

MATHEMATICS PAPER 2

EXPECTED QUESTIONS IN KCSE

**Comprises 6 KCSE prediction set exams
(Class of KCSE March 2022).**

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Educators via the contacts above.**

PREDICTION 1

NAME..... INDEX NO

SCHOOL..... Date

FORM 4 MATHEMATICS PAPER 2 2021 TIME 2 ½ HOURS

Instructions to candidates:

1. Write your name and index number in the spaces provided above in this page.
2. The paper consists of two sections; section 1 and 2
3. Answer all questions in section 1 and only five questions in section 2.
4. All working and answers must be written on the question paper in the spaces below each question.
5. Marks may be given for correct working even if the answer is wrong.
6. Use mathematical tables and electronic calculator where necessary.

For examiners use only

Section 1

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

Section 2

17	18	19	20	21	22	23	24	Total

**Grand
Total**

Section 1 (compulsory section – 50 marks)

1. Solve the equation $\frac{x+1}{2} - \frac{x-3}{3} = 4$
(2mks)

2. If point A (1,3), B(5, -2) and C(-11, y) are collinear, calculate the value of y.
(3mks)

3. Simplify $\frac{12x^2 - 16x}{20 - 11x - 3x^2}$ (3mks)

4. Vector **a** passes through the point (5,10) and (3,5) and vector **b** passes through (x, 6) and (-5, -4). If a and b are parallel, find the value of x. (3mks)

5. Make t the subject of the formula

$$P = \frac{1}{n}$$

6. Find the equation of a line that passes through (3,7) and which is perpendicular to another line whose equation is $3y = 9x - 5$. (3mks)

7. Two similar containers have masses of 256kg and 108kg respectively. If the surface area of the smaller container is 810cm^2 , calculate the surface area of the larger container. (3mks)

8. In the figure below, O is the center of the circle $\angle BCA = 80^\circ$ and $\angle CBO = 10^\circ$. Determine the size of $\angle CAB$ (3mks)

9. Expand $(1 - a)^8$ Hence use the expansion to evaluate 0.98^8 to 4 Significant figures. (4mks)

10. Simplify the expression

$\frac{\sqrt{3 - \sqrt{2}}}{\sqrt{3 + \sqrt{2}}}$ giving your answer in the form $a + b\sqrt{c}$, where a , b and c are real numbers (3mks)

11. The dimensions of a rectangle are given as 12.5cm and 6.75cm respectively. Calculate the percentage error in its area correct to 2 decimal places (4mks)

12. Factorise the expression $2x^2 + x - 15$, and hence solve the equation $2x^2 + x - 15 = 0$ (3mks)

13. Find the integral value of x for which. (3mks)

$$5 \leq 3x + 2$$

$$3x - 7 \leq 2$$

14. Wanjiru Ayuma and Atieno shared the profits from their joint business in the ratio 3:7:9 respectively. If Ayuma received sh. 60,000. Find how much profit they realized. (2mks)

15. Basket A contain 5 oranges and 3 lemons while basket B contain 4 oranges and 3 lemons. A basket is selected at random and two fruits picked from it, one at a time without replacement. Find the probability that the fruits picked are of the same type. (3mks)

16. The figure below shows a triangle PQR, $PR = 15\text{cm}$, $TR = 5\text{cm}$ and ST is parallel to QR . If the area of triangle PQR is 315cm^2 find the area of the quadrilateral QRTS. (4mks)

SECTION II (Attempt only five questions 50)

17. Using a ruler and a pair of compasses only construct a triangle ABC in which $BC = AC = 6\text{cm}$ and $\angle ACB = 135^\circ$ measure AB. (3mks)

a) Measure AB (3mks)

b) From A drop a perpendicular to meet BC, extended at D. (3mks)

c) Measure the length of AD (1mk)

ii) Calculate the area of the triangle ABC.

(3mks)

18. The table below shows marks scored by 38 students in a test.

35	47	69	57	75	58	48	56
46	49	81	67	63	56	80	72
62	70	46	26	41	58	68	73
64	49	64	54	74	35	51	
25	41	61	56	57	28	40	

a) Starting with the mark of 25 and using a class interval of 10, make a frequency distribution table. (3mks)

b) State the modal class. (1mk)

c) Calculate the mean mark. (3mks)

d) Calculate the median mark. (3mks)

19.a) Complete the table below for the equation $y = x^3 + 4x^2 - 5x - 5$ for the range $-5 \leq x \leq 2$ (2mks)

X	-5	-4	-3	-2	-1	0	1	2	3
Y			19			-5			

b) On the grid provided, draw the graph of $y = x^3 + 5x^2 - 5x - 5$ for $-5 \leq x \leq 2$. Using a scale of 1cm to represent 1 unit in the horizontal axis and 1cm to represent 5 units vertically. (3mks)

c) Use the graph to solve the equation $x^3 + 4x^2 - 5x - 5 = 0$ (2mks)

ii) By drawing a suitable line graph, solve the equation $x^3 + 4x^2 - 5x - 5 = -4x - 1$ (3mks)

20) In the figure below, PQR is a tangent to the circle at Q. TS is a diameter and TSR and QUV are straight lines. QS is parallel to TV. $\angle SQR = 40^\circ$ And $\angle TQV = 55^\circ$

a) Find the angles below giving reasons for each answer.

i) $\angle QTS$ (2mks)

ii) $\angle QRS$ (2mks)

iii)QVT(2mks)

iv)UTV(2mks)

v)USQ(2mks)

21. In the diagram below OPQ is such that $QN : NP = 1:2$, $OT:TN = 3:2$, and M is the mid point of OQ

a) Given that $OP = p$ and $OQ = q$. Express the following vectors in terms of p and q

i) PQ

ii) ON

iii) PT

iv) PM

b) i) Show that point P, T and M are collinear (3mks)

ii) Determine the ratio $MT:TP$ (1km)

22. The first term of an AP is 2. The sum of the first 8 terms is 156

i) Find the common difference of the AP (2mks)

ii) Given that the sum of the first n terms of the AP is 416. Find n . (2mks)

b) The 3rd, 5th and 8th terms of another AP correspond to the first three consecutive terms of a GP. If the common difference of the AP is 3, find

i) The first term of the AP (3mks)

ii) The sum of the first 8 terms of the GP to 4 significant figures (3mks)

23) Three variables P, Q and R are such that P varies directly as Q and inversely as the square of R

a) When $P = 9$, $Q = 12$ and $R = 2$ Find P when $Q = 15$ and $R = 5$ (4mks)

b) Express Q in terms of P and R (1mk)

c) If P is increased by 20% and R reduced by 10%, find

i) a simplified expression for the change in Q in terms of P and R (3mks)

ii) The percentage change in Q (2mks)

24. OABC is a parallelogram with vertices $O(0,0)$, $A(2,0)$, $B(3,2)$ and $C(1,2)$. $O^1A^1B^1C^1$ is the image of OABC under transformation matrix $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$

a) Find the coordinates of $O^1A^1B^1C^1$ (2mks)

ii) On the grid provided, draw OABC and $O^1A^1B^1C^1$ (2mks)

b) Find $O^{11}A^{11}B^{11}C^{11}$, the image of $O^1A^1B^1C^1$ under transformation matrix $\begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix}$
(2mks)

ii) On the same grid draw $O^{11}A^{11}B^{11}C^{11}$ (1mk)

c) Find a single matrix that maps $O^{11}A^{11}B^{11}C^{11}$ onto OABC (3mks)

PREDICTION 2

NAME: INDEX NO:

SCHOOL: DATE :

CANDIDATE'S SIGNATURE:

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

INSTRUCTIONS TO CANDIDATES

- a) Write your Name and Index Number in the spaces provided at the top of this page.
- b) Sign and write the date of examination in the spaces provided above.
- c) This paper contains TWO sections: section I and section II
- d) Answer all the questions in section I and any FIVE questions from section II.
- e) All answers and working must be written on the question paper in the spaces provided below each question.
- f) Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question.
- g) Marks may be given for correct working even if the answer is wrong.
- h) Non-programmable silent electronic calculators and KNEC mathematical tables may be used except where stated otherwise.

FOR EXAMINER'S 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

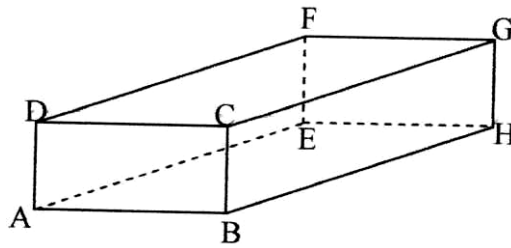
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SECTION I: (50 MARKS)

Answer ALL Questions in this section

1. Use logarithm table to evaluate:

(4mks)



Find the length AM and determine the inclination of AM to EFGH.

