   Variance   (4mks)

    c)   Standard deviation   (2mks)

18.   A bag contains 5 red, 4 white and 3 blue beads. Three beads are selected at random without replacement. Find the probability that
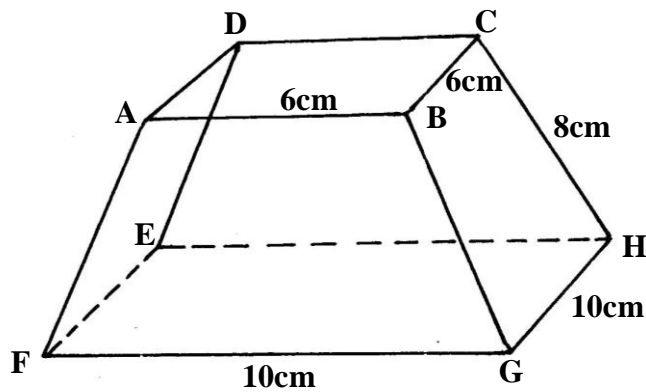a)   The first red bead is the third bead picked.   (2mks)

b) The beads selected were, white and blue: (2mks)
   i) In that order

   ii) In any order (2mks)

c) No red bead is picked (2mks)

d) Beads picked are of the same colour. (2mks)

19. The figure below shows solid frustum of a pyramid with a square top of side 6cm and a square base of side 10cm. The slant edge of the frustum is 8cm.

a) Calculate the total surface area of the frustum (4mks)

b)   Calculate the volume of the solid frustum.   (3mks)

c)   Calculate the angle between the planes **BCHG** and the base **EFGH**.   (3mks)

20.   a)   Using a ruler and pair of compasses only construct triangle **ABC** in which **AB** = 6.5cm,
               BC= 5.0cm and angle **ABC** = 60^0. Measure **AC**   (3mks)

       b)   On same side of **AB** as **C**   (3mks)
       i)   Determine the locus of a point **P** such that angle **APB** = 60^0 (3mks)
       ii) Construct the locus of **R** such that **AR** = 3cm.   (1mk)
       ii) Identify the region **T** such that **AR** $\geq$ 3 and $\angle$**APB** $\geq 60^0$ by shading the unwanted part.
                                                                                       (3mks)

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21. The table below shows income tax rates

| Monthly income (Kshs)	Tax Rate (%)
Up to 9680	10
9681 – 18800	15
18801-27920	20
27921-37040	25
37041 and above	30

Omari's monthly taxable income is Ksh. 24200

a) Calculate the tax charged on Omari's monthly earnings. (4mks)

b) Omari is entitled to the following tax relief of 15% of the premium paid. Calculate the tax Omari pays each month if he pays a monthly insurance premium of Ksh. 2400 (2mks)

c) During a certain month, Omari received additional earnings which were taxed at 20% each shilling. Given that he paid 36.3% more tax that month, calculate the percentage increase in his earning. (4mks)

22. The curve of the equation $y = x + 2x^2$, has $x = \frac{1}{2}$ and $x = 0$ as x-intercepts. The area bounded by the x-axis, $x = \frac{1}{2}$ and $x = 3$ is shown by the sketch below.

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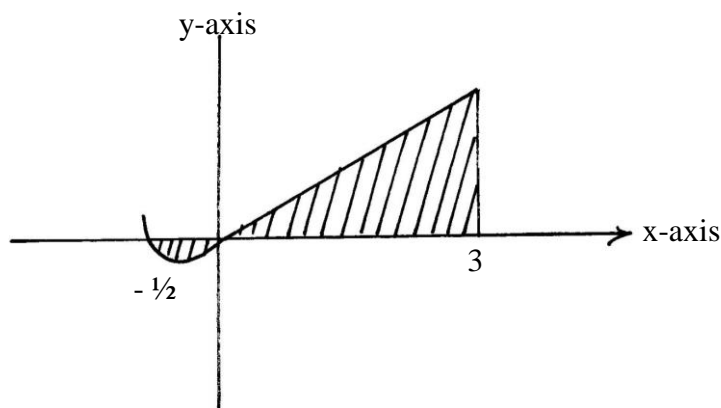
Find
a) $\int (x + 2x^2)\, dx$ (3mks)

b) The exact area bounded by the curve, *x* axis (7mks)
   x= -½ and *x*=3 (Give your answer to 2dp)

23. a) Fill in the table below to 2 decimal places for the graph of $y = \sin x$ and $y = 2\sin (x\text{-}30)$
    for the range $-180 \le x \le 180$ (2mks)

x^0	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180
Sin x^0	0			-1.0	-0.87		0		0.87			0.5	
2 Sin $(x-30)^0$	1			-1.73	-2.0		-1		1.0			1.73	

b) On a graph, using a scale of 1cm to represent 30^0 on the x-axis and 1cm to represent 0.5 units
   on the *y*-axis, draw the graph of $y= \text{Sin } x^0$ and $y = 2\sin(x-30)^0$ on the same axes
   (4mks)

c) Using your graph
i) State the amplitude and the period of the graph $y = 2\sin (x\text{-}30)^0$ (1mk)

ii) Solve the equation
    $\text{Sin } x^0 = 2\sin (x\text{-}30)^0$ (1mk)

iii) Describe fully the transformation that will map $y = 2\sin (x\text{-}30)^0$ on $y = \sin x$ (2mks)

24. A tailor makes two types of garments **A** and **B.** Garment **A** requires 3 metres of material while
    garment **B** requires 2 ½ metres of material. The tailor uses not more than 600 metres of material
    daily in making both garments. He must make not more than 100 garments of type **A** and not less
    than 80 of type **B** each day.

    (a). Write down all the inequalities from this information. (3mks)

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b)   Graph the inequalities in (a) above   (3mks)

c)   If the business makes a profit of shs. 80 on garment **A** and a profit of shs. 60 on garment **B,** how many garments of each type must it make in order to maximize the total profit?

                                                                              (4mks)