MATHEMATICS PP2, SERIES 1, K.C.S.E EXAMINERS' FORECAST 10 QUESTION PAPERS



MATHEMATICS PP2, SERIES 1, K.C.S.E EXAMINERS' FORECAST 10 QP

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K.C.S.E EXAMINERS' FORECAST SERIES 1
QUESTION PAPER NO: 1

121/1
MATHEMATICS
PAPER 2
TIME 2 ½ HOURS.

SECTION I (50 MARKS)

1. Use logarithm to solve tables to evaluate **(4mks)**

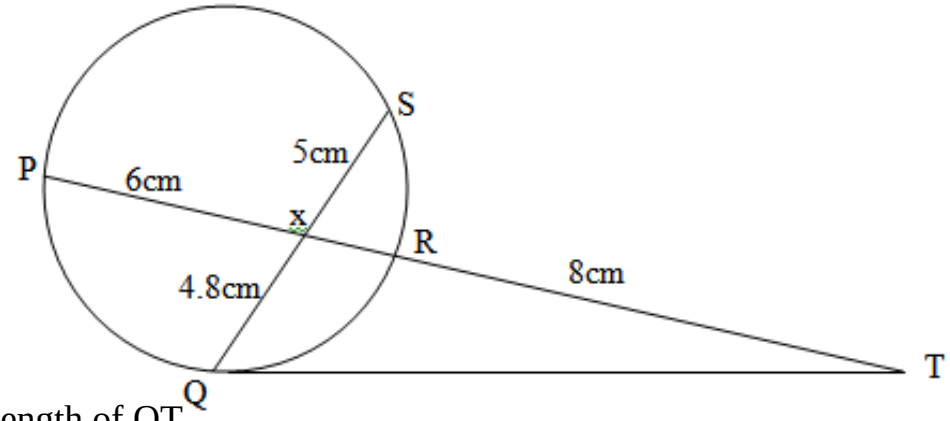
$$\sqrt[3]{\frac{45.3 \times 0.00697}{0.534}}$$

2. The length and breadth of a rectangular paper were measured to be the **nearest** centimeter and found to be 20cm and 15 cm respectively. Find the percentage error in its perimeter leaving your answer to 4 significant figures. **(3mks)**

3. Simplify the following surds leaving your answer in the form $a + b\sqrt{c}$

$$\frac{\sqrt{5}}{2\sqrt{2}-\sqrt{5}} + \frac{\sqrt{2}}{2\sqrt{2}+\sqrt{5}}$$ **(3mks)**

4. In the figure below QT is a tangent to the circle at Q. PXRT and QXS are straight lines. PX = 6cm, RT = 8cm, QX = 4.8cm and XS = 5cm.



Find the length of QT **(3mks)**

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5. Mary and Jane working together can cultivate a piece of land in 6 days. Mary alone can complete the work in 15 days. After the two had worked for 4 days Mary withdrew the services. Find the time taken by Jane to complete the remaining work. **(3mks)**

6. The equation of a circle is given by $3x^2 + 3y^2 - 18x + 12y - 9=0$. Determine the radius and the center of the circle. **(3mks)**

7. Make Q the subject of the formula **(3mks)**

$$T = P\sqrt{\frac{Q}{Q-1}}$$

8. Solve for x in the equation

$2\sin^2 x - 1 = \cos^2 x + \sin x$ for $0^0 \leq x \leq 360$ **(3mks)**

9. Solve for x in $3\log_3 x + 4 = \log_3 24$ **(3mks)**

10. In a transformation, an object with area $4cm^2$ is mapped onto an image whose area is $48cm^2$ by a transformation matrix $\begin{pmatrix} y+1 & y \\ 4 & 2 \end{pmatrix}$ Find the value of y **(3mks)**

11.(a) Expand $(2 + 2y)^5$. **(2mks)**

(b) Hence find the value of $(2.02)^5$, correct to 4 decimal places when substitution for y is up to y^4. **(2mks)**

12. A coffee blender mixes 6 parts of type A with 4 parts of type B. If type A costs sh 72 and type B costs him sh 66 per Kg respectively, at what price should he sell the mixture in order to make 5% profit? Give your answer to the nearest ten cents. **(3mks)**

13. The data below represents the ages in months at which 11 babies started walking:
9,15 , 12, 9, 8, 13, 7, 11, 13, 14 and 10.
Calculate the interquartile range of the above data **(3mks)**

14. Karimi deposited sh 45000 in a bank which paid compound interest of 12% per annum. Calculate the amount after 2 years to the nearest whole number**.** **(3mks)**

15. Use tables of reciprocals only to work out **(3mks)**

$$\frac{3}{0.6735} + \frac{13}{0.156}$$

16. PQR is a triangle of area 9 cm^2. If PQ is the fixed base of the traingle and 6cm long draw it and describe the locus of point R. **(3mks)**

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SECTION II (50 MARKS)

Answer FIVE questions ONLY from this section

17. Income tax is charged on annual income at the rates shown below.

Taxable annual income (K£)	Rate sh per k £
1 - 2300	2
2301 -4600	3
4601 - 6900	5
6901 -9200	7
9201 -11, 500	9
11501 and above	10

Personal relief of ksh. 1056 per month

Insurance relief of ksh. 480 per month

Mr. Kimathi earns a basic salary sh. 13800 per month. In addition to his salary he get a house allowance of ksh.8000 per month and medical allowance of sh. 5000 per month.
Calculate;

a) Mr. Kimathi's taxable income per annum in K£ **(2mks)**

b) Mr. Kimathi's net tax per month in Kenya shillings. **(5mks)**

c) Calculate Mr. Kimathi's net monthly salary in Kenya shillings. **(3mks)**

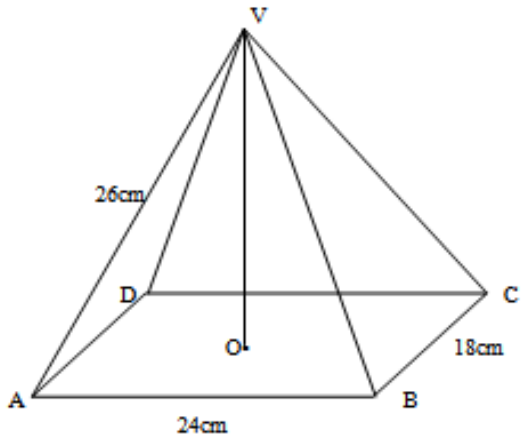
18. (a) An arithmetic progession is such that the first term is -5, the last is 135 and the sum of the progression is 975. Calculate:

(i) The number of terms in the series **(4mks)**

(ii) The common difference of the progression **(2mks)**

(b) The sum of the first three terms of a geometric progression is 27 and first term is 36. Determine the common ration and the value of the fourth term **(4mks)**

19. The diagram below represents a pyramid standing on rectangular base ABCO. V is the vertex of the pyramid and $VA = VB = VC = VD = 26$ cm. M and N are the midpoints of BC and AC respectively. $AB = 24\ cm$ and $BC = 18\ cm$.



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Calculate:-

a) The length of the line AC **(2mks)**
b) The length of projection of the VA on the plane ABCD. **(1mk)**
c) The angle between line VA and the plane ABCD. **(2mks)**
d) The vertical height of the pyramid. **(2mks)**
e) The size of the angle between the planes VBC and ABCD. **(3mks)**

20. Three quantities R, S and T are such that R varies directly as S and inversely as the square of T.

a) Given that R = 480 when S = 150 and T =5, write an equation connecting R, S and T. **(4mks)**
b) (i) Find the value of R when S = 360 and T = 1.5. **(2mks)**
(ii) Find the percentage change in R if S increases and T decreases by 20%. **(4mks)**

21. The water supply in a town depends entirely on two water pumps. A and B. The probability of pump A failing is 0.1 and the probability of pump B failing is 0.2.

a) Draw a tree diagram to represent this information **(2mks)**
b) Calculate the probability that;
(i) Both pumps are working **(2mks)**
(ii) There is no water in the town **(2mks)**
(iii) Only one pump is working **(2mks)**
(iv) There is some water in the town **(2mks)**

22. Complete the table below by filling in the blank spaces. (2 marks)

x^0	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0	240	270^0	300	330	360^0
Cos x^0	1.00		0.50			-0.87		-0.87					
2 Cos ½ x	2.00	1.93					0.00						

a) On the grid provided using a scale of 1cm to represent 30^0 on the horizontal axis and 4 cm to represent 1 unit on the vertical axis draw the graph of $y = \cos x^0$ and $y = 2\cos ½ x^0$ **(4mks)**

b) State the amplitude and period of $y = 2\cos ½ x$ **(2mks)**

c) Use your graph to solve the equation **(2mks)**

$2 \cos ½ x - \cos x = 0$

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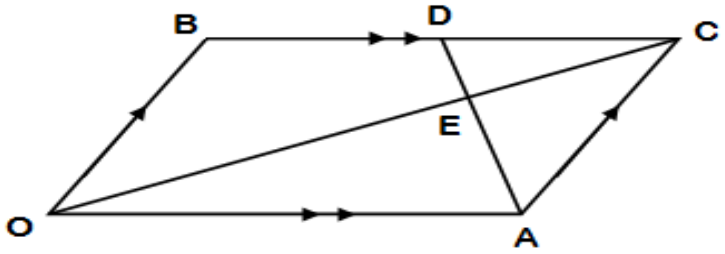
23. ABCD is a quadrilateral with coordinates $A\ (2,1), B\ (3,2), C\ (3,4)$ and $D\ (0,3)$. ABCD is mapped onto A'B'C'D' under transformation **T** given by a shear with x – axis invariant such that A' (4, 1).

a) Determine the 2×2 transformation matrix representing **T** and hence determine the coordinates of B', C' and D'. **(4mks)**

b) A'B'C'D' is transformed to A"B"C"D" under a transformation **H** such that A" $(-6,-9)$ and D"$(-12,-15)$. Determine the 2×2 matrix representing **H** and hence determine the coordinates of B" and C" **(3mks)**

c) A"B"C"D" mapped onto A"'B"'C"'D"' under a transformation **V** representing a reflection in the line $y = -x$. Determine the 2×2 matrix representing **V** and hence determine the coordinates of A"'B"'C"'D"' **(3mks)**

24. A parallelogram OACB is such that **OA** = **a**, **OB** = **b.** D is the mid-point of BC. **OE** = h**OC** and **AE** = k**AD**.



(a) Express the following in terms of **a**, **b**, h and k.

(i) OC **(1mk)**

(ii) OE **(1mk)**

(iii) AD **(1mk)**

(iv) AE **(1mk)**

(b) Find the values of h and k. **(4mks)**

(c) Determine the ratios:

(i) AE : ED **(1mk)**

(ii) OE : OC **(1mk)**

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K.C.S.E EXAMINERS' FORECAST SERIES 1
QUESTION PAPER NO: 2

121/1
MATHEMATICS
PAPER 2
TIME 2 ½ HOURS.

