MATHEMATICS
121 / 2
SECTION I (50 Marks)
Answer all questions from this section

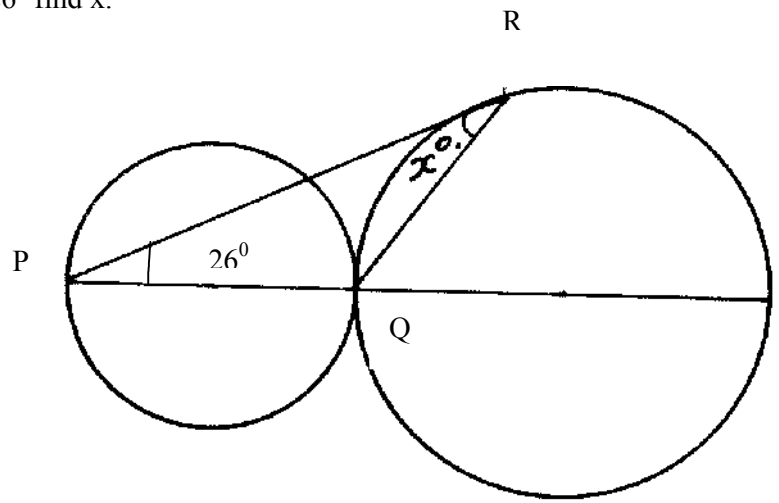
1. Given that $\log_a 2 = 0.7419$, find the logarithm to base a of.
   (a) 32 1mk *NDI*
   (b) 0.125 2mks*NDI*

2. Given that $\frac{5}{\sqrt{11} - \sqrt{7}} + \frac{3}{\sqrt{11} + \sqrt{7}} = a\sqrt{11} + b\sqrt{7}$
   where a and b are rational numbers, find the values of a and b. 3mks*NDI*

3. Find the product of 25.2 and 18.5 measured to the nearest one tenth. 1mk*NDI*
   Hence or otherwise find the relative error in the product. 3mks*NDI*

4. Solve for x if
   $6x^2 - 9x - 4 = 0$ 3mks*NDI*

5. In the figure below, the two circles touch at Q, PQ is a diameter, PR is a tangent and angle RPQ = 26^0 find x. 3mks*NDI*



6. Given that x = 3i + 2j – 4k, y = -3i + 5j – 2k and z = 4i + 3j + 5k and that P = 4x – 2y + 3z, find the magnitude of P to 4 significant figures. 3mks*NDI*

7. Three friends Loice, Rachel and Jane went out for shopping. Loice bought 2 safaricom cards, 2kg of rice and ½ kg of meat. Rachel bought 1 safaricom card, 3kg of rice and 1 ½ kg of meat; Jane bought 5 cards of safaricom , 4kg of rice and 2kg of meat.
   a) Write this information in the form of a matrix. 1mk*NDI*

   b) The cost of a safaricom card is sh.100, a kg of rice at ksh 60 and a kg of meat ksh.150. Use matrix multiplication to find the amount of money spent by each of the three girls. 2mks*NDI*

8. Make x the subject of the formula. 3mks*NDI*
   $W = \sqrt{\frac{X - P}{X - Q}}$

9. The sum of the first four terms of an arithmetic progression is 14. If the sum of the first eight terms is 108, find the sixth term of this progression. 3mks*NDI*

10. Expand $(3 + a)^5$ 1mk*NDI*
    Hence evaluate $(2.97)^5$ correct to 4 significant figures. 2mks*NDI*

11. The base length of a square based pyramid is 24cm. The slant edges are 20cm long. Calculate the angle between a sloping face and the base. 3mks*NDI*

12. Two bags M and N are on a desk. Bag M contains 12 red pens and 16 black pens; bag N contains 8 red pens and 12 black pens. A bag is chosen at random and two pens drawn from it, one at a time without replacement. Find the probability that the first pen picked is black and the second is red. 3mks*NDI*

13. Grade A tea costs Ksh 100 per kg while grade B costs ksh 150 per kg. Find the ratio in which the two grades should be mixed to get a mixture worth ksh.140 per kg. 3mks*NDI*

14. Use 5 trapezia and the trapezium rule to estimate the area bounded by $y=x(x-5)$ and the x - axis 3mks*NDI*

15. Given below are three points A, B and C. Locate point D such that AD=BD = CD and measure AD. Construct the locus of a point P whose distance from D is always =AD 3mks*NDI*