(3mks)

6. Use square roots, reciprocals and square tables to evaluate the expression: (3mks)

$$(0.00546667)^{\frac{1}{2}} + \left(\frac{3}{0.043279} \right)^2$$

7. A member of a county assembly sold his car for shs. 1,250,000 and deposited this money in a savings account in one of the banks in Kaiboi town. The banks paid 18%p.a compounded quarterly. After two years, the member of the county assembly withdrew a half of the amount from the account. He left the rest for a further two and a half years. Calculate the total interest he earned in the 4½ year period. (4mks)

8. Given that x^0 is an angle in the third quadrant such that $16\sin^2x^0 + 4\cos x^0 = 10$. Find $\tan x$. (3mks)

9. Two variables P and L are such that P varies partly as L and partly varies inversely as the square root of L .
- (a) Determine the relationship between P and L given that $L = 16$ when $P = 500$ and $L = 25$ when $P = 800$. (3mks)

(b) Hence find P when $L = 81$. (1mk)

10. The angle of elevation from the base of a wall to the top of the flag post 70 metres away is 62° . The angle of depression from the top of the flag post to the wall is 25° . Calculate:-

(a) The height of the flag post. (1mk)

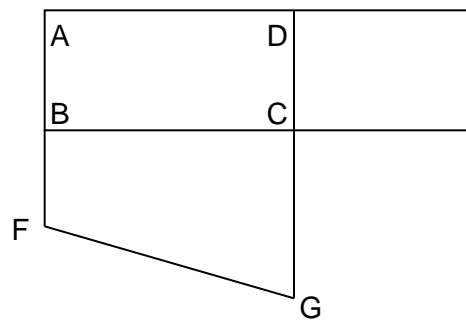
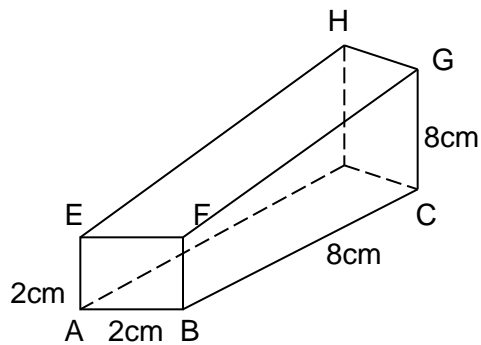
(b) The height of the wall. (2mks)

11. Given that $\log 3 = 1.583$ and $\log 5 = 2.322$, evaluate without using table or calculator:
Log 135 (2mks)

12. Two values of **a** and **b** are such that $7.1 \leq a \leq 7.3$ and $12.5 \leq b \leq 12.7$. Calculate the percentage error in **b**, giving your answer correct to 2 decimal places. (3mks)

13. The following figure is a solid and its incomplete net.

(a) Complete and label the net.



(b) Hence or otherwise, find the surface area of the solid. (2mks)

14. Solve for x in the equation: (3mks)

$$9^{x+1} - 54 = 3^{2x+1}$$

15. The points P (-6, 5) and Q (2, -1) are the ends of a diameter of a circle centre M.

Determine:-

(a) The coordinates of M. (1mk)

(b) The equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$. (2mks)

16. Solve the simultaneous equations: (3mks)

$$y + 2x + 1 = 0$$

$$x^2 + xy = -6$$

SECTION II (50 MARKS)

Answer ONLY FIVE questions in this section in the spaces provided

17. Mr. Maiyo, who works in a sugarcane plantation, owns a bicycle which he sometimes rides to work. Out of the 21 working days in a month, he rides to work for 18 days. If he rides to work, the probability that he is bitten by a rabid dog is $\frac{4}{15}$ otherwise it is only $\frac{1}{13}$. When he is bitten by the dog, the probability that he will get treated is $\frac{4}{5}$ and if he does not get treated, the probability that he will get rabies is $\frac{5}{7}$.

(a) Draw a tree diagram using the given information. (3mks)

(b) Using the tree diagram in (a) above, determine the probability that;

(i) Maiyo will not be bitten by a rabid dog. (2mks)

(ii) He will get rabies. (3mks)

(iii) He will not get rabies. (2mks)

18. Tax rates in operation in a certain year in Kenya are as given in the table below.

Income	Tax Rates
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(kf p.a.)	(sh. Per £)
1 – 4,512	2
4,513 – 9,024	3
9,025 – 13,536	4
13,537 – 18,048	5
18,049 – 22,560	6
Over 22,560	6.5

- (a) Mr. Koech pays Ksh. 2,172 P.A.Y.E. monthly. He was entitled to a house allowance of Ksh. 5,000 and a medical allowance of Ksh. 2,000 and gets a monthly tax relief of Ksh. 1,093. Calculate his monthly basic salary. (8mks)

- (b) Mr. Koech's other deduction per month were as follows:-

NHIF – Kshs. 320

Co-op Loan – Kshs. 4,000

Calculate Koech's net pay per month.

(2mks)

19. Using a ruler and a pair of compasses only:

- (a) Three points A, B and C are vertices of a triangle ABC such that AB = 8cm, BC =

- 5cm and $AC = 6.4\text{cm}$. Draw triangle ABC with AB as the base. (2mks)
- (b) Construct the locus of P such that it is equidistance from the sides AB, BC and AC. (3mks)
- (c) On the opposite side of point C on AB, construct the locus L such $\angle ALB = 60^\circ$. (3mks)
- (d) Hence determine the area of the major sector bounded by the locus L. (2mks)

- 20.(a) Complete the table below for the functions $y = 4 \cos 2x$ and $y = 3 \sin (2x + 30^\circ)$ giving the values to 1 decimal place. (2mks)

	-30°	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°
$4 \cos 2x$	2.0	4.0	2.0		-4.0	-2.0		4.0	2.0		-4.0
$3 \sin (x+30^\circ)$	0.0	1.5	2.6	3.6		1.5	0		-2.6		-2.6

(b) Draw the graphs of $y = 4 \cos 2x^\circ$ and $y = 3 \sin (x + 30^\circ)$ for $-30 \leq x \leq 270^\circ$ on the same axes. Use a scale of 1cm for 30° on x-axis and 1cm for 1 unit on the y-axis.

(4mks)



(c) Use your graphs in (b) above to solve the equation:

(i) $3 \sin (x + 30^\circ) - 4 \cos 2x = 0.$

(2mks)

(ii) $3 \sin (2x + 30^\circ) + 1 = 0$

(1mk)

(d) Determine the period of the function $y = 4 \cos 2x.$

(1mk)

21. An aircraft takes off from the airport X(65°N , 36°E) and flies by the most direct route to another airport Y ($R^\circ\text{N}$, 144°W) covering a distance of 4800nm.

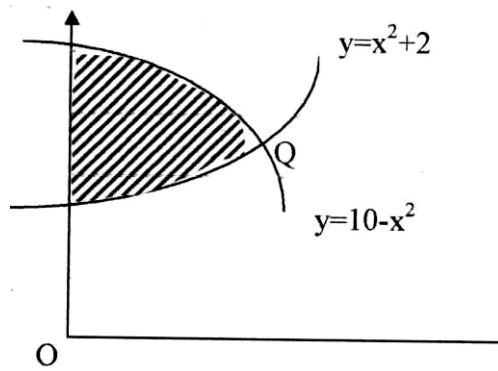
(a) Find R^0

(1mk)

(b) If instead, the aircraft had flown along the meridian 144^0W to point Y, find how much further it would have flown. (5mks)

(c) Two aircrafts takes off from X to Y at the same time. Given that both fly at the same speed and one flies on the direct route and the other takes the route described in (b) above, state the position of the second aircraft when the first is landing at Y. (2mks)

22. The diagram shown below represents the area between the curves $y = x^2 + 2$ and $y = 10 - x^2$ and y-axis.



Find:-

(a) The coordinates of Q (a point of intersection)

(1mk)

(b) The area of the shaded region, by use of mid-ordinate rule with 8 ordinates(6mks)

(c) Use integration method to calculate the same area as in (b) above.

