

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

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MATHEMATICS

PAPER 2

DECEMBER, 2020

TIME: 2 ½ HOURS

## LANJET JOINT EVALUATION TEST 2020

*Kenya Certificate of Secondary Education (K.C.S.E)*

### INSTRUCTIONS TO CANDIDATES

- Write your name and Admission number in the spaces provided at the top of this page.
- This paper consists of two sections: Section I and Section II.
- Answer ALL questions in section 1 and ONLY FIVE questions from section II
- All answers and workings must be written on the question paper in the spaces provided below each question.
- Show all the steps in your calculation, giving your answer at each stage in the spaces below each question.
- Non – Programmable silent electronic calculators and KNEC mathematical tables may be used, except where 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

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*This paper consists of 15 printed pages. Candidates should check the question paper to ascertain that all pages are printed as indicated and that no pages are missing.*

**SECTION A: (50MARKS)**

**Answer all questions in this section in the spaces provided.**

1. Use logarithms tables to evaluate.

(4mks)

$$\sqrt[3]{\frac{36.72 \times (0.46)^2}{185.4}}$$

2. If  $A = 2.3$ ,  $B = 8.7$  and  $C = 2.0$ . Find the percentage error in calculating  $\frac{A+B}{C}$

(3mks)

3. Given that  $M = i - 3j + 4k$ ,  $W = 6i + 3j - 5k$  and  $Q = 2M + 5N$ , find the magnitude of  $Q$  to 3 significant figures.

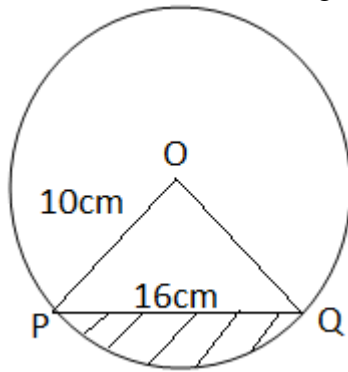
(3mks)

4. Solve the following equation  $2^{2x+3} - 2^{x+4} = 17(2^x) - 4$  (4mks)

5. If  $\frac{1}{3-\sqrt{5}} - \frac{2+2\sqrt{5}}{3+\sqrt{5}} = a + b\sqrt{c}$ , find the value of a, b and c (3mks)

6. Pipe A can fill an empty water tank in 3hrs while Pipe B can fill the same tank in 6hrs. When the tank is full it can be emptied by Pipe C in 8hrs. Pipe A and B are opened at the same time when the tank is empty. If one hour later Pipe C is also opened, find the total time taken to fill the tank. (3mks)

7. The figure below shows a circle center  $O$ , radius  $10\text{ cm}$ . The chord  $PQ = 16\text{ cm}$ . Calculate the area of the unshaded region. (4mks)



8. The mean weight of 36 students is  $45\text{ kg}$ ; two of the students leave and the mean weight increases by  $0.5\text{ kg}$ . If one of the students who left weighed  $43\text{ kg}$ , find the weight of the other one. (3mks)
9. Use the trapezium rule to estimate the area bounded by the curve  $y + x^2 = 4$  and the lines  $y = 0$ ,  $x = -2$  and  $x = 2$  using four strips. (3mks)

10.  $4x^2 - 10x + 4y^2 + 12y - 1 = 0$  represents a circle centre C (a, b) and of radius K. Find the values of a, b and K. (3mks)

11. Make  $x$  the subject of the equation (3mks)

$$\frac{t}{s} = \frac{b}{\sqrt{x-4}}$$

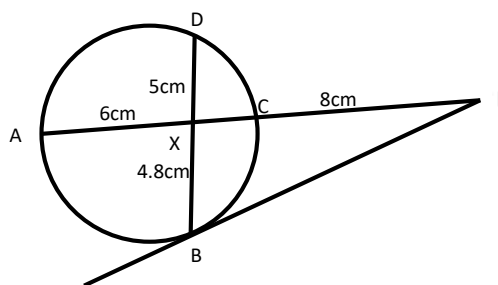
12. Use reciprocal, square and cube root tables to evaluate to 4 significant figures, the expression. (3mks)

$$\sqrt[3]{\frac{9}{0.03746}} + 0.6042^2$$

13. (a) Expand the expression  $(1 + \frac{1}{2}x)^5$  in ascending powers of  $x$ , leaving the coefficients as fractions in their simplest form. (2mks)

(b) Use the first three terms of the expansion in (a) above to estimate the value of  $(1^{1/20})^5$ . (2mks)

14. In the diagram below,  $BT$  is a tangent to the circle at  $B$ .  $AXCT$  and  $BXD$  are straight lines.  $AX = 6\text{cm}$ ,  $CT = 8\text{cm}$ ,  $BX = 4.8\text{cm}$  and  $XD = 5\text{cm}$ .