SECTION I (50 MARKS)

1. Use logarithm tables to solve; **(4mks)**

$$\sqrt[3]{\frac{45.23\times 0.1122}{6394}}$$

2. Solve for θ in the equation $\sin(4\theta + 10^o) - \cos(\theta + 70^o) = 0$ **(3mks)**

3. A quantity K is partly constant and partly varies as M. When K = 45, M = 20, and when K = 87, M = 48

a) Find the formulae connecting K and M **(1mk)**
b) Find K when M = 36 **(2mk)**

4. (i) Expand $(2x-1)^5$ in ascending powers of x **(1mk)**

(ii) Hence use your expansion up to the third term to evaluate $(-0.98)^5$ **(2mks)**

5. Find the equation of the normal to the curve $y = x^2 + 4x - 3$ at point (1, 2). **(3mks)**

6. Using a ruler and a pair of compass only, construct triangle ABC in which BC is 6.6cm, AC=3.8cm and AB= 5.6cm. Locate point E inside triangle ABC which is equidistant fromponts A, and C such thatangle AEC=90^0. **(3mks)**

7. Solve the following trigonometric equation $2\cos 2(x+30) = 1$ for $0 \le x \le 360^0$ **(3mks)**

8. The position vectors of A and B are given as **a**= 2**i**-3**j**+4**k** and **b**= -2**i**-**j**+2**k** respectively. Find to 2decimal places, the length of the vector $\overrightarrow{AB}$. **(3mks)**

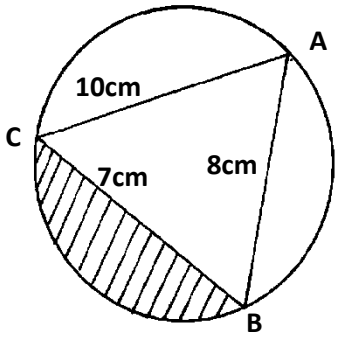
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9. A T.V set was bought on hire purchase. A down payment (deposit) of Ksh 5000 was paid and a 15 monthly installment of Kshs 1500 was required.

a) Calculate the total amount paid on hire purchase **(1mk)**

b) If the hire purchase payment is 20% than cash payment, find the cash price **(2mks)**

10. The figure below shows a triangle ABC inscribed in a circle. AC = 10cm, BC = 7cm and AB = 10cm. Find the radius of the circle.(Leave your answer to the nearest 1 decimal place) **(3mks)**



11. The floor of a rectangular room measures 4.8m by 3.2m. Estimate the percentage error in the area. **(3mks)**

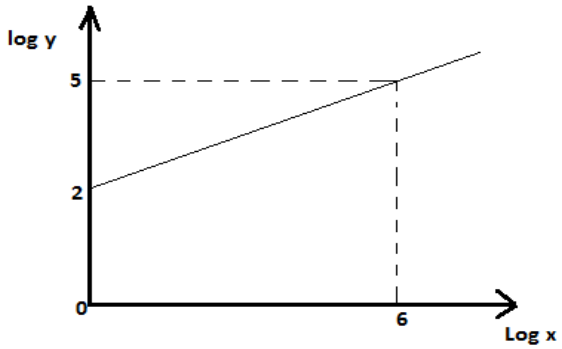
12. Simplify without using mathematical tables or a calculator **(3mks)**

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

13. Rationalize the denominator fully and simplify, leaving your answer in surd form. **(3mks)**

$$\frac{2}{\sqrt{5}+\sqrt{3}} - \frac{5}{\sqrt{7}-\sqrt{6}}$$

14. The figure below shows the graph of logy against logX



If the law connecting x and y is of the form $y = ax^b$, where a and b are constants.

Find the values of a and b. **(3mks)**

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15. Solve the equation by completing square method $2x^2 + 3x - 5 = 0$ **(3mks)**

16. Find the area bounded by the curve $y = x(x-1)(x+2)$ and the x-axis . **(4mks)**

SECTION II (50 MARKS)

17. Mr. Ouma is a civil servant on a basic salary of Kshs.18,000. On top of his salary, he gets a monthly house allowance of Kshs.14,000, medical allowance of Kshs. 3080 and a commuter allowanceof Kshs. 4640. He has a life insurance policy for which he pays a premium of kshs.800 p.m and claims an insurance relief of shs 3 for every 20/= on the monthly premiums. He is entitled to a personal relief of kshs.1056 p.m

a) Using the tax table below calculate his PAYE

Income in K£ p.m	Rate %
1 – 484	10
485 – 940	15
941 – 1396	20
1397 – 1852	25
over 1852	30

b) In addition to PAYE the following deductions are made on his pay every month.

- Wcps at 2% of his basic salary
- NHIF of kshs. 400
- Loan repayment of kshs. 4000
- Co-op shares of kshs. 800

(i) Calculate his total monthly deductions in Kshs. **(7mks)**

(ii) Calculate his net monthly pay in Kshs. **(3mks)**

18. The points $A^1B^1C^1$ are images of ABC A (1, 4), B (-2, 0), C (4, -2) respectively under a transformation N presented by the matrix $N = \begin{pmatrix} 3 & 1 \\ 4 & 0 \end{pmatrix}$.

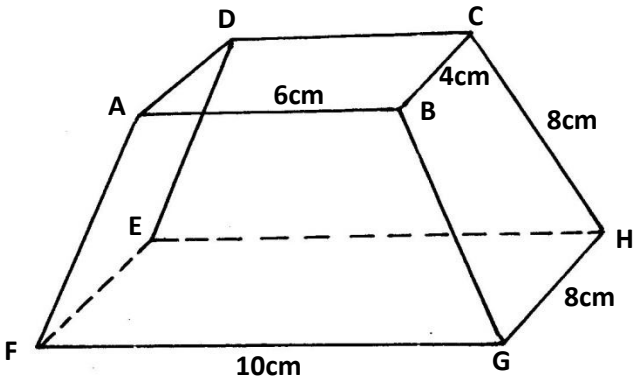
a) Write down the co-ordinates of $A^1B^1C^1$ **(3mks)**

b) $A^{11}B^{11}C^{11}$ are the images of $A^1B^1C^1$ under a transformation represented by matrix $M = \begin{pmatrix} 2 & -2 \\ 1 & 0 \end{pmatrix}$. Write down the co-ordinates of $A^{11}B^{11}C^{11}$. **(3mks)**

c) A transformation N followed by M can be represented by a single transformation K. Determine the matrix K **(4mks)**

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19. The figure below shows a solid frustum of a pyramid with a rectangular top of side 6cm by 4 cm and a rectangular base of side 10cm by 8 cm. The slant edge of the frustum is 8cm.



a) Calculate the height of the frustrum **(3mks)**
b) Calculate the volume of the solid frustum. **(3mks)**
c) Calculate the angle between the line FC and the plane FGHE **(2mks)**
d) Calculate the angle between the planes **BCHG** and the base **EFGH**. **(2mks)**

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

(a) The 1^{st} term and the common difference. **(3mks)**
(b) The first three terms of the G.P and the 10^{th} term of the G.P. **(4mks)**
(c) The sum of the first 10 terms of the G.P. **(3mks)**

21. Hospital records indicating the maternity patients that stayed in a hospital for a number of days are as shown in the table below.

No of days stayed	Frequency (No of patients)
3	15
4	32
5	56
6	19
7	5

Find the probability that

a) A patient stayed exactly 5 days **(2mks)**
b) A patient stayed less than 6 days **(2mks)**
c) A patient stayed at most 4 days **(2mks)**
d) A patient stayed at least 5 days **(2mks)**
e) A patient stayed less than 7 days but more than 4days **(2mks)**

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22. The position of two towns **X** and **Y** are given to the nearest degree as **X** (45^0 N, 110^0 W) and **Y** (45^0 N, 70^0 E)**.** Take $\pi = 3.142$, **R** = 6370km.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)**

23. A transporter has a van and a pick-up available for trips to the nearest town. He can allow atmost 120 litres of petrol and 4 litres of oil to be used each day. Each trip,the van uses 10litres of petrol and 0.2 litres of oil. Each trip the pick-up uses 6 litres of petrol and 0.8 litres of oil. The profit made on each trip by the van is shs. 60 and on each trip by the pick-up is shs. 80. If he makes x trips in the van and y trips in the pick-up;

a) Write down four inequalities which must be satisfied by x and y **(4mks)**

b) Represent the inequalities above graphically using a scale of 1cm to represent 2 units in both axes, and then determine the number of trips made by each vehicle to give maximum profit by use of a search line. Then give the maximum profit. **(6mks)**

24. A stone is thrown straight up from the edge of a roof, 80m above the ground, at a speed of 10m/s. Given that the acceleration due to gravity is $10m/s^2$

a) How far is the stone 3 seconds later? **(5mks)**

b) What time does it hit the ground? **(3mks)**

c) What is the velocity of the stone when it hits the ground? **(2mks)**

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K.C.S.E EXAMINERS' FORECAST SERIES 1
QUESTION PAPER NO: 3

121/1
MATHEMATICS
PAPER 2
TIME 2 ½ HOURS.

SECTION 1: (50 MARKS)

1. Evaluate using logarithms. **(4mks)**

$$\sqrt[4]{\frac{723.9 \times \log 8.765}{3400 + 23.4}}$$

2. Given the expression 9.7 ÷ 3.7, find to four significant figures the percentage error in its quotient. **(3mks)**

3. Solve for Θ given that $2\sin\Theta = \tan\Theta$ for $0^0 \leq \Theta \leq 360^0$. **(3mks)**

4. Simplify $\frac{3\sqrt{2}}{\sqrt{5}-\sqrt{2}}$, leaving the answer in the form $a + b\sqrt{c}$, where a, b and c are rational numbers **(3mks)**

5. (i) Find the inverse of the matrix $\begin{pmatrix} -3 & 4 \\ 2 & 5 \end{pmatrix}$ **(2mks)**

(ii) Hence solve the simultaneous equations; **(2mks)**

$$4y - 3x = 6$$
$$2x + 5y = 19$$

6. The cost of maize flour and millet flour is Kshs 44 and Kshs 56 respectively. Calculate the ratio in which they were mixed if a profit of 20% was made by selling the mixture at Kshs. 54. **(3mks)**

7. The equation of a circle is given by $4x^2 + 4y^2 + 12x - 16y - 11 = 0$. Determine the radius and the co-ordinates of the centre of the circle. **(3mks)**

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8. Solve the following linear inequalities and list the integral values of x. **(3mks)**

$\frac{1}{3}x + 7 \geq -2x$

$0.5x + 4 > 1.5x$

9. The cash price of a music system is kshs. 30,000. It can be bought under hire purchase terms by paying a deposit of kshs. 10,000 and twelve monthly installments of Kshs. 3,200 per month. Determine the percentage rate of interest per month. **(3mks)**

10. Evaluate $\int_0^1 (3x^2 - 6x + 3)dx$ **(3mks)**

11. Make h the subject of the formula $n = \sqrt[3]{\frac{yx^2h}{m-h}}$ **(3mks)**

12. Solve for x in $\log(2x+4) - \log(x-1) = 3\log 2$. **(3mks)**

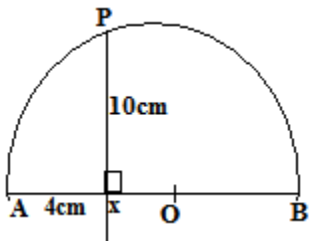
13. The average of the first and fourth terms of a GP is 185. Given that the first term is 27, find the common ratio. **(3mks)**

14. The equation $3x^2 - 8px + 12 = 0$ has real roots. Find the value of P. **(3mks)**

15. (a) Expand $(2 - x)^7$ up to the fifth term. **(2mks)**

(b) Use your expansion in (a) above to evaluate 1.98^7 to four significant figures. **(2mks)**

16. In the figure below O is the centre of the circle diameter AB. <AXP = 90^o, AX = 4cm and PX = 10cm. Calculate the radius of the semi-circle. **(3mks)**



SECTION II (50 MARKS)

17. The table below shows the distribution of ages in years of 50 adults who attended a clinic:-

Age	21-30	31-40	41-50	51-60	61-70	71-80
Frequency	15	11	17	4	2	1

(a) State the median class **(1mk)**

(b) Using a working mean of 45.5, calculate:-

(i) The mean age **(3mks)**

(ii) The standard deviation **(3mks)**

(iii) Calculate the 6^{th} decile. **(3mks)**

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18. (a) Complete the table given below by filling the blank spaces. **(2mks)**

x	0^o	15^o	30^o	45^o	60^o	75^o	90^o	105^o	120^o	135^o	150^o	165^o	180^o
$2\sin(2x+30)^o$	1.00	1.73	2.00	1.73		0	-1.00	-1.73				0	1.00
$4\cos 2x$	4.00		2.00	0	-2.00		-4.00	-3.46		0	2.00		4.00

(b) On the grid provided draw on the same axes, the graph of $y = 4\cos 2x$ and $y = 2\sin(2x + 30^0)$ for $0^0 \le x \le 180^0$. **(5mks)**

(c) From your graph

(i) State the amplitude of $y = 4\cos 2x$ **(1mk)**

(ii) Find the period of $y = 2\sin(2x + 30^0)$ **(1mk)**

(d) Use your graph to solve $4\cos 2x - 2\sin(2x + 30^0) = 0$ **(1mk)**

19. OPQ is a triangle in which $OP = p$ *and* $OQ = q$. X is a point on OP such that OP: XP = 5: 2 and Y is another point on PQ such that PY: YQ = 1: 2. Lines OY and XQ intersect at T.

(a) Express the following vectors in terms of p *and* q.

