MATHEMATICS PAPER 121/1 K.C.S.E 1998
QUESTIONS
SECTION 1 (52 Marks)

Answer all the questions in this section

1. Evaluate without using mathematical tables
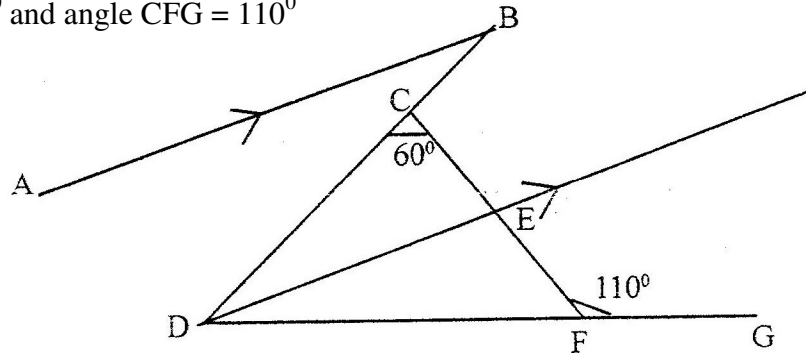
$$1000\sqrt{\frac{0.0128}{200}}$$

2. Factorize $a^2 – b^2$
    Hence find the exact value of $2557^2 - 2547^2$

3. The mass of 6 similar books and 4 similar biology books is 7.2 kg. The mass of 2 such art books and 3 such biology books is 3.4 kg. Find the mass of one art book and mass of one biology book.

4. In the figure below, AB is parallel to DE, DE bisects angle BDG, angle DCF = 60^0 and angle CFG = 110^0

    Find
    (a) $\angle$ CDF

    (b) $\angle$ ABD
    Give reasons for your answers

5. A salesman gets a commission of 2.4% on sales up to Kshs 100.00. He gets an additional commission of 1.5% on sales above this. Calculate the commission he gets on sales worth Kshs 280.000

6. A point A is directly below a window. Another point B is 15 m from A and at the same horizontal level. From B angle of elevation of the top of the bottom of the window is 300 and the angle of elevation of the top of the window is 350. Calculate the vertical distance.
    (a)   From A to the bottom of the window
    (b)   From the bottom to top of the window

7. A matrix A is given by A = $\begin{pmatrix} x & 0 \\ 5 & y \end{pmatrix}$

    a) Determine A^2

    b) If $A^2 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$,   determine the possible pairs of values of x and y

8. Given that $\log y = \log (10^n)$ make n the subject

9. A quantity T is partly constant and partly varies as the square root of S.
    a) Using constants a and b, write down an equation connecting T and S.
    b) If S = 16, when T = 24 and S = 36 when T = 32, find the values of the constants a and b,

10. The third and fifth term of an arithmetic progression are 10 and -10 respectively
    a) Determine the first and the common difference
    b) The sum of the first 15 terms

11. A cyndrical container of radius 15cm has some water in it. When a solid is submerged into the water, the water level rises by 1.2 cm.
    (a)   Find, the volume of the water displaced by the solid leaving your answer in terms of Π
    (b)   If the solid is a circular cone of height 9 cm, calculate the radius of the cone to 2 decimal places.

12. Six weeks after planting the height of bean plants were measured correct to the nearest centimeter. The frequency distribution is given in the table below.

Height (x)	$0 \le x \le 4$	$4 \le x \le 8$	$8 \le x \le 12$	$12 \le x \le 16$	$16 \le x \le 20$
Frequency	3	8	19	14	6
Cumulative Frequency					

    (a) Enter the cumulative frequency values in the above table
    (b) Estimate the median height of the plants

13. A financial institution charges compound interest on money borrowed. A business woman borrowed Kshs. 16, 000 from the financial institution. She paid back Kshs 25,000 after 2 years. Find the interest rate per annum.

14. Solve the equation $\cos (3\theta + 120^0) = \sqrt{3}/2$ for $0 \le \theta \le 180^0$

15. The radius of circle is given as 2.8 cm to 2 significant figures
    (a)   If C is the circumference of the circle, determine the limits between which $^C/_\Pi$ lies

(b)   By taking ∏ to be 3.142, find, to 4 significant figures the line
        between which the circumference lies.