Find the length of  $BT$ . (2mks)

15. Find  $x$  if  $\cos x = \frac{\sqrt{3}}{2}$  for  $-180^\circ \leq x \leq 180^\circ$ . (2mks)

16. The following were recorded on a field note book by a surveyor. Taking the base line as 550m. Find the area in  $\text{m}^2$ . (3mks)

		B			
		550	120	TO	A
C	150	450			
		250	90	TO	D
E	60	40			
		F			

## **SECTION II (50mrks)**

### **Attempt any FIVE questions from this section**

17. Mr. Kobe is a civil servant who earns a monthly salary of Ksh. 21200. He has a house allowance of Ksh. 12000 per month, other taxable allowances are commuter Ksh. 1100, medical allowance Ksh. 2000. He is entitled to a personal relief of Ksh. 1240 per month.

Using the income rates below, solve the questions that follow.

Income in Ksh. per month	Rates in Ksh per sh 20
1 – 8,400	2
8401 – 18,000	3
18001 – 30,000	4
30001 – 36,000	5
36001 – 48,000	6
Above 48,000	7

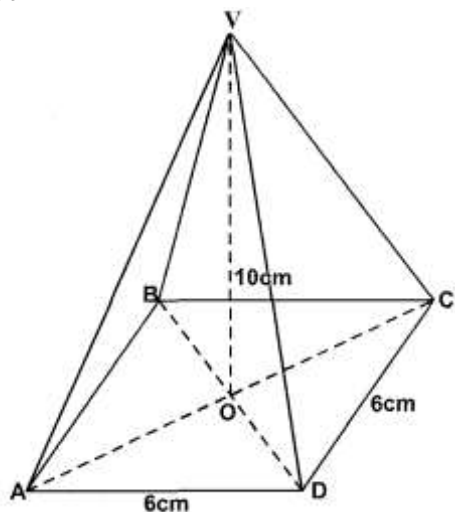
Determine;

- a) i) His monthly taxable income. (2mks)

- ii) Net tax (PAYE) (5mks)

- b) In addition to the PAYE, the following deductions were made. Ksh. 250 for NHIF, Ksh. 120 service charges, he repays a loan at sh. 4500 and contributes towards savings at sh. 1800 every month. Calculate his net salary per month. (3mks)

