MATHEMATICS I
PART I

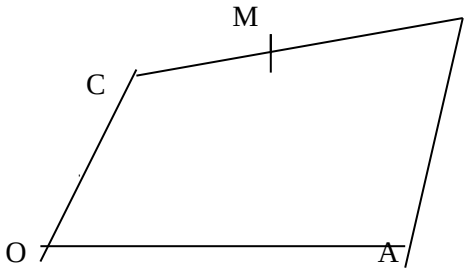
SECTION I (50 MARKS)

1. Evaluate without mathematical tables leaving your answer in standard form

$$\frac{0.0171^2 \times 3}{855 \times 0.531}$$

(2 Mks)

2. Six men take 14 days working 8 hours a day to pack 2240 parcels. How many more men working 5 hours a day will be required to pack 2500 parcels in 2 days (3 Mks)

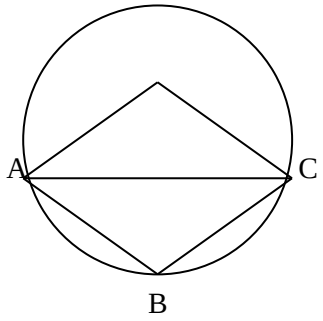
3. 

In quadrilateral OABC, OA = 4i - 3j. OC = 2i + 7j AB = 3OC. cm: mB = 2:3. Find in terms of i and j vector Om (3 Mks)

4. By matrix method, solve the equations

$5x + 5y = 1$
$4y + 3x = 5$

(3 Mks)

5. 

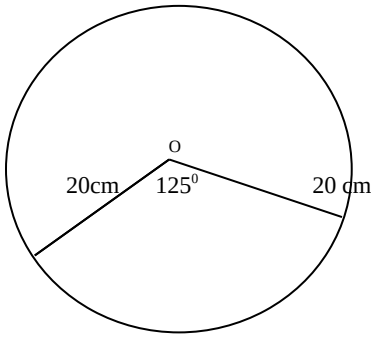
In the given circle centre O, $\angle ABC = 126^0$. Calculate $\angle OAC$ (3 Mks)

6. Solve the equation

$2(3x - 1)^2 - 9(3x - 1) + 7 = 0$ (4 Mks)

7. Maina, Kamau and Omondi share Shs.180 such that for every one shilling Maina gets, Kamau gets 50 Cts and for every two shillings Kamau gets, Omondi gets three shillings. By how much does Maina's share exceed Omondi's (3 Mks)
8. Expand $(2 + {}^1/_2x)^6$ to the third term. Use your expression to evaluate 2.4^6 correct to 3 s.f (3 Mks)
9. The probability of failing an examination is 0.35 at any attempt. Find the probability that
   (i) You will fail in two attempts (1 Mk)
   (ii) In three attempts, you will at least fail once (3 Mks)
10. Line $y = mx + c$ makes an angle of 135^0 with the x axis and cuts the y axis at y = 5. Calculate the equation of the line (2 Mks)
11. During a rainfall of 25mm, how many litres collect on 2 hectares? (3 Mks)
12. Solve the equation $\frac{a}{3} - \frac{3a - 7}{5} = \frac{a - 2}{6}$ (3 Mks)
13. The sum of the first 13 terms of an arithmetic progression is 13 and the sum of the first 5 terms is –25. Find the sum of the first 21 terms (5 Mks)

14. The curved surface of a core is made from the shaded sector on the circle. Calculate the height of the cone. (4 Mks)

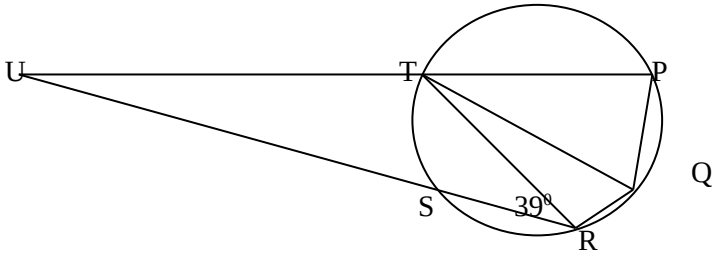


15. Simplify $\frac{(wx - xy - wz + yz)(w + z)}{z^2 - w^2}$ (3 Mks)

16. The bearing of Q from P is North and they are 4 km apart. R is on a bearing of 030 from P and on a bearing of 055 from Q. Calculate the distance between P and R. (3 Mks)

SECTION II (50 MARKS)

17. In the given circle centre O, $\angle QTP = 46^0$, $\angle RQT = 74^0$ and $\angle URT = 39^0$



Calculate

(a) $\angle RST$ (1 Mk)
(b) $\angle SUT$ (3 Mks)
(c) Obtuse angle ROT (2 Mks)
(d) $\angle PST$ (2 Mks)

18. The exchange rate on March 17th 2000, was as follows: -
1 US$ = Kshs.74.75
1 French Franc (Fr) = Kshs.11.04

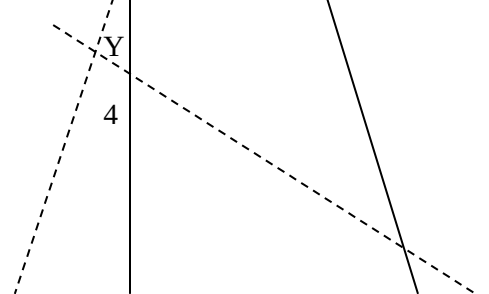
A Kenyan tourist had Kshs.350,000 and decided to proceed to America

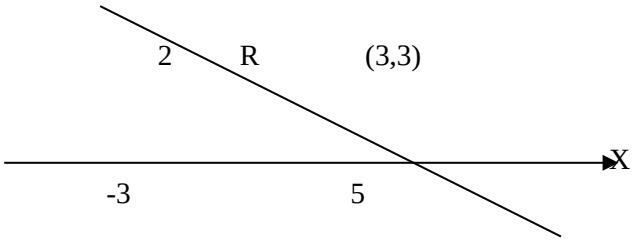
(a) How much in dollars did he receive from his Kshs.350,000 in 4 s.f? (2 Mks)
(b) The tourist spend ¼ of the amount in America and proceeded to France where he spend Fr 16,200. Calculate his balance in French Francs to 4 s.f (3 Mks)
(c) When he flies back to Kenya, the exchange rate for 1 Fr = Kshs.12.80. How much more in Kshs. does he receive for his balance than he would have got the day he left? (3 Mks)

19. On the provided grid, draw the graph of $y = 5 + 2x - 3x^2$ in the domain $-2 \leq x \leq 3$ (4 Mks)
(a) Draw a line through points (0,2) and (1,0) and extend it to intersect with curve $y = 5 + 2x - 3 \times 2$ read the values of x where the curve intersects with the line (2 Mks)
(b) Find the equation whose solution is the values of x in (a) above (2 Mks)

20. (a) Using a ruler and compass only, construct triangle PQR in which PQ = 3.5 cm, QR = 7 cm and angle PQR = 30^0 (2 Mks)
(b) Construct a circle passing through points P, Q and R (2 Mks)
(c) Calculate the difference between area of the circle formed and triangle PQR (4 Mks)

21. The given Region below (unshaded R) is defined by a set of inequalities. Determine the inequalities (8 Mks)



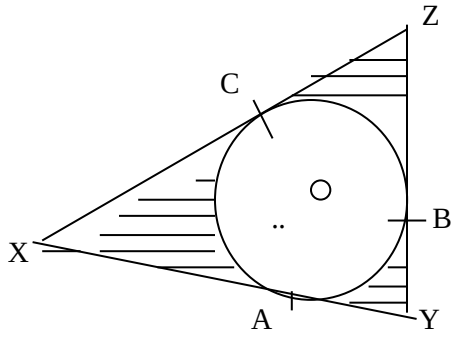


22. The table below shows the mass of 60 women working in hotels

Mass (Kg)	60 – 64	65 – 69	70 – 74	75 - 79	80 – 84	85 - 89
No. of women	8	14	18	15	3	2

(a) State (i) The modal class (1 Mk)
(ii) The median class (1 Mk)
(b) Estimate the mean mark (4 Mks)
(c) Draw a histogram for the data (2 Mks)

23. XY, YZ and XZ are tangents to the circle centre O at points A, B, C respectively. XY = 10 cm, YZ = 8 cm and XZ = 12 cm. (2 MKS)



(a) Calculate, length XA (2 Mks)
(b) The shaded area (6 Mks)

24. Maina bought a car at Kshs.650,000. The value depreciated annually at 15%
(a) After how long to the nearest 1 decimal place will the value of the car be Kshs.130,000 (4 Mks)
(b) Calculate the rate of depreciation to the nearest one decimal place which would make the value of the car be half of its original value in 5 years (4 Mks)

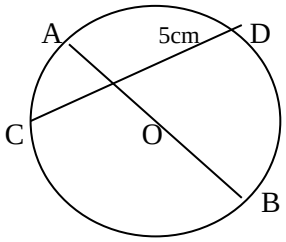
MATHEMATICS I
PART II
SECTION 1 (50 MARKS)

1. Simplify $\left(\frac{32a^{10}}{b^{15}}\right)^{-2/5} \div \left(\frac{9b^4}{4a^6}\right)^{1/2}$ (2 Mks)

2. Use logarithm tables to evaluate
$\sqrt{0.375 \cos 75}$

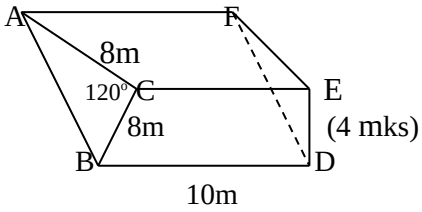
tan 85.6 (4 Mks)

3. The marked price of a shirt is Shs.600. If the shopkeeper gives a discount of 20% off the marked price, he makes a loss of 4%. What was the cost of the shirt? (3 Mks)
4. The surface area (A) of a closed cylinder is given by $A = 2\pi r^2 + 2\pi rh$ where r is radius and h is height of the cylinder. Make r the subject. (4 mks)
5. In the circle centre O, chords AB and CD intersect at X. XD = 5 cm
   XC = 1/4 r where r is radius. AX:XO = 1:2 Calculate radius of the circle. (3 mks)



6. Simplify $\frac{2}{5 - 2\sqrt{3}} - \frac{1}{5 + 2\sqrt{3}}$ (3 mks)

7. P is partly constant and partly varies as q2. When q = 2, P = 6 and when q = 3, P = 16. Find q when P = 64 (4 mks)
8. The figure on the side is a tent of uniform cross-section ABC. AC = 8m, BC = 8m, BD = 10m and (ACB = 120^0. If a scout needs 2.5 m^3 of air, how many scouts can fit in the tent. (4 mks)



9. The length of a rectangle is given as 8 cm and its width given as 5 cm. Calculate its maximum % error in its perimeter (3 mks)
10. ABCD is a rectangle with AB = 6 cm, BC = 4 cm AE = DH = 4 cm BF = CG = 12 cm. Draw a labelled net of the figure and show the dimensions of the net
11. Expand $(1 + 2x)^6$ to the 3rd term hence evaluate $(1.04)^6$ (4 mks)
12. The eye of a scout is 1.5m above a horizontal ground. He observes the top of a flag post at an angle of elevation of 20^0. After walking 10m towards the bottom of the flag post, the top is observed at angle of elevation of 40^0. Calculate the height of the flag post (4 mks)
13. A bottle of juice contains 405ml while a similar one contains 960ml. If the base area of the larger Container is 120 cm^2. Calculate base area of the smaller container. (3 mks)
14. It takes a 900m long train 2 minutes to completely overtake an 1100m long train travelling at 30km per hour. Calculate the speed of the overtaking train (3 mks)
15. Okoth traveled 22 km in $2\frac{3}{4}$ hours. Part of the journey was at 16 km/h and the rest at 5 km/h. Determine the distance at the faster speed (3 mks)
16. P and Q are points on AB such that AP:PB = 2:7 and AQ:QB = 5:4 If AB = 12 cm, find PQ (2 Mks)

SECTION B (50 MARKS)

17. The income tax in 1995 was collected as follows:

Income in Kshs. p.a	*rate of tax %*
1 - 39,600	10
39,601 - 79,200	15
79,201 - 118,800	25
118,801 - 158,400	35
158,401 - 198,000	45

Mutua earns a salary of Kshs.8,000. He is housed by the employer and therefore 15% is added to his salary to arrive at its taxable income. He gets a tax relief of Shs.400 and pay Shs.130 service charge. Calculate his net income *(8 Mks)*

18. The probability Kioko solves correctly the first sum in a quiz is $^2/_5$ Solving the second correct is $^3/_5$ if the first is correct and it is $^4/_5$ if the first was wrong. The chance of the third correct is $^2/_5$ if the second was correct and it is $^1/_5$ if the second was wrong. Find the probability that
    (a) All the three are correct (2 Mks)
    (b) Two out of three are correct (3 Mks)
    (c) At least two are correct (3 Mks)
19. A businessman bought pens at Shs.440. The following day he bought 3 pens at Shs.54. This purchase reduced his average cost per pen by Sh.1.50. Calculate the number of pens bought earlier and the difference in cost of the total purchase at the two prices (8 mks)

20. In Δ OAB, OA = a, OB = b
    OPAQ is a parallelogram.
    ON:NB = 5:-2, AP:PB = 1:3
    Determine in terms of a and b vectors
    (a) OP (2 Mks)
    (b) PQ (2 Mks)
    (c) QN (2 Mks)
    (d) PN (2 mks)

21. A cylindrical tank connected to a cylindrical pipe of diameter 3.5cm has water flowing at 150 cm per second. If the water flows for 10 hours a day
    (a) Calculate the volume in M^3 added in 2 days (4 ms)
    (b) If the tank has a height of 8 m and it takes 15 days to fill the tank, calculate the base radius of the tank (4 mks)
19. A joint harambee was held for two schools that share a sponsor. School A needed Shs.15 million while School B needed 24 million to complete their projects. The sponsor raised Shs.16.9 million while other guest raised Shs.13.5 million.
    (a) If it was decided that the sponsor's money be shared according to the needs of the school with the rest equally, how much does each school get (5 mks)
    (b) If the sponsor's money was shared according to the schools needs while the rest was in the ratio of students, how much does each school get if school A has 780 students and school B 220 students (3 mks)
23. Voltage V and resistance E of an electric current are said to be related by a law of the form $V = KE^n$ where k and n are constants. The table below shows values of V and E

V	0.35	0.49	0.72	0.98	1.11
E	0.45	0.61	0.89	1.17	1.35

    By drawing a suitable linear graph, determine values of k and n hence V when E = 0.75(8mks)
24. The vertices of triangle P,Q,R are P(-3,1), Q (-1,-2), R (-2,-4)
    (a) Draw triangle PQR and its image $P^IQ^IR^I$ of PQR under translation T = $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ on the provided grid (2 Mks)
    (b) Under transformation matrix m = $\begin{pmatrix} 4 & 3 \\ 1 & 2 \end{pmatrix}$, $P^IQ^IR^I$ is mapped on to $P^{II}Q^{II}R^{II}$. Find the co-ordinates of $P^{II}Q^{II}R^{II}$ and plot it on the given grid (4 Mks)
    (c) If area of Δ $P^IQ^IR^I$ is 3.5 cm^2, find area of the images $P^{II}Q^{II}R^{II}$ (2 Mks)