16. A and B are towns 360 km apart. An express bus departs form A at 8 am and
     maintains an average speed of 90 km/h between A and B. Another bus starts
     from B also at 8 am and moves towards A making four stops at four equally
     spaced points between B and A. Each stop is of duration 5 minutes and the
     average speed between any two spots is 60 km/h. Calculate distance between the
     two buses at 10 am.

17. Wainaina has two dairy farms. A and B. Farm A produces milk with 3 ½ percent
    fat and farm B produces milk with 4 ¾ percent fat.
        (a)   Determine
            (i)   The total mass fat in 50 kg of milk from farm A and 30 kg of milk
                    from farm B
            (ii)   The percentage of fat in a mixture of 50 kg of milk from A and
                    30 kg of milk from B

    (c) Determine the range of values of mass of milk from farm B that must be used
        in a 50 kg mixture so that the mixture may have at least 4 percent fat.

18. The table below shows monthly income tax rates

Monthly taxable pay K £	Rate of tax Kshs per £
1 - 342	2
343 - 684	3
685 - 1026	4
1027-1368	5
1369 - 1710	6
Over 1710	

    A civil servant earns a monthly salary of Kshs 20,000 and is provided with a
    house at a nominal rent of Kshs 700 per month
    (a)   Taxable pay is the employee's salary, plus 15% of salary, less nominal
            rent.
            Calculate the civil servant's taxable pay in K £
    (b)   Calculate the total tax
    (c)   If the employee is entitled to a personal relief of Kshs. Per month, what is
            the net tax.

19. A quadrilateral ABCD has vertices A (4, -4), B(2, -4), C(6, -6) and D (4, -2)
        (a)   On the grid provided draw the quadrilateral ABCD.
        (b)   A'B'C'D is the image of ABCD under positive quarter turn about the
                origin. On the same grid draw the image A'B'C'D
        (c)   A'B'C'D' is the image of A' B' C' D' under the transformation
                given by the matrix $\begin{pmatrix} 1 & -2 \\ 0 & 1 \end{pmatrix}$

(i)   determine the coordinators of A" B" C" D"
(ii)   On the same grid draw the quadrilateral A" B" C" D"

(d)   Determine a single matrix that maps ABCD onto A" B"C"D"

20. The position of two towns X and Y are given to the nearest degree as
X (45^0 N, 10^0W) and Y (45^0 N, 70^0W)
Find
   (a)   The distance between the two towns in
     (i)   Kilometers (take the radius of the earth as 6371)
     (ii)   Nautical miles (take I nautical mile to be 1.85 km)
 (c) The local time at X when the local time at Y is 2.00 pm.

21. A cyndrical can has a hemisphere cap. The cylinder and the hemisphere are of
radius 3.5 cm.
The cylindrical part is 20 cm tall.
Take $\prod$ to be 22/7 calculate

(a) the area of the circular base

(b) the area of the curved cylindrical surface

(c) the area of the curved hemisphere surface

(d) The total surface area.

22. The figure below shows a grid of equally spaced parallel lines
AB = a and BC = b
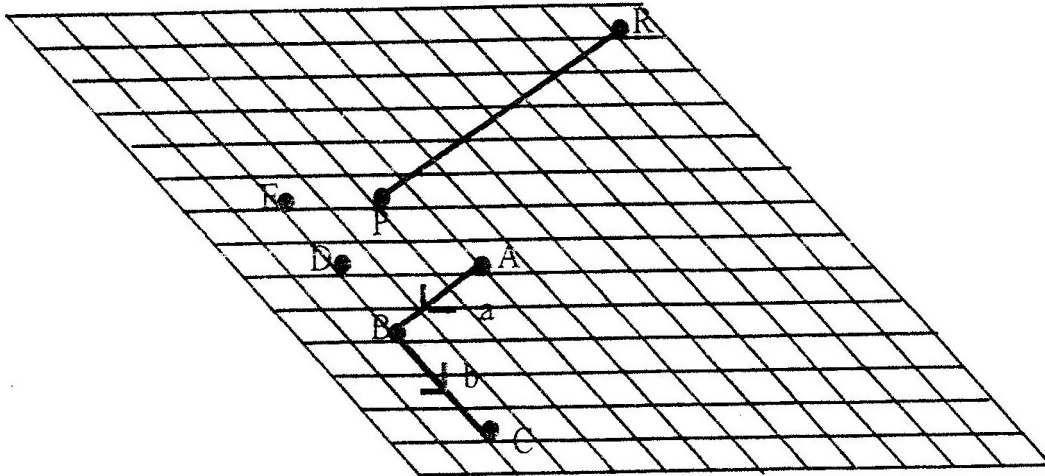
(a) Express
(i)   AC in terms of a and b
(b) Using triangle BEP, express BP in terms of a and b