(i) $\underset{\sim}{PQ}$ **(1mk)**

(ii) $\underset{\sim}{OY}$ **(1mk)**

(iii) $\underset{\sim}{QX}$ **(1mk)**

(b) If $\underset{\sim}{OT} = k\,\underset{\sim}{OY}$ and $\underset{\sim}{QT} = h\,\underset{\sim}{QX}$ express $\underset{\sim}{OT}$ in two different ways. Hence or otherwise find the values of h and k. **(6mks)**

(c) Determine the ratio OT: TY. **(1mk)**

20. Using a ruler and a pair of compass only;

a) Construct a triangle PQR such that PR=7.5cm, PQ=3.0cm and <QPR=60° **(3mks)**

b) Construct the locus T of points which are equidistant from a point L and passes through the vertices P, Q and R. **(2mks)**

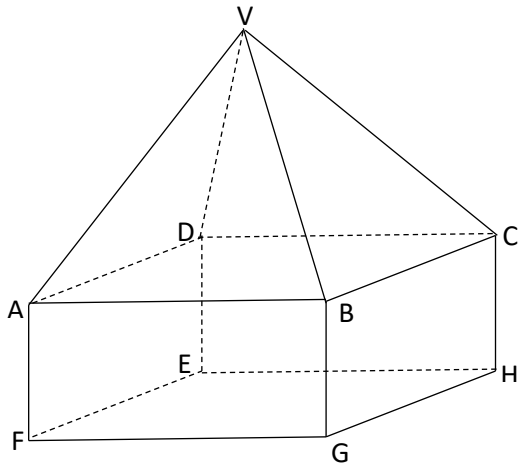
c) Locate the locus S on T such that it is equidistant from sides PQ and QR of the triangle. **(2mks)**

d) Locate the locus of points G enclosed by PQ and QS such that QG <2cm. **(2mks)**

e) Measure SL. **(1mk)**

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21. The figure shows a right pyramid mounted onto a rectangular block. The length AB=8cm, BC = 6cm, CH = 3cm and VC = 15cm



Given that M is the centre of the plane ABCD and P is a point on MV such that MP = $\frac{1}{5}$ MV, Calculate:-

(a) The length of EG. **(1mk)**

(b) The height MV of the pyramidal section to 2 decimal places. **(2mks)**

(c) The angle between the plane BPC and the pyramidal base ABCD. **(3mks)**

(d) The angle between the line GV and the plane EFGH. **(2mks)**

(e) The volume of the solid to four significant figures. **(2mks)**

22. Triangle ABC is such that A(-5, 1), B(-1, 1) and C(-3, 4). Triangle A′B′C′.is the image of ΔABC under transformation $T = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

a) Determine the co-ordinates of Δ A′B′C′. **(2mks)**

b) On the grid provided draw ΔABC and Δ A′B′C′. **(2mks)**

c) Describe the transformation T fully. **(1mk)**

d) Δ A″B″C″ is a reflection of the Δ A′B′C′ on the line y = -x. Construct Δ A″B″C″. **(3mks)**

e) Determine a single matrix that maps Δ A″B″C″ onto ΔABC. **(2mks)**

23. Every evening before the end of preps, Eunice either reads a novel or solves a mathematical problem. The probability that she reads a novel is $\frac{4}{5}$. If she read a novel, there is a probability of $\frac{3}{4}$ that she will fall asleep. If he solves a mathematical problem, there is a probability of $\frac{1}{4}$ that she will fall asleep. Sometimes the teacher on duty enters Eunice's classroom. When

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Eunice is asked whether she had been asleep, there is a probability of only $\frac{1}{5}$ that she will admit that she had been asleep and a probability of $\frac{3}{5}$ that she will claim to have been asleep when she had not been asleep.

a) Draw a tree diagram to represent this information. **(2mks)**

b) Use the tree diagram to find the probability that;

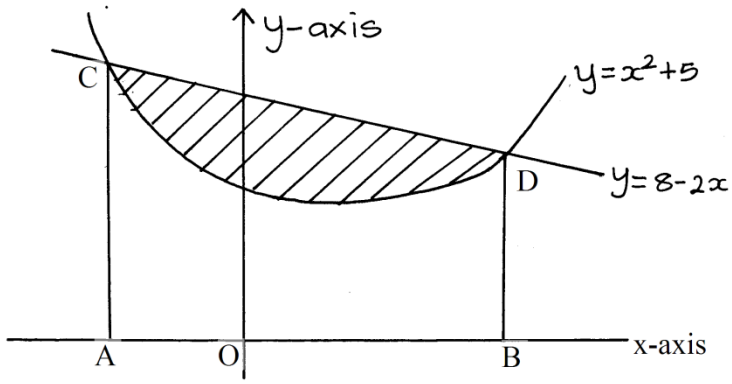
I. She sleeps and admits **(2mks)**

II. She sleeps and does not admit **(2mks)**

III. She does not sleep and says that she has not been asleep **(2mks)**

IV. She does not sleep but claims that she had been asleep **(2mks)**

24. 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. **(2mks)**

(d) Hence determine the area of the shaded region. **(1mk)**

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K.C.S.E EXAMINERS' FORECAST SERIES 1
QUESTION PAPER NO: 4

121/1
MATHEMATICS
PAPER 2
TIME 2 ½ HOURS.

SECTION A 50 MARKS

1. Use logarithm tables to evaluate; $\sqrt[3]{\frac{648\times 0.0079}{(968-94)\div 0.0046}}$ **(3mks)**

2. The middle digit of a number between 100 and 1000 is zero, and the sum of the other digits is 11. If the digits are reversed the number so formed exceeds the original by 495. Find the number. **(3mks)**

3. Without using mathematical tables or a calculator evaluate

$$\sqrt{\frac{0.3-0.098\ \div\ (0.84\ -\ 0.14\ )}{(0.28+0.12)\div\ 0.8\ x\ 0.5}}$$

Leaving the answer as a decimal **(3mks)**

4. Expand $(0.07)^5$ using binomial theorem giving your answer to four significant figures **(3mks)**

5. Solve for θ in the equation Sin $(3\theta + 120^0) = \frac{\sqrt{3}}{2}$ in the range $0 \leq \theta \leq 180^{0.}$ **(3mks)**

6. Rationalize the denominator leaving your answer in the form **a + b**$\sqrt{c}$ where**a, b** and **c** are constants $\frac{5-2\sqrt{3}}{2+3\sqrt{3}}$ **(3mks)**

7.A farmer bought a machine at a current price of Ksh 224,000. If the depreciation rate is 5% in every 3 months. Calculate the sum of its value in 3 years ago and 3 years' time. **(3mks)**

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8. Without using logarithm table or calculators, find the value of p in the equation.

Log n^3 + log 4n = 10 log2 – log $(^2/_8)$ **(3mks)**

9. Using mid-ordinates rules, estimate the area under the curve y= ½ x^2-2, using six strips between x=2 and x=8 and x-axis **(3mks)**

10.(a) Using a pair of compass and a ruler only Construct a triangle PQR in which PQ=QR=4cm and angle QPR= 30^0. **(2mks)**

(b) A point T is always on the same side of PQ as R and angle PRQ=angle PTQ. Construct the locus of T and describe it. **(2mks)**

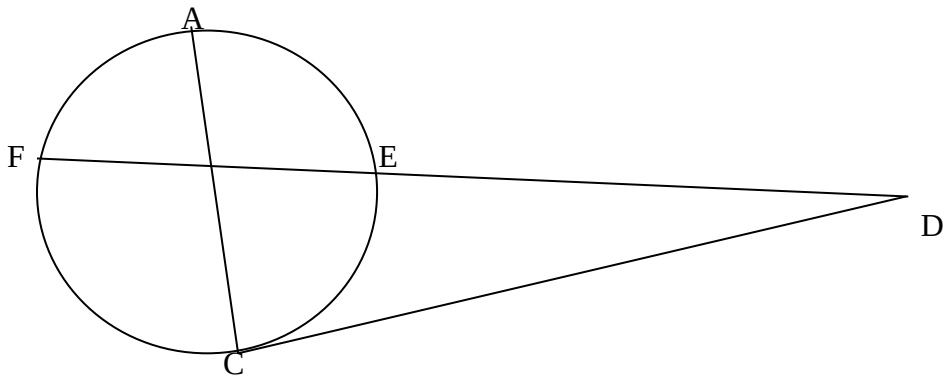
11. R is partly constant and partly varies as the square of q. when R = 5, q = q and R = 21, when q = 3. Find the value of R when q = 5. **(3mks)**

12. The first, the third and the seventh term of an increasing arithmetic progression are three consecutive terms of a geometric progression. If the first term of the arithmetic progression is 10, find the common difference of the arithmetic progression **(3mks)**

13. The equation of a circle is $x^2 – 8x + y^2 + 12y + 16 = 0$

Determine the coordinates of the Centre of the circle and its radius. **(3Mks)**

14.



In the diagram above CD is a tangent to the circle at C. AC and FD intersect at B. FED is a straight line. Given that CD = 10 cm, AB = 2 cm AC = 8 cm, FB = 3 cm. Find the length ED.

4mks

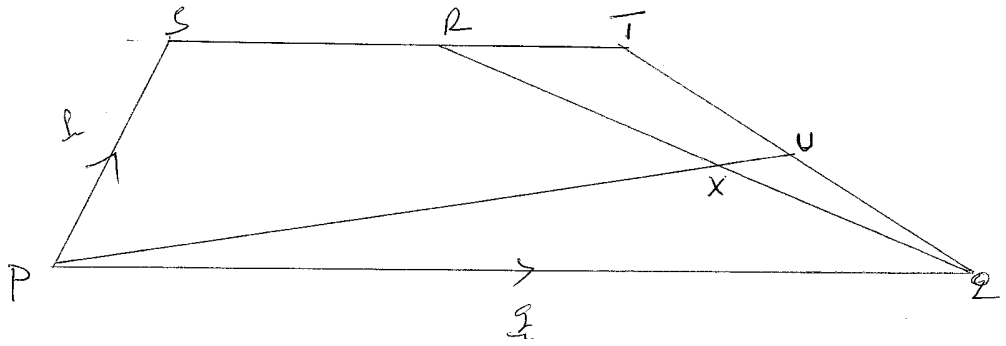
15. The cost of 2 brands of coffee A and B per kilogram are 59.40 and Sh.72 respectively. The two brands are mixed in the ratio x:y and sold at a profit o9f 20% above the cost. If the selling price per kilogram mixture is Ksh.72. find the value of x and y **(3mks)**

16. Evaluate $\int_{-1}^{3} \frac{2x^3 - 3x^2 - 8x + 12}{x^2 - 4} dx$ **(3mks)**

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SECTION B 50 MARKS

17. In the trapezium shown below $\overrightarrow{PQ} = 3\overrightarrow{ST}$. T divides SR in the ratio 4 :1 and U is the midpoint of **QT. PU** and QR intersect at X. **PX = hPU** and **QX = kQR.**



Given that PQ = **q** and PS = **p**

(a) Express QR in terms of **P** and **q** **(1mk)**

(b) Express PX in terms of **P, q** and h. **(2mks)**

(c) Express PX in terms of **P, q** and k. **(3mks)**

(d) Hence; obtains the values of h ad k. **(3mks)**

(e) Determine the ratio in which X divides QR. **(1mk)**

18. The table below shows the distribution of marks of 40 candidates in a test

Marks	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Frequency	2	2	3	x	12	5	2	3	1	1

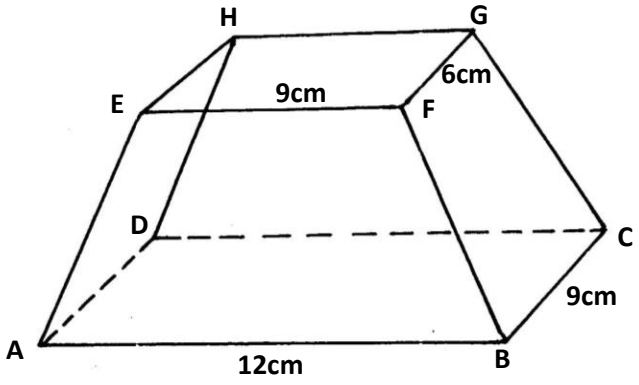
(a)(i) Find the value of x **(1mk)**

(ii) State the modal class **(1mk)**

(iii) Calculate the median **(4mks)**

(iv) Calculate the mean. **(4mks)**

19. The figure below is a frustum of a rectangular pyramid with AB=12CM, EF=8CM,BC=9CM and height of 6 CM



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Calculate:

a) The full height of the pyramid **2mks**

b) Angle that the plane ABFE makes with the base ABCD **2mks**

c) Angle that AG makes with the base ABCD **3mks**

d) Angle that AC makes with line AE **1mk**

e) Angle that plane BCGF makes with the base ABCD **2mks**

20. (a) A point a (35^0 N, 40^0W) and b (40^0S, 40^0W), Calculate the distance between A and B in Kilometers. Take earth radius o be 6370 km. answer to 1 d.p. **(3mks)**

(b) A and B are points on latitude 70^0C. Their longitudes are 62^0W and 118^0 E respectively. Find the distance from A to B along a parallel of latitude. **(4mks)**

(c) Peter was in Mombasa 39^0E and Mary was in Banju 17^0W. Calculate the time difference between the two. **(3mks)**

21. ABCD is a quadrilateral with vertices as follows: **A** (3, 1), **B** (2, 4) **C** (4, 3) and **D** (5, 1)

(a) (i) On the grid provided draw the quadrilateral **ABCD** and the image **A'B'C'D'** under a transformation With matrix $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$. Find the co-ordinates of **A'B'C'D'** **(3mks)**

(b) Describe the transformation that maps **ABCD** onto **A'B'C'D'** fully **(1mk)**

(c) A transformation represented by the matrix $^{0}\begin{bmatrix} 1 & \\ 0 & -1 \end{bmatrix}$ maps **A'B'C'D'** onto **A''B''C''D''** find the co-ordinates of **A''B''C''D''.** Plot **A''B''C''D''** on the same grid. **(3mks)**

(d) Determine a single transformation that maps **A''B''C''D''** onto **ABCD**. Describe this transformation fully. **(3mks)**

22. The table below shows the income tax rates in Kenya.

Income in K£ per month	Rate in Ksh / K£
1 - 325	2
326 - 975	3
976 - 1300	5
1301 - 1625	6
Over 1625	7.5

(a) Mr. Sigei is a public servant who lives in a government house and pays a nominal rent of Ksh. 1220 per month. He earns a basic salary of Ksh. 24,800 and taxable allowances of Ksh. 13,380 per month. He is entitled to a monthly tax relief of Ksh. 1120. Calculate his monthly

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i) Taxable income in K£. **(2mks)**

ii) Gross tax. **(3mks)**

iii) Tax due **(2mks)**

(b) Apart from income tax, the following monthly deductions are made from his salary.

i) HELB loan repayment Ksh. 2400

ii) NHIF Ksh 320

iii) 2% basic salary as union dues.