MATHEMATICS I
PART 1
MARKING SCHEME

1. $\underline{171 \text{ X } 171 \text{ X } 3 \text{ X } 10^{-5}}$ M1

$$\frac{855 \times 531}{}$$

$= 2 \times 10^{-6}$ A1

2

2. No. of men $= \frac{6 \times 14 \times 8 \times 2500}{2 \times 5 \times 2240}$ M1

$= 75$ A1

Extra men $= 75 - 6 = 69$ B1

3

3. $OM = 2i + 7j + 2/5\,(4i - 3j + 6i + 21j - 2i - 7j)$ M1

$= 2i + 7j + 2/5\,(8i + 11j)$ M1

$= \frac{26}{5} i + \frac{57}{5} j$ A1

3

4. $\begin{pmatrix} 2 & 5 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ 5 \end{pmatrix}$ M1

$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -1/7 & 5/7 \\ 3/7 & -2/7 \end{pmatrix} \begin{pmatrix} 1 \\ 5 \end{pmatrix}$ M1

$\begin{pmatrix} x = 3 \\ y = -1 \end{pmatrix}$

x, 3, y = -1 A1

3

5. Reflex $\angle AOC = 126 \times 2 = 252^0$ B1

Obtuse $\angle AOC = 360 - 252 = 108^0$ B1

$= \frac{1}{2}(180 - 108)^0$

$= 36^0$ B1

3

6. $18x^2 - 39x + 18 = 0$

$6x^2 - 13x + 6 = 0$ B1√ equation

$6x^2 - 9x - 4x + 6 = 0$

$3x(2x - 3)(3x - 2) = 0$ M1

$x = 2/3$ or A1

$x = 1\frac{1}{2}$ B1

4

7. M : K : O = 4 : 2 : 3 B1√ ratio

Maina's = 4/9 X 180

= 80/- B1√ Omondi's

Omondi's = 60/- *and Maina's*

Difference = Shs.20/- *B1 difference*

3

8. $(2 + \frac{1}{2}x)^6 = 2^6 + 6(2^5)(\frac{1}{2}x + 15(2^4)(\frac{1}{2}x)^2$ M1

$= 64 + 96x + 60x^2$ A1

$2.4^6 = (2 + \frac{1}{2}(0.8))^6$

$= 64 + 96(0.8) + 60(0.64)$ M1

$= 179.2$

$\cong 179$ to 3 s.f A1

4

9. P (FF) = $^{7}/_{20}$ X $^{7}/_{20}$
= $^{49}/_{100}$ B1

P (at least one fail) = 1 – P ($F^{l}F^{l}F^{l}$)
= $1-\left\{^{13}/_{20}\right\}^{3}$ M1
= $1 - \frac{2197}{8000}$ M1
= $\frac{5803}{8000}$ *A1*

4

10. grad = term 135
= -1 B1
y = mx + c
y = -x + 5 B1

2

11. Volume = $\frac{2 \times 10{,}000 \times 10{,}000 \times 25}{1000 \quad 10}$ M1√ x section area
M1√ conv. to litres
= 500,000 Lts A1

3

12. 10a - 6(3a - 7) = 5(a -2) M1
10a - 18a + 42 = 5a - 10
- 13a = -52 M1
a = 4 A1

3

13. 2a + 12d = 2
2a + 4d = -10 M1
8d = 12
d = $1^{1}/_{2}$ A1
a = -8 B1
S_{21} = $^{21}/_{2}$ (-16 + 20 X 3/2) M1
= 147 A1

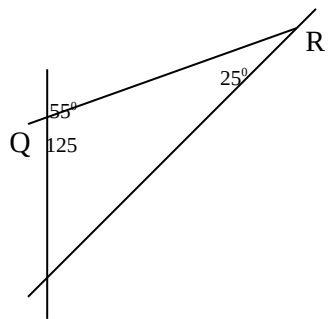
5

14. 2 π r = $\frac{120}{360}$ x π x 40 M1
r = 6.667 cm A1
h = √ 400 - 44.44 M1
= 18.86 cm A1

4

15. = $\frac{(w (x - z) – y (x - z)) (w + z)}{(z - w) (z + w)}$ M1√ factor
= $\frac{(w - y) (x - z) (w + z)}{(z - w) (z + w)}$ M1√ grouping
= $\frac{(w - y) (x - z)}{z - w}$ A1

3

16. 

B1√ sketch

PR = $\frac{4 \sin 125}{}$ M1

A1

P^{30} 3

17. (a) $\angle RST = 180^0 - 74^0 = 106^0$ B1

(b) $\angle RTQ = 90^0 - 74^0 = 16^0$ B1

$\angle PTR = 46^0 + 16^0 = 62^0$ B1

$\angle SUT = 62^0 - 39^0 = 23^0$ B1

(c) Reflex $\angle RQT = 180 - 2 \times 16$

$= 180 - 32 = 148^0$ B1

Obtuse $ROT = 360 - 148 = 212^0$ B1

(d) $\angle PTS = 46 + 180 - 129 = 97^0$ B1

$\angle PST = 180 - (97 + 39) = 44^0$ B1

8

(a) Kshs.350,000 = $ $\frac{350,000}{74.75}$ M1

$= \$ 4682$ A1

(b) Balance $= \frac{3}{4} \times 4682$

$= \$ 3511.5$ B1

$3511.5 = Fr \frac{3511.5 \times 74.75}{11.04}$ M1

$= Fr\ 23780$ A1

Expenditure = Fr 16 200

Balance = Fr 7580

(c) Value on arrival = Kshs.7580 X 12.80

= Kshs.97,024

Value on departure = Kshs.7580 X 11.04 B1 both√

= Kshs.83 683.2

Difference = Kshs.97,024 - 83683.2 M1

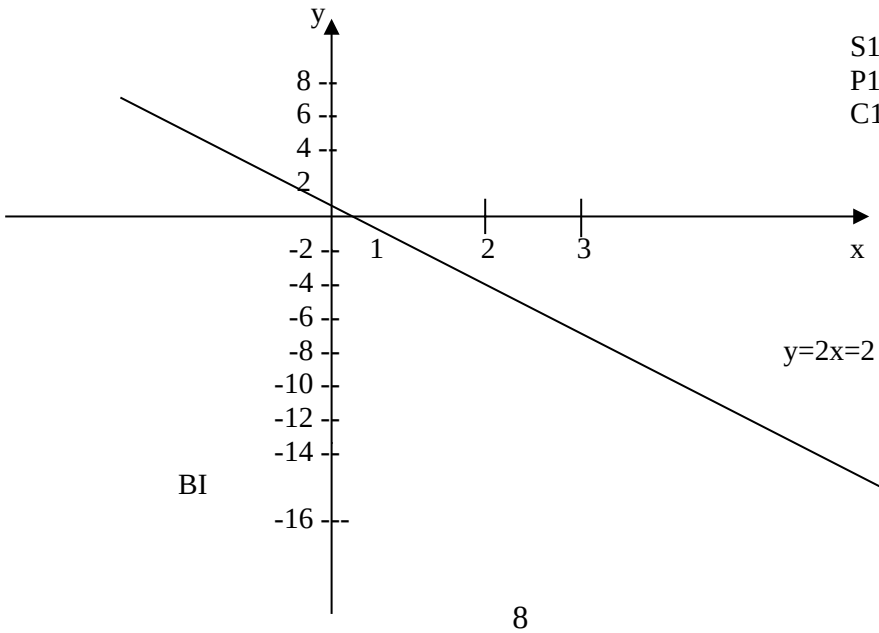
= Kshs.13,340.80 A1

8

19.

X	-2	-1	0	1	2	3
Y	-11	0	5	4	-3	-16

B1√values



S1√ scale
P1√ plotting
C1 √ curve

x =-0.53 + 0.1

Nx = 1.87+ 0.1

BI

$y = 5+2x-3x^2 = 2-2x$ MI for equation

$3x^2-4x-4x-3=0$ AI equation

8

$x = -0.53 \pm 0.1$

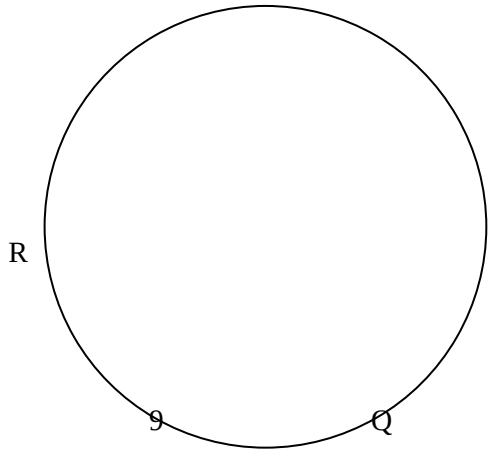
$mx = 1.87 \pm 0.1$ } B1

$y = 5 + 2x – 3x^2 = 2 – 2x$ M1 √ for equation

$\therefore$ 3x2 – 4x – 3 = 0 MA1 √ equation

8

20.



B1 √ 30^0

B1 √ 2 ⊥ PQ, QR

B1 √ 2 ⊥ bisectors

B1 √ circle

Radius = 4.2 ± 0.1 B1√ radius

Area of circle = $^{22}/_7$ x 4.22

= 55.44 ± 3 cm2

Area of Δ PQR = $^1/_2$ x 3.5 x 7.5 sin 30 M1√ Δ and circle

= 6.5625 cm^2

Difference = *55.44 - 6.5625* *M1√sub*

= 48.88 cm^2 A1

8

21. Line (i) $^y/_2 + ^x/_5 = 1$

5y + 2x = 10 B1√equation

5y + 2x = 10 B1√ inequality

Line (ii) $^y/_4 + ^x/_{-3} = 1$

3y = 4x + 12 B1√ equation

3y < 4x + 12 or 3y - 4x < 12 B1√ inequality

Line (iii) *grad* = $^{-1}/_3$ *y inter = 4*

3y + x = 12 or 3y = -x + 12 B1√ equation

3y + x < 12 B1√ inequality

Line (iv) $\frac{y - 3}{x - 3} = \frac{-3}{2}$

2y + 3x = 15 B1√ equation

$\therefore$ 2y + 3x ≤ 15 B1√ equation

8

22.

CLASS	**F**	**x**	**Fx**	**Cf**
60 – 64	8	62	496	8
65 – 69	14	67	938	28
70 – 79	18	72	1296	40
75 – 79	15	77	1155	55
80 – 84	3	82	246	58
85 – 89	2	87	174	60
	Σf = 60		Σfx 3809	

B1√ x column
B1√ f column

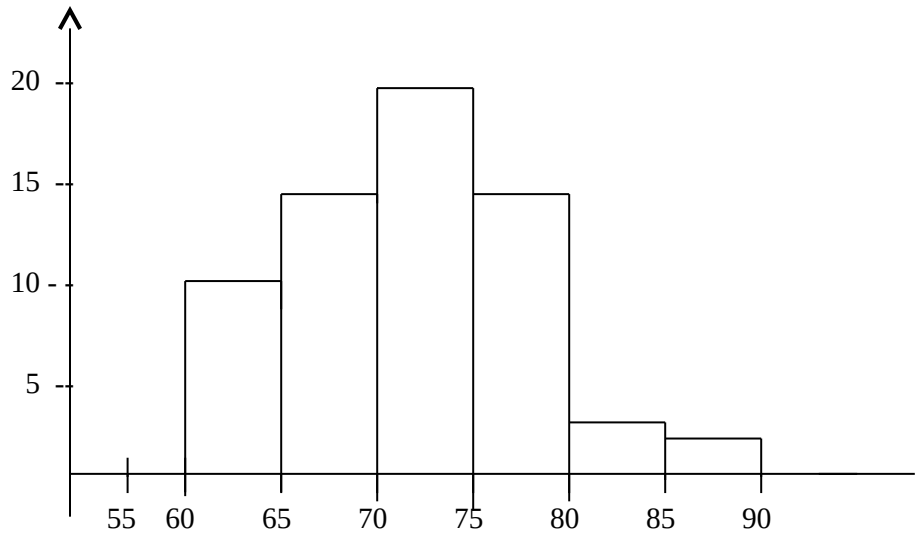
(a) (i) Modal class = 70 - 74 — B1√ model class
(ii) Median class = 70 - 74 — B1√ median

(b) Mean = $\frac{3809}{60}$ — M1
= 63.48 — A1

S1√ scale
B1 √ blocks
59.5 - 64.5
64.5 - 69.5 e.t.c.
8

(c)

Histogram



23. (a) XA = a, YA = 10 - a, YB = 10 - a, CZ = 10 - a = ZB
YZ = 10 - a + 12 - a = 8 — M1
2a = 14
a = 7 cm — A1
Cos X = $\frac{100 + 144 - 64}{240}$ — M1√ any angle of the Δ

$= 0.75$

$X = 41.41^0$

$^1/_2 X = 20.70^0$ — A1√ $^1/_2$ of the angle

$r = OA = 7\tan 20.7$ — B1 √ radius

$= 2.645$ cm

Shaded area $= {}^1/_2 X\ 10\ X\ 12 \sin 41.41 - {}^{22}/_7 X\ 2.645^2$ — M1 √ Δ & circle

$= 39.69 - 21.99$

$= 17.7\ cm^2$ — A1√

8

24. (a) $650{,}000\ (0.85)^n = 130{,}000$ — M1√ formula

$1.15n = 0.2$

$n = \dfrac{\log 0.2}{\log 0.85}$ — M1√

$= \dfrac{1.3010}{1.9294}$

$= \dfrac{-0.6990}{-0.0706}$ — M1

$= 9.9$ years — A1

(b) $650{,}000\ (1 - {}^r/_{100})^5 = 325{,}000$ — M1

$(1 - {}^r/_{100})^5 = 0.5$

$1 - {}^r/_{100} = 0.5^{1/5}$ — M1

$= 0.8706$

${}^r/_{100} = 0.1294$ — A1

$r = 12.9\ \%$ — B1

8

MATHEMATICS I
PART II
MARKING SCHEME

SECTION I (50 MARKS)

1. $= \left(\dfrac{b^{15}}{32a^{10}}\right)^{2}/_{5} \quad X \quad \left(\dfrac{4a^6}{9b^4}\right)^{3}/_{2}$ — M1√ reciprocal

$= \left(\dfrac{2a^5}{27}\right)$ — A1

2

2.