(c) PR produced meets BA produced at X and Pr = $^{1b}/_9$ - $^{8a}/_3$

By writing PX as kPR and BX as hBA and using the triangle BPX determine the ratio PR: RX

23. Use a ruler and a pair of compasses only for all constructions in this question.
    (a)   On the line BC given below, construct triangle $\angle$ABC such that $ABC = 30^0$ and BA = 12 cm

    (b)   Construct a perpendicular from A to meet BC produced at D. Measure CD

    (c)   Construct triangle A'B'C' such that the area of triangle A'B'C is the three quarters of the area of triangle ABC and on the same side of BC as triangle ABC.

    (d)   Describe the lucus of A'
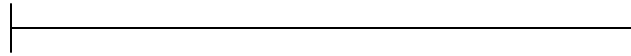
24.   In a livestock research stations a new drug for a certain fowl disease is being tried. A sample of 36 fowls were diagnosed to have the disease. Twenty (20) fowls were treated with the drug and the rest were not.

        (a)   Calculate the probability that a fowl picked at random is

        (i)   treated with the drug

        (ii)   Not treated with the drug

25. If a fowl is treated, probability of dying is 1/10 while if not treated the probability is 7/10 calculate the probability that, a fowl picked at random from the 36 fowl is

            (i)   treated with the drug and will die
            (ii)   Not treated with the drug and will die
            (iii)   Not treated with the drug and will not die

Answer the entire question in this section

1. Use logarithms to evaluate
$$55.9 \div (02621 \times 0.01177)^{1/5}$$

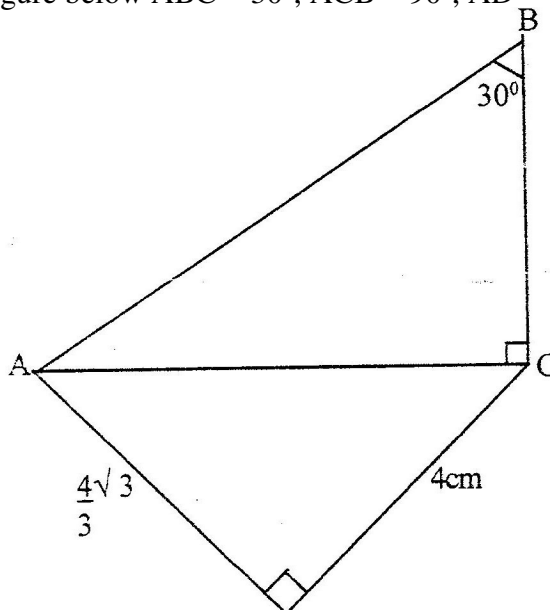2. Simplify the expression $\dfrac{x-1}{x} - \dfrac{2x+1}{3x}$

   Hence solve the equation
   $$\dfrac{x-1}{x} - \dfrac{2x+1}{3x} = \dfrac{2}{3}$$

3. Simplify as far as possible, leaving your answer in the form of surd
   $$\dfrac{1}{\sqrt{4} - 2\sqrt{3}} - \dfrac{1}{\sqrt{14} + 2\sqrt{3}}$$