18. The figure below is a square based pyramid  $ABCDV$  with  $AD=DC = 6\text{cm}$  and height  $V = 10\text{cm}$

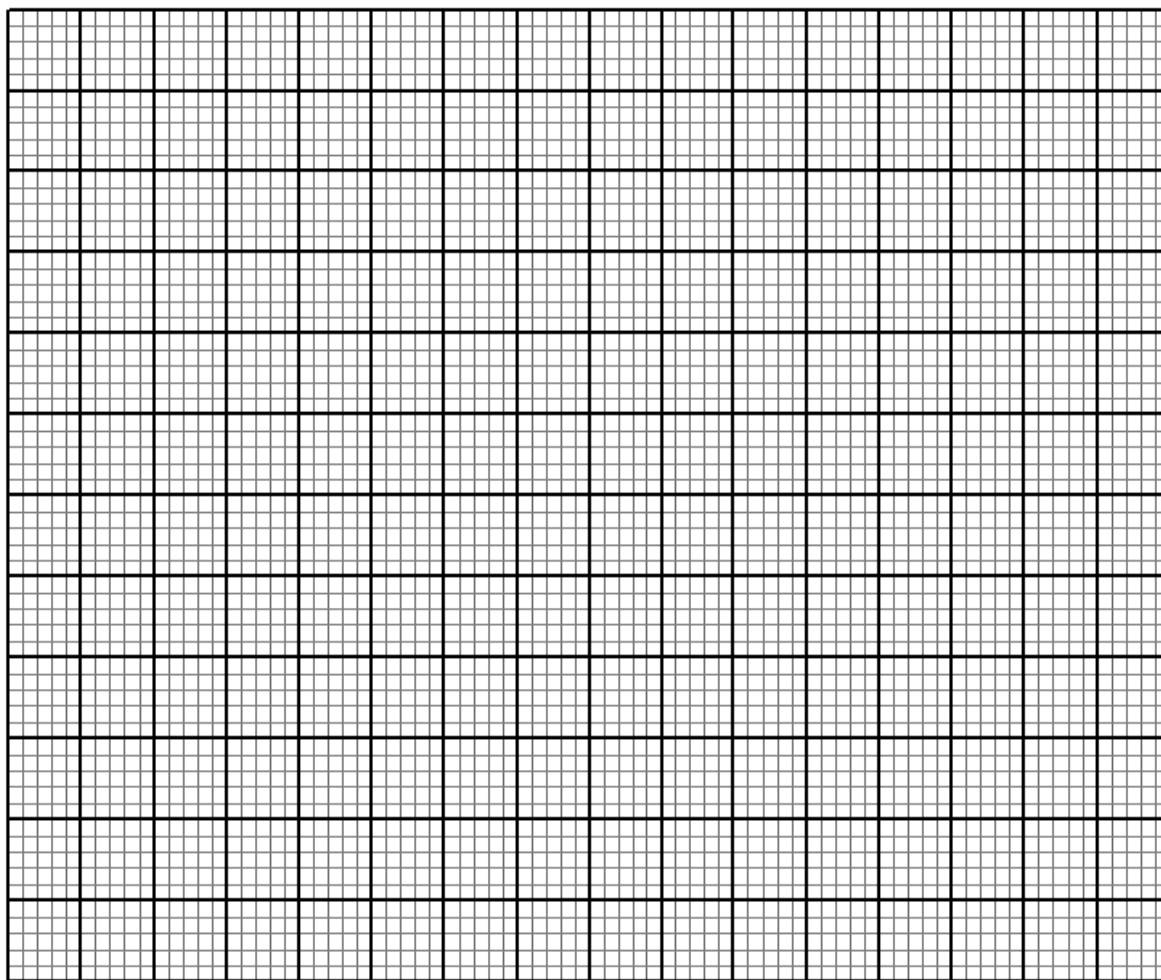


- a) State the projection of  $VA$  on the base  $ABCD$ . (1mk)
  
- b) Find:
  - i) The length of  $VA$  (3mks)
  
  - ii) The angle between  $VA$  and  $ABCD$  (2mks)
  
  - iii) The angle between the planes  $VDC$  and  $ABCD$  (2mks)
  
  - iv) Volume of the pyramid (2mks)

19. a) Complete the table below for  $y = \sin 2x$  and  $y = \sin (2x + 30)$  giving values to 2d.p.(2mks)

X	0	15	30	45	60	75	90	105	120	135	150	165	180
Sin 2x	0				0.87				-0.87				0
Sin ( 2x +30)	0.5				0.5				-1				0.5

b) Draw the graphs of  $y = \sin 2x$  and  $y = \sin (2x + 30)$  on the axis. (4mks)

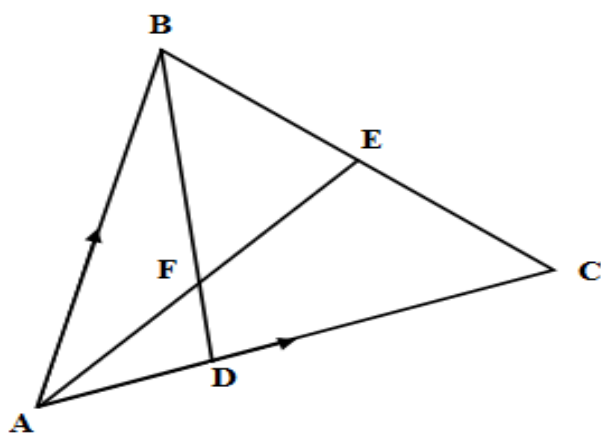


c) Use the graph to solve  $\sin (2x + 30) - \sin 2x = 0$  (1mk)

d) Determine the transformation which maps  $\sin 2x$  onto  $\sin (2x + 30)$  (1mk)

e) State the period and amplitude of  $y = \sin (2x + 30)$  (2mks)