(3mks)

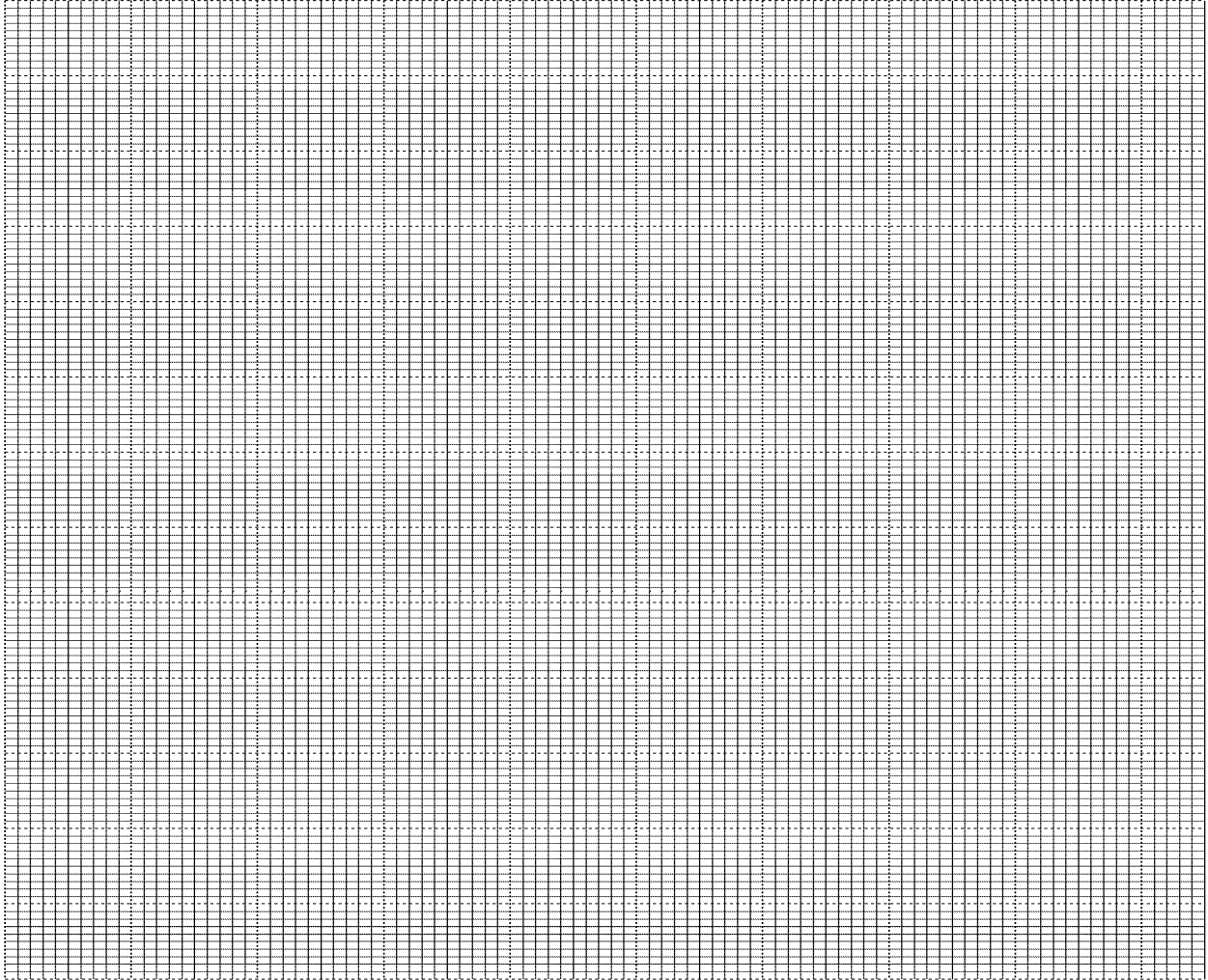
23. Two quantities of p and r are given below.

P	1.2	1.5	2.0	2.5	3.5	4.5
r	1.58	2.25	3.39	4.74	7.86	11.5

(a) State the linear equation connecting p and r.

(1mk)

(b) Using the scale 2cm to represent 0.1 units on both axes, draw a suitable straight line graph on the grid provided;



Hence estimate the value of k and n.

(8mks)

(c) Write an equation connecting p and n.

(1mk)

24. An aircraft leaves point A and flies on a bearing of 020° to a second point B, which is

600km from A. From B, the aircraft then flies on a bearing of 320° to a third point C which is 1000km from B. The aircraft then flies directly back to A from C at a speed of 200km/hr. By scale drawing, find:-

(a) Time taken to fly directly from C to A. (6mks)

(b) The bearing in which it would fly from C to A. (1mk)

(c) Locate point D on a bearing 170° from C and 280° from A. Calculate BD in kilometers. (2mks)

(d) What is the bearing of D from B? (1mk)

PREDICTION 3

NAME: INDEX NO:

SCHOOL:

CANDIDATE SIGN:

DATE:

121/2

MATHEMATICS

PAPER 2

TIME: 2 ½ HOURS

KCSE PREDICTION 3

INSTRUCTIONS TO CANDIDATES:

- (a) Write your name and index number in the spaces provided above
- (b) Sign and write the date of examination in the spaces provided above.
- (c) This paper consists of **TWO** sections: **Section I** and **Section II**.
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- (h) **Non-programmable** silent electronic calculators and KNEC Mathematical tables may be used except where stated otherwise.

FOR EXAMINER'S 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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SECTION 1 : 50 MARKS.
ANSWER ALL THE QUESTIONS

1. Evaluate without using Mathematical tables or a calculator. (3mks)

$$2\log 5 - \frac{1}{2}\log 16 + 2\log 40$$

2. The sum of K terms of sequence 3,9,15,21.....is 7500. Determine the value of K. (3mks)

3. Use matrix method to solve (3mks)

$$5x + 3y = 35$$

$$3x - 4y = -8$$

4. Calculate the percentage error in the volume of a cone whose radius is 9.0cm and slant length 15.0cm. (3mks)

5. Make y the subject of the formula (3mks)

$$\frac{p}{w} = \frac{my-2}{ny+4}$$

6. Solve for x : $\tan^2 x - 2 \tan x = 3$ for the interval $0 \leq x \leq 180^\circ$ (3 marks)

7. The table below shows income tax rates in the year 2013.

Monthly Income in Ksh	Tax rate in each shilling
Up to 9680	10%
9681-18800	15%
18801 – 27920	20%
27921 – 37040	25%
Over 37040	30%

In that year, a monthly personal tax relief of ksh 1056 was allowed. Calculate the monthly income tax by a constable who earned a monthly salary of ksh.

42500 (3mks)

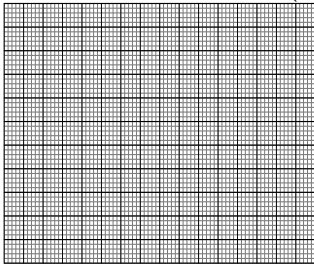
8. Simplify $\frac{2\sqrt{2}}{1+\sqrt{2}} - \frac{\sqrt{2}}{1-\sqrt{2}} = a+b\sqrt{c}$ leaving your answer in the form $a+b\sqrt{c}$, where a , b and c are rational numbers. (3mks)

9 a) Expand $(1-n)^5$ (2mks)

b) Use the expansion in (a) up to the term in n^3 to approximate the value of $(0.98)^5$ (2mks)

10 The probability that three candidates; Anthony, Beatrice and Caleb will pass an examination are $\frac{3}{4}$, $\frac{2}{3}$ and $\frac{4}{5}$ respectively. Find the probability that:-all the three candidates will not pass. (2mks)

11. The equation of a circle is $X^2 + Y^2 - 4x + 6y + 4 = 0$. On the graph provided draw the circle (4mks)

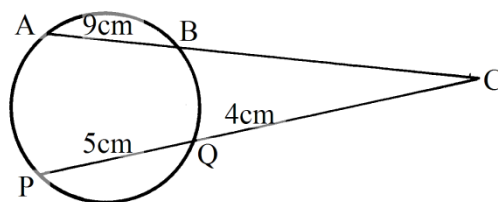


12. Find the shortest distance between points A(50°S,25°E) and B(50°S, 140°E) in KM (Take R=6370 Km) (3mks)

13. The mid-point of AB is (1,-1.5, 2) and the position vector of a point A is $-1 + j$. Find the magnitude of \vec{AB} correct to 1dp. (3mks)

14. Without using a calculator or mathematical tables. Express $\frac{3}{1-\cos 30^\circ}$ in surd form and simplify (3mks)

15. The figure below shows a circle centre O. AB and PQ are chords intersecting externally at a point C. AB = 9cm, PQ= 5cm and QC = 4cm. Find the length of BC. (3mks)



16. Evaluate without using tables

$$\text{Log}(3x+8) - 3\log 2 = \log(x-4)$$

(4mks)

SECTION II (50 MARKS)