4. In the figure below $ABC = 30^0$, $ACB = 90^0$, $AD = 4\sqrt{3}$ and $DC = 4$cm

$\dfrac{8}{\sqrt{3}} + \dfrac{I}{\sqrt{3}}$ if A is lost

Calculate the length of   (a) AC
   (b) BC

5. A plot of land was valued at Kshs 50,000 at the start of 1994. It appreciated by 20% during 1994. Thereafter, every year, it appreciated by 10% of its previous years value.

    a. The value of the land at the start 0f 1995

    b. The value of the land at the end 0f 1997

6. During a certain period, the exchange rate were follows
1 sterling pound = Kshs. 102.0
1 sterling pound = Kshs. U.S dollar
1 U.S dollar = Kshs. 60.6

A school management intended to import textbooks worth Kshs 500,00 from U.K. It changed the money to sterling pounds. Later the management found out that books were cheaper in U.S.A. Hence it changed the sterling pounds to dollars. Unfortunately, a financial crisis arose and the money had to be reconverted to Kenya shillings.
Calculate the total amount of money the management ended up with

7. A manufacturer sells bottle of fruit juice to a trader at a profit of 40%. The trader sells it for Kshs 84 at a profit of 20%. Find
    (a) The trader's buying price

    (b) The cost of manufacture of one bottle

8. In the figure below a line XY and three points. A,B and C are given. On the figure construct
(a) The perpendicular bisector of AB
(b) A point P on line xy such that $\angle APB = \angle ACB$
    C
    X

    Y

    A X   X B

    X
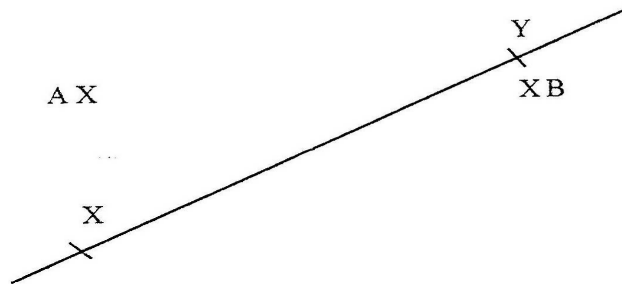
9. In the figure, KLMN is a trapezium in which KL is parallel to NM and KL = 3 NM
   N   u   M
    w   v
    K   L
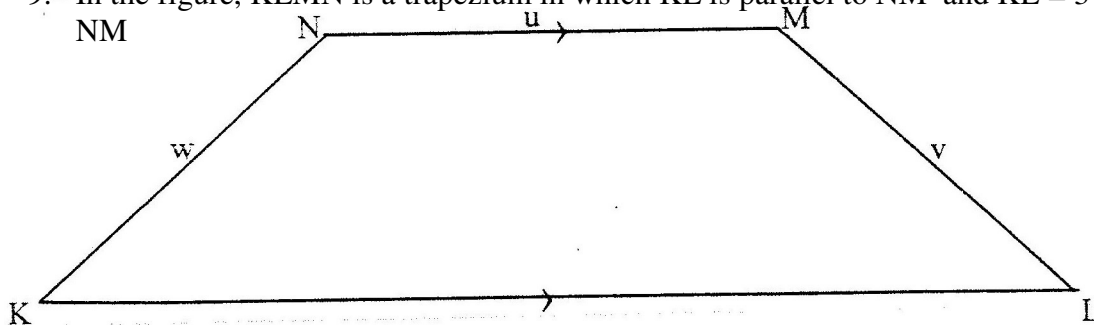
Given that KN = w, NM = u and ML = v
Show that 2 u = v= w

10. Given that P = 3 y express the equation $3^{2y-1} + 2 \times 3^{y-1} = 1$ terms of AP Hence or otherwise find the value of y in the equation $3^{2y-1} + 2 \times 3^{y-1} = 1$

11. A balloon, in the form of a sphere of radius 2 cm, is blown up so that the volume increase by 237.5%. Determine the new volume of balloon in terms of $\prod$

12. Find x if
$$-3 \log 5 + \log x^2 = \log \frac{1}{125}$$

13. (a) Write down the simplest expansion $(1 + x)^6$
    (b) Use the expansion up to the fourth term to find the value of $(1.03)^6$ to the nearest one thousandth.