20. In the figure below E is the midpoint of BC. AD: DC 3:2 and F is the meeting point of BD and AE.



- a) If  $AB = \mathbf{b}$  and  $AC = \mathbf{c}$ , find:
- $BD$  (2mks)
  - $AE$  (2mks)
- b) If  $BF = t BD$  and  $AF = n AE$ . Find the value of  $t$  and  $n$ . (5mks)
- c) State the ratio of  $BD$  to  $BF$ . (1mk)

21. The position of two towns **X** and **Y** are given to the nearest degree as **X** ( $45^{\circ}$  N,  $110^{\circ}$  W) and **Y** ( $45^{\circ}$  N,  $70^{\circ}$  E). Take  $\pi = 3.142$ ,  $R = 6370\text{km}$ . Find:
- (a) The distance between the two towns along the parallel of latitude in km. (3mks)

- (b) The distance between the towns along a parallel of latitude in nautical miles. (3mks)

- (c) A plane flew from **X** to **Y** taking the shortest distance possible. It took the plane 15hrs to move from **X** and **Y**. Calculate its speed in Knots. (4mks)

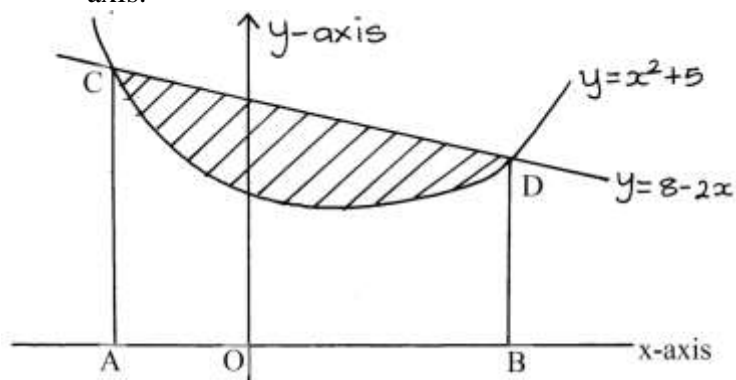
- d) If the plane left town **X** on Monday 12:45PM. Find the local time it arrived at town **Y**. (3mks)

22. The 2<sup>nd</sup> and 5<sup>th</sup> terms of an arithmetic progression are 8 and 17 respectively. The 2<sup>nd</sup>, 10<sup>th</sup> and 42<sup>nd</sup> terms of the A.P. form the first three terms of a geometric progression. Find
- (a) The 1<sup>st</sup> term and the common difference. (3mks)

- (b) The first three terms of the G.P and the 10<sup>th</sup> term of the G.P. (4mks)

- (c) The sum of the first 10 terms of the G.P. (3mks)

23. The diagram below, not drawn to scale shows part of the curve  $y = x^2 + 5$  and the line  $y = 8 - 2x$ . The line intersects the curve at points C and D. Lines AC and BD are parallel to the y-axis.



- (a) Determine the coordinates of C and D. (4mks)
- (b) Use integration to calculate the area bounded by the curve and the x-axis between the points C and D. (3mks)
- (c) Calculate the area enclosed by the lines CD, CA, BD and the x-axis. (3mks)
- (d) Hence determine the area of the shaded region. (1mk)

24. Using a ruler and pair of compasses only.

- a) Construct triangle  $ABC$  in which  $AB = 9\text{cm}$ ,  $AC = 8\text{cm}$  and angle  $BAC = 60^\circ$ .  
Measure  $BC$  (2mks)
- b) On the same side of  $AB$  as  $C$ , draw the locus of a point such that angle  $APB = 60^\circ$  (3mks)
- c) A region  $T$  is within the triangle  $ABC$  such that  $AT > 4\text{cm}$  and angle  $ACT \geq$  angle  $BCT$ . Show the region  $T$  by shading it. (5mks)