Calculate Mr. Sigei's monthly net salary. **(3mks)**

23. An airline has to fly 1000 passengers and 35000 kg of luggage from Nairobi to Kampala. Two types of aircrafts are available. Type A takes 100 passengers and 2000 kg of luggage. Type B takes 60 passengers and 3000 kg of luggage. The airline must not use more than 16 aircrafts altogether.

(a) If the airline hires x type A aircrafts and y type B aircrafts, write down 3 inequalities to represent the information above. **(3mks)**

(b) Draw the inequalities on a grid. **(3mks)**

(c) Find the minimum number of aircrafts the airline could use. **(1mk)**

(d) If the cost of hiring charges for each aircraft is sh 100,000 and sh 120,000 for type A and b respectively, find:

(i) The number of planes of each type that should minimize the cost **(2mks)**

(ii) Minimum cost **(1mk)**

24. In a mathematics test, the probability of 3 students, Kamau, Otieno and Mwala passing are ⅔, ¾ and ⅚ respectively

(a) Draw a tree diagram to represent this information **(3mks)**

(b) Use the tree diagram to find the probability that:

(i) All the three students will fail **(2mks)**

(ii) At least two students will pass**.** **(3mks)**

(iii) Only one student will pass **(2mks)**

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K.C.S.E EXAMINERS' FORECAST SERIES 1
QUESTION PAPER NO: 5

121/1
MATHEMATICS
PAPER 2
TIME 2 ½ HOURS.

SECTION I: (50 MARKS)

1. Evaluate using logarithms. **(4mks)**

$$\sqrt[3]{\frac{(0.07432)^2 \times (48.38)^3}{8458}}$$

2. A rectangular plot measures 31.4m by 28.3m. What is the percentage error in getting it's area. **(3mks)**

3. Make M the subject in $K = \left(\frac{MV^2}{\chi + M}\right)^{\frac{1}{2}}$. **(3mks)**

4. Solve the equation.
Sin $(2\chi - 30^o) = {}^1/_2$ for $0^o \leq x \leq 360^o$. **(3mks)**

5. y varies inversely as the square of χ. The difference between the value of y when $\chi = 6$ and when $\chi = 10$ is 16. Find the law connecting χ and y. **(3mks)**

6. (a) Without using a calculator, expand $(10 - 2\chi)^5$. **(2mks)**

(b) Use your expansion in (a) above to find the value of $(9.8)^5$. **(1mk)**

7. Solve the simultaneous equation.

$\text{Log}_3 (2\chi + y) = 2$

$\text{Log}_2 (3\chi + 4y) = 4$ **(3mks)**

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8. Find the inverse of the matrix $\begin{pmatrix} 2 & -2 \\ 3 & 1 \end{pmatrix}$ hence use the matrix method to solve the simultaneous equations. **(3mks)**

$2\chi - 2y = 6$

$3\chi + y = 5$

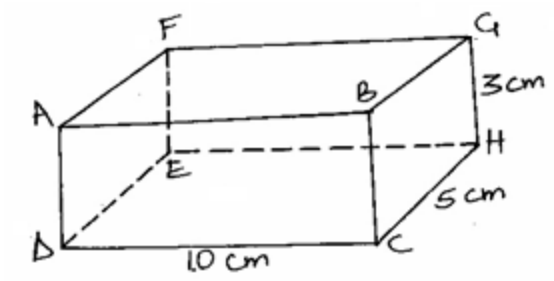
9. A shopkeeper mixes sugar costing Sh.40 per kg with another type which costs Sh.60 per kg. Find the ratio in which the two types should be mixed so that if a kilogram of the mixture is sold at Sh.55, a profit of 10% is realised. **(3mks)**

10. A point R divides vector PQ in the ratio 5: -2. Find the coordinates of R given that P (3, -6) and Q (-9, 2). **(3mks)**

11. χ and Y are complementary angles and $Tan\ \chi = 3\sqrt{3}$. Find the value of $\frac{1}{2 - Tan\ y}$ hence rationalize the surd. **(3mks)**

12. Find the distance between the centre A of a circle whose equation is $2\chi^2 + 2y^2 + 6\chi + 10y + 7 = 0$ and point B (-4, 1). **(3mks)**

13. The figure is a cuboid. The dimensions of the cuboid are 10cm by 5cm by 3cm.



(a) Find the angle between.

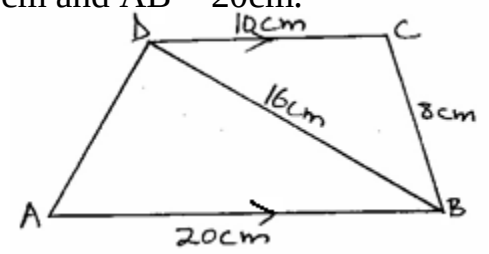
(i) lines CG and DE. **(2mks)**

(ii) lines FG and DB. **(2mks)**

14. Simplify: $\frac{\chi - 3}{\chi + 3} - \frac{\chi^2 - 3\chi}{\chi^2 - 9}$. **(3mks)**

15. Evaluate: $\int_3^5 (\chi^3 - 7\chi^2 + 7\chi + 15)\, d\chi$. **(3mks)**

16. In the figure below ABCD is a trapezium with DC parallel to AB. DC = 10cm, BC = 8cm, DB = 16cm and AB = 20cm.



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(a) Calculate the sine of angle BDC. **(2mks)**

(b) Hence calculate the area of ΔABD. **(1mk)**

SECTION II: (50 MARKS)

17. (a) A die and a coin (both fair) are thrown on a horizontal floor.

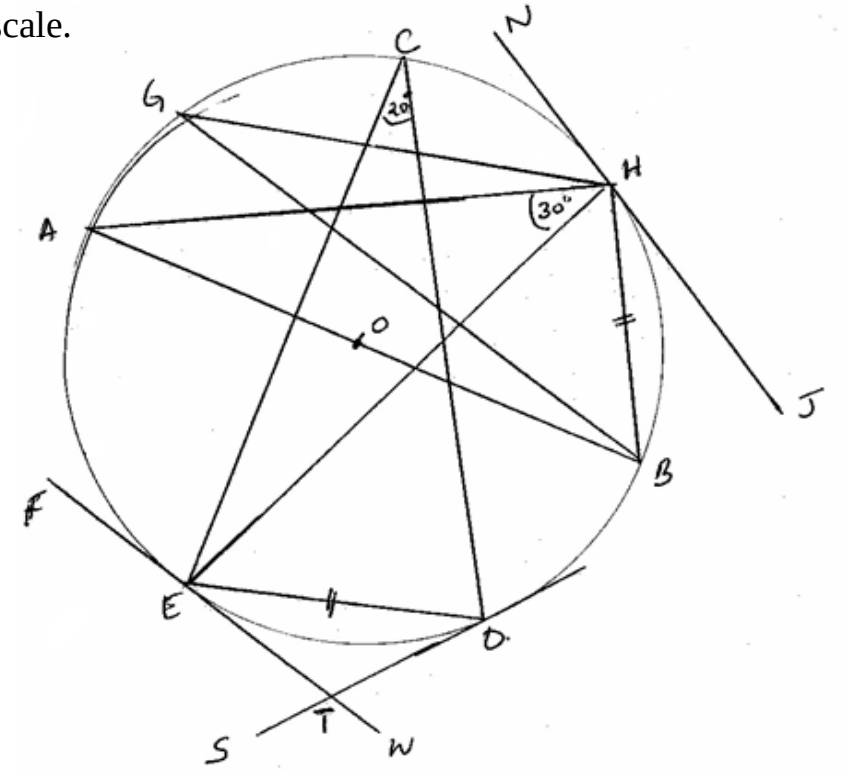
(i) List all the possible outcomes. **(2mks)**

(ii) Find the probability of getting even number on the die and a tail on the coin or an odd number on the die and a head on the coin. **(3mks)**

(iii) Find the probability of getting a number greater than or equal to 3 on the die and a head on the coin. **(2mks)**

(b) The probability that a student gets grade A in Mathematics is $\frac{9}{10}$. If she gets grade A in Mathematics then the probability that she gets grade A in Physics is $\frac{4}{5}$. If she does not get grade A in Mathematics then the probability that she gets grade A in Physics is $\frac{3}{8}$. Calculate the probability that she gets grade A in Physics only. **(3mks)**

18. The figure below shows a circle centre O, AB is a diameter. Chords ED and BH are equal NHJ, FET, STD are tangents to the circle angle ECD = 20º and ∠AHE = 30º. The figure is not drawn to scale.



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Determine angles.

(i) EHB. **(2mks)**

(ii) ETS. **(2mks)**

(iii) HGB. **(2mks)**

(iv) EHJ. **(2mks)**

(v) AOE. **(2mks)**

19. An arithmetic progression has the first term as a and the common difference as d.

(a) Write in terms of a and d, the 3^{rd}, 9^{th} and 25^{th} terms of the progression. **(1mk)**

(b) The progression is increasing and the 3^{rd}, 9^{th} and 25^{th} terms form the first three consecutive terms of a geometric series. If the sum of the 7^{th} term and twice the 6^{th} term of the arithmetic progression is 78.

Calculate:

(a) The first term and the common difference of the arithmetic progression. **(6mks)**

(b) Find the sum of the first nine terms of the A.P. **(3mks)**

20. The table below shows tax rates in the year 2012.

Income in K£ p.a.	Rates of tax in %
1 – 5208	10
5209 - 9744	15
9745 – 14292	20
14293 - 18840	25
Over 18840	30

(a) Mrs. Mwangi pays Ksh.5400 as PAYE. She is entitled to a house allowance of Ksh.9000p.m and claims a monthly tax relief of Ksh.1093.

Calculate;

(i) Her gross tax per annum. **(2mks)**

(ii) Her monthly basic salary in Ksh. **(6mks)**

(b) She also has monthly contributions as follows:

(i) Cooperative society contribution of Ksh.2000.

(ii) Loan repayment of Ksh.2500.

Calculate her net monthly salary. **(2mks)**

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21. The table below shows the marks scored by students in a Mathematics test.

Marks	30 - 39	40 - 49	50 - 54	55 - 59	60 - 64	65 - 69
No. of students	6	20	19	20	20	15

(a) Calculate the median mark. **(3mks)**

(b) Using an assumed mean of 52, calculate the mean mark. **(3mks)**

(c) On the grid provided, draw a histogram to represent the information shown above. **(4mks)**

(PROVIDE A GRAPH PAPER)

22.(a) Draw the graph of the function.

$$y = 6\chi + \chi^2 - \chi^3 \text{ for } -3 \leq x \leq 4$$

(PROVIDE A GRAPH PAPER)

(b) By drawing a suitable straight line(s) on the graph in (a) above estimate the roots of the following equations.

(i) $6\chi + \chi^2 - \chi^3 = 0$

(ii) $2\chi + \chi^2 - \chi^3 = 0$

23. In a school trip there were χ buses and y luxury vans. Each bus was hired at Ksh.1000 and could carry 60 students. Each van was hired at Ksh.2000 and could carry 30 students.

(a) Express the following statements as inequalities in χ and y.