No.	Log.
0.375	1.5740 +
cos 75	1.4130
	2.9870 _
tan 85.6	1.1138
3.8732 = 4 + 1.8732	
2 2	
	2.9366
	0.0864

3. S. Price = $\frac{80}{100}$ X 600

= Shs.480 B1

Cost Price = x

$\frac{96x}{100}$ = 480 M1

x = Shs.500 A1

3

4. $r^2 + hr = {}^{A}/_{2\pi}$ M1

$r^2 + hr + ({}^{h}/_{2})^2 = {}^{A}/_{2A} + {}^{h}/_{4}$ M1

$(r + {}^{h}/_{2})^2 = \sqrt{\frac{2A + h^2}{4\pi}}$ M1

$r = {}^{-h}/_{2} \pm \sqrt{\frac{2A + h^2}{4\pi}}$ A1

4

5. $(1{}^{2}/_{3}r)\ ({}^{1}/_{3}\ r) = ({}^{1}/_{4}\ r)\ (5)$ M1

$4r^2 - qr = 0$

$r(4r - q) = 0$ M1

r = 0

or r = 2.25 A1

3

6. $= \frac{2\ (5 + 2\sqrt{3}) - 1\ (5 - 2\sqrt{3})}{(5 - 2\sqrt{3})\ (5 + 2\sqrt{3})}$ M1

$= \frac{10 + 4\sqrt{3} - 5 + 2\sqrt{3}}{13}$ M1

$= \frac{5 + 6\sqrt{3}}{13}$ A1

3

7. $P = Kq^2 + c$

$6 = 4k + c$

$16 = 9k + c$ M1 √ subtraction

$5k = 10$

$k = 2$

$c = -2$ A1 √ k and c

$P = 64 \quad 2q^2 = 66$

$q = \sqrt{33}$

$= \pm 5.745$ A1

4

8. Volume = ${}^{1}/_{2}$ X 8 X 8 sin 120 X 10 M1 √ area of x-section

No. of scouts = $\frac{32 \sin 60 \text{ X } 10}{2.5}$ *M1 √volume*

M1

= 110.8

= 110 A1

3

9. Max. error = $\frac{2(8.5 + 5.5) - 2(7.5 + 4.5)}{2}$

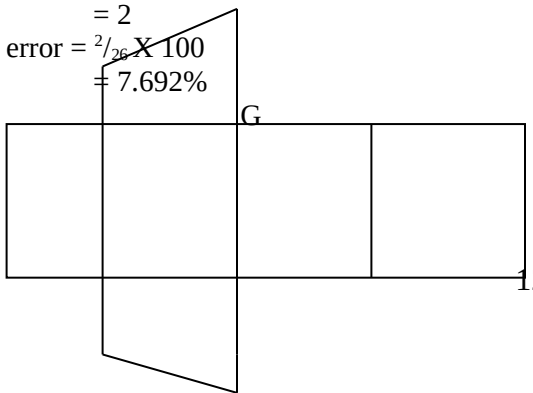
= 2 B1

% error = ${}^{2}/_{26}$ X 100 M1

= 7.692% A1

3

10.



B1 √ net

H D G H B1 √ dimen. FE must be 10cm

4cm 4cm

B1 √ labelling

E 4cm A 12cm F 10cm E 3

4cm 12cm

E

F

11. $(1 + 2x)^6 = 1 + 6(2x) + 15 (2x)^2$ M1

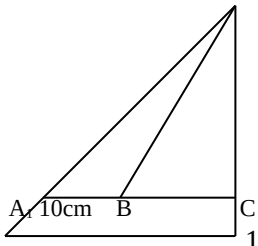
$= 1 + 12x + 60x^2$ A1

$(1.04)^6 = (1 + 2(0.02))^6$

$= 1 + 12 (0.02) + 60(0.02)^2$ M1

$= 1.264$ A1

4

12. 

1-5

BT = 10 cm B1

CT = 10 sin 40 M1

= 6.428 m A1

h = 6.428 + 1.5

= 7.928 B1

4

13. A.S.F = $\left(\frac{405}{960}\right)^{2/3} = \left(\frac{27}{64}\right)^{2/3} = \frac{9}{10}$ B1

smaller area = $\frac{29}{164}$ X 120 M1

= 67.5 cm^2 A1

3

14. Relative speed = (x - 30)km/h B1

2 km = 2 hrs

(x - 30)km/h 60 M1

2x - 60 = 120

x = 90 km/h A1

3

15.

16 Km/h	5 Km/hr
x Km	(22 - x) Km

$\frac{x}{16} + \frac{22 - x}{5} = \frac{11}{4}$ M1

5x + 352 - 16x = 220 M1√ x-multiplication

11x = 132

x = 12 km A1

3

16. AP = $^2/_9$ x 12 = $2^2/_3$ cm B1 √ both AP & AQ

AQ = $^5/_9$ x 12 = $6^2/_3$ cm

∴ PQ = $6^2/_3 - 2^2/_3 = 4$ cm B1 √ C.A.O

2

17. Taxable income = $^{115}/_{100}$ x 8000 M1

= Shs.9200 p. m

= Shs.110,400 p.a A1

Tax dues = $^{10}/_{100}$ x 39600 + $^{15}/_{100}$ x 39600 + $^{25}/_{100}$ x 31200 — M1 √ first 2 slabs

= 3960 + 5940 + 7800 — M1 √ last slab

= Shs.17,700 p.a

= 1475 p.m — A1

net tax = 1475 - 400

= Shs.1075 — B1 √ net tax

Total deductions = 1075 + 130

= Shs.1205

net income = 8000 - 1205 — M1

= Shs.6795 — A1

8

18.

(a) P (all correct) = $^{2}/_{3}$ x $^{3}/_{5}$ x $^{2}/_{5}$ — M1

= $^{12}/_{125}$ — A1

(b) P (2 correct) = $^{2}/_{5}$ x $^{3}/_{5}$ x $^{3}/_{5}$ + $^{2}/_{5}$ x $^{2}/_{5}$ X $^{1}/_{5}$ + $^{3}/_{5}$ x $^{4}/_{5}$ x $^{2}/_{5}$

M1

= $^{18}/_{125}$ + $^{4}/_{125}$ + $^{24}/_{125}$ — M1

= $^{46}/_{125}$ — A1

(c) P (at least 2 correct)

= P(2 correct or 3 correct)

= $^{46}/_{125}$ + $^{12}/_{125}$ — M1

= $\frac{46 + 12}{125}$ — M1

= $\frac{58}{125}$ — A1

8

19. Old price/pen = $\frac{440}{x}$

New price/pen = $\frac{494}{x + 3}$ — B1√both expressions

$\frac{440}{x} - \frac{494}{x + 3} = 1.50$ — M1 √ expression

$440(x + 3) - 494x = 1.5x^2 + 4.5x$ — M1√ x-multiplication

$x^2 + 39x - 880 = 0$ — A1 √ solvable quad. Eqn

$x^2 + 55x - 16x - 880 = 0$ — M1 √ factors or equivalent

(x - 16) (x + 55) = 0

x = -55

or x = 16 — A1 √ both values

∴ x = 16

difference in purchase = 19 X 1.50 — M1

= Shs.28.50 — A1

8

20. (a) OP = a + $^{1}/_{4}$ (b - a) — M1

= $^{3}/_{4}$ a + $^{1}/_{4}$ b — A1

(b) PQ = PO + OQ

= -$^{3}/_{4}$ a - $^{1}/_{4}$ b + $^{1}/_{4}$ (a - b) — M1

= -$^{1}/_{2}$ a - $^{1}/_{2}$ b — A1

(c) QN = QO + ON

= $^{1}/_{4}$ (b - a) + $^{5}/_{3}$ b — M1

= $^{23}/_{12}$ b - $^{1}/_{4}$ a — A1

(d) PN = PB + BN

$= {}^{3}/_{4}(b - a) + {}^{2}/_{3}\, b$ M1

$= {}^{17}/_{12}\, b - {}^{3}/_{4}\, a$ A1

8

21. (a) Volume in 2 days = $\frac{22}{7} \times \frac{3.5}{2} \times \frac{3.5}{2} \times \frac{150 \times 20 \times 3600}{1{,}000{,}000}$ M1 √ area of x-section

M1 √ volume in cm^3

$= 103.95\ m^3$ M1 √ volume in m^3

(b) $\frac{22}{7} \times r^2 \times 8 = \frac{103.95 \times 15}{2} \times 7$ M1

5

$r^2 = \frac{103.95 \times 15 \times 7}{2 \times 2 \times 8}$ M1

$= 31.01$ M1

$r = 5.568$ m A1

8

22. (a) Ration of needs for A:B = 5:8

A's share $= {}^{5}/_{13} \times 16.9 + {}^{1}/_{2} \times 13.5$ M1

$= 13.25$ Million A1

B's share = (13.5 + 16.9) - 13.25 M1

= 13.25 M1

(a) A's share $= {}^{5}/_{13} \times 16.9 + {}^{39}/_{50} \times 13.5$

6.5 + 10.53

= 17.03 m A1

B's share = 30.4 - 17.03 M1

= 13.37 Million A1

8

23. Log V = n Log E = log k

Log V	-0.46	-0.13	-0.14	-0.01	0.05
Log E	-0.35	-0.21	-0.05	0.07	0.13

B1√ log V all points

B1√ log E all points

S1 √ scale

P1√ plotting

Log V = n log E + log K L1 √ line

Log K = 0.08

K = 1.2 ± 0.01 B1 √ K

$N = {}^{0.06}/_{0.06}$ B1 √ n

$= \underline{1 \pm 0.1}$

∴ v = 1.2E B1√ v

when E = 0.75, V = 0.9 ± 0.1 8

24. (a) $T\begin{pmatrix}3\\4\end{pmatrix} PQR \rightarrow P^{I}Q^{I}R^{I}$

P^{I} (0,5), Q^{I} (2,2) R^{I} (1,0)

$P^{I}\ Q^{I}\ R^{I} \qquad P^{II}\ Q^{II}\ R^{II}$

(b) $\begin{pmatrix}4 & 3\\1 & 2\end{pmatrix}\begin{pmatrix}0 & 2 & 1\\5 & 2 & 0\end{pmatrix} = \begin{pmatrix}15 & 14 & 4\\10 & 6 & 1\end{pmatrix}$ M1 √

A1 √

P^{II} (15,10), Q^{II} (14,6), R^{II} (4,1) B1√

(c) Area s.f = det M

= 5

area of $P^{II}\ Q^{II}\ R^{II}$ = 5 (area $P^{I}Q^{I}R^{I}$)

= 5 X 3.5 M1√

$= 16.5\ cm^2$ A1

8

MATHEMATICS 2
PART I

SECTION A:

1. Use logarithm tables to evaluate (4 mks)

$$\frac{0.0368 \times 43.92}{361.8}$$

2. Solve for x by completing the square (3mks)
$2x^2 - 5x + 1 = 0$

3. Shs. 6000 is deposited at compound interest rate of 13%. The same amount is deposited at 15% simple interest. Find which amount is more and by how much after 2 years in the bank (3mks)

4. The cost of 3 plates and 4 cups is Shs. 380. 4 plates and 5 cups cost Shs. 110 more than this. Find the cost of each item. (3mks)

5. A glass of juice of 200 ml content is such that the ratio of undiluted juice to water is 1: 7 Find how many diluted glasses can be made from a container with 3 litres undiluted juice (3mks)

6. Find the value of θ within $\theta < \theta < 360^O$ if $\cos(2\theta + 120) = \frac{\sqrt{3}}{2}$ (3mks)

7. A quantity P varies inversely as Q^2 Given that $P = \frac{4}{a}$ When Q = 2. , write the equation joining P and Q hence find P when Q = 4 (3mks)

8. A rectangle measures 3.6 cm by 2.8 cm. Find the percentage error in calculating its perimeter. (3mks)

9. Evaluate: $\dfrac{11/6 \times ¾ - 11/12}{½ \text{ of } 5/6}$ (3mks)

10. A metal rod, cylindrical in shape has a radius of 4 cm and length of 14 cm. It is melted down and recast into small cubes of 2 cm length. Find how many such cubes are obtained (3mks)

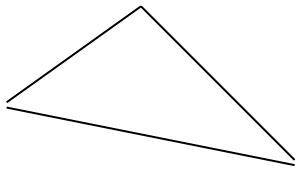
11. A regular octagon has sides of 8 cm. Calculate its area to 3 s.f. (4mks)

12. Find the values of x and y if (2 mks)

$$\begin{matrix} 3 & x & 1 \\ 2 & 1 & -1 \end{matrix} = \begin{matrix} 2 \\ y \end{matrix}$$

13. An equation of a circle is given by $x^2 + y^2 – 6x + 8y – 11 = 0$ (3mks)
Find its centre and radius

14. In the figure given AB is parallel to DE. Find the value of x and y



15. A line pass through A (4,3) and B(8,13). Find (6 mks)
    (i) Gradient of the line
    (ii) The magnitude of AB
    (iii) The equation of the perpendicular bisector of AB.

16. A train is moving towards a town with a velocity of 10 m/s. It gains speed and the velocity becomes 34 m/s after 10 minutes . Find its acceleration (2mks)

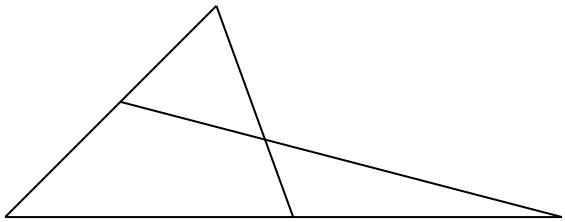
SECTION B:

17. Construct without using a protractor the triangle ABC so that BC=10cm, angle ABC = 60^0 and BCA = 45^0
    a. On the diagram , measure length of AC
    b. Draw the circumference of triangle ABC
    c. Construct the locus of a set of points which are equidistant from A and B.
    d. Hence mark a point P such that APB = 45^0 and AP = PB
    e. Mark a point Q such that angle AQB = 45^0 and AB = AQ

18. (a) A quadrilateral ABCD has vertices A(0,2) , B(4,0) , C(6,4) and D(2,3). This is given a transformation by the matrix $\begin{matrix} -2 & 0 \\ 0 & -2 \end{matrix}$ to obtain its image $A^I B^I C^I D^I$. under a second transformation which has a rotation centre (0,0) through -90^0 , the image A^{II} B^{II} C^{II} D^{II} of A^I B^I C^I D^I is obtained. Plot the three figures on a cartesian plane (6mks)

    (b) Find the matrix of transformation that maps the triangle ABC where A (2,2) B (3,4) C (5,2) onto A B C where A(6,10) B (10,19) C (12, 13). (2mks)

19.