14. A science club is made up of boys and girls. The club has 3 officials. Using a tree diagram or otherwise find the probability that:
    (a) The club official are all boys

    (b) Two of the officials are girls

15. A river is flowing at uniform speed of 6km/ h. A canoeist who can paddle at 10 km/h through still water wishes to go straight across the river.
    Find the direction, relative to the bank in which he should steer.

16. The triangular prism shown below has sides AB= DC = EF = 12 cm. The ends are equilateral triangle of sides 10cm. The point N is the midpoint FC.

12 cm
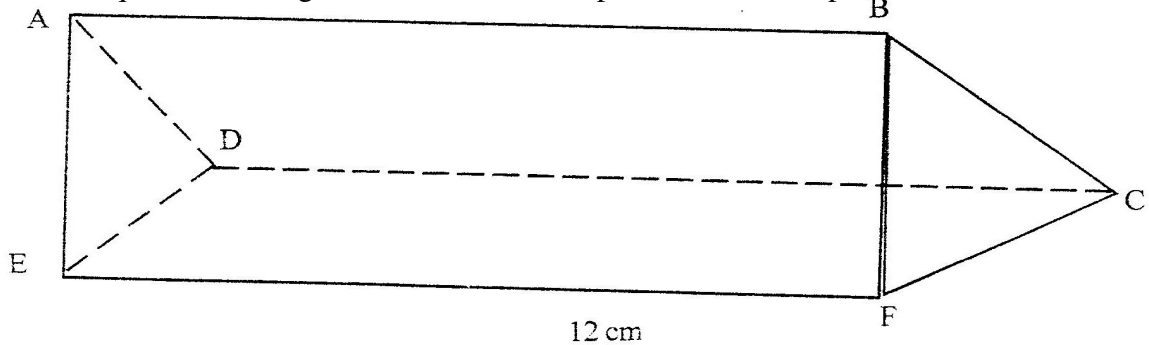
    (a) Find the length of
        (i)   BN

        (ii)   EN

    (b) Find the angle between the line EB and the plane CDEF

SECTION II (48 marks)

Answer any six questions from this section

17. A cylindrical water tank is a diameter 7 meters and height 2.8 metre
    (a) Find the capacity of the water tank in litres

    (b) Six members of a family use 15 litres per day. Each day 80 litres are used
        for cooking and washing and a further 60 litres are wasted.
        Find the number of complete days a full tank of water would last the
   family.

18. (a) Complete the table below for the value of $y = 2\sin x + \cos x$.

x	0^0	30^0	45^0	60^0	90^0	120^0	135^0	150^0	180^0	225^0	270^0	315^0	360^0
2 sin x	0		1.4	1.7	2	1.7	1.4	1	0		-2	-1.4	0
Cos x	1		0.7	0.5	0	-0.5	-0.7	-0.9	-1		0	0.7	1
y	1		2.1	2.2	2	1.2	0.7	0.1	-1		-2	-0.7	1

(b) Using the grid provided draw the graph of $y = 2\sin x + \cos x$ for 0^0. Take 1 cm
    represent 30^0 on the x- axis and 2 cm to represent 1 unit on the axis.

(c) Use the graph to find the range of x that satisfy the inequalities $2\sin x \cos x > 0.5$