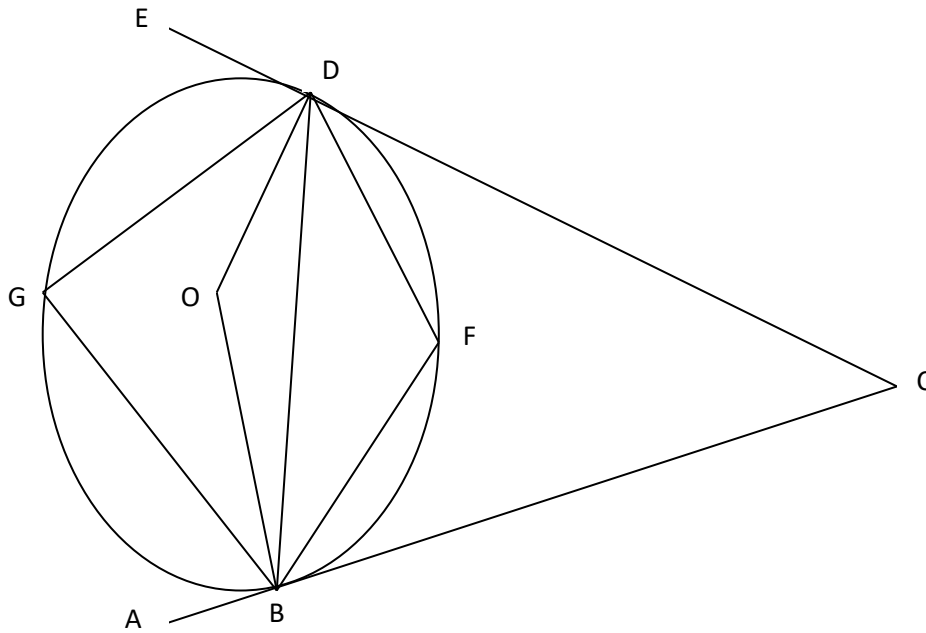
Answer ONLY FIVE questions in this section

17. a) Use the trapezium rule with six trapezia to estimate the areas bounded by the curve $Y=2n^2+ 3n +1$, the axis and the ordinate $x=0$ and $x=3$. (5mks)

b) Calculate the exact area in (a) above by integration. (3mks)

c) Assuming they are calculated in (a) above is an estimate, calculate the percentage error made when the trapezium rule is used leaving your answer to 2 decimal places. (2mks)

18. In the diagram below $\angle EDG = 36^\circ$ and $\angle ABG = 42^\circ$. Line EDC and ABC are tangents to the circle at D and B respectively.



Calculate by giving reason

a) $\angle DGB$ (2mks)

b) Obtuse $\angle DOB$ (2mks)

c) $\angle GDB$ (2mks)

d) $\angle DCB$ (2mks)

e) $\angle DFB$ (2mks)

19. The table below shows the rate at which income tax is charged for all income earned in a month in 2015.

Taxable Income p.m (Kenya pound) pound	Rate in % per Kenya
1 -236	10%
237 -472	15%
473 -708	20%
709 – 944	25%
945 and over	30%

Mrs.mumanyi earns a basic salary of 18000.She is entitled to a house allowance of Ksh. 6,000 a person relief of Ksh. 1064 month

. Every month she pays the following.

- (i) Electricity bill shs.580
- (ii) Water bill shs. 360
- (iii) Co-operative shares shs. 800
- (iv) Loan repayment Ksh. 3000

(a) Calculate her taxable income in k£ p.m (2Marks)

(b)Calculate her P.A.Y.E (6Marks)

(c) Calculate her net salary (2Marks)

20. A flower garden is in the shape of a triangle ABC such that $AB = 9M$, $AC=7.5M$ and angle $ACB=75\%$. Using a rule and a pair of compass only.

a) Construct $\triangle ABC$ (3mks)

b) Construct a locus of P such that $AP = pc$ (2mks)

c) Construct locus of Q such that it is equal distance from AB and BC and locus of R which is 2M from AC. (2mks)

d) Flowers are to be planted such that they are nearer AC than AB and less than 5m from a shade the portion with flowers. (3mks)

21. A tank has two water taps P and Q and another tap R. When empty the tank be filled by tap P alone in 5 hours or by tap Q in 3 hours .When full the tank can be emptied in 8 hours by tap R

a)The tank is initially empty . Find how long it would take to fill up the tank

i) If tap R is closed and taps P and Q are opened at the same time (2mks)

ii) If all the three taps are opened at the same time .Giving your answer to the nearest minute (2mks)

b) Assume the tank initially empty and the three taps are opened as follows

P at 8:00 am

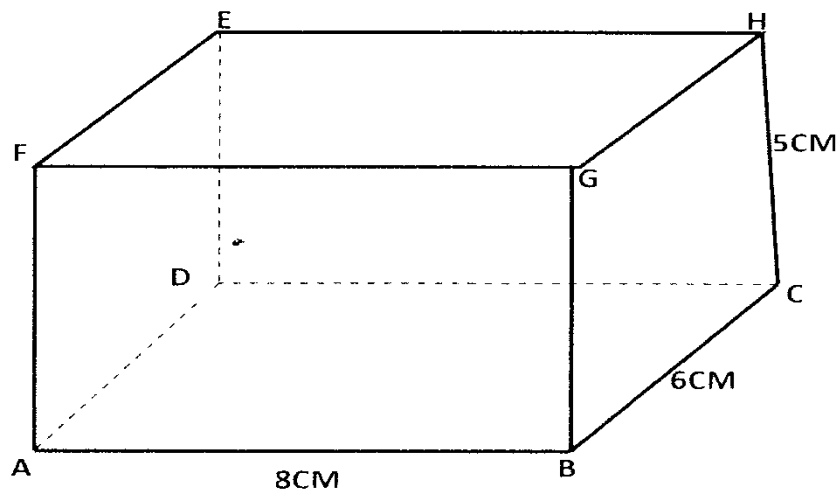
Q at 9:00 am

R at 9:00 am

i) Find the fraction of the time that would be filled by 10:00 am
(3mks)

ii) Find the time the tank would be fully filled up. Give your answer to the nearest minute (3mks)

22. The figure below shows a cuboid.



Calculate

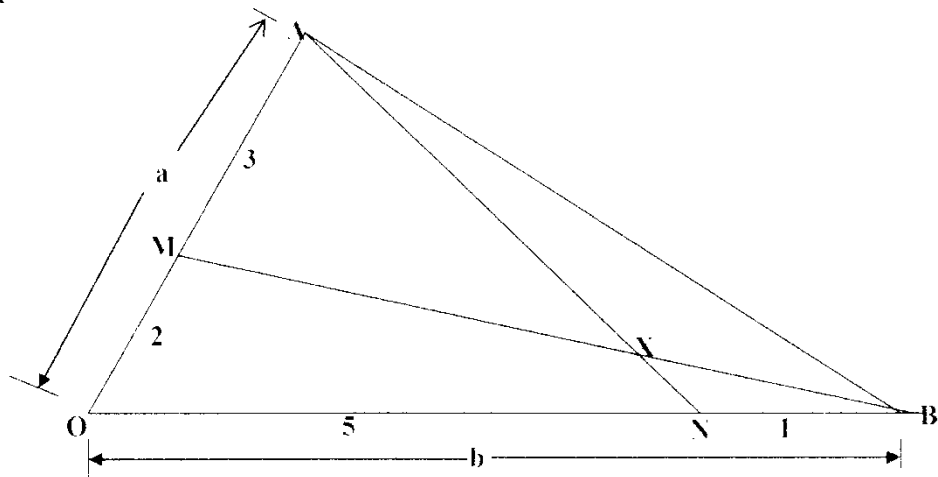
(a) The length BE (2Mks)

(b) The angle between BE and plane ABCD (3Mks)

(c) The angle between FH and BC. (2Mks)

(d) The angle between plane AGHD and plane ABCD. (3Mks)

23. In triangle OAB below $OA = a$, $OB = b$ point M lies on OA such that $OM : MA = 2:3$ and point N lies on OB such that $ON : NB = 5:1$ line AN intersect line MB at X



(a) Express in terms of a and b

(i) AN (1 m k)

(ii) BM (1 m k)

b) Given that $AX=kAN$ and $BX=rBM$ where k and r are scalars.
 i. write down two different expression for OX in terms of a , b , k and r . (2mks)

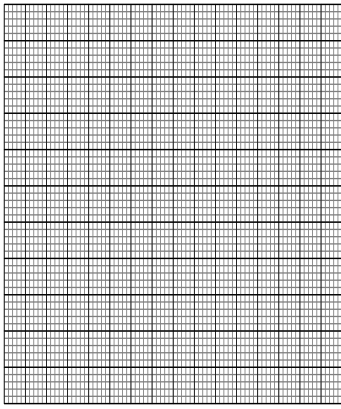
ii. Find the value of k and r . (4mks)

iii. Determine the ratio in which x divides line MB . (2mks)

24. (a) Complete the table below for the function $y=n^3-3k^2-k+2$ for $-2 \leq n \leq 4$.
 (2mks)

X	-2	-1	0	1	3	4
Y	-6		2			14

b) On the grid provided, draw the graph of $y =n^3-3n^2-n+2$. (3mks)



a) (i) Use the graph to solve the equation

$$n^3 - 3n^2 - x + 2 = 0$$

(2mk)

(ii) By drawing a suitable line on the graph, solve the equation

$$n^3 - 3n^2 - 3n + 3 = 0$$

(3mks)

PREDICTION 4

Name:

Class:Adm.No.....