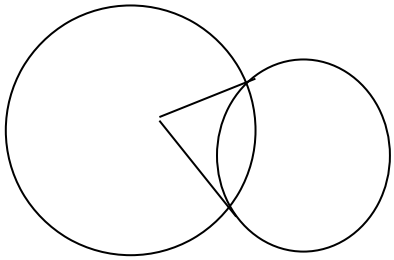
In the triangle OAB, OA = 3a , OB = 4b and OC = 5/3 OA. M divides OB in the ratio 5:3

a. Express AB and MC in terms of a and b
b. By writing MN in two ways, find the ratio in which N divides
    i. AB
    ii. MC

20. In the figure below, SP = 13.2 cm, PQ = 12 cm, angle PSR = 80° and angle PQR = 90^{0}. S and Q are the centres (8mks)

Calculate:

The area of the intersection of the two circles
The area of the quadrilateral S P Q R
The area of the shaded region



21. In an experiment the two quantities x and y were observed and results tabled as below

X	0	4	8	12	16	20
Y	1.0	0.64	0.5	0.42	0.34	0.28

a. By plotting 1/y against x, confirm that y is related to x by an equation of the form

$$Y = \frac{q}{P + x}$$

where p and q are constants. (3mks)

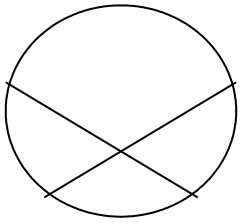
(b) Use your graph to determine p and q (3mks)

(c) Estimate the value of (i) y when x = 14
(ii) x when y = 0.46 (2mks)

22. A racing cyclist completes the uphill section of a mountain course of 75 km at an average speed of v km/hr. He then returns downhill along the same route at an average speed of (v + 20) km/hr. Given that the difference between the times is one hour, form and solve an equation in v.
Hence
a. Find the times taken to complete the uphill and downhill sections of the course.
b. Calculate the cyclists average speed over the 150km.

23. In the diagram below, X is the point of intersection of the chords AC and BD of a circle. AX = 8 cm, XC = 4cm and XD = 6 cm
a. Find the length of XB as a fraction
b. Show that XAD is similar to XBC
c. Given that the area of AXD = $6cm^2$, find the area of BXC
d. Find the value of the ratio

$$\frac{\text{Area of AXB}}{\text{Area of DXC}}$$



24. A town B is 55 km on a bearing of 050^0. A third town C lies 75km due south of B. Given that D lies on a bearing of 255^0 from C and 170^0 from A, make an accurate scale drawing to show the positions of the four towns. (3mks)

(scale 1cm rep 10 km)

From this find,

(a) The distance of AD and DC in km (2mks)

(b) The distance and bearing of B from D (2mks)

(c) The bearing of C from A (1mk)

MATHEMATICS 2
PART 1
MARKING SCHEME (100MKS)

1.

No.	Log
0.3681	2.5660
0.3682	1.6427 +
	0.2087
361.8	2.5585
	3.6502

= 3.6502

-4 = $\frac{1.6502}{2}$ = 2.8251

Logs

+ - v ans (4) 6.6850×10^{-2}

= 0.06685

2. $2x^2 - 5x + 1 = 0$

$x^2 - \frac{5}{2}x + \frac{1}{2} = 0$

$x^2 - \frac{5}{2}x = -\frac{1}{2}$

$x - \frac{5x}{2} + \left(\frac{-5}{4}\right)^2 = -\frac{1}{2} + \left(\frac{-5}{4}\right)^2$ (m)

$= x - \frac{5}{4} = -\frac{1}{2} + \frac{25}{16} = \frac{17}{16}$ (3)

$= x - 5/4 = 17/16 = 1.0625$

$x - 5/4 \pm 1.031$

$X_1 = -1.031 = 1.25 = 0.2192$

$X_2 = 1.031 + 1.25 = 1.281$

3. $A_1 = P(1 + R/100)^2 = 6000 \times 113/100 \times 113/100 = \text{Sh. } 7661.40$

$A_2 = P + PRT/100 = \frac{6000 + 15 \times 2}{100} = 6000 + 1800$

= Shs. 7800

Amount by simple interest is more by Shs. (7800 – 7661. 40)

Shs. 138.60

4. Let a plate be p and a cup c.

$3p + 4c = 380 \times 5 \quad 15p + 20c = 1900$

$4p + 5c = 490 \times 4 \quad 16p + 20c = 1960$

$-p \quad -60$ (m)

p = Shs 60

3(60) + 4 c = 380
4c = 380 –180 = 2000 (3)
c= Shs. 50

Plate = Shs. 60 , Cup = Shs. 50 (A both)

5. Ratio of juice to water = 1 : 7
In 1 glass = 1/8 x 200 = Sh 25
3 litres = 300 ml (undiluted concentrate) (3)
No. of glasses =v $\frac{3000}{25}$ = 120 glasses

6. Cos (2 θ + 120) = 3/2 = 0.866
Cos 30 , 330, 390, 690, 750 ….
2 θ + 120 = 330
2 θ = 210 , $= 105^0$ (3)
2 θ = 390 – 120 $= 270^0$, θ_2 135^0
2 θ = 690 – 120 $= 570^0$, θ_3 285^0 (for 4 ans)
$\theta_4 = 315^o$ (for >2)
2 θ = 750 – 120 $= 630^0$,

7. P = $\frac{k}{Q^2}$ $\frac{4}{9}$ = K/4 (substitution)
K = $\frac{4 \text{ X } 4}{9}$ = $\frac{16}{9}$
P = $\frac{16}{9Q^2}$ v when Q = 4

P = $\frac{16}{9x4x4}$ = 1/9 (A) (3)

8. The perimeter = (3.6 + 2.8) x 2 = 12.8 cm
Max perimeter = (3.65 + 2.85) x 2 = 23 cm Expressions
% error = $\frac{13 - 12.8}{12.8}$ x 100 **m** = $\frac{0.2}{12.8}$ x 100 (3)
= 1.5620% (A)

9. $\frac{1\ 1/6 \text{ x } ¾ - 11/12}{½ \text{ of } 5/6} = \frac{(7/6 \text{ x } ¾) - 11/12}{½ \text{ of } 5/6} = \frac{7/8 - 11/12}{5/12} = \frac{21-22}{5/12}$
$= \frac{-1/24}{5/12} = \frac{-1}{24} \text{ x } \frac{12}{5} = \frac{-1}{10}$ (3)

10. Volume of rod = $\Pi r^2 h$ = 22/7 x 4 x 14 = $704cm^3$ **(m)**
Volume of each cube = 2x2x2 = $8\ cm^3$ A

No. of cubes = 704 /8 = $88\ cm^3$ A

11. $< AOB = \frac{360}{8} = 45^0$

Tan $67.5 = \frac{h}{4}$

$h = 4 \times 2.414$ A

$= 9.650$cm

Area of 1 triangle = ½ x 8 x 9.656 x 8 cm = 38.628 x 8 vm

Octagon area = 38.628 x 8 m

$= 309.0\ cm^2$ (A)

12. $\begin{matrix} 3 & 2 \\ 2 & 1 \end{matrix} \quad \begin{matrix} -1 \\ -1 \end{matrix} \quad \begin{matrix} 2 \\ y \end{matrix}$

=

$3 - x = 2$ (1) $x = 1$ (2)

$2 - 1 = y$ $y = 1$ (A)

13. $x^2 + y^2 - 6x + 8y - 11 = 0$

$x^2 - 6x + (-3)^2 + y^2 + 8y + (4)^2 = 11 + (-3)^2 + (4)^2$ (completing the square)

$(x - 3)^2 + (y+4)^2 = 11 + 9 + 16 = 36$

$(x - 3)^2 + (y + 4)^2 = 6^2$

Centre is (3, -4)

Radius = 6 units As (3)

14.

Figs A C B and D C E are similar

$\frac{AB}{DE} = \frac{AC}{DC}$ = and $\frac{AB}{DE} = \frac{BC}{CE}$

$\frac{10}{3} = \frac{6 + x}{6}$

$= \frac{10}{3} = \frac{15 + y}{y}$, m

$10y = 15 + 3y$

$60 = 18 + 3x$

$3x = 42$

7y = 15 x = 14

y = 15/7 (A) (3)
A (4 , 3) B(8,13)

15. (i) gdt = $\frac{\text{change in y}}{\text{change in x}} = \frac{13-3}{8-4} = \frac{10}{4} = \frac{5}{2}$

(ii) Mag AB = $\begin{matrix} 8 & -4 & 4 \\ 13 & -3 & 10 \end{matrix}$ =

Length = $\sqrt{4^2 + 10^2} = \sqrt{116} = 10.77$ units

(iii) Mid point = $\frac{4+8}{2}, \frac{3+3}{2}$

= (6, 8) (mid point) (5 mks)

gdt of perpendicular to AB = -ve rec. of 5/2

-2/5

Eqn is y = -2/5 x + c

8 = -2/5 x 6 + c = 40 = -12 + 5c

= c = 52/5

y = -2/5 x + 52/5 (A)

16. Acceleration = $\frac{\text{Change in velocity}}{\text{Time}}$

= $\frac{(34 - 10) \text{ m/s}}{60 \times 10}$ = $\frac{24 \text{ m/s}}{600}$

= 0.04m/s_{2-} (2)

17.

Triangle (8)
AC = 9cm
Circumference Centre
Circle
Perpendicular bisector of AB
P
Q

18. (b)

a	b	2	3	5	6	10	12
c	d	2	4	2	10	19	13

2a +2b = 6 x 2 = 49 + 4b = 12
3a + 4b = 10 3a + 4b = 10
a = 2 4 + 2b = b

2c + 2d = 10x2 = 4c + 4d = 20 2 b = 2 b = 1
3c + 4d = 19 3c + 4d = 19

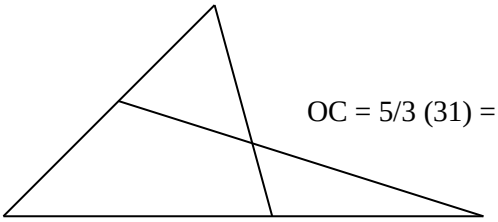
c = 1

2 (1) + 2d = 10

2d = 8 Matrix is 2 1 (A)

d = 4 1 4

19.



OC = 5/3 (31) = 5A

(a) = AO + OB MC = MO + OC

= -3a = 4b = -5/8 (4b) + 5

= 5A – 5/2 b

(b) MN = 5 Mc = 3(5a – 5/2 b)

= 5 s a – 5/2 s b

MN = BN + BN

= 3/8 (4 b) + (1 – t) (-BA)

= 3/8 (4 b) + (1 – t)(3a – 4 b)

= 3/2 b + 3 ta –4b + 4tb

= (3-3t) a (4t – 5/2)b

MN = MN

= 5 s a – 5/2 sb = (3-3t)a + (4t – 5/2)b

= 5 a = 3 – 3t = 5s + 3t =3

= -5/2 s = 4t –5/2 v 5s + 8t = 5

-5t = -2t = 2/5

5 s = 3 – 3(2/5)

= 3 – 6/5 = 9/5

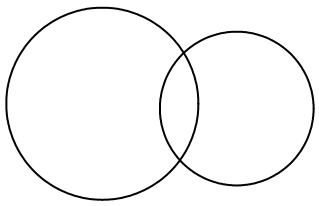
= 3 – 6/5 = 9/5

s = 9/25

(i) AN : NB = 2 : 3

(ii) MN : 9 : 16

20.



$\frac{\theta \times \pi r^2}{360}$

a. Area of sector SPR = 80/360 x 13.2 x 13.2 x 3.142

= 121.6

Area of triangle SPR ½ x 13.2 x 13.2 x sin 80

$= 85.8\ cm^2$

(m of area of) A (*at least one*)

(m of area) A(*at least one)*

Area of segment = 121.6 – 85.8

$= 35.8\ cm^2$

Area of sector QPR = 90/360 x 3.142 x 12 x12

Area of PQR = ½ x 12 x 12 = 72^2

Area of segment = 113.1 – 72

$= 41.1 cm^2$

Area of intersection = (35.8 + 41.1) = $76.9\ cm^2$

b). Area of quadrilateral = Area of PQR + SPR

$= 85.8 + 72 = 157.8 cm^2$

Area of shaded region = Area of Quadrilateral – Area of sector SPR

$= 157.8 – 121.6$

$= 36.2\ cm^2$

21. $y = \frac{q}{p + x}$ $\quad p + x = \frac{q}{y}$ $\quad \frac{1}{y} = \frac{x}{q} + \frac{p}{q}$

Gradient = 1/q at (0, 0.95) (8,2.0) (8,2.0) gradient = $\frac{2.0 – 0.95}{8} = \frac{1.05}{8}$

$\frac{1}{q} = 0.1312$

$q = \frac{1}{0.1312} = 7.619$

$q = 7.62.$

y(1/y) Intercept $\frac{p}{q} = 0.95$ $\quad \frac{P}{7.62} = 0.95$

$p = 7.62 \times 095 = 7.27$

at x = 14, y = 2.7

at y = 0.46, 1/y = 2.174

x = 9.6.

22. a) Distance = 75km uphill speed = vkm/h

uphill Time = 75/v hrs

Downhill speed = (+ 20) km/h

Downhill Time = $\frac{75}{v + 20}$ hrs.

Takes larger uphill

$\frac{75}{v} - \frac{75}{v+20} = 1$

$\frac{75(v+20) – 75v}{v(v + 20)} = \frac{1}{1}$

$75v + 1500 – 75v = v(v + 20) = v^2 + 20v.$

$v^2 + 20v - 1500 = 0$

$$v = -\frac{20 + 20^2 - 4(1)(-1500)}{2(1)}$$

$$v = -\frac{-20 + 400 + 6000}{2} = -\frac{-20 + v6400}{2.}$$

$V_1 = -\frac{20 + 80}{2} = 30\text{km/hr}$

$V_2 = -\frac{20 - 80}{2}$ X impossible

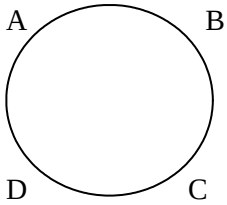
speed uphill = 30 km /hr, $T = \frac{75}{30}$ time = 2 ½ hrs

speed downhill = 50 km /hr Time = $\frac{75}{50}$ Time = 2 ½ hr

Average speed = $\frac{\text{Total distance}}{\text{Total time}} = \frac{150\text{km}}{4\text{hrs}} = \frac{37.5\text{ km/ hr}}{}$

X	0	4	8	12	16	20
Y	1.0	0.64	0.5	0.42	0.34	0.28
1/y	1.0	1.56	2.0	2.38	2.94	3.57

23.



A x X x C = BX . XD

8 x 4 = 6BX

$BX = \frac{8 \times 14^2}{6} = \frac{16}{3}$

X AD = XBC

$\frac{XA}{XB} = \frac{8}{16} = \frac{24}{16} = \frac{3}{2}$

$\frac{XD}{XC} = \frac{6}{4} = \frac{3}{2}$

< AXD = BXC (vertically opposite $<_s$)

SAS holds : they are similar.