19. In the figure below, QOT is a diameter $\angle$QTR = 48^0, $\angle$TQR = 76^0 and $\angle$SRT = 37^0
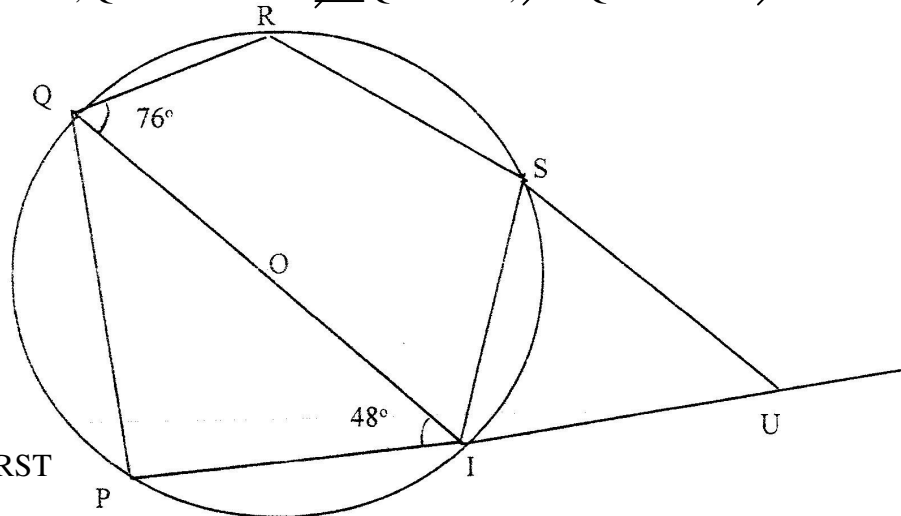
Calculate

(a) $\angle$ RST

(b) $\angle$ SUT

(c) Obtuse $\angle$ RUT

(d) $\angle$ PST

20. (a) Find the value of x at which the curve $y = x - 2x^2 - 3$ crosses the x-axis

    (b) $s(x^2 - 2x - 3)dx$

    (c) Find the area bounded by the curve $y = x^2 - 2x - 3$, the axis and the lines x= 2 and x = 4

21. Two variables R and V are known to satisfy a relation $R = kV^n$, where k and n are constants. The table below   shows data collected from an experiment involving the two variables R and V.

V	3	4	5	6	7	8
R	27	48	75	108	147	192

    (a) Complete the table of log V and R given below, by giving the value to 2 decimal places.

| Log V	0.48	0.60	0.70	0.78	0.85	0.90
Log R	1.43	1.88	2.03	1.80	2.28	

    (b) On the grid provided draw a suitable straight line graph to represent the relation $R = kV^n$

    (c) (i) the gradient of the line
        (ii) a relationship connecting R and V.

22. Two aeroplane P and Q leaves an airport at the same time. P lies on a bearing of 240^0 at 900 km/ h while Q flies due east at 750 km/ h.
    (a) Using a scale of 1 cm to represents 100km, make a scale drawing to show the position of the aeroplane after 40 minutes.
    (b) Use the scale drawing to find the distance between the two aeroplane after 40 minutes.
    (c) Determine the bearing
        (i)   P from Q
        (ii)   Q from P

23. The figure below represents a rectangle PQRS inscribed in a circle centre 0 and radius 17cm . PQ = 16cm.
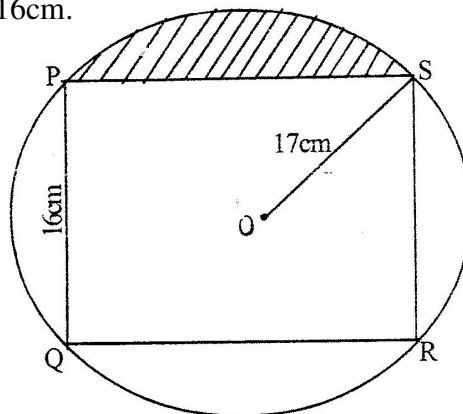
Calculate
      (d) The length PS of the rectangle

      (e) The angle POS

      (f) The area of the shaded region

24. A draper is required to supply two types of shirts A and type B.
The total number of shirts must not be more than 400. He has to supply more type A than of type B however the number of types A shirts must be more than 300 and the number of type B shirts not be less than 80.
Let x be the number of type A shirts and y be the number of types B shirts.

    (a) Write down in terms of x and y all the linear inequalities representing the information above.

    (b) On the grid provided, draw the inequalities and shade the unwanted regions

        Type A: Kshs 600 per shirt

        Type B: Kshs 400 per shirt
        (i)   Use the graph to determine the number of shirts of each type that should be made to maximize the profit.

        (ii)   Calculate the maximum possible profit.