School:

Date:

Sign:

121/2

MATHEMATICS

PAPER 2

TIME: 2 ½ HOURS

KCSE PREDICTION 4

Kenya Certificate to Secondary Education

Instructions

- Write your name, class, admission number, school, date and signature in spaces provided above.
- The paper contains **two** sections **A** and **B**.
- Answer **all** questions in section **A** and **any five** questions from section **B** in the spaces provided below each question.
- Show all the steps in your calculations giving your answers at each stage in the spaces below each question.
- Non-programmable silent electronic calculator and mathematical tables may be used except where stated otherwise.

For Examiner's Use Only

SECTION A

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

SECTION B

17	18	19	20	21	22	23	24	TOTAL

PERCENTAGE
SCORE

--

SECTION A (50 MARKS)

(Answer **all** questions in this section in the spaces provided)

1. Use logarithm table to evaluate.

(4mks)

$$\sqrt[4]{\frac{(27 \times 0.0293)^2}{(825 - 94) \div 0.2861}}$$

2. Three sisters, Ann, Beatrice and Caroline together invested Ksh. 48,000 as capital and started a small business. If the share of profit is Ksh. 2,300, Ksh. 1,700 and Ksh. 800 respectively, shared proportionally. Find the capital invested by each of them. (3mks)

3. Make t the subject of formula in $x = \left(\frac{p+t}{t}\right)^{\frac{1}{3}}$

(3mks)

4. Without using a calculator or mathematical tables, express $\frac{\sqrt{3}}{1 - \cos 30^\circ}$ in surd form and simplify.

(3mks)

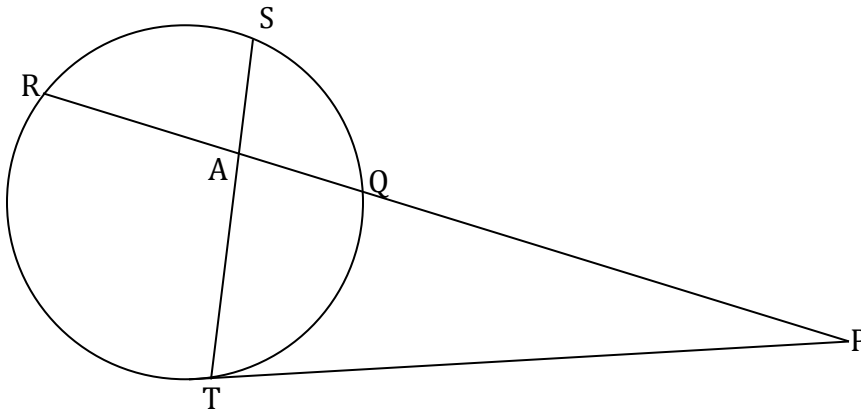
5. Expand and simplify $(3x - y)^4$ hence use the first three terms of the expansion to approximate the value of $(6 - 0.2)^4$. (4mks)

6. Find x without using tables if $3 + \log_2 3 + \log_2 x = \log_2 5 + 2$ (3mks)

7. Find the value of m for which the matrix transforms an object into a straight line. (3mks)

$$\begin{pmatrix} m^2 & 1 \\ 2m - 1 & 1 \end{pmatrix}$$

8. In the figure below PT is a tangent to the circle at T , $PQ = 9\text{cm}$, $SA = 6\text{cm}$, $AT = 8\text{cm}$ and $AR = 3\text{cm}$. Calculate the length of;



(a) AQ (2mks)

(b) PT (1mk)

9. A right angled triangle has a base of 15.3 cm and height 7.2 cm , each measured to the nearest 3 mm . Determine the percentage error in finding the area of the triangle, giving your answer to 2 decimal places. (3mks)

10. Given that $\sin x = 0.8$, without using a mathematical table and calculator find $\tan(90-x)$
(3mks)

11. The point $B(3,2)$ maps onto $B^1(7,1)$ under a translation T_1 . Find T_1 (2mks)

12. Using a ruler and a pair of compasses only, construct triangle ABC in which $BC=6\text{cm}$, $AB=8.8\text{cm}$ and angle $ABC= 22.5^\circ$. (3mks)

13. Two grades of tea A and B, costing sh 100 and 150 per kg respectively are mixed in the ratio 3:5 by mass. The mixture is then sold at sh 160 per kg. Find the percentage profit on the cost price.

(3mks)

14. The first, the third and the ninth term of an increasing AP, makes, the first three terms of a G.P. If the first term of the AP is 3, find the difference of the AP and common ratio of GP.

(4mks)

15. The matrix $M = \begin{pmatrix} 3 & -2 \\ -5 & y \end{pmatrix}$ maps a triangular object of area 7 square units onto one with area of 35 square units. Find the value of x . (4mks)

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

SECTION B (50 MARKS)

*(Answer any **five** questions in this section)*

17. A bag contains 3 black balls and 6 white balls. If two balls are drawn from the bag one at a time, find the:
- a) Probability of drawing two white balls:

i) With replacement (2mks)

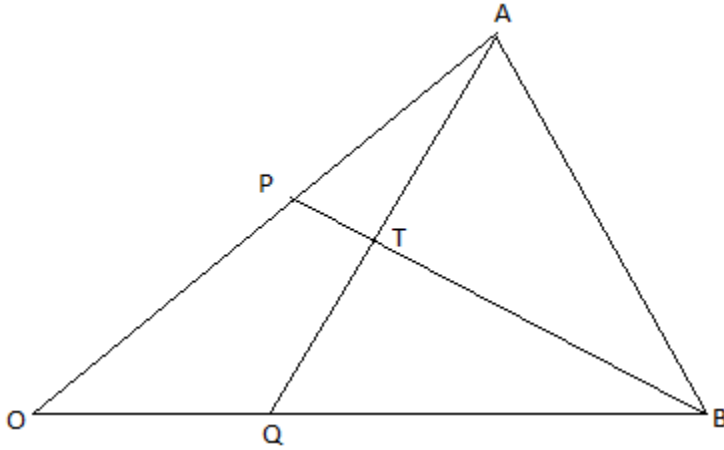
ii) Without replacement (2mks)

b) Probability of drawing a black ball and white ball:

i) With replacement (3mks)

ii) Without replacement. (3mks)

18. In the triangle below P and Q are points on OA and OB respectively such that $OP:PA = 3 : 2$ and $OQ : QB = 1 : 2$. AQ and PQ intersect at T. Given that $\mathbf{OA} = \mathbf{a}$ and $\mathbf{OB} = \mathbf{b}$.



(a) Express AQ and PQ in terms of \mathbf{a} and \mathbf{b} . (2mks)

(b) Taking $BT = kBP$ and $AT = hAQ$ where h and k are real numbers.
 (i) Find two expressions for OT in terms of \mathbf{a} and \mathbf{b} . (2mks)

(ii) Use the expression in b(i) above to find the values of h and k . (4mks)

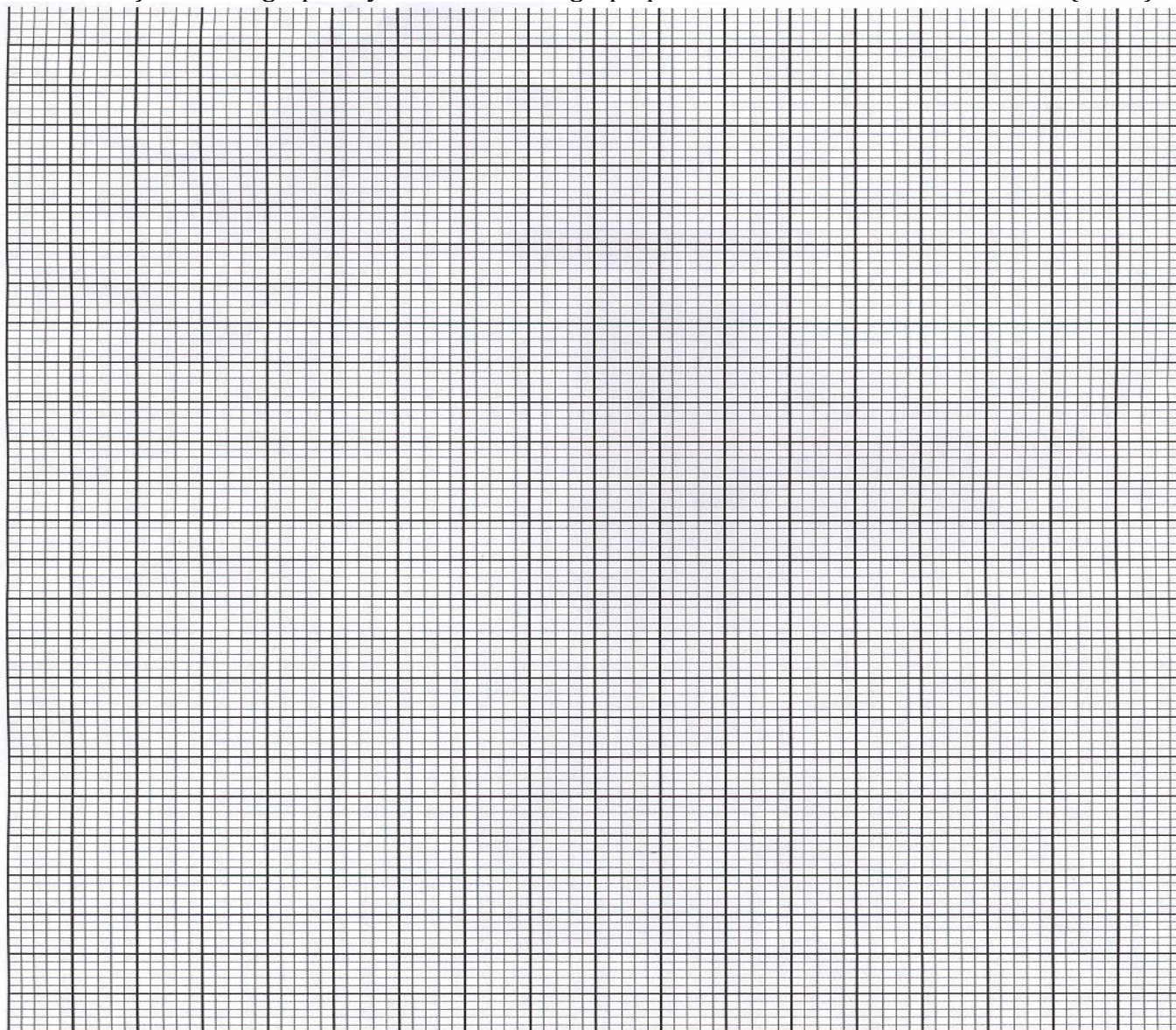
(c) Give the ratio $BT:TP$. (2mks)