(i) There must be some van or vans. **(1mk)**

(ii) There should at least 3 buses. **(1mk)**

(iii) The school should be not spend more than Ksh.18000 on the trip. **(1mk)**

(iv) Not more than 420 students are to go on the trip. **(1mk)**

(b) Illustrate inequalities graphically. **(4mks)**

(PROVIDE A GRAPH PAPER

(c) Use your graph to determine the maximum number of students that can go on the trip and corresponding expenditure. **(2mks)**

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24. Using a ruler and compasses only.

(i) Construct a parallelogram ABCD such that AB = 10cm, BC = 7cm and angle ABC = 105º. **(3mks)**

(ii) Construct the loci of P and Q within the parallelogram such that AP ≤ 4cm and BQ ≤ 6cm. **(3mks)**

(iii) Calculate the area within the parallelogram but outside regions bounded by the loci of P and Q. **(4mks)**

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K.C.S.E EXAMINERS' FORECAST SERIES 1
QUESTION PAPER NO: 6

121/1
MATHEMATICS
PAPER 2
TIME 2 ½ HOURS.

1. Use logarithms correct to 4 decimal places. **(4mks)**

Evaluate: $\frac{(0.528)^{2/3}}{3.25\ x \log 4.8}$

2. Factorise $2x^2y^2 - 5xy - 12$ **(2mks)**

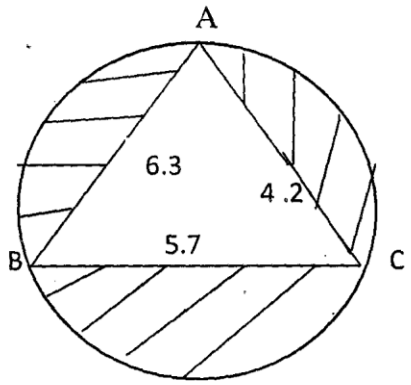
3.a) Expand and simplify the expression **(2mks)**

$$\left[10 + \frac{2}{x}\right]^5$$

b) Use the expansion in (a) above to find the value 14^5 **(2mks)**

4. The straight line through the points D (6,3) and E (3, -2) meets the Y-axis at point F. find the co-ordinates of F. **(3mks)**

5. The circle below whose area is 18.05cm^2 circumscribes a triangle ABC where AB = 6.3cm, BC = 5.7cm and AC = 4.8cm. Find the area of the shaded region. **(4mks)**

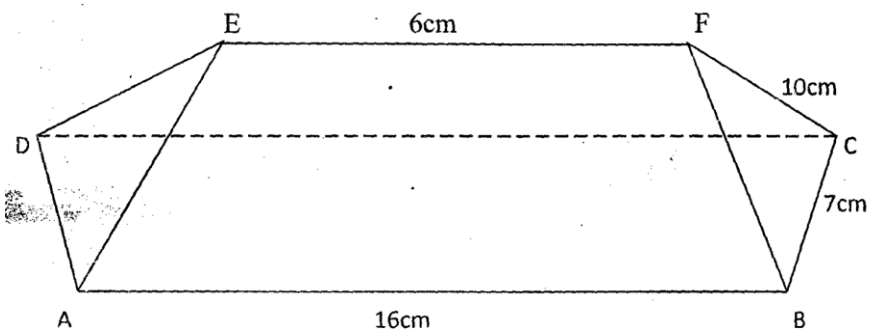


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6. Using a pair of compasses and ruler only construct a quadrilateral ABCD in which AB = 4cm, BC=6cm, AD = 3cm and angle ABC= 135^0 and angle DAB= 60^0. Measure the size of angle BCD **(4mks)**

7. Find the interquartile range of the following numbers 2,4,3,1,2,4,14,6,9,6,1. **(2mks)**

8. The figure below shows a model of the roof with a rectangular base ABCD. AB = 16cm BC= 7cm and EF = 6cm. The ridge EF is parallel to the base and centrally placed. The edges AE, BF and CF and DE are each 10cm long. Calculate the angles between the planes ABFE and ABCD. Give your answer to 1 d.p.



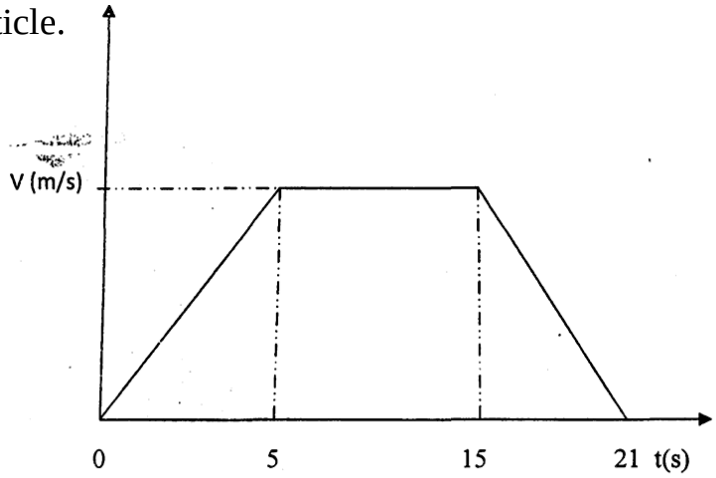
9. Type A of tea costing sh.36 per satchet is mixed with type B of tea costing sh.44 per satchet. In what ratio should the two brands be mixed so as to cost sh.42 per satchet. **(3mks)**

10. Tap A can fill a tank with water in 2 hours. Tap B can fill it in 5 hours and tap C can fill it in 4 hours. Tap D can empty the tank in 10 hours and Tap E can empty it in 3 hours. All taps are opened and the tank is filled. How many hours are used to fill the tank when all pipes are working. **(3mks)**

11. The velocity time graph drawn below shows the distance travelled by a particle is 620m. Calculate ;

a) The velocity V.

b) The deceleration of the particle.



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12. When A is obtuse, Sin A = $^4/_5$ find the value of Cos A – tan A **(4mks)**

13. If a = I – 2j + 3k, b = -2i + 3j – k, c = 3i – j – 4k and p = 3a – 2b + c
Find to one decimal place the length of vector p **(3mks)**

14. Without using calculator evaluate: **(3mks)**

$$\frac{2\,^1/_5 + \,^2/_5 \,of\, 3\,^3/_4 - 4\,^1/_6}{1\,^1/_4 - 2\,^2/_5 \div 1\,^1/_3 + 3\,^3/_4}$$

15. The diagonal of a rectangular garden measures $11\,^1/_4$ while its width measures $6\,^3/_4$. Calculate the perimeter of the garden.

16. An aeroplane flies at an average speed of 500 knots due East from a point P$(53.4^0N, 40^0E)$ To another point Q. It takes $2\,^1/_4$ hours to reach point Q.
Calculate;

i. The distance in nautical miles it travelled **(1mk)**

ii. The longitude of point Q to 2 d.p

SECTION B

17. Two variables X and Y are related by the formula Y = Ka^x where a and k are constants. The values x and y are given in the table below.

X	0	2	4	5	7	9	12
y	256	286	316	339	385	437	525
Log y		2.46			2.59		

a) Compare the table above for all values of y correcting each value to 2 d.p **(2mks)**

b) Given that the relation between values of x and log y approximate to a linear form Log y =x log a + log k where a and k are constants.

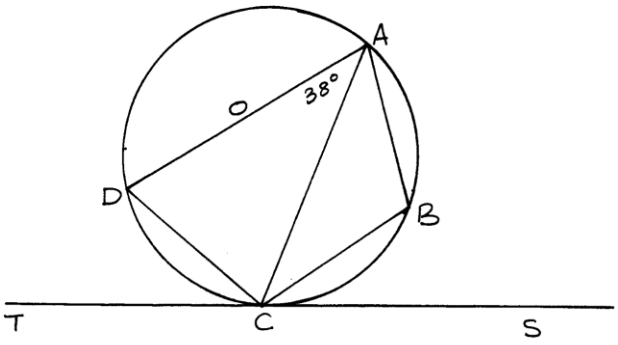
i) Use the axis on the grid provided to draw the line of best fit for the graph of log y against x **(4mks)**

ii) Use the graph to estimate the values of a and k.

iii) Write down the relationship between x and y

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18. In the figure below OA is a diameter of the circle ABCD centre O, radius 10cm. TCS is a tangent to the circle at C. AB = BC and angle DAC = 38^0



a) Find the size of the angle **(2mks)**

i. ACS

ii. BCA **(2mks)**

b) Calculate the length of **(i)** AC

ii) AB

19. Complete the table below giving the values correct to 2 d.p **(2mks)**

X	0	30	60	90	120	150	180	210	240	270	300	330	360
Sin 2x	0		0.87		-0.87		0	0.87	0.87				0
3 cos x – 2	1	0.60		-2	-3.5			-4.6			-0.5		1

b) On the grid provided draw the graphs of Y = sin 2X and Y = 3cos x-2 for $0^0 \leq x \leq 360^0$ On the same axes. Use a scale of 1cm to represent 30^0 on the X- axis and 2cm to represent 1 unit on the Y axis.

c) Use the graph in (6) above to solve the equation $3\cos x - \sin 2x = 2$

20. Three quantities R,S and T are such that R varies directly as S and inversely as the square of T.

a) Given that R = 480 when S = 150 and T = 5, write down an equation connecting R, S and T **(4mks)**

b) Find the value of R when s = 360 and T = 1.5 **(2mks)**

21. Find the % change in R if S increases by 5% and T decreases by 20% **(4mks)**

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22. The triangle ABC has vertices A(1,2) B (2,1) and C (2,3). A,B,C is the image of ABC under the transformation given by the matrix $\begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$

a) What are the co-ordinates of A_1 B_1 C_1? Plot ABC and A_1 B_1 C_1 on the same axis **(3mks)**

b) State the ratio of the areas of the two triangles and use the area of ABC to calculate the area of $A_1B_1C_1$

c) If A_2 B_2 C_2 is the image ABC under the transformation given by the matrix $\begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix}$

Find the co-ordinates of A_2 B_2 C_2. Plot A_2 B_2 C_2 and describe the transformation fully.

23. The following shows the distribution of marks in a C.A.T in a form four class.

Marks	31-40	41-50	51-60	61-70	71-80	81-90
No of students	2	5	14	12	6	1

a) i) On the grid provide draw a cumulative frequency curve for this data. **(3mks)**

ii) Using the graph, estimate the median mark **(1mk)**

b) Taking 55.5 as the assumed mean, calculate

i. The mean mark **(3mks)**

ii. The standard deviation **(3mks)**

24. Four towns P,Q,R and S are such that Q is 1500km due East of town P. Town R is 1080km due North of town Q. Town S is on a bearing of 300^0 from R

a) Use a ruler a pair of compasses and show the positions of town P,Q,R and S.
(Take a scale of 1cm = 3000km) **(5mks)**

b) i) Determine the distance of PS in km **(2mks)**

ii) Determine the distance RS in km **(2mks)**

iii) Determine the bearing of town S and Q **(1mk)**

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K.C.S.E EXAMINERS' FORECAST SERIES 1
QUESTION PAPER NO: 7

121/1
MATHEMATICS
PAPER 2
TIME 2 ½ HOURS.

SECTION 1 (50 MARK)

1. Use the tables of logarithms to evaluate

$$\sqrt{\frac{80.26\log 7.25}{(9.367+1.98)^2}}$$ **(4mks)**

2. Make b the subject of the formula **(3mks)**

$$\frac{bd}{\sqrt{b^2+d}}=\frac{l}{r}$$

3. The sides of a rectangle were measured and recorded as 7cm and 13 5 mi. Calculate the percentage error in the area correct to 2 decimal places **(3mks)**

4. The first four terms of a up are 81 ,p,q,3. Find the values of p and q. **(3mks)**

5. By using completing square method, solve for x in

$4x^2$ 3x- 6= 0 **(3mks)**

6. Use binomial expansion to simplify

$$\left(\sqrt{2}+\sqrt{3}\right)^4-\left(\sqrt{2}-\sqrt{3}\right)^4$$ **(3mks)**

7. The equation of a circle is $x^2 + y^2 + 6x – l0y – 2= 0$. Determine the coordinates of the centre of the circle and its radius. **(3mks)**

8. A quantity Z varies directly as the square of X and inversely as the square root of MY. If X increases by 20%, Y decreases by 36% and M increases by 44%, find the percentage change in Z. **(3mks).**

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9. Solve the equation 3cos 2(x 20) -1= 0 for $0° \leq x \leq 360°$ **(3mks)**

10. Without using mathematical table or a calculator, evaluate

$$\frac{Cos\,30°}{Tan\,60° - \sin 45°}$$ **(3mks)**

11. Given that log 3 r. express the following expression in terms of r.

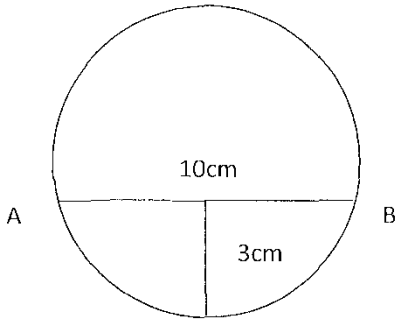
Log $\left(10/3\right)$ - log $\left(\frac{1}{27}\right)$ + log 81. **(3mks)**

12. A trader mixes grade A rice costing shs. 600 per kg, with grade B rice costing shs. 280 per kg in the ratio 3 : 5. Find the price at which he must sell 1 kg of the mixture to make a profit of 20%. **(3mks)**

14. Chord AR is of length 10cm and the maximum distance between the chord and the lower part of circle is 3cm. determine the radius of the circle.