. C

.B

.A

16. The distance S in metres covered by a moving particle after time t in seconds is given by*NDI*

$$S = t^3 + 4t^2 - 3t + 2$$

Find

(a) the distance covered at t=4 seconds. 1mk*NDI*

(b) the instant at which the particles is at rest. 3mks*NDI*

SECTION II (50 Marks)

Answer any five questions from this section

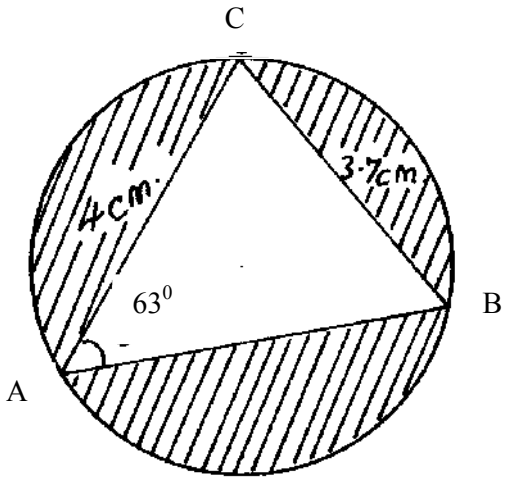
17. Quadrilateral WXYZ with vertices W(5,0), x (2,-3) Y(8, -3) and Z(8,-1) is mapped onto quadrilateral W, X,Y,Z by reflection on the line y=x. $W_2X_2Y_2Z_2$ is the image of W,X,Y,Z under a reflection on the line y = 0

a) Plot the three quadrilaterals on the grid below. 4mks*NDI*

b) Describe fully the single transformation which maps WXYZ onto $W_2X_2Y_2Z_2$ 2mks*NDI*

c) Determine a single matrix which maps $W_2X_2Y_2Z_2$ onto WXYZ. 4mks *NDI*

18. The figure below shows a triangle ABC. AC = 4cm BC = 3.7cm and angle BAC = 63^0. *NDI*



a) Find the radius of the circle that passes through A, B and C. 3mks*NDI*
b) Calculate the length of AB. 3mks*NDI*
c) Determine the shaded area 4mks*NDI*

19. Rates of tax in operation in January 2006 are as given in the table below.

Monthly taxable income (sh)	Rate of tax (%)
1 – 8680	10
8681 – 16240	15
16241 – 23820	20
23821 – 31400	25
Over 31,400	30

Mr. Kemboi pays ksh.5400 as P.A.Y.E monthly after getting a monthly relief of ksh1093. calculate his monthly salary. 10mks*NDI*

20. The masses of 50 students in a form 4 class were taken and recorded as in the table below.

Mass (kg)	40 – 42	43 – 45	46 – 48	49 – 51	52 – 58	59 – 69
Frequency	3	11	20	9	5	2

a) Calculate the median mass. 4mks*NDI*
b) Calculate the semi-interquartile range 4mks*NDI*
c) If the students are arranged in order from the lightest to the heaviest, find the mass of the 45^{th} student. 2mks*NDI*

21. Complete the table below for the functions y= 2 sin 3x and y = tan x for $O^0 \leq x \leq 360^0$.

x^0	0	30	60	90	120	150	180	210	240	270	300	330	360
3x	0	90	180	270	360	450	540	630	720	810	900	990	1080
2sin3x													
tan x													