19. Complete the table below for the functions $y=3\cos x-2$ for $0^\circ \leq x \leq 360^\circ$ (2mks)

x	0	30	60	90	120	150	180	210	240	270	300	330	360
$y=3\cos x-2$													

2													
---	--	--	--	--	--	--	--	--	--	--	--	--	--

a) Plot the graph of $y=3\cos x-2$ in the graph provided below. (3mks)



- b) From the graph
- i. Find the amplitude of the wave. (2mks)
 - ii. The period of the wave. (1mk)
 - iii. Find the solution to $3\cos x=2$ (2mks)

20. A plane leaves an airport A (41.5°N , 36.4°W) at 9:00am and flies due north to airport B on latitude 53.2°N . Taking π as $\frac{22}{7}$ and the radius of the earth as 6370Km,

a) Calculate the distance covered by the plane in km (4mks)

b) The plane stopped for 30minutes to refuel at B and flew due east to C, 2500km from B.

Calculate:

i) position of C (3mks)

ii) The time the plane lands at C if its speed is 500km/h (3mks)

21. The curve given by the equation $y = x^2 + 1$ is defined by the values in the table below.

(a) Complete the table by filling in the missing values. (2mks)

X	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
Y	1.0		2.0		5.0		10.0		17.0		26.0		37.0

(b) Sketch the curve for $y = x^2 + 1$ for $0 \leq x \leq 6$ (2mks)

(c) Use the mid-ordinate rule with 5 ordinates to estimate the area of the region bounded by the curve $y = x^2 + 1$, the x-axis, the lines $x = 0$ and $x = 6$. (2mks)

(d) Use method of integration to find the exact value of the area of the region in (c) above. (2mks)

(e) Calculate the percentage error involved in using the mid-ordinate rule to find the area. (2mks)

22. (a) Using a ruler and pair of compasses only construct triangle PQR in which

$PQ = 7.5\text{cm}$ $QR = 6.0\text{cm}$ and angle $PQR = 60^\circ$. Measure PR (3mks)

(b) On same side of PQ as R

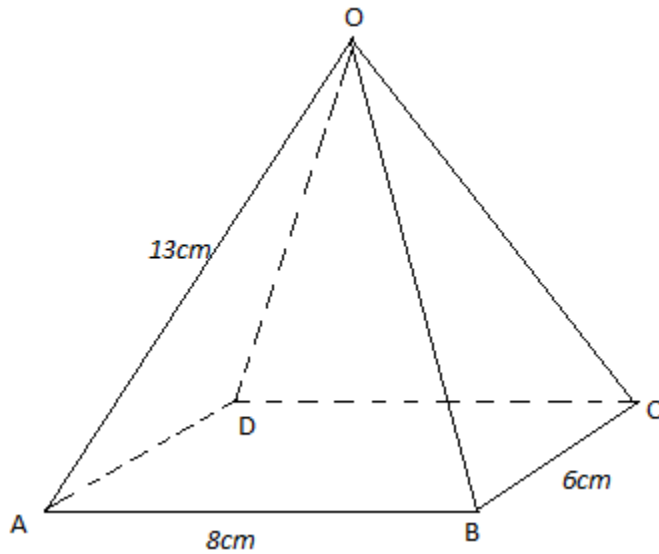
(i) Determine the locus of a point T such that angle $PTQ = 60^\circ$ (3mks)

(ii) Construct the locus of **M** such that $PM = 3.5\text{cm}$. (2mks)

(iii) Identify the region **W** such that $PR \geq 3$ and angle $PTQ \geq 60^\circ$ by shading the unwanted part. (2mks)

23. OABCD is a right pyramid on a rectangular base with $AB = 8\text{ cm}$, $BC = 6\text{ cm}$,
 $OA = OB = OC = OD = 13\text{ cm}$. Calculate;

(a) the height of the pyramid. (3mks)



(b) the inclination of OBC to the horizontal. (2mks)

(c) the angle between;
 (i) OB and DC (3mks)

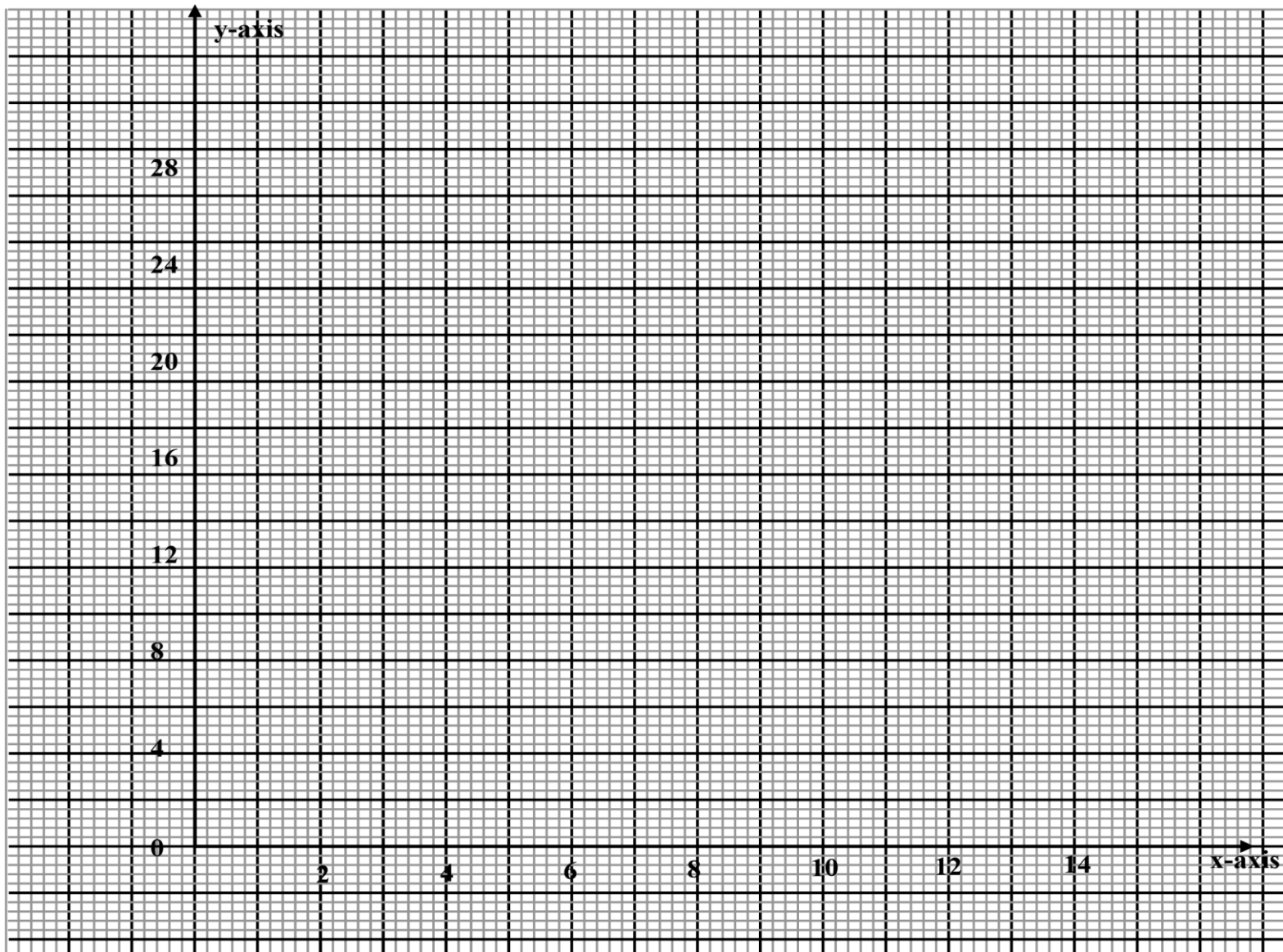
(ii) the planes OBC and OAD (2mks)