13. The points P,Q and R lie on a straight line. The position vectors of P and Rare 2i + 2j +3k and 5i - 3j + 4k, respectively. Q divides PR internally in the ratio 2:1. Find the position vector of Q and its magnitude. **(3mks)**

14. Chord AR is of length 10cm and the maximum distance between the chord and the lower part of circle is 3cm. determine the radius of the circle. **(3mks)**



15. The displacement, s metres of a particle moving along a straight line after t seconds is s $3t + t^2 - 4t^3$. Find its initial acceleration. **(3mks)**

16. On average, the rate of depreciation of a generator is 12% per annum. After four years its value was shs. 450,000. Find a5 value at the start of the four year period. **(3mks)**

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SECTION II: (50 MARKS)

17. The table below shows the tax rates for 2014.

Taxable monthly income (shs)	Rates (%)
0- 9,860	10
9861 18800	15
18801 27920	20
27,921 - 37,040	25
37,04 and above	30

John's monthly earning are as follows:

Basic salary - shs. 40,000
House allowance - shs. 20.000
Medical allowance - shs. 3,000
Commuter allowance - shs. 2,000

If John is allowed a tax relief of Shs. 1,162 per month, calculate:

(a) His monthly taxable income **(2mks)**

(b) The tax he pays **(6mks)**

(c) John is awarded a 5% increment is his basic salary. Find the percentage increase in the lax paid if his allowance remains constant.

18.(a) A triangle ABC with coordinates A(4,-2), (-2,-2) and C (-2,-4) is transformed by M $=\begin{bmatrix} -1.5 & 0 \\ 0 & -1.5 \end{bmatrix}$

(i) Find the coordinates of A'B'C' and plot it on the same grid. **(3mks)**

(ii) Describe this transformation fully **(lmk)**

(b) Triangle A'B'C' is rotated through +900 about the origin to A"B"C". draw it **(2mks)**

(c) Triangle A"B"C" is reflected along the X-axis to give A"B"C".

(i) Draw triangle A"B"C" and state the coordinates **(3mks)**

(ii) Give the transformation Matrix for reflection in the X-axis. **(lmk)**

19. The table below shows the marks obtained by 80 students in u physics test.

Marks	20 -24	25- 29	30 -34	35 -39	40 -44	45-49	50- 54
No. of student	3	10	26	22	12	5	2

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(a) State the modal class **(1mk)**

(b) Using a working mean of 37,

Calculate:

(i) The mean mark **(3mks)**

(ii) The standard deviation **(3mks)**

(iii) The range of marks obtained by the middle 50% of the students. **(3mks)**

20. Given points x (30°N, 70°F) and y (30°N, 20°W) taking $\pi = 22/7$ and radius of the earth R= 6370km, Calculate:

(a) The distance between X and Y along the parallel of latitude.

(i) In km **(2mks)**

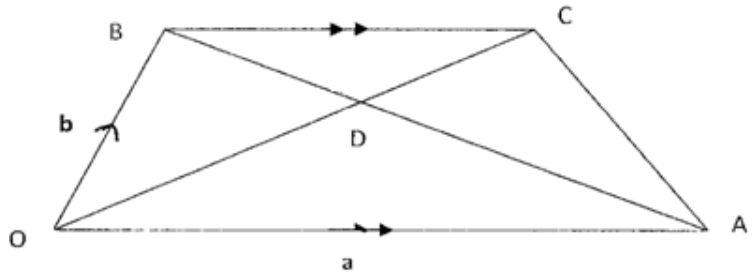
(ii) In nm **(1mk)**

(b) The local time at x if the local time at y is 2030 hours. **(2mks)**

(c) The position of z if z is 5,700nm south of y. **(2mks)**

(d) The shortest distance between Z and K in nm given the position of K(65°S, 20°E). **(3mks)**

21. In the figure below shows a trapezium in which OA is parallel to BC.OA = a and OB= b and BC: OA = 3:4.



(a) Express the following vectors in terms of a and b. **(1mk)**

(i)BA **(1mk)**

(ii)OC **(1mk)**

(b) If BD=m BA and OD = n OC, express OD in terms of:

(i) a,b and m **(2mks)**

(ii) a,b and n **(1mk)**

Find the values of m and n hence find the ratio OD: DC. **(5mks)**

22. Alex commutes to work by either a bus or a taxi. If he commutes by bus on any one day the probability that he will commute by taxi the following day is $1/4$. If he commutes by taxi on any one day. the probability that be commute by bus the following day is $5/6$. The probability that he will commute by bus on Tuesday is $2/3$

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Find the probability that he will commute by:

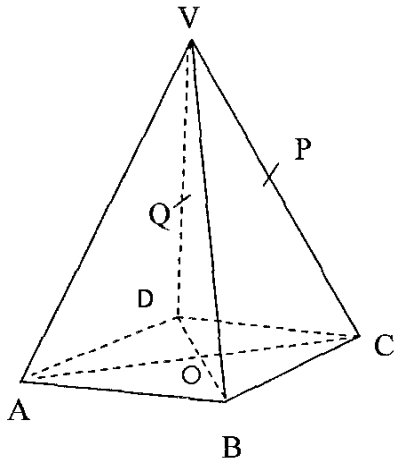
(a) Bus on Wednesday **(2mks)**

(b) Taxi on Wednesday **(2mks)**

(c) Bus on Thursday **(3mks)**

(d) Taxi on Thursday **(3mks)**

23. The diagram below shows a right pyramid VABCD with V as the vertex. The base of the pyramid is rectangle ABCD, with AB = 4CM and BC = 3CM. The height of the pyramid is 6cm,



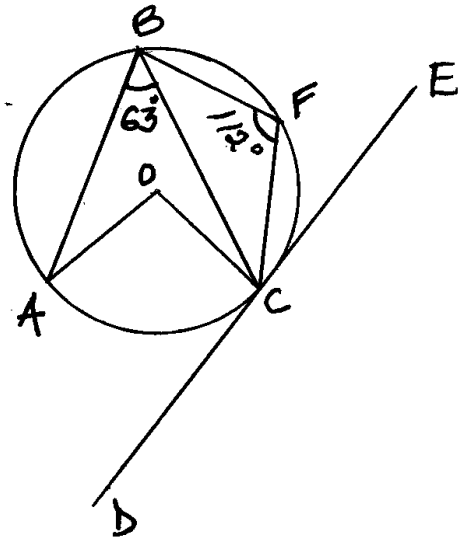
(a) Calculate;

i. The length of the projection of VA on the base **(2mks)**

ii. The angle between the face VAB and the base **(3mks)**

(b) P is the mid point of VC and Q is the midpoint of VD. Find the angle between the planes VAB and the plane ABPQ. **(5mks)**

24. In the figure below O is the centre of the circle. DCE is a tangent at point C. angle ABC 63° And angle BFC= 112°



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Stating reasons find

(i) Angle ACD **(2mks)**

(ii) Obtuse angle AOC **(2mks)**

(iii) Angle BAC **(2mks)**

(iv) Angle BCE **(2mks)**

(v) Angle OCB **(2mks)**

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K.C.S.E EXAMINERS' FORECAST SERIES 1
QUESTION PAPER NO: 8

121/1
MATHEMATICS
PAPER 2
TIME 2 ½ HOURS.

SECTION I: (50 MARKS)

1. Use logarithms to evaluate, correct to 4 decimal places.

$$\sqrt{\frac{7.24 + 3.072}{23.2\ Cos 70^o}}$$ **(4mks)**

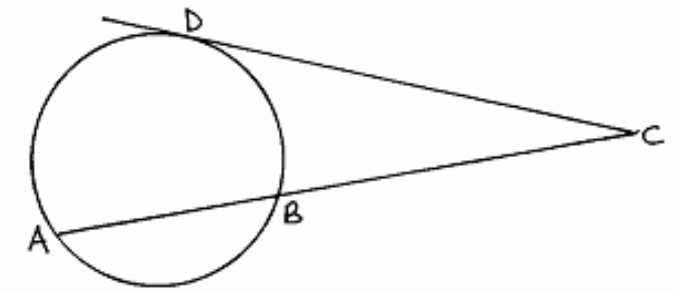
2. Make R the subject of the formula

$A = \prod (R + r)(R - r)$ **(3mks)**

3. The seventh term of an arithmetic sequence is 17, three times the third term is 3. Calculate the first term and the common difference of the sequence. **(3mks)**

4. Find the value of χ given that $\begin{pmatrix} \chi & 6 \\ 4 & \chi - 2 \end{pmatrix}$ is a singular matrix. **(2mks)**

5. In the figure below DC is a tangent to the circle at point D. Given that ABC is straight line where AB 9.45cm and BC = 5cm. Find the length of DC. **(3mks)**



6. Tap A can fill a bath in 4min. Tap B can fill the same bath in 6min and tap C can

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empty the bath in 8min.

(a) Calculate how long it would take to fill the bath if all the taps were left running. **(2mks)**

(b) Calculate how long it would take to fill the bath if all taps were left running for 3min after which tap C is closed. **(2mks)**

7. Rose cocoa beans cost Sh.60 per kg while Wairimu beans cost Sh.90 per kg. In what ratio should they be mixed such that by selling the mixture at Sh.84 per kg, a profit of 20% is made. **(3mks)**

8. A point Q divides a line PR internally in the ratio 2: 1 and a point T divides the line internally in the ratio 3: 1. In what ratio does T divide PQ? **(3mks)**

9. Given that $y = \frac{\chi(\chi^2 - 1)}{\chi + 1}$ is the equation of a curve, find the gradient of the tangent to the curve at the point (2, 4). **(3mks)**

10. Find the quartile deviation of the data below 2, 4, 6, 8, 10, 5, 6, 9, 4, 6. **(3mks)**

11. Under a shear with χ-axis invariant a square with vertices A (1, 0), B (3, 0), C (3, 2) and D (1, 2) is mapped onto a parallelogram with vertices A^1 (1, 0), B^1 (3, 0), C^1 (7, 2) and D^1 (5, 2). Find the shear matrix. **(3mks)**

12. Find the value of χ given that $\log (15 - 5\chi) - 1 = \log (3\chi - 4)$. **(3mks)**

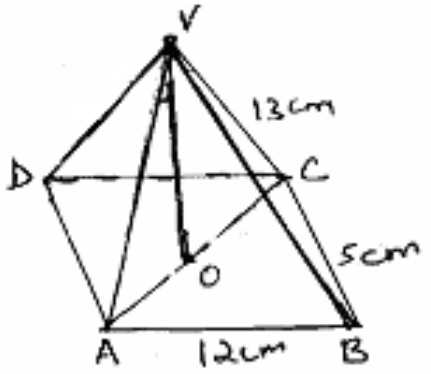
13. Simplify, without using tables or calculators

$\frac{1 - Cos\ 60^o\ Sin\ 60^o}{1 + Cos\ 30^o\ Sin\ 30^o}$ leaving your answer in the form $a + b\sqrt{c}$. **(4mks)**

14. A triangle ABC is such that AB = 9cm, BC = 7cm and AC = 11cm. Find the radius of a circle which passes through A, B and C correct to 2d.p. **(3mks)**

15. Find the percentage error in using 0.67 as an estimate of $^2/_3$. **(3mks)**

16. In the figure below, VABCD is a right pyramid on a rectangular base. Point O is vertically below the vertex V. AB = 12cm, BC = 5cm and CV = 13cm.



Calculate the angle between the edge CV and the base ABCD. **(3mks)**

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SECTION B: (50 MARKS)

17. Mobile dealer sells phones of two types Nokia and Motorola. The price of one Nokia and one Motorola phone is Ksh.2000 and Ksh.1600 respectively. The dealer wishes to have at least fifty mobile phones. The number of Nokia phones should be at least the same as those of Motorola phone. He has Ksh.120000 to spend on phones.