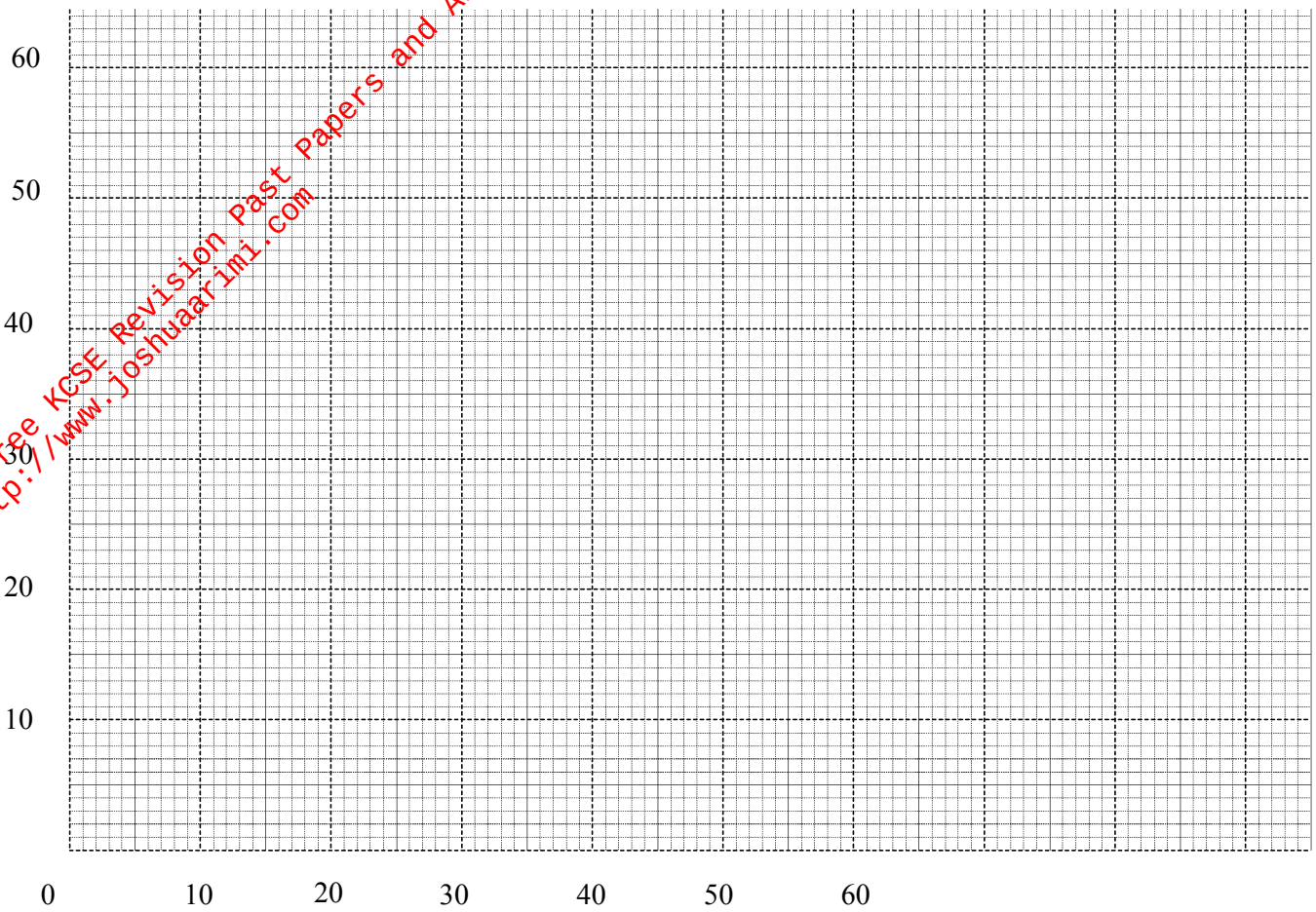
2mks*NDI*

a) On the same axes, draw the graphs of y= 2 sin 3x and y = tan x. 5mks*NDI*
b) Use your graphs to solve the equation. 3mks*NDI*
tan x – 2 sin 3x = 0

22. The positions of two towns on the surface of the earth are given as A(30^0S, 20^0W) and B(30^0S, 80^0E)
Find
a) the difference in longitude 2mks*NDI*
b) the distance between the two towns along a parallel of latitude in
(i) km (take the radius of the earth as 6370km and $\pi = {}^{22}/_{7}$) 3mks*NDI*
(ii) nm 2mks*NDI*
c) Find the local time in town B when it is 1:45pm in town A. 3mks*NDI*

23. The equation of a curve is given as
$y = x^3 + x^2 - 6x$.
a) Show that $y = \frac{-1 + \sqrt{19}}{3}$ is a minimum turning point. 4mks*NDI*
b) determine the coordinates of the other stationary point. 3mks*NDI*
c) find the area bounded by the curve and the x-axis. 3mks*NDI*

24. Eldoret Airport is planning to build a fire fighting plant on a space of $250m^2$. Two types of machines are to be installed, machine x which occupies a space of $5m^2$ and machine Y which occupies $10m^2$. The airport can have a maximum of 40 machines at a time. At most 15 machines of type Y are used at any given time.
a) write down three inequalities other than x>0, and y>0. 3mks*NDI*
b) On the grid below, show the region satisfying the given conditions. 3mks*NDI*



c) The profit from a type x machine is Ksh 1000 and that of type y is 4000.

(i) Write down the objective function. 1mk*NDI*

(ii) Use the graph to obtain the number of machines of each type that should be installed to obtain maximum profit. 2mks*NDI*

(iii) Calculate the maximum profit. 1mk*NDI*