LSF = 3/2 ASF = $(3/2)^2$ = 9/4

Area A x A = $6cm_2$ Area B x C = $6 \times \frac{9}{4} = 27 = \underline{13.5cm^2}$

24.

a) AD = 50km
DC = 35km
BD = 90km
Bearing is 020^0
Bearing is 134° (8mks)

MATHEMATICS I
PART II

SECTION (52 MARKS)

1. Without using tables, simplify
$$\frac{1.43 \times 0.091 \times 5.04}{2.86 \times 2.8 \times 11.7}$$ (3mks)

2. Make x the subject of the formula if
$y = a/x + bx$ (3mks)

3. Give the combined solution for the range of x values satisfying the inequality
$2x + 1 < 10 - x < 6x - 1$ (3mks)

4. A man is employed at a KShs. 4000 salary and a 10% annual increment. Find the total amount of money received in the first five years (4mks)

5. A town A is 56 km from B on a bearing 062^0. A third town C is 64 km from B on the bearing of 140°. Find
(i) The distance of A to C (2mks)
(ii) The bearing of A from C (3mks)

6. Expand $(x + y)^6$ hence evaluate (1.02) to 3d.p. (3mks)

7. Rationalise the denominator in (2mks)
$$\frac{\sqrt{3}}{1 - v3}$$

8. The table below shows daily sales of sodas in a canteen for 10 days.

Day	1	2	3	4	5	6	7	8	9	10
No. of	52	41	43	48	40	38	36	40	44	45

Calculate the 4 day moving averages for the data (3mks)

9. Find the image of the line $y = 3x = 4$ under the transformation whose matrix is.
3mks

2 1

-1 2

10. Three points are such that A (4 , 8), B(8,7), C (16, 5). Show that the three points are collinear (3mks)

11. Write down the inverse of the matrix $\begin{matrix} 2 & -3 \\ 4 & 3 \end{matrix}$ hence solve for x and y if

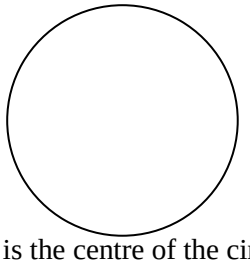
$2x - 3y = 7$

$4x + 3y + 5$ (3mks)

12. Use the table reciprocals to evaluate to 3 s.f. 3mks

$1/7 + 3/12 + 7/0.103$

13.



Given that O is the centre of the circle and OA is parallel to CB, and that angle ABC = 107^0, find

(i) Angles AOC, (ii) OCB (iii) OAB (3mks)

14. Two points A and B are 1000m apart on level ground, a fixed distance from the foot of a hill. If the angles of elevation of the hill top from A and B are 60° and 30° respectively, find the height of the hill (4 mks)

15. Two matatus on a dual carriageway are moving towards a bus stop and are on level 5 km from the stop. One is travelling 20 km/hr faster than the other, and arrives 30 seconds earlier. Calculate their speeds. (5mks)

16. If log x = a and log y = b, express in terms of a and b

$\text{Log } \frac{x^3}{VY}$ (2mks)

SECTION B:

17. The table below gives the performance of students in a test in percentage score.

Marks	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79
No. of Students	2	4	7	19	26	15	12	5

Using an assumed mean of 44.5, calculate

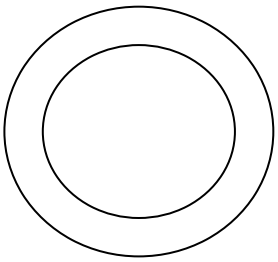
a. The mean
b. The standard deviation
c. Find the median mark

18. Draw the graph of $y = 2x^2 - x - 4$ for the range of $x \ -3 = x = 3$. From your graph State the minimum co-ordinates

b. Solve the equations

i. $2x^2 - x - 4 = 0$

ii. $2x^2 - 3x - 4 = 0$

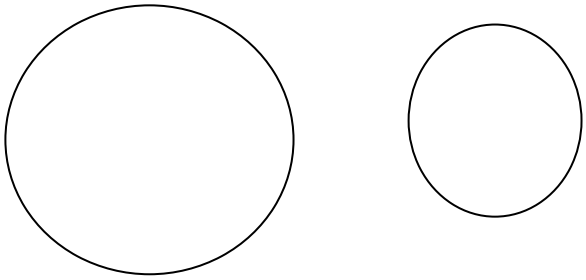


19.

a. Two concentric circles are such that the larger one has a radius of 6cm and the smaller one radius of 4 cm. Find the probability that an item dropped lands on the shaded region 4mks

b. Two unbiased dice are thrown. Find the probability of obtaining (4mks)
   i. A product of 6
   ii. A sum of 8
   iii. The same number showing (4mks)

20.



Two pulley wheels centers A and B are joined by a rubber band C D E F G H C round them. Given that larger wheel has radius of 12 cm and AB = 20 cm, CD and GF are tangents common to both wheels and that CBA = 60°), Find

i. BD (Length)
ii. CD
iii. Arc length CHG and DEF, hence find the length of the rubber.

21. V A B C D is a right pyramid with a square base A B C D of side 5 cm. Each of its four triangular faces is inclined at 75^0 to the base. Calculate

a. The perpendicular height of the pyramid
b. The length of the slant edge VA
c. The angle between edge VA and base A B C D
d. The area of the face VAB

22. Plot the graphs of $y = \sin x^o$ and $y = \cos 2x^o$ on the same axes for $-180 \leq x \leq 180^o$.
Use your graphs to solve the equation $2 \sin x = \cos 2x$

23. The depth of the water in a rectangular swimming pool increases uniformly from 1M at the shallow end to 3.5m at the deep end. The pool is 25m long and 12m wide. Calculate the volume of the pool in cubic meters.
The pool is emptied by a cylindrical pipe of internal radius 9cm. The water flows through the pipe at speed of 3 metres per second. Calculate the number of litres emptied from the pool in two minutes to the nearest 10 litres. (Take II = 3.142)

24. A rectangle A B C D is such that A and C lie on the line y = 3x. The images of B and D under a reflection in the line y = x are B^1 (-1, -3) and D^1 (1,3) respectively.

a. Draw on a cartesian plane, the line y = x and mark points B^1 and D^1
b. Mark the points B and D before reflection
c. Draw the line y = 3x hence mark the points A and C to complete and draw the rectangle ABCD. State its co-ordinates, and these of A^1 and C^1.
d. Find the image of D under a rotation, through - 90^0, Center the origin.

MATHEMATICS I
PART II
MARKING SCHEME.

1. $\frac{1.43 \times 0.091 \times 5.04}{2.86 \times 2.8 \times 11.7} \times \frac{100000}{10^5} \quad \frac{91 \times 504}{2 \times 28 \times 117 \times 10^3} = 7/10^3$

(3)

$= 0.007(A)$

2. $y = a/x + bx \quad yx = a + bx^2$

Either

$bx^2 - yx + a = 0$

$x = \frac{y \pm \sqrt{y^2 - 4ab}}{2b}$ (3)

3. $2x + 1 \leq 10 - x \leq bx - 1$

$2x + 1 \leq 10 - x \qquad 10 - x \leq 6x - 1$

$3x \leq 9 \qquad 11 \leq 7x$

$x \leq 3 \qquad x \leq 11/7$ (3)

$11/7 \leq x \leq 3$

4. $a = 4000 \quad r = 110/100 = 1.1$ (4000, 4000 + 4000, 4400 + 0/100 (4400------)

(a and r)

$Sn = \frac{a(r^n - 1)}{R - 1}$

1.1 Log = 0.04139

X 5

0.20695

0.1 (4)

$= \frac{4000 (1.1^5 - 1)}{1.1 - 1}$ (any) $\qquad \frac{4000 (1.6 - 1)}{0.1}$

0.1

$A = \frac{4000 (0.6105)}{0.1}$

$= \text{Sh. } \frac{2442}{0.1} = \text{Sh. } 24{,}420$ (A) (4)

5. (i) $b^2 = a^2 + b^2 - 2ab \cos B$

$= 64^2 + 56^2 - 2(64)(56) \cos 78$

$= 4096 + 3136 - 7168 (0.2079)$

$= 7232 - km\ 1490.3$

$b^2 = 5741.7 = 5.77$ km **(5)**

(ii) $\frac{b}{\sin B} \quad \frac{a}{\sin A}$

$\frac{75.77}{\sin 78} = \frac{64}{\sin A} \qquad \sin A = \frac{64 \times 0.9781}{75.77}$

$\sin A = 0.08262$

$A = 55.7^0$ (or $B = 46.3^0$)

Bearing = 90 – 28 – 55.7

$= 0.06.3^0$ (A)

6. $(x + y)^6 = 1(x)^6(y)^0 + 6(x)^5(y)^1 + 15(x)^4(y)^2 + 20x^3y^3 + 15x^2y^4 + 6xy^5 + y^6$

$(1.02)^6 = (1 + 0.02)^6$ x = 1

y = 0.02

$(1.02)^6 = 1 + 6(0.02) + 15(0.02)^2 + 15(0.02) + 20(0.02)^3 + 15(0.02)^4$

$= 1 + 0.12 + 0.006 + 0.00016$

= 1.12616

= 1.126 (to 3 d.p) (3)

7. $\frac{3(1 + \sqrt{3})}{(1 - \sqrt{3})(1 + \sqrt{3})} = \frac{3 + \sqrt{3}}{1 - 3} \quad \frac{3 + \sqrt{3}}{2}$

9. Moving averages of order 4

$M_1 = \frac{52 + 41 + 43 + 48}{4} \quad \frac{184}{4} = 146$

$M_2 = \frac{184 - 52 + 40}{4} = \frac{172}{4} = 43$ for 7

for > 4

$M_3 = \frac{172 - 40 + 38}{4} = \frac{170}{4} = 42.5$

$M_4 = \frac{170 - 38 + 36}{4} = \frac{168}{4} = 42$

$M_5 = \frac{168 - 36 + 40}{4} = \frac{173}{4} = 43$ **(3)**

$M_6 = \frac{172 - 40 + 44}{4} = \frac{176}{4} = 44$

$M_7 = \frac{176 - 44 + 45}{4} = \frac{177}{4} = 44.25$

9. y = 3x + 4

A(0,4) B (1,7) Object points

A	B	A	B		
2	1	0	1	4	9
			=		
-1	2	4	7	8	13

Y = Mx + C

$M = \frac{13 - 8}{9 - 4} = \frac{5}{5} = 1$

y = x+c y = x + 4

8 = 4 + c c = 4

10. $AB = \begin{matrix} 8 & -4 \\ 7 & -8 \end{matrix} = \begin{matrix} 4 \\ -1 \end{matrix}$ $BC = \begin{matrix} 16 & -8 & -8 \\ 5 & -7 & -2 \end{matrix}$ for either

AB = ½ BC and AB and BC share point B.

A,B,C are collinear. **(3)**

11. $\begin{matrix} 2 & -3 \\ 4 & 3 \end{matrix}$ det. = 6 + 12 = 18

Inv.= $\frac{1}{18} \begin{matrix} 3 & 3 \end{matrix}$

18

-4 2

$\frac{1}{18}$ 3 3 2 -3 x $\frac{1}{18}$ 3 3 7

-4 2 4 2 y -4 2 5

x 36

$\frac{1}{18}$

y -18 (3)

x = 2, y = -1 (A)

12. 1/7 + 3/12.4 + 7/0.103

$1/7 + 3/1.24 \times 10^{-1} + 7/1.03 \times 10^{-1}$

$0.1429 + \frac{3(0.8064) + 7 \times 10 (0.9709)}{10}$

= 0.1429 + 0.2419 + 67.96 **(3)**

=70.52 **(A)**

13. (i) ADC = 2x73

$= 146^0$

(ii) OCB = x = 180 – 146 = 34

(iii) 360 – 107 – 146 – 34

$= 73^0$

14. $\text{Tan } 30^0 = y/x \quad y = x \tan 30$

$\text{Tan } 60^0 = \frac{1000}{X} + y \quad ; \quad y = x \tan 60 - 1000$

X tan 30^0 = x tan 60 – 1000
0.5773 x = 1.732x – 1000
1.732x – 0.577 = 1000
1.155x = 1000
x = 1000
1.155 = 866.0 m (A) (4)

15. 5 km Slower speed = x km/hr
Time = 5/x
Faster = (x+20) k/h
Time = 5/x=20 $T_1 - T_2 = 5/x - 5/x+20 = 30/3600$
$\frac{5(x+20) - 5x}{x(x+20)} \quad \frac{1}{120}$
$120 (5/x + 100 – 5x) = x^2 + 20x$ (5)
$x^2 + 20x – 12000$
$x = \frac{-20 \quad 400 + 48000}{2}$
$x = \frac{-20 \pm 220}{2}$
Spd = 100 km/h
And x = 120 km/h (A)

16. Log x = a log y = b
Log $\frac{x^3}{y}$ = Log x^3 - log $y^{½}$
= 3 Log x – ½ Log y
= 8a – ½ ab

SECTION B

17.

Marks	Mid point (x)	d = x-44.5	F	E = d/10	Ft	T^2	Ft^2 v
0-9	4.5	-40	2	-4	-8	16	32
10-19	14.5	-30	4	-3	-12	9	36
20-29	24.5	-20	7	-2	-14	4	28
30-39	34.5	-10	19	-1	-19	1	19
40-49	44.5	-0	26	0	0	0	0
50-59	54.5	-10	15	1	15	1	15
60-69	64.5	20	12	2	24	4	48
70-79	74.5	30	5	3	15	9	45
			=90		=1		=223

(a) Mean = (1 / 90 x 10) + 44.5 = 44.5 + 0.111
= 44.610

(b) Standard deviation = $10 \sqrt{233/90 - (1/90)^2}$
$10 \sqrt{2.478 - 0.0001}$ (8)
$10 \sqrt{2.478}$
10 x 1.574 = 15. 74 (A)

(c) Median 45.5^{th} value = 39.5 + (13.5 x 10/ 26)
39.5 + 5.192 (A)
44.69

(a) The probability = Shaded area
Large circle area

Shaded area = $\Pi R^2 - \Pi r^2$

$= 22/7 (4^2 - 3^2)$ v $= 22/7 \times 7 = 22$

Large area $= 22/7 \times 4 \times 4 = 352/7$ (A)

Probability = $\frac{22}{352/7} = 22 \times \frac{7}{352} = \frac{7}{16}$

(b)

	1	2	3	4	5	6
1	1,1	1,2	1,3	1,4	1,5	1,6
2	2,1	2,2	2,3	2,4	2,5	2,6
3	3,1	3,2	3,3	3,4	3,5	3,6
4	4,1	4,2	4,3	4,4	4,5	4,6
5	5,1	5,2	5,3	5,4	5,5	5,6
6	6,1	6,2	6,3	6,4	6,5	6,6

(M)

(i) P(Product of 6) = P((1,6) or (2,3) or (3,2) or (6,1))
$= 4/36 = 1/9$

(4)

(ii) P (sum of 8) = P((2,6) or (3,5) or (4,4) or (5,3) or (6,2))
$= 5/36$ (A)

(iii) P (same number) = P (1,1) or (2,2) or (3,3) or (4,4) or (5,5) or (6,6)
$6/36 = 1/6$ (A)

20.