If he purchases χ Nokia phones and y Motorola phones:

(a) Write down all the inequalities to represent the above information. **(4mks)**

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

(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. **(2mks)**

(PROVIDE A GRAPH PAPER)

18. Given that $-2\chi^2\ 3\chi + 11 = y$

(a) Complete the table below.

χ	-4	-3	-2	-1	0	1	2	3
y	-9		9		11		-3	

(2mks)

(b) On the grid provided draw the graph of $y = -2\chi^2 - 3\chi + 11$ for values of χ from -4 to 3. **(3mks)**

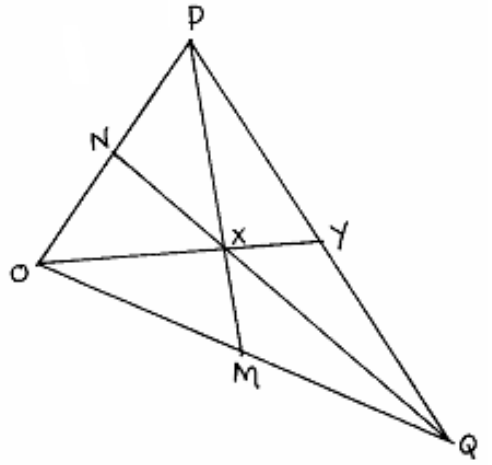
(c) Use the graph to solve.

$-2\chi^2 - 3\chi + 11 = 0$ **(2mks)**

$-2\chi^2 - 5\chi + 10 = 0$ **(3mks)**

(PROVIDE A GRAPH PAPER)

19. The figure below triangle OPQ in which $\underset{\sim}{OP} = \underset{\sim}{p}$ and $\underset{\sim}{OQ} = \underset{\sim}{q}$. M and N are points on OQ and OP respectively such that ON = NP = 1: 3 and OM: MQ = 2: 1.



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(a) Express the following vectors in terms of $\underset{\sim}{p}$ and $\underset{\sim}{q}$. **(3mks)**

(i) PM.

(ii) QN.

(iii) PQ.

(b) Lines PN and QN intersect at X such that PX = hpm and QX = KQN. Express OX in two different ways and find the value of h and K. **(6mks)**

(c) OX produced meets PQ at Y such that PY: YQ = 3: 2. Using the ratio theorem or otherwise, find OY in terms of p and q. **(1mk)**

20. Income tax is charged on annual income at the rate shown below.

Taxable income K£ p.a.	Rate Ksh. Per £
1 – 2300	2
2301 – 6900	3
6901 – 9200	5
9201 - 11500	7
11501 and over	9

Mr. Njoroge earn a basic salary of Ksh.15000 per month and lives in a company house for which he pays a nominal-rent of Ksh.1250 per month. He enjoys personal relief of Ksh.1056 per month and insurance relief of Sh.270 per month. Calculate.

(a) Taxable pay is the employee's salary + 15% of salary less his taxable income nominal rent. Calculate Njoroge's taxable income in K£ p.a. **(3mks)**

(b) The amount of tax he pays per month in Kenya shillings. **(5mks)**

(c) His net monthly salary in shillings. **(2mks)**

21. Use ruler and compasses only for all constructions in this question.

(a) Construct triangle ABC given that AC = 6cm, AB = 5.6cm and angle BAC = 75°. Measure BC. **(3mks)**

(b) L_1 is the locus of points equidistant from BA and BC. Construct L_1. **(2mks)**

(c) Construct L_2, the perpendicular from C to AB. **(2mks)**

(d) L_1 and L_2 meet at P. Locate P. **(1mk)**

(e) Find the point inside the triangle which is furthest from point P. What is the distance of that point from P? **(2mks)**

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22. The table below shows marks scored by 40 candidates in an examination.

Marks	Frequency
11 – 20	1
21 – 30	5
31 – 40	8
41 – 50	9
51 – 60	8
61 – 70	4
71 – 80	2
81 - 90	3

Using an assumed mean of 45.5 estimate:

(i) Mean. **(3mks)**

(ii) Standard deviation. **(3mks)**

(iii) Calculate the quartile deviation. **(4mks)**

23. Two bags X and Y contains ten and eight balls respectively. Bag X has 6 green and 4 red balls while bag Y has 3 and 5 red balls. A bag is selected at random and 2 balls selected without replacement.

(a) Draw a tree diagram to represent the above information. **(4mks)**

(b) Find the probability of selecting a green ball the first time. **(2mks)**

(c) What is the probability of selecting at most one red ball? **(2mks)**

(d) Find the probability of selecting two green balls. **(2mks)**

24. The length and the width of a rectangular are $(6\chi - 1)$ and $(\chi - 2)$ respectively. If the length and the width are increased by 4cm the new area is thrice that of the initial rectangle.

(a) Find the dimension of the initial rectangle. **(6mks)**

(b) By what percentage does the area of the rectangle increase after the change? **(2mks)**

(c) What is the difference in size between the length and the width of the initial length? **(2mks)**

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K.C.S.E EXAMINERS' FORECAST SERIES 1
QUESTION PAPER NO: 9

121/1
MATHEMATICS
PAPER 2
TIME 2 ½ HOURS.

SECTION 1 (50 MARKS):

1. Use logarithms to evaluate **(4Mks)**

$$\sqrt[3]{\frac{45.3\ x\ 0.00697}{0.534}}$$

2. Form the quadratic equation whose roots are x = $-\frac{5}{3}$ and x = 1 **(2Mks)**

3. W varies directly as the cube of x and inversely as y. Find W in terms of x and y given that W = 80 when x = 2 and y = 5. **(2Mks)**

4. A cold water tap can fill a bath in 10 minutes while a hot water tap can fill it in 8 minutes. The drainage pipe can empty it in 5 minutes. The cold water and hot water taps are opened for 4 minutes. After four minutes all the three taps are opened. Find how long it takes to fill the bath. **(3Mks)**

5. Object A of area 10cm^2 is mapped onto its image B of area 60cm^2 by a transformation. Whose matrix is given by p = $\begin{pmatrix} x & 4 \\ 3 & x+3 \end{pmatrix}$. Find the positive values of x **(3Mks)**

6. Make P the subject of the formula in L = $\frac{2}{3}\sqrt{\frac{x^2 - PT}{y}}$ **(3Mks)**

7. **(a)** Expand the expression $\left(1 + \frac{1}{2}x\right)^5$ in ascending order 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 $(1.05)^5$ **(2Mks)**

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8. By rounding each number to the nearest tens, approximate the value of $\frac{2454\ x\ 396}{66}$

Hence, calculate the percentage error arising from this approximation to 4 significant figures. **(3Mks)**

9. Without using a calculator or mathematical tables, express $\frac{\sqrt{3}}{1-Cos\ 30^0}$ in surd form and simplify **(3Mks)**

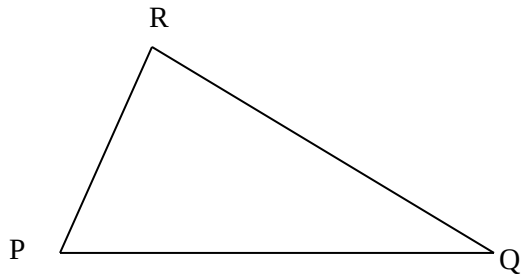
10. Kasyoka and Kyalo working together can do a piece of work in 6 days. Kasyoka, working alone takes 5 days longer than Kyalo. How many days does it take Kyalo to do the work alone? **(3Mks)**

11. The second and fifth terms of a geometric progression are 16 and 2 respectively. Determine the common ratio and the first term. **(3Mks)**

12. A particle moves along a straight line AB. Its velocity V metres per second after t seconds is given by $v = t^2 - 3t + 5$ Its distance from A at the time t = 1 is 6 metres.

Determine its distance from A when t = 3 **(3mks)**

13. On the triangle PQR, draw a circle touching PR, QP produced and QR produced. **(3Mks)**



14. Two containers havebase area of $750cm^2$ and $120cm^2$ respectively. Calculate the volume of the larger container in litres given that the volume of the smaller container is $400cm^3$. **(3Mks)**

15. Solve for x in the equation

$2\ Sin^2\ x - 1 = Cos^2x + Sin\ x$, where $0^0 \leq x \leq 360^0$. **(4Mks)**

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

$2x^2 + 2y^2 - 3x + 2y + \frac{1}{2} = 0$ **(4mks)**

SECTION II (50 MARKS):

17. A bag contains 5 red, 4 white and 3 blue beads. Two beads are selected at random.

(a) Draw a tree diagram and list the probability space. **(3Mks)**

(b) Find the probability that

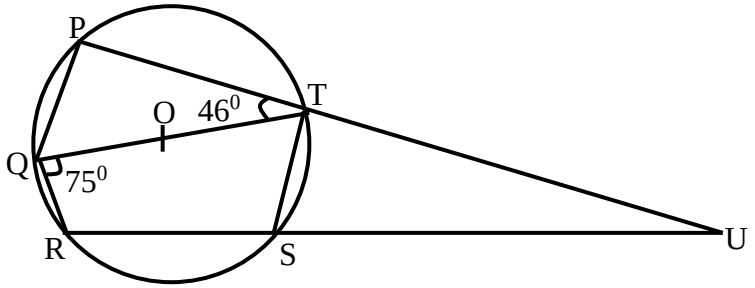
(i) The last bead selected is red. **(2Mks)**

(ii) The beads selected were of the same colour **(2Mks)**

(iii) At least one of the selected beads is blue **(3Mks)**

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18. The figure below shows a circle centre O in which line QOT is a diameter. Angle QTP = 46^0, angle TQR = 75^0 and angle SRT = 38^0, PTU and RSU are straight lines.



Determine the following, giving reasons in each case:

(a) Angle RST **(2Mks)**

(b) Angle SUT **(2Mks)**

(c) Angle PST **(2Mks)**

(d) Obtuse angle ROT **(2Mks)**

(e) Angle SQT **(2Mks)**

19. P, Q and R are three villages such that PQ = 10km, QR = 8km and PR = 4km where PQ, QR and PR are connecting roads.

(a) Using a scale of 1cm rep 1 km, locate the relative positions of the three villages **(2Mks)**

(b) A water tank T is to be located at a point equidistant from the three villages. By construction locate the water tank T and measure its distance from R. **(3Mks)**

(c) Determine the shortest distance from T to the road PQ by construction **(2Mks)**

(d) Determine the area enclosed by the roads PQ, QR and PR by calculation **(3Mks)**

20. For a sample of 100 bulbs, the time taken for each bulb to burn was recorded. The table below shows the result of the measurements.

Time (in hours)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
Numberof bulbs	6	10	9	5	7	11	15	13	8	7	5	4

(a) Using an assumed mean of 42, calculate

(i) The actual mean of distribution **(4Mks)**

(ii) The standard deviation of the distribution **(3Mks)**

(b) Calculate the quartile deviation **(3Mks)**

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21. A plane leaves an airport P (10^0S, 62^0E) and flies due north at 800km/h.

(a) Find its position after 2 hours **(3Mks)**

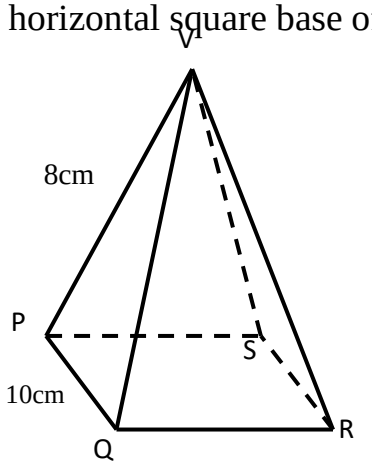
(b) The plane turns and flies at the same speed due west. It reaches longitude Q, 12^0W.

(i) Find the distance it has traveled in nautical miles. **(3Mks)**

(ii) Find the time it has taken (Take $\pi = \frac{22}{7}$, the radius of the earth to be 6370km and 1 nautical mile to be 1.853km) **(2Mks)**

(c) If the local time at P was 1300 hours when it reached Q, find the local time at Q when it landed at Q **(2Mks)**

22. PQRSV is a right pyramid on a horizontal square base of side 10cm.The slant edges are all 8cm long. Calculate



(a) The height of the pyramid **(2Mks)**

(b) The angle between

(i) Line VP and the base PQRS **(2Mks)**

(ii) Line VP and line RS **(2Mks)**

(iii) Planes VPQ and the base PQRS **(2Mks)**

(c) Volume of the pyramid **(2Mks)**

23. Complete the table below for the functions y = sin 3 θ and y = 2 Cos (θ + 40^0) **(2Mks)**

θ^0	0^0	10^0	20^0	30^0	40^0	50^0	60^0	70^0	80^0	90^0
3 Sin 3θ	0	1.50		3.00			0.00			-3.0
2 Cos (θ + 40^0)	1.53	1.29			0.35			-0.69		-1.29

(a) On the grid provided, draw the graphs of Y = 3 Sin 3 θ and y = 2 Cos (θ + 40^0) on the same axis.