24. The games master wishes to hire two matatus for a trip. The operators have a Toyota which carries 10 passengers and a Kombi which carries 20 passengers. Altogether 120 people have to travel. The operators have only 20litres of fuel and

the Toyota consumes 4 litres on each round trip and the Kombi 1 litre on each round trip. If the Toyota makes x round trips and the kombi y round trips;

(a) write down four inequalities in x and y which must be satisfied . (2mks)

(b) Represent the inequalities graphically on the grid provided. (3mks)



(c) The operators charge shs.100 for each round trip in the Toyota and shs.300 for each round trip in the kombi;

(i) determine the number of trips made by each vehicle so as to make the total cost a minimum. (4mks)

(ii) find the minimum cost. (1mk)

PREDICTION 5

Name.....Class

Index Number Class Number.....

KCSE PREDICTION 5

MATHEMATICS PAPER 2

Instructions to candidates

1. Write your name, index and class number in the spaces provided above.
2. The paper consists of two sections: *section I* and *section II*.
3. Answer **all** the questions in **section I** and any **five** in **section II**
4. Section I has **sixteen** questions and section two has **eight** questions
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. KNEC Mathematical table and silent non-programmable calculators may be used.

For examiner's 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

--

1. Without using logarithm tables or calculator, solve $3^{2x+3} - 28(3^x) + 1 = 0$. (3 mks)

2. Use a mathematical table to evaluate: (3 mks)

$$\left(\frac{4.28 \times 0.01677}{\tan 20} \right)^{\frac{1}{5}}$$

3. Simply and leave answer in surd form. (3 mks)

$$\frac{-9}{\sqrt{13} + \sqrt{3}} - \frac{5}{\sqrt{3} - \sqrt{13}}$$

4. The sides of triangles were measured and recorded as 8.4 cm, 10.5 cm and 15.3. Calculate the percentage error in perimeter correct to 2 d.p. (3 mks)

5. Simplify: (3 mks)

$$\frac{\log 16 + \log 81}{\log 8 + \log 27}$$

6. Simplify the expression: (4 mks)

$$\frac{(-36 + 9x^2) + (-6y + 3xy)}{3x - 6}$$

7. Given that $\frac{x(x^2-1)}{x+1}$, find dy/dx at the point (2,4). (3 mks)

8. (a) Expand and simplify the expression $\left(10 + \frac{2}{x}\right)^5$ (2 mks)

(b) Use the expression in (a) above to find the value of 14^5 . (1 mk)

9. John buys and sells rive in packets. He mixes 30 pockets of rive A costing sh 400 per packet with 50 packets of another kind of rive B costing sh 350 per packet. If he sells the mixture at a gain of 20%, at what price does he sell a pocket? (3 mks)

10. A chord of AB of length 13cm subtends an angle of 67° at the circumference of a circle centre O. find the radius of the circle. (3 mks)

11. Find the coordinates of the image of a point (5, -3) when its rotated through 180° about (3,1). (3 mks)

12. Two points P (-3,-4) and Q (2,5) are the points on a circle such that PQ is the diameter of the circle. Find the equation of the circle in the form $ax^2 + by^2 + cx + dy + e = 0$ where a, b, c and e are constants. (4 mks)

13. Two metal spheres of radius 2.3 cm and 2.86 cm are melted. The molten material is used to cast equal cylindrical slabs of radius 8 mm and length 70mm. If $\frac{1}{20}$ of the meal is lost during casting. Calculate the number of complete slabs cast. (3 mks)

14. A right pyramid has a rectangular base of 12 cm by 16cm. its slanting lengths are 26 cm. Determine:

(a) The length of AC (1 mk)

(b) The angle AV makes with the base ABCD. (2 mks)

15. Determine the inverse, T^{-1} of the matrix $T \begin{pmatrix} 4 & 6 \\ 6 & -2 \end{pmatrix}$ hence solve : (3 mks)

$$2x + 3y = 30$$

$$3x - y = 10$$

16. Use squares, square roots and tables to evaluate: (3 mks)

$$3.045^2 + (49.24)^{-1/2}$$

SECTION B

17. The table below shows the frequency distribution of diameter for 40 tins in millimeters.

Diameter (mm)	130 – 139	140 – 149	150 – 159	160 – 169	170 – 179	180 – 180
No of tins	1	3	7	13	10	6

Using a suitable working mean calculate:

(a) The actual mean for the grouped lengths. (4 mks)

(b) The standard deviation of the distribution. (6 mks)

18. A $\frac{3}{2}$ Bao yearly plan is a school pocket money (SPM) saving scheme requiring 12 months payments of a fixed amount of money on the same date each month. All savings earn interest at a rate of $p\%$ per complete calendar month.

Lewis Kamau decides to invest K£ 30 per month in this scheme as advised by Gumbo and Oteinde 4Q and 4P class governors a.k.a class secretaries and witnesses by very determined mathematics. Martine Mutua Mukumbu (M^3) and makes no withdrawals during the year.

- (a) Show that after 12 complete calendar months, Lewis first payment has increased in value to K£ $30 r^{12}$, where $r = 1 + \frac{P}{100}$ (4 mks)

- (b) Show that the total value, after 12 complete calendar months, of all 12 payments is K£ $30 r = \frac{r(r^{12}-1)}{(r-1)}$ (3 mks)

- (c) Hence calculate the total interest received during the 12 months when the monthly rate of interest is $\frac{1}{2}$ per cent. (3 mks)

19. A mobile dealer sells phones of two types: Nokia and Motorola. The price of one nokia and one Motorola phone is Ksh 2000 and Ksh 16000 respectively. The dealers wishes to have at least fifty mobile phones. The number of Nokia phones should be atleast the same as those of Motorola phones. He has Ksh 120,000 to spend on phones. If he purchases x Nokia phones and y Motorola phones;

(a) Write down all the inequalities to represent the above information. (3 mks)

(b) Represent the inequalities in part (a) above on the grid provided. (4 mks)

(c) The profit on a nokia phone is Ksh 200 and that on a Motorola phone is Ksh 300. Find the number of phones of each type he should stock so as to maximize profit. (3mks)

20. The vertices of parallelogram are O (0,0), A (5,0) B (8,3) and C (3,3). Plot on the same axes:

- (i) Parallelogram O'A'B'C', the image of OABC under reflection in the line $x = 4$
(4 mks)
- (ii) Parallelogram O''A''B''C'' the image of O'A'B'C' under a transformation described by the matrix $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ Describe the transformation. (4 mks)
- (iii) Parallelogram O'''A'''B'''C''' under the enlargement, centre (0,0) and scale factor $\frac{1}{2}$
(2 mks)

21. A particle moving with acceleration $a = (10 - t) \text{ m/s}^2$. When $t = 1$ velocity $V = 2 \text{ m/s}$ and when $t = 0$ displacement $S = 0 \text{ m}$.

(a) Express displacement and velocity in terms of t .

(b) Calculate the velocity when $t = 35$

(c) What is the displacement when $t = 5$

(d) Calculate maximum velocity.

22. (a) Three quantities x , y and t were such that the square root of y varies directly as x and inversely as t . find the percentage change in t if x decreases in ratio $4 : 5$ and y increases by 44% . (5 mks)

(b) If y varies as the square root of x and the sum of the value of y when $x = 4$ and $y = 100$ is 2:

(i) Find y in terms of x (3 mks)

(ii) Find x correct to one d.p when $y = 14$ (2 mks)

23. Use a ruler and pair of compasses only in this question. ABC is a fixed triangle in which $AB = AC = 6$ cm and angle $BAC = 90^\circ$. Show clearly on a two dimensional drawing the locus of Q in each case below.

(a) When Q is equidistant from both lines CA and CB. (5 mks)

(b) When the area of triangle ABC = areas of triangle QBC. (5 mks)

24. Two fair dice are tossed once. The event A and B are defined as follows:

A: the score on the two dices are the same

B: at least one die shows a 4.