(i) $\cos 60 = x/20$ $x = 20 \times 0.5 = 10$ cm
BD = 12 – 10 = 2 cm

(ii) CD = y $\sin 60 = y/20$ $y = 20x\ 0.8666$
CD = 17.32 cm

(iii) CHG = 120 reflex $= 240^0$
CHG = $240/360 \times 2 \times \pi \times r$
$= 50.27$
DBF = $120^0/360 \times 2 \times \Pi \times r = 1/3 \times 2 \times 3.142 \times 2$
$= 4.189$ (A)
Length C D E f G H C = $50.27 + 2(17.32) + 4.189$
$= 89.189$ (A)

21. (a) From the diagram, XO = 5/2 = 2.5

Tan 75^0 = VO/2.5 v m
VO = 2.5 x 3.732

Perpendicular height = VO = $\frac{9.33 \text{ cm}}{2}$ (A)

b. Diagonal of base = $5^2 + 5^2 = 50$
Length of diag. 50 = 7.071 = 5.536
$VA^2 = AO^2 + VO^2$ (m)
$3.536^2 + 9.3^2$
12.50 + 87.05
= 99.55 = 9.98 cm^2 (A) (8)

(c) = VAO Tan = $\frac{9.33}{3.536}$ = 2.639
VAO = 69.24^0 (A)

(d) Cos VBA = = 2.5 /9.98 = 0.2505
VBA = 75.49^0
Area VBA = ½ x 5 x 4.99 x sin 75.45 m (or other perimeter)
= 5 x 4.99 x 0.9681
= 24.15 cm^2 (A)

23. Volume = cross – section Area x L
X-sec Area = (1 x 25) + (½ x 25 x 2.5)
= 25 + 31.25 = 56. M
Volume = 56.25 x 12
= 675 m^3
Volume passed / sec = cross section area x speed
= $\Pi r^2 x l$ = 3.14 x 9/100 x 9/100 x 3 (8)
= 0.07635 m^3/sec v (M)
Volume emptied in 2 minutes
= 0.07635 x 60 x 2
= 9.162 m^2 (A)
1 m^3 = 1000 l
= 9.162 litres
= 9160 litres (A)

24.

MATHEMATICS II
PART I

SECTION A (52 MARKS)

1. Use tables to evaluate

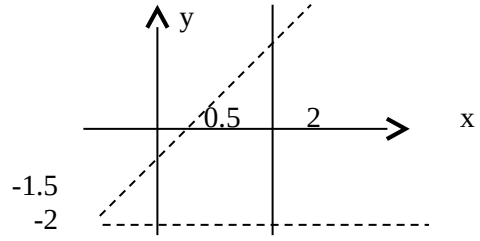
$$\sqrt[3]{\frac{0.0912^2 + \sqrt{3.152}}{0.1279 \times 25.71}}$$ (5mks)

2. Simplify $\frac{(a-b)^2}{a^2 - b^2}$ (2mks)

3. The gradient function of a curve that passes through point: (-1, -1) is 2x + 3.
   Find the equation of the curve. (3mks)
4. Find the value of k for which the matrix $\begin{pmatrix} k & 3 \\ 3 & k \end{pmatrix}$ has no inverse. (2mks)
5. Without using tables, evaluate $\frac{\log 128 - \log 18}{\log 16 - \log 6}$ (3mks)
6. Find the equation of the locus of points equidistant from point L(6,0) and N(-8,4). (3mks)
7. The value of a machine is shs. 415,000. The machine depreciates at a rate of 15% p.a. Find how many years it will take for the value of the machine to be half of the original value. (4mks)
8. Use reciprocal tables to evaluate to 3 d.p. $\frac{2}{0.321} - \frac{1}{n2.2}$ (4mks)
9. Using the trapezium rule, estimate the area bounded by the curve $y = x^2$, the x – axis and the co-ordinates x = 2 and x = 5 using six strips. (4mks)
10. Solve the equation for $0^0 \leq \theta \leq 360^0$ and $\cos^2\theta + \frac{1}{2}\cos\theta = 0$ (3mks)
11. Point P divides line MK in the ratio 4:5. Find the co-ordinates of point P if K is point (-6,10) and M is point (3,-8) (3mks)
12. How many multiples of 3 are there between 28 and 300 inclusive. (3mks)
13. The line y = mx – 1, where m is a constant , passes through point (3,1). Find the angle the line makes with the x – axis. (3mks)
14. In the figure below, AF is a tangent to the circle at point A. Given that FK = 3cm, AX = 3cm, KX = 1.5cm and AF = 5cm, find CX and XN. (3mks)

15. Make X the subject of the formula (3mks)
    $V = \sqrt[3]{\frac{k + x}{sk - x}}$

16. Write down the inequalities that describe the unshaded region below. (4mks)



SECTION B (48 MARKS)

17. Draw the graph of $y = -x^2 + 3x + 2$ for $-4 \leq x \leq 4$. Use your graph to solve the equations
(i.) $3x + 2 - x^2 = 0$ (ii) $-x^2 - x = -2$ (8mks)

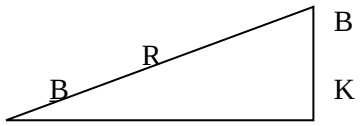
18. The marks obtained by Form 4 students in Examination were as follows:

Marks	0-9	10-19	20-29	30-39	40-49	50-59
No. of students	2	8	6	7	8	10

Marks	60-69	70-79	80-89	90-99
No. of Students	9	6	3	

Using 74.5 as the Assumed mean, calculate:
(i) The mean mark
(ii) The standard deviation (8mks)

19. In the figure below, $\underline{a}$ and $\underline{b}$ are the position vectors of points A and B respectively. K is a point on $\underline{AB}$ such that the AK:KB = 1:1. The point R divides line OB in the ratio 3:2 and point S divides OK in the ratio 3:1.



(a) Express in terms of $\underline{a}$ and $\underline{b}$
(i) $\underline{OK}$ (iii) $\underline{RS}$
(iii) $\underline{OS}$ (iv) $\underline{RA}$
(b) Hence show that R,S and A are collinear. (8mks)

20. The figure below is the roof of a building. ABCD is a rectangle and the ridge XY is centrally placed.

Calculate:
(i) The angle between planes BXC and ABCD.
(ii) The angle between planes ABXY and ABCD. (8mks)

21. On the same axis, draw the graph of $y = 2\cos x$ and $y = \sin \frac{1}{2}x$ for $0^0 \leq x \leq 180^0$, taking intervals of 15^0 (6mks)

From the graph, find:
(a) The value of x for which $2\cos x = \sin \frac{1}{2} x$ (1mk)
(b) The range of values of x for which $-1.5 \leq 2\cos x \leq 1.5$ (1mk)

22. Two towns T and S are 300km apart. Two buses A and B started from T at the same time travelling towards S. Bus B travelled at an average speed of 10km/hr greater than that of A and reached S 1 ¼ hrs earlier.

(a) Find the average speed of A. (6mks)
(b) How far was A from T when B reached S. (2mks)

23. P and Q are two ports 200km apart. The bearing of Q from P is 040^0. A ship leaves port Q on a bearing of 150^0 at a speed of 40km/hr to arrive at port R 7 ½ hrs later. Calculate:
(a) The distance between ports Q and R. (2mks)
(b) The distance between ports P and R. (3mks)
(c) The bearing of port R from port P. (3mks)
24. A farmer has 15 hectares of land on which he can grow maize and beans only. In a year he grows maize on more land than beans. It costs him shs. 4400 to grow maize per hectare and shs 10,800 to grow beans per hectare. He is prepared to spend at most shs 90,000 per year to grow the crops. He makes a profit of shs 2400 from one hectare of maize and shs 3200 from one hectare of beans. If x hectares are planted with maize and y hectares are planted with beans.
(a) Write down all the inequalities describing this information. (13mks)
(b) Graph the inequalities and find the maximum profit he makes from the crops in a year. (5mks)

MATHEMATICS II
PART II

1. Use logarithm tables to Evaluate
$$\sqrt[3]{\frac{36.5 \times 0.02573}{1.938}}$$
(3mks)
2. The cost of 5 shirts and 3 blouses is sh 1750. Martha bought 3 shirts and one blouse for shillings 850. Find the cost of each shirt and each blouse. (3mks)
3. If $K = \left(\frac{y-c}{4p}\right)^{1/2}$
a) Make y the subject of the formula. (2mks)
b) Evaluate y, when K = 5, p = 2 and c = 2 (2mks)
4. Factorise the equation:
$x + 1/x = 10/3$ (3mks)
5. DA is the tangent to the circle centre O and Radius 10cm. If OD = 16cm, Calculate the area of the shaded Region. (3mks)

6. Construct the locus of points P such that the points X and Y are fixed points 6cm apart and $\angle XPY = 60^0$. (2mks)
7. In the figure below, ABCD is cyclic quadrilateral and BD is diagonal. EADF is a straight line, $CDF = 68^0$, $BDC = 45^0$ and $BAE = 98^0$.

Calculate the size of: (2mks)

a) $\angle ABD$ b) $\angle CBD$

8. Otieno bought a shirt and paid sh 320 after getting a discount of 10%. The shopkeeper made a profit of 20% on the sale. Find the percentage profit the shopkeeper would have made if no discount was allowed? (2mks)
9. Calculate the distance:
   i) In nautical miles (nm)
   ii) In kilometres (km)
   Between the two places along the circle of Latitude:
   a) A(30^0N, 20^0E) and B(30^0N, 80^0E) (Take Radius of Earth = 6371Km). (2mks)
   b) X(50^0S, 60^0W) and Y(50^0S, 20^0E) (Take Radius of Earth = 6371Km). (2mks)
10. A rectangular tank of base 2.4m by 2.8m and height 3m contains 3,600 litres of water initially. Water flows into the tank at the rate of 0.5m/s. Calculate the time in hours and minutes required to fill the tank. (4mks)
11. Expand $(1 + a)^5$ up to the term of a power 4. Use your expansion to Estimate $(0.8)^5$ correct to 4 decimal places. (4mks)
12. A pipe is made of metal 2cm thick. The external Radius of the pipe is 21cm. What volume of metal is there in a 34m length of pipe ($\pi = 3.14$). (4mks)
13. If two dice are thrown, find the probability of getting: a sum of an odd number and a sum of scoring more than 7 but less than 10. (4mks)
14. Find the following indefinite integral $\int \frac{8x^5 - 3x}{x^3} dx$ (4mks)
15. The figure below represents a circle of radius 14cm with a sector subtending an angle of 60^0 at the centre.

.

Find the area of the shaded segment. (3mks)

16. Use the data below to find the standard deviation of the marks.

Marks (x)	Frequency (f)
5	3
6	8
7	9
8	6
9	4

(4mks)

SECTION II (48MKS)

17. The figure below shows a cube of side 5cm.

Calculate:

a) Length FC (1mk)

b) Length HB (1mk)

c) Angle between GB and the plane ABCD. (1mk)

d) Angle between AG and the Base. (1mk)

e) Angle between planes AFC and ABCD. (2mks)

f) If X is mid-point of the face ABCD, Find angle AGX. (2mks)

18. Draw on the same axes the graphs of $y = \text{Sin } x^0$ and $y = 2\text{Sin } (x^0 + 10^0)$ in the domain $0^0 \leq x^0 \leq 180^0$

i) Use the graph to find amplitudes of the functions.

ii) What transformation maps the graph of $y = \text{Sin } x^0$ onto the graph of : $y = 2\text{Sin } (x^0 + 10^0)$.

19. The table below shows the masses to the nearest gram of 150 eggs produced at a farm in Busiro country.

Mass(g)	44	45	46	47	48	49	50	51	52	53	54	55
Freq.	1	2	2	1	6	11	9	7	10	12	16	16
Mass(g)	56	57	58	59	60	61	62	63	64	65	70	
Freq.	10	11	9	7	5	3	4	3	3	1	1	

Make a frequency Table with class-interval of 5g. Using 52g as a working mean, calculate the mean mass. Also calculate the median mass using ogive curve.

20. A shopkeeper stores two brands of drinks called soft and bitter drinks, both produced in cans of same size. He wishes to order from supplies and find that he has room for 1000 cans. He knows that bitter drinks has higher demand and so proposes to order at least twice as many cans of bitter as soft. He wishes however to have at least 90cans of soft and not more than 720 cans of bitter. Taking x to be the number of cans of soft and y to be the number of cans of bitter which he orders. Write down the four inequalities involving x and y which satisfy these conditions. Construct and indicate clearly by shading the unwanted regions.

21. Two aeroplanes, A and B leave airport x at the same time. A flies on a bearing 060^0 at 750km/h and B flies on bearing of 210^0 at 900km/h:

a) Using a suitable scale draw a diagram to show the positions of Aeroplanes after 2hrs.

b) Use your graph to determine:

i) The actual distance between the two aeroplanes.

ii) The bearing of B from A.

iii) The bearing of A from B.

22. The Probabilities that it will either rain or not in 30days from now are 0.5 and 0.6 respectively. Find the probability that in 30 days time.

a) it will either rain and not.

b) Neither will not take place.

c) One Event will take place.

23. Calculate the Area of each of the two segments of $y = x(x+1)(x-2)$ cut off by the x axis. (8mks)
24. Find the co-ordinates of the turning point on the curve of $y = x^3 - 3x^2$ and distinguish between them.

MATHEMATICS II
PART I
MARKING SCHEME:

1. $0.0912^2 = (9.12 \times 10^{-2})^2 = 0.008317$

$\sqrt{3.152} = 1.776$

$\sqrt[3]{\underline{1.776 + 0.008317}}$

0.1279×25.91

$= \sqrt[3]{\underline{1.784317}}$ | No. | log

0.1279×25.91 | 1.784 | 0.2514

0.1279 | -1.1069

25.71 | $\underline{1.4101 +}$

$\underline{0.5170}$

-1.7344

$\underline{\times 1/3}$

$10^{-1} \times 8.155(6)$ | $1^{-1}.9115$

Or 0.8155(6)

2. $\frac{(a-b)(a-b)}{(a-b)(a+b)} = \frac{a-b}{a+b}$

3. $\frac{dy}{dx} = 2x + 3$

$y = x^2 + 3x + c$

$-1 = 1 - 3 + c$

$c = 1$; E.g $y = x^2 + 3x + 1$

4. $K^2 - 9 = 0$

$K = \pm 3$

5. $\frac{\log\left(\frac{128}{18}\right)}{\log\left(\frac{16}{6}\right)} = \frac{\log\left(\frac{64}{9}\right)}{\log\left(\frac{8}{3}\right)}$

$= \frac{2 \log (8/3)}{\log (8/3)}$

$= 2$

6. Midpoint $\left(\frac{-8+6}{2}, \frac{4+0}{2}\right) \Rightarrow (-1, 2)$

Gradient of LN = 4/-14 = -2/7

Gradient of $\perp$ bisector = 7/2

$\frac{y-2}{x+1} = 7/2$

$y = 7/2X + 11/2$

7. $207,500 = 415,000(1 - \frac{15}{100})^n$

$0.5 = (\frac{85}{100})^n$

$0.5 = 0.85^n$

$\log 0.5 = n \log 0.85$

$\frac{\log 0.5}{\log 0.85} = n$

$n = \frac{-1.6990}{-1.9294} = \frac{-0.3010}{-0.0706} = 4.264\text{yrs}$

8. $2 \times \frac{1}{3.21 \times 10^{-1}} = \frac{1}{3.21} \times 20 = 0.3115 \times 20 = 6.230$

$\frac{1}{172.2} = \frac{1}{1.722 \times 10^2} = \frac{0.5807}{100} = 0.005807$

$6.230 - 0.005807 = 6.224193$

$= 6.224$ (3d.p)

9.