Take 1 cm to represent 10^0 on the x-axis and 4 cm to represent 2 unit on the y – axis. **(5mks)**

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(b) From the graph find the roots of the equation.

(i) $\frac{3}{4}$ Sin $3\theta = \frac{1}{2}$ Cos $(\theta + 40^0)$ **(2Mks)**

(ii) 2 Cos $(0 + 40^0) = 0$ in the range $0 \leq \theta \leq 90^0$ **(1Mk)**

24. The gradient function of a curve is given by the expression $2x + 1$. If the curve passes through the point (-4, 6)

(a) Find:

(i) The equation of the curve **(3Mks)**

(ii) The values of x, at which the curve cuts the x-axis **(3Mks)**

(b) Determine the area enclosed by the curve and the x –axis **(4Mks)**

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K.C.S.E EXAMINERS' FORECAST SERIES 1
QUESTION PAPER NO: 10

121/1
MATHEMATICS
PAPER 2
TIME 2 ½ HOURS.

SECTION 1(50 marks)

1. Use logarithms, correct to 4 decimal places, to evaluate; **(4mks)**

$$\frac{(1934\times 0.0569)^2}{436}$$

2. Solve the quadratic equation **(3mks)**

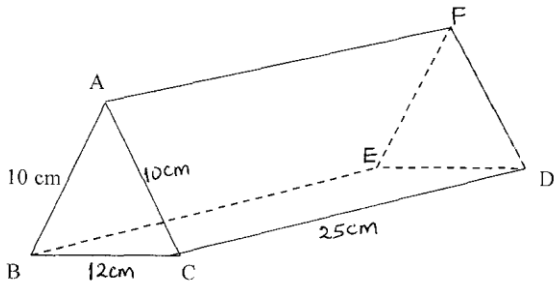
$3x^2 - 4x - 5 = 0$ giving the roots correct to 3 decimal places.

3. Without using a calculator, find the value of **(3mks)**

$$\frac{1}{2}\text{Log}_3 9 - \log_3 \frac{2}{3} + \log_3 54$$

4. Onsongo bought a new car for sh 750 000 and used it for three years. Over this period the car had been depreciating at a steady rate. He sold it through an agent who charged a commission of 8 % of its current price. If Onsongo received sh 462, 246 from the agent, determine the annual rate of depreciation of the car. **(3mks)**

5. In the figure below, ABCDEF is a prism 25 cm long whose triangular ends are isosceles triangles. Calculate the angle the line AE makes with the base BCDE. **(3mks)**



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6. Given that $x = \sqrt{6}$, simplify the quadratic expression $x^2 + 3x - 12x^{-1}$, giving the answer in the surd form $a + \sqrt{b}$, where *a* and *b* are real numbers. **(2mks)**

7. A contractor requires 24 tonnes of concrete to construct a building. He mixes cement, sand and gravel such that the ratio of cement to sand is 2: 3 and the ratio of cement to gravel is 1 : 3 : 5. Determine the number of 50 kg bags of cement he requires in constructing the building. **(4mks)**

8. Make *t* the subject of the formula **(3mks)**

$$e^2 = \frac{t - k}{k(1 - kt)}$$

9. The quantity P varies as the square of the quantity Q and inversely as the quantity . If P = 40 when Q 1O and R 36, express P in terms of Q and R. **(2mks)**

10. Solve the equation **(3mks)**

$6\cos^2 x - \sin x - 4 = 0 \text{ for } 0^0 \le x \le 180^0$ x 180.

11. The equation of a circle is $x^2 + y^2 + 6x - 14y + 58 = r^2$ If the circle passes through the point (2, 7). determine its radius and the co ordinates of it centre. **(4mks)**

12. Without using tables or a calculator, evaluate (0.97)4, giving the answer correct to 4 decimal places. **(3mks)**

13. A lady measured the internal dimensions of her room and recorded them as 4.3 m and 3.6 m. Calculate the maximum area of a carpet she can order to cover the floor of her room. **(3mks)**

14. The third and sixth terms of a geometric progression (G.P.) are -64 and 8 respectively. Find;

(a) The common ratio, **(2mks)**

(b) The first term of the G.P. **(1mk)**

15. Calculate the standard deviation of the set of numbers

29. 31, 28, 29, 31. 46, 39, 31, **(4mks)**

16. Given the matrices B $\begin{pmatrix} 3 & 2 \\ -1 & 4 \end{pmatrix}$ and C = $\begin{pmatrix} -9 & 14 \\ 3 & 0 \end{pmatrix}$, find the inverse of B.

Hence find a 2 × 2 matrix A such that BA = C. **(3mks)**

SECTION II (50 marks)

17. (a) Expand (2t -1) (t -1) (t-2). **(2mks)**

(b) The height, s, metres of a stone thrown vertically upwards from a cliff after a time, t, seconds is given by the equation $S = bt - at^2 + 10$, where *a* and *b* are constants. The following table gives some of the values of s and t.

t	0	1	2	3	4	5	6	7	8	9	10
s		4.51						45.9			-80

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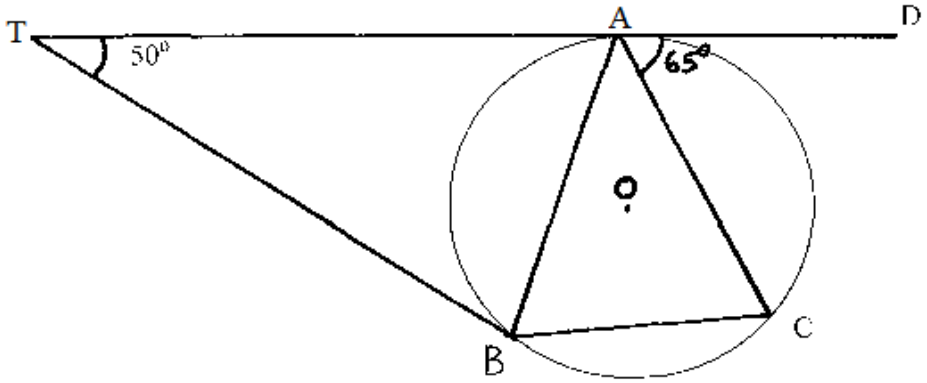
(i) Determine the values of *a* and *b*.

Hence write down the equation of s in terms of t. **(5mks)**

(ii) Use the equation in (b)(i,) above to complete the table above. **(2mks)**

(iii) Give the maximum height attained by the stone. **(1mk)**

18. In the figure below, TAD and TB are tangents to a circle centre, O. <ATB = 50^0 and <DAC=65^0



(a) Find, giving reasons, the size of the following angles;

(i)<TAB **(2mks)**

(ii) <TBC. **(2mks)**

(b) Show that triangle ABC is isosceles. **(2mks)**

(c) Given that the radius of the circle is 8.4 cm, calculate the area of the minor segment cut off by the chord BC. **(4mks)**

19.A certain Sub-county advertised for a tender to construct its headquarters. Two contractors A and B assessed the work. Contractor A indicated would do the same work in 12 months while contractor B indicated would do the same work in 18 months. The two contractors were awarded the tender. Contractor B did the work for three months then it was joined by contractor A.

(a) Determine;

(i) The fraction of the work done by contractor A in 3 months, **(2mks)**

(ii) How long the two contractors took to complete the remaining work. **(4mks)**

(b) Given that contractors A and B would incur expenditure amounting to sh 120 000 per month and sh 90 000 per month respectively, calculate the total expenditure of each contractor. **(4mks)**

20.(a) Complete the table below for the function $y=x^3+4x-x-6$. **(2mks)**

x	-5	-4	-3	-2	-1	0	1	2	3
y	-26			4		-6		16	

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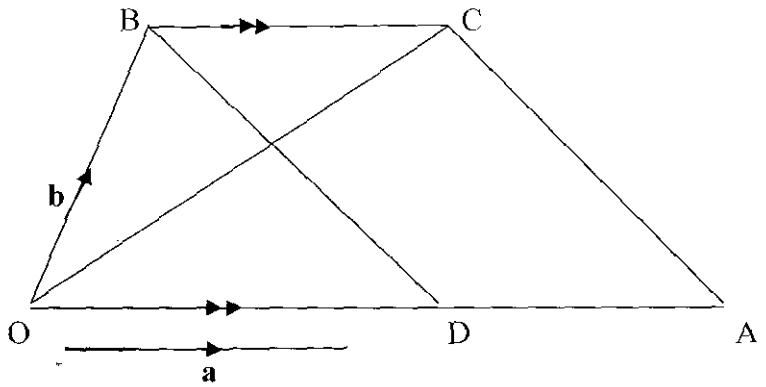
(b) On the grid provided draw the graph of function $y=x^3+4x^2-x-6$. **(3mks)**

(c) Use the graph to solve the equations.

(i) $y=x^3+4x^2-x-6=0$. **(2mks)**

(ii) $y=x^3+4x^2-3x$ **(3mks)**

21. The figure below shows a trapezium OBCA in which BC //OA and **OA** = **a** and **OB** = **b**. The lines OC and BD intersect at X. The ratio OD : DA 2 : 1 and OA = 3 BC.



(a) Express the following vectors in terms of **a** and **b**

(i) OC **(1mk)**

(ii)BD **(2mks)**

(b) Given that OX= s OC and BX= tRD. express OX:

(i) In terms of a, b and the scalar s. **(1mk)**

(ii) In terms of a, b and the scalar t. **(1mk)**

(c) Use the results in above to find the values of the scalars of s and t. **(4mks)**

(d) Find the ratio BX:XD. **(1mk)**

22. An opaque bag contains a mixture of one hundred red. blue and green beads, all of the same size. The probability of picking a red bead at random from the bag is $\frac{3}{5}$ and the probability of picking a blue bead at random from the bag is $\frac{3}{10}$.

(a) Determine;

(i) The fraction of green beads in the bag. **(3mks)**

(ii) Tthe number of beads of each colour in the bag. **(3mks)**

(b) Two beads are picked at random from the bag in succession with replacement. Determine the probability that the two beads are of the same colour. **(4mks)**

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23. A principal of a certain Girls High school had sh 21 000 available and decided to purchase a number of Kiswahili and Business studies text books. A Kiswahili text book and a Business studies text book costs sh 280 and sh 350 respectively. She has to buy at least 26 Kiswahili text books and twice the number of Business studies text books bought must be less than the number of Kiswahili text hooks. Take the number of Kiswahili text books and of Business studies text books bought to be x and y respectively.

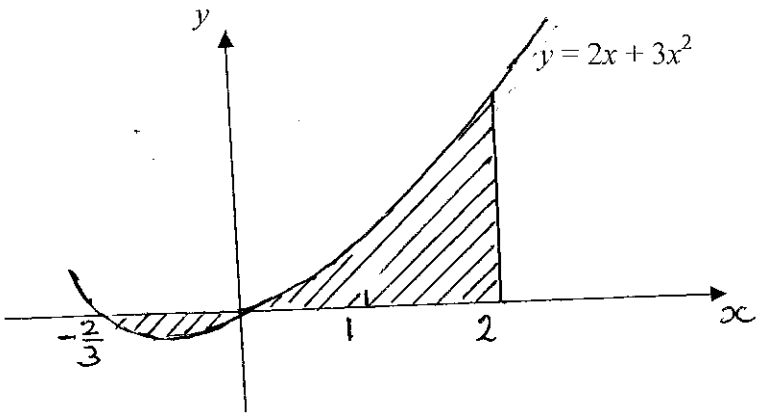
(a) Write down three inequalities satisfying the conditions in the information above. **(3mks)**

(b) On the grid provided, represent the inequalities in (a) above and shade out unwanted regions. **(3mks)**

(c) Determine the number of text book of each kind that must be bought for the total cost to be minimum. Hence find the minimum cost. **(4mks)**

24. (a) Find the gradient of the curve $y = x^2\left(x + \frac{1}{2} - \frac{1}{x}\right)$ at point $\left(1, \frac{1}{2}\right)$ **(3mks)**

(b) The figure below shows a sketch of the curve y $2x + 3x^2$.



Find;

(i) $\int (2x + 3x^2)dx$ **(1mk)**

(ii) the shaded area between $x = -\frac{2}{3}$ and $x = 0$, **(2mks)**

(iii) the shaded area between x=0 and x=2, **(2mks)**

(iv) the total shaded area. **(2mks)**

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