- (a) Draw a probability space representing the tossing. (2 mks)
- (b) Calculate:
- (i) The probability of even A (1 mk)
 - (ii) The probability of even B (2 mks)
 - (iii) The probability of even A and B (2 mks)
- (c) If the two dice are tossed three time
- (i) Draw a tree diagram showing the event A happening for the three tosses. (1 mk)
 - (ii) Calculate the probability that A occurs:
 - (a) Exactly once (1 mk)
 - (b) At least once (2 mk)
 - (c) At most once (2 mks)

PREDICTION 6

NAME:..... INDEX NO.

SIGNATURE: DATE:

121/2
MATHEMATICS
PAPER 2
TIME: 2 ½ HOURS

KCSE PREDICTION 6

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.

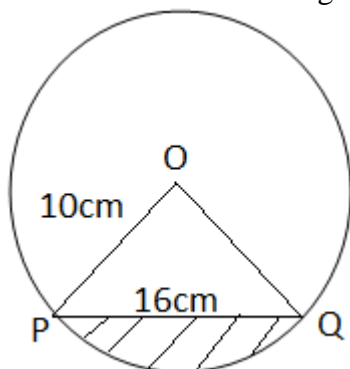
(3mks)

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 cm . The chord $PQ = 16\text{ cm}$. Calculate the area of the unshaded region. (4mks)



8. The mean weight of 36 students is 45 kg ; two of the students leave and the mean weight increases by 0.5 kg . If one of the students who left weighed 43 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)

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

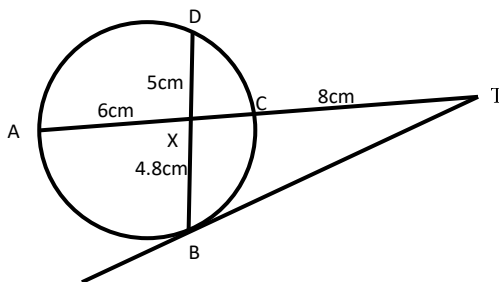
12. Use reciprocal, square and cube root tables to evaluate to 4 significant figures, the expression. (3mks)

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

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 $(1\frac{1}{20})^5$. (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 m². (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

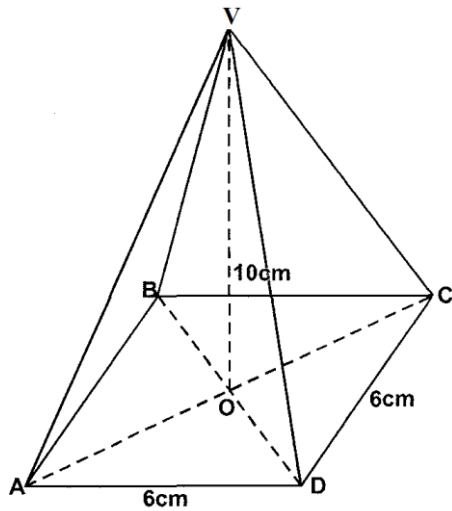
Determine;

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)

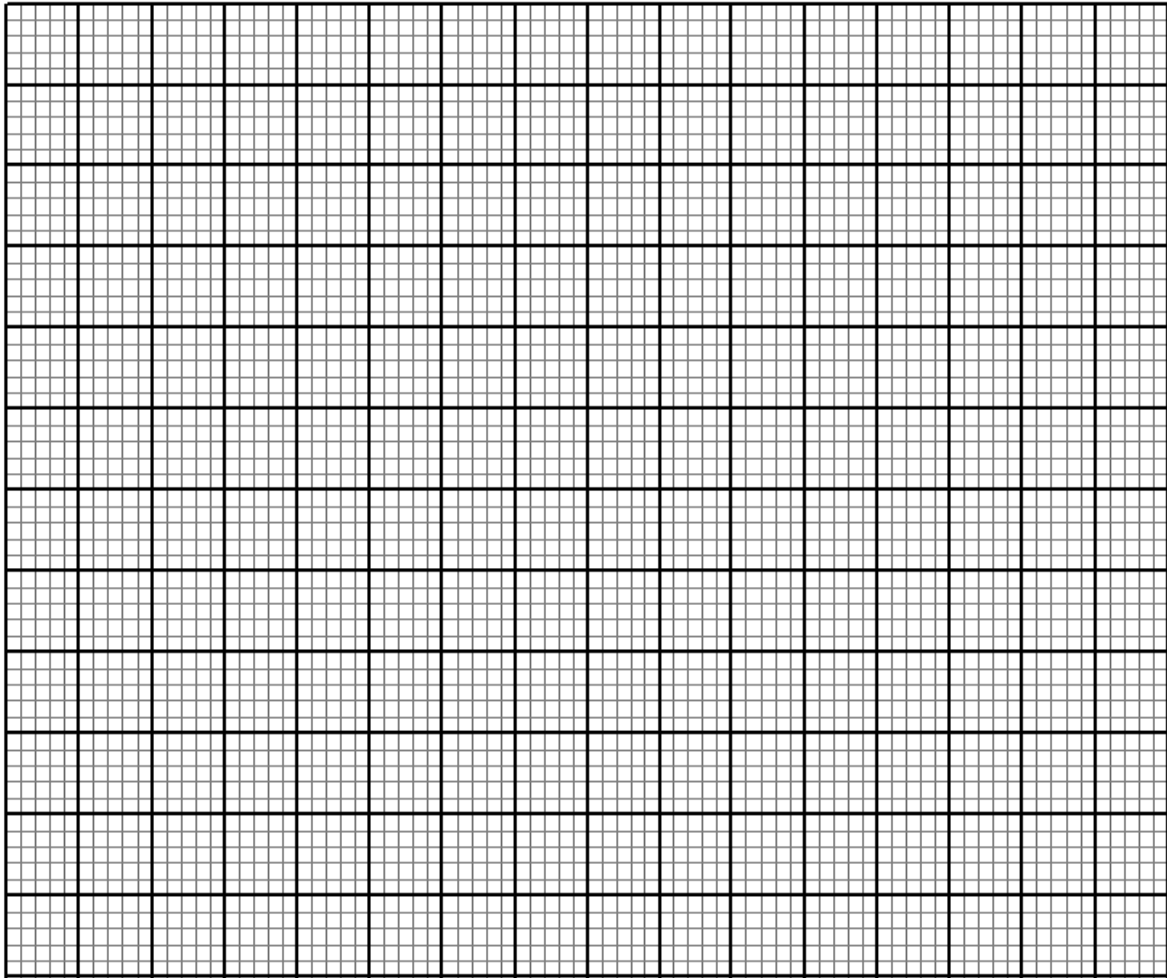
iii) The angle between the planes VDC and $ABCD$ (2mks)

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)

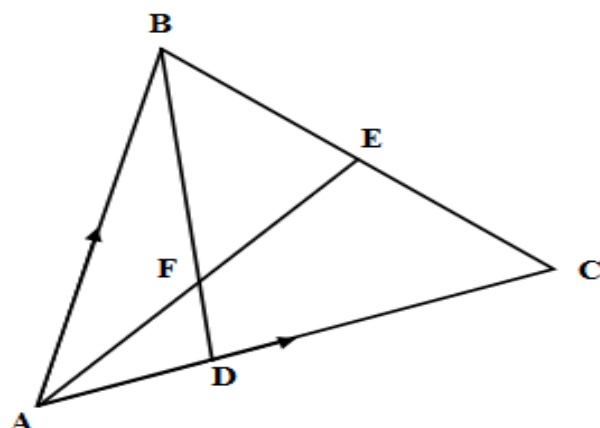


c) Use the graph to solve $\sin (2x + 30) - \sin 2x = 0$ (1mk)

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:

i) BD

(2mks)

ii) 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° N, 110° W) and **Y** (45° N, 70° 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)

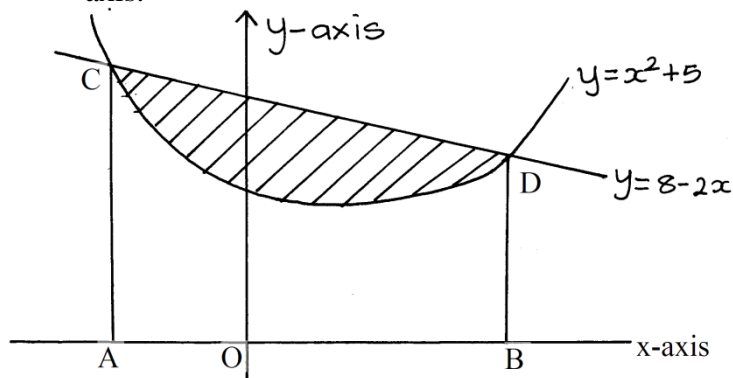
22. The 2nd and 5th terms of an arithmetic progression are 8 and 17 respectively. The 2nd, 10th and 42nd terms of the A.P. form the first three terms of a geometric progression. Find

(a) The 1st term and the common difference. (3mks)

(b) The first three terms of the G.P and the 10th 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)