X	2	2.5	3	3.5	4	4.5	5
y	4	6.25	9	12.25	16	20.25	25

$h = ½$

Area $= ½ \times ½[29+2(6.25+9+12.25+16+20.25+25)]$

$= ¼ [29 + 127.5]$

$= ¼ \times 156.5 = 39.125$ sq. units.

10. $\cos\theta(\cos\theta + ½) = 0$

$\cos\theta = 0 \qquad \cos\theta = -0.5$

$\theta = 90^0, 270^0 \qquad \theta = 120^0, 240^0$

$\therefore \theta = 90^0, 120^0, 240^0, 270^0$

11. $MP = \frac{4}{9} MK \qquad MK = \begin{pmatrix} -9 \\ -18 \end{pmatrix}$

$MP = \frac{4}{9}\begin{pmatrix} -9 \\ -18 \end{pmatrix} = \begin{pmatrix} -4 \\ 8 \end{pmatrix}$

$\therefore$ P is $(-1, 0)$

12. $a = 30 \quad d = 3 \quad l = 300$

$300 = 30 + 3(n - 1)$

$300 = 30 + 3n - 3$

$300 - 27 = 3n$

$273 = 3n$

$91 = n$

13. $y = mx - 1$

$1 = 3m - 1$

$m = 2/3 = 0.6667$

$\tan\theta = 0.6667 \; ; \quad \theta = 33.69^0$

14. $FK \times FC = FA^2$

$FC = 25/3 = 8\ ^1/_3$ cm

$CX = 8^1/3 - 9/2 = 23/6 = 3^5/6$ cm

$CX \times XK = XA \times XN$

$3^3/6 \times 3/2 = 3 \times XN$

$\therefore XN = 1^{11}/12$ cm

15. $V^3 = \frac{k + x}{k - x}$

$V^3k - V^3x = k + x$

$V^3k - k = x + V^3x$

$V^3k - k = x(1 + v^3)$

$\frac{V^3k - k}{1 + V^3} = x$

16. (i.) $x = 2 \Rightarrow x \leq 2$

(ii) $y = -2 \Rightarrow y > -2$

(iii)pts. (0.5,0)

(0,-1.5)

$m = \frac{-1.5 - 0}{0 - 0.5} = 3$

Eq. $Y = 3x - 1.5 \quad y < 3x - 1.5$

SECTION B

17.

X	-4	-3	-2	-1	0	1	2	3	4
Y	-26	-16	-8	-2	2	4	4	2	-2

(i) Roots are $x = -0.5 \quad x = 3.6$

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

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

$y = 4x \quad (-2, -8) \; (1, 4)$

Roots are $x = -2, x = 1$

18. class	x	f	d=x-74.5	fd	d^2	fd^2	
0 – 9	4.5	2	- 70	- 140	4900	9800	
10 – 19	14.5	8	- 60	- 480	3600	28,800	
20 – 29	24.5	6	- 50	- 300	2500	15,000	
30 – 39	34.5	7	- 40	- 280	1600	11,200	
40 – 49	44.5	8	- 30	- 240	900	7,200	
50 – 59	54.5	10	- 20	- 200	400	4,000	
60 – 69	64.5	9	- 10	- 90	100	900	
70 – 79	74.5	6	0	0	0	0	
80 – 89	84.5	3	10	30	100	300	
90 – 99	94.5	1	20	20	400	400	
		$\Sigma f =$ 60	$\Sigma fd =$	-1680		$\Sigma fd^2 =$	77,600

(i) Mean $= 74.5 + \frac{-1680}{60}$

$= 74.5 - 28 = 46.5$

(ii) Standard deviation $= \sqrt{\frac{77600}{60} - \left(\frac{-1680}{60}\right)^2}$

$= \sqrt{1283.3 - 784}$

$= \sqrt{499.3} = 22.35$

19. a (i.) $OK = OA + AK = \frac{1}{2} a + \frac{1}{2} b$

(ii) $OS = \frac{3}{4} OK = 3/8 \; a + 3/8 \; b$

(iii)$RS = RO + OS = 3/8 \; a - 9/40 \; b$

(iv) $RA = RO + OA = - 3/5 \; b + a$

b. RA = a – 3/5 b RS = 3/8 a + 9/40 b
= 3/8(a – 3/5 b)
∴ RS = 3/8 RA
The vectors are parallel and they have a common point R ∴ point R, S and A are collinear

20.

KB = 3m NK = 1.5m XB = 5m

(i) XK = $\sqrt{5^2 - 3^2} = \sqrt{16} = 4$m

let ∠XKN = θ

$\cos\theta = \frac{1.5}{4} = 0.375$

$\theta = 67.97(8)^0$

(ii) In ΔXNK

XN = $\sqrt{4^2 - 1.5^2} = \sqrt{13.75} = 3.708$

In Δ SMR; MR = KB = 3m

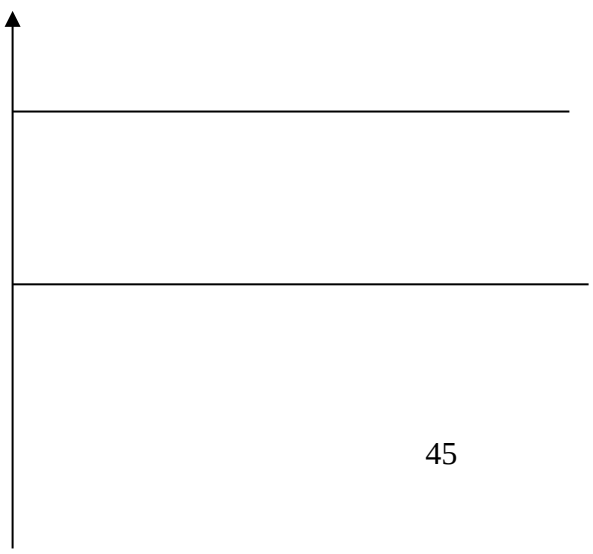
SM = XN = 3.708m

Let ∠SRM = α

$\tan\alpha = \frac{3.708}{3} = 1.236$

$\alpha = 51.02(3)^0$

21.



21.

	0	15^0	30^0	45^0	60^0	75^0	90^0	105^0	120^0	135^0	150^0	165^0	180^0
Y =2cosX	2.00	1.93	1.73	1.41	1.00	0.52	0.00	-0.52	-1	-1.41	-1.73	-1.93	-2.00
Y = sin ½ X	0.00	0.13	0.26	0.38	0.50	0.61	0.71	0.79	0.87	0.92	0.97	0.99	1.00

(a) $X = 73^0 \pm 1^0$

(b) Between 40.5^0 and 139.5^0

22. 300km

T S

Let the speed of A be X km/hr

Speed of B = (X + 10) km/hr

Time taken by A = $\frac{300}{X}$ hrs

Time taken by B = $\frac{300}{X + 10}$ hrs

$\frac{300}{x} - \frac{300}{x + 10} = \frac{5}{4}$

$\frac{300(x + 10) - 300x}{x(x + 10)} = \frac{5}{4}$

$\frac{300x + 300 - 300x}{x^2 + 10x} = \frac{5}{4}$

$x^2 + 10x$

$x^2 + 10x - 2400 = 0.$

$x = 44.25$

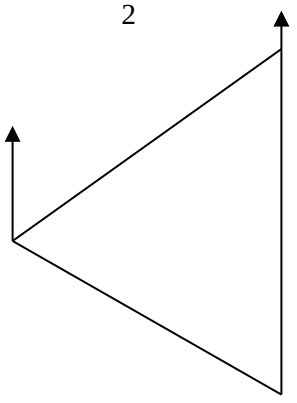
$X = -54.25$ N/A

(b) Distance covered by A in 1 ¼ hrs = 44.25 x 5/4 = 55.3 km

Distance of A from T is 300 – 55.3 = 244.7 km

23. (a) Distance = $\frac{15}{2}$ x 40 = 300km

(b)



$PR^2 = 200^2 + 300^2 - 2x\ 200 \times 300 \cos 70^0$

$= 130{,}000 - 41040 = 88{,}960$

$PR = 298.3$ km

(c) $\frac{298.3}{\sin 70^0} = \frac{300}{\sin \alpha}$

$\sin \alpha = \frac{300 \sin 70^0}{298.3}$

$= 0.9344$

$\alpha = 69.1^0$

Bearing of R from P is

$40 + 69.1 = 109.1^0$

24. (i.) $X > y$

(ii) $4{,}400X + 10{,}800Y \leq 90{,}000$

Simplifies to $11X + 27y \leq 225$

(iii) $X + y \leq 15$

$X > 0;\ y > 0$

Boundaries

$x = y$ pts (6,6) (12,12)

$11x + 27y = 225$ pts (13,3) (1,8)

$X + y = 15$ pts (0,15) (8,7)

Objective function

$2400 \times 3200y$

(pt (2,1)

$2400X + 3200y = 8000$

Search line $\rightarrow 3X + 4y = 10$

Point that give maximum profit is (12,3)

$\therefore$ maximum profit

$= 2400 \times 12 + 3200 \times 3 = 38{,}400$ shs.

MATHEMATICS II
PART II
MARKING SCHEME

1.

No	log.
36.5	1.5623
0.02573	-2.4104 +
	-1.9727
1.938	0.2874 –
	-1.6853

$\frac{-3}{3} + \frac{2.6853}{3}$

-1 + 0.8951
1.273(4) ← 0.1049
= 1.273(4)

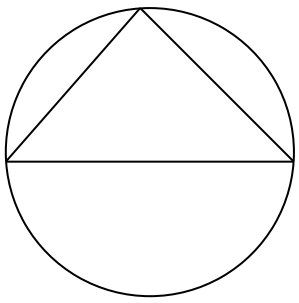
2. Let shirt be sh x,
let blouse be sh. y.
5x + 3y =1750 (i.)
3x + y = 850 (ii)
mult (ii) by 3
9x + 3y = 2550 (iii)
Subtract (iii) – (i.)
- 4x = -800
Subt for x
y. = 250
Shirt = sh 200 ; Blouse = sh 250

3. (a) $K^2 = \frac{y - c}{4p}$
$y - c = 4pK^2$
$y = 4pK^2 + c$
(b) $y = 4 \times 2 \times 25 + 2$; $y = 202$

4. $x^2 + 1 - \frac{10x}{3} = 0$
$3x^2 - 10x + 3 = 0$
$3x(x - 3) - 1(x - 3) = 0$
$(3x - 1)(x - 3) = 0$
$x = 1/3$ or $x = 3$

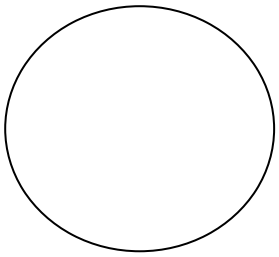
5. Area Δ OAD pyth theorem AD =12.49cm
½ x 12.49 x 10 = $62.45cm^2$
Cos θ = 10/16 = 0.625
$\theta = 51.3^0$ 62.5
Sector $\frac{57.3^0}{360} \times 3.14 \times 100$ $\frac{40.2}{}$ -
= 22.3

6. $\angle XPY = 60^0$
$\therefore \angle XC_1Y = 120^0$
B1 $\therefore \angle C_1XY = \angle C_1YX$
$= \frac{180^0 - 120^0}{2} = 30^0$



Construct 30^0 angles
at XY to get centres
B1 C_1 and C_2 mojar arcs drawn
2 on both sides with C_1X and C_2X

as centres.

7. 

$DAB = 180^0 - 98^0 = 82^0$

$ADB = 180 - (68 + 45) = 67^0$

$ABD = 180 - (67 + 82)$

$= 31^0$

(a) $180^0 - (67 + 82)^0 = 31^0$

$\angle ABD = 31^0$

Opp $= 180^0$

$82 + 98 = 180^0$

(b) $(180 - 82)^0 = 98^0$

$180^0 - (98^0 - 45^0) =$

$\angle CBD = 37^0$ _ $180 - (98 + 45)^0$

$= 37^0$

8. $\frac{10}{100}$ x 320

Discount = sh 32

Sold at sh 288

If no Discount = $\left(\frac{320}{288} \times 20\right)\% = 22.7\%$

9. (a) Dist along circle of lat.

Long diff x 60 x cos θ nm

100 x 60 x Cos 50^0

100 x 60 x 0.866

5196nm = $\frac{100}{360} \times 2\pi R \cos 50^0$

$\frac{100}{360}$ x 2 x 3.14 x 6371

= 5780Km

(b) 80 x 60 Cos 50 = 3895 Km

10. Vol =2.8 x 2.4 x 3 = $20.16m^3$

$1m^3 = 1000$ L

$20.16m^3 = 20160$ L

$\frac{20160}{3600}$

16560 L to fill

0.5 L – 1 sec

16560 L - ?

$\frac{165600}{5 \times 3600}$

$\frac{33120}{3600}$ hr

≅ 9.41 hrs ; ≅ 564.6 min.

11. $1^5 + 5.1^4a + 10.1^3.a^2 + 10.1^2a^3 + 5.1.a^4$

$a = -0.2$

$1 + 5(-0.2) + 10(-0.2)^2 + 10(-0.2)^3 + 5(-0.2)^4$

$1 - 1.0 + 0.4 - 0.08 + 0.008 = 0.3277$ (4d.p)

12. Area of metal : Material – Cross section.

$\pi(R^2 - r^2)$

$3.14 (21 - 19)$

Vol $6.28cm^2$ x 3400cm

$= 215.52m^3$

13. Possibility space:

.	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

P(odd) = 3/6 = ½

P(Sum > 7 but < 10) = 9 /36

∴ P(odd) and P(sum > 7 but < 10)

= ½ x 9/36 = 9/72 = 1/8

14. $\int (8x^5/x^3 - 3x/x^3)\, d_4$

$\int (8x^2 - 3x^{-2})\, d_4$

$16x^3/3 + 6x^{-3}/-3 + C$

$16x^3/3 - 2/x^3 + C$

15. Area of ΔAOB

½ x 14 x 14 x 0.866 = $84.866cm^2$

Area of sector = $\frac{60}{360}$ x3.14 x 14 x14 = 10.257

Shaded Area

84.666 - 10.257 = $74.409cm^2$

16.

Marks	**F**	**Fx**	**fx^2**
5	3	15	75
6	8	48	288
7	9	63	441
8	6	48	384
9	4	36	324

$\Sigma x = \quad \Sigma f=30 \quad \Sigma fx=210 \quad 1512$

$S.d = \sqrt{\frac{\Sigma fx^2}{\Sigma f}} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2$

$= \sqrt{\frac{1512}{30}} - \left(\frac{210}{30}\right)^2$

$= \sqrt{50.4 - 49}$

$= \sqrt{1.4} = 1{,}183$

SECTION II

17. (a) FC $= \sqrt{5^2 + 7.07^2} = \sqrt{50} = 7.071$

(b) HB $= \sqrt{5^2 + 7.07^2} = \sqrt{75} = 8.660$

(c) $\theta = \text{Tan}^{-1} 5/5 = \text{Tan}^{-1} = 45^0$

(d) $\beta = \text{Tan}^{-1} 5/7.071 = \text{Tan}^{-1} 0.7071 = 35.3^0$

(e) $y = \text{Tan}^{-1} 5/3.535 = \text{Tan}^{-1} = 54.7^0$

(f) $\angle AGX = 19.4^0$

18. $y = \text{Sin } x$

x^0	0^0	30^0	60^0	90^0	120^0	150^0	180^0
$\sin x^0$	0	0.50	0.66	1.00	0.866	0.500	0

$y = 2 \text{ Sin } (x^0 + 10^0)$

X^0	0^0	30^0	60^0	90^0	120^0	150^0	70^0
2 Sin$(x+10^0)$	0.3472	1.286	1.8794	1.286	0.3472	-0.3472	-1.8794

Amplitudes for $y = \text{Sin } x^0$ is 1

For

$y = \text{Sin}(x+10^0)$ is 2.

19.

c.f	X	F
61	53	12
16		54
93	55	16
103	56	10
11		57
123	58	9
130	59	7
135	60	5
138	61	3

142	62	4
145	63	3
148	64	3
149	65	1
150	70	1

Mean = x + 52 + $\frac{-4}{150}$

52 - 0.02

= $\underline{51.08}$

Median = 51.4g.

class interval 59

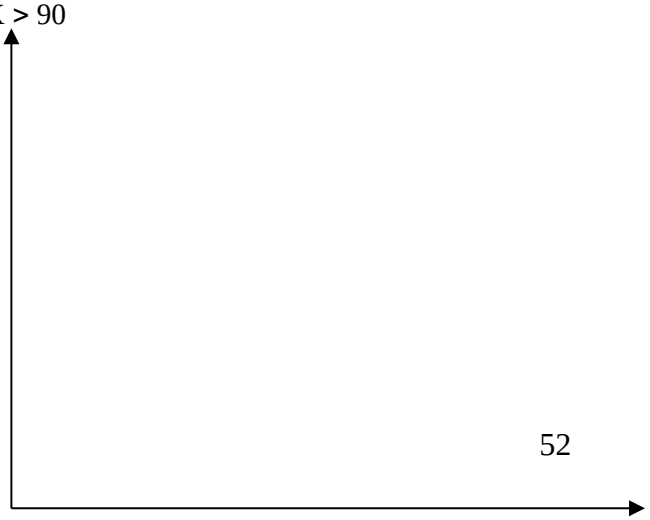
Class interval	mid point	Freg.	c.f
44-48	46	12	12
49-53	51	49	61
54-58	56	64	125
59-63	69	22	147
64-68	66	3	130
69-73	71	1	150

20. $X + Y \leq 1000$

$X \leq 2Y$

$Y < 720$

$X > 90$



21.(a) 1cm = 200Km/h
A = 200 x 7.5 = 1500 Km
B = 200 x 9 = 1800Km.

(b) (i.) 15.8cm x 200
= 3160 Km.

(ii) Bearing 224^0

(iii) Bearing 049^0

22. (a) $P(R) \times P(R)^1$
= 0.5 x 0.6
= 0.3

(b) $P(R)' \times P(R)$
0.5 x 0.4
= 0.2

(c) $P(R) \times P(R')$
$P(R)' \times P(R)$
0.5 x 0.6 = 0.3
0.5 x 0.4 = 0. 2= 0.5

23. $y = x(x + 1)(x – 2)$
$= x^3 – x^2 – 2x$
$A_1 = \int (x^3 – x^2 –2x)\, d_4$
$^{-1}[¼ x^4 – 1/3 x^2]_{-1}$
$= 0 – (¼ + 1/3 – 1) = 5/12$
$A_2 = {}^2\int (x^3 – x^2 –2x)\, d_4$
$= {}^0\int ¼ x^4 – 1/3 x^3 – x^2)^{-2}{}_0$
$= (¼ .16 – 1/3 .8 – 8)$
$= 4^{-0} – 8/3 – 4 = - 8/3$
$A_1 = 5/12 = A_2 = 2\,{}^2/_3$ __

_____

24. $y = x^3 – 3x^2$
$\frac{dy}{} = 3x^2 – 6x$
At stationary
Points $\frac{dy}{dx} = 0$
i.e $3x^2 – 6x = 0$
$3x(x – 2) = 0$
$x = 0$ or 2
Distinguish
$\frac{dy}{dx} = 3x^2 – 6x$
$\frac{d^2y}{dx^2} = 6x – 6$

(i) $x = 0$ $\frac{dy^2}{dx^2} = 6x – 6 = -6$
$-6 < 0$ – maximum.
$\therefore$ (0,0) Max Pt.

(ii) $x = 2$
$\frac{d^2y}{dx^2} = 6$
$6 > 0$ hence
Minimum Pt.
x = 2, y = 8 – 12 = -4
(2, -4) minimum point.

MATHEMATICS II
PART I

SECTION 1 (52 Marks)

1. Without using tables evaluate:

$$\frac{\sqrt{7.5625} \times \sqrt[3]{3.375}}{15}$$ (5 mks)

2. Make k the subject of the formula.

$$y = \frac{1}{T^2}\sqrt{\frac{k+y}{k}}$$

(3 mks)

3. If A = (x, 2) and $xB = \begin{pmatrix} x \\ -2 \end{pmatrix}$ and if AB = (8), find the possible values of x. (3 mks)

4. Simplify completely. (3 mks)

$$\frac{rx^4 - r}{2xr - 2r}$$

5. Solve the equation. (3 mks)

$\text{Log}_3 (8-x) - \log_3 (1+x) = 1$

6. Under an enlargement scale factor -1, A(4,3) maps onto A^1 (4,-5). Find the co-ordinates of the centre of enlargement. (3 mks)

7. Find the equation of the line perpendicular to the line 4x-y = -5 and passing through the point (-3,-2). (2 mks)

8. Find the standard deviation of the data below:
   3,5,2,1,2,4,6,5 (4 mks)

9. What is the sum of all multiples of 7 between 200 and 300? (4 mks)

10. Solve the equation.
    ½ tan x = sin x for $-180^0 \leq x \leq 360^0$. (3 mks).

11. Expand $(1-2x)^4$. Hence evaluate $(0.82)^4$ correct to 5d.p. (4 mks)

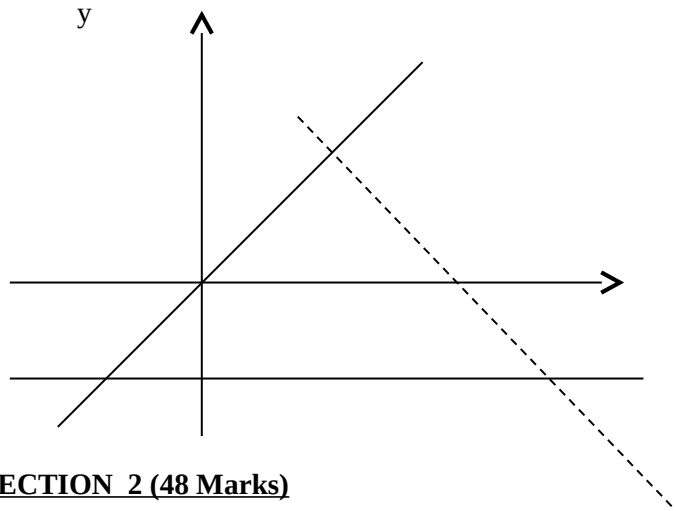
12. The line y = mx - 3 passes through point (5,2). Find the angle that the line makes with the x-axis. (2 mrks)

13. A two digit number is such that 3 times the units digit exceed the tens digit by 14. If the digits are reversed, the value of the number increases by 36. Find the number (4 mks)

14. In the figure below, O is the centre of the circle, OA = 7 cm and minor arc AB is 11 cm long. Taking $\Pi = {}^{22}/_{7}$, find the area shaded. (3 mks)

15. A box contains 36 balls, all identical except for colour. 15 of the balls are black, 15 are brown and the rest are white. Three balls are drawn from the box at random, one at a time, without replacement. Find the probability that the balls picked are white, black and brown in that order. (2 mks)

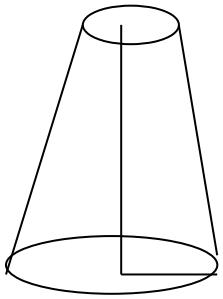
16. Find the inequalities that describe the unshaded region R below. (4 mks)



SECTION 2 (48 Marks)

17. Draw the graph of $y = x^2 + x - 6$ for $-4 \leq x \leq 4$.
Use your graph to solve the equations.
(i) $x^2 + x - 6 = 0$ (ii) $x^2 + 2x - 8 = 0$ (8 mks)

18. The diagram below represents a bucket that has been placed upside down. The radius of the top surface is 15cm and that of the bottom is 40cm. The vertical height of the bucket is 50cm.



Determine:-
(a) The volume of the bucket.
(b) The curved surface area of the bucket. (leave your answers in terms of π)

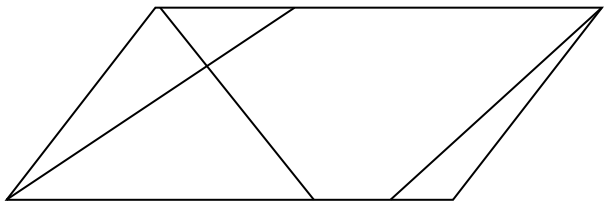
19. Draw, on the same axes, the graphs of $y = \cos\theta$ and $y = 5\sin\theta$ for $-180^0 \leq \theta \leq 180^0$
(a) From your graph, determine the amplitude of each wave.
(b) For what value(s) of θ is $\cos\theta - 5\sin\theta = 0$ (8 mks)

20. A point P lies on a coast which runs from West to East. A ship sails from P on a bearing of 032^0. When it reaches Q, 7km from P, a distress signal is observed coming from another ship at R. Given that R is N.E of P and on a bearing of 066^0 from Q, calculate:
(i) $\angle PRQ$.
(ii) The distance QR, between the two ships.
(iii) The shortest distance from R to the shore. (8 mks)

21. A bag contains x red balls and y yellow balls. Four times the number of red balls is equal to nine times the number of yellow balls and twice the total number of balls exceeds the number of yellow balls by 44.
    (a) How many balls of each colour are three in the bag?
    (b) If two balls are drawn out of the bag at random one at a time with replacement what is the probability that the two balls are red? (8 mks)

22. A Kenyan businessman goes on a trip to West Germany through Italy and back to Kenya. In Kenya he is allowed to take Ksh. 67,000 for sales promotion abroad. He converts the Kenya currency into US dollars. While in Italy, he converts $^{2}/_{5}$ of his dollars into Italian lire, which he spends in Italy. While in West Germany, he converts $^{5}/_{8}$ of the remaining dollars into Deutsche marks which he uses up before coming to Kenya. Using the conversion rates 1 US dollar = 1.8 Deutsche marks = 16.75
    Ksh = 1340 Italian lire. Answer the following questions:
    (a) How many US dollars did he take out of Kenya?
    (b) How many Italian lire did he spend in Italy?
    (c) How much money, in Deutsche marks did he spend in West Germany?
    (d) How much money in Ksh. did he have on his return to Kenya? (8 mks)

23. PQRS is a parallelogram in which PQ = r and PS = h. Point A is the midpoint of QR and B is a point on PS such that PS : PB = 4:3. PA and QB intersect at M.



    Given that PM = kPA and BM = tBQ where k and t are scalars, express PM in two different ways and hence find the values of k and t.
    Express PM in terms of r and h only. (8 mks)

24. Two variables T and X are connected by the equation $T = ab^{x}$ where a and b are constants. The values of T and X are given in the table below:

T	6.56	17.7	47.8	129	349	941	2540	6860
X	2	3	4	5	6	7	8	9

Draw a suitable straight line graph and use it to estimate the values of a and b. (8 mks)

MATHEMATICS III
PART II

Section I: (52 Marks)

1. Use mathematical tables to evaluate:

$$\frac{8.67}{\sqrt{0.786 \times (21.72)^3}}$$ (3 mks)

2. Simplify completely. (3 mks)

$$\frac{4}{x^2 - 4} - \frac{1}{x-2}$$

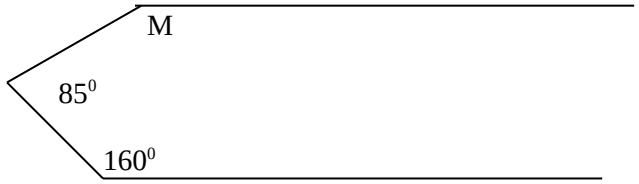
3. An Indian on landing at Wilson Airport changes Re 6000 into Kenya shillings when the exchange rate is Re = Ksh. 1.25. He spent Ksh. 5000 when in Kenya and converted the remaining amount to Rupees at the same rate as before. Find out how much the Indian is left with in Rupees. (3mks)

4. The last of three consecutive odd numbers is (2x+3). If their sum is 105, find the value of x. (4 mks)

5. $a * b$ is defined by: $a * b = \frac{(a + b)}{ab}$

   If $B * (2 * 3) = 4 * 1$, Find B. (3 mks)

6. Find the value of M. (3 mks)



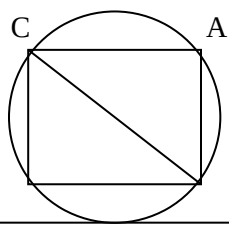
7. (a) Expand $(1+2x)^6$ upto the term containing x^3 . (2 mks)

   (b) By putting x = 0.01, find the approximate value of $(1.02)^6$ correct to 4 S.F. (2 mks)

8. Show that x is the inverse of : $Y = 3\begin{pmatrix} -3 & 1 \\ -5 & 2 \end{pmatrix}$ $X = \begin{pmatrix} 2 & 1 \\ 5 & 3 \end{pmatrix}$ (3 mks)

9. The probabilities of three candidates K, M and N passing an examination is $^2/_3$, ¾ and $^4/_5$ respectively. Find the probability that :
   (a) All pass: (1 mk)
   (b) At least one fails: (2 mks)

10. In the figure, PR is tangent to the circle centre O. If $\angle BQR=30^0$, $\angle QBC=27^0$,and $\angle OBA=37^0$, find $\angle BAC$ and $\angle ACB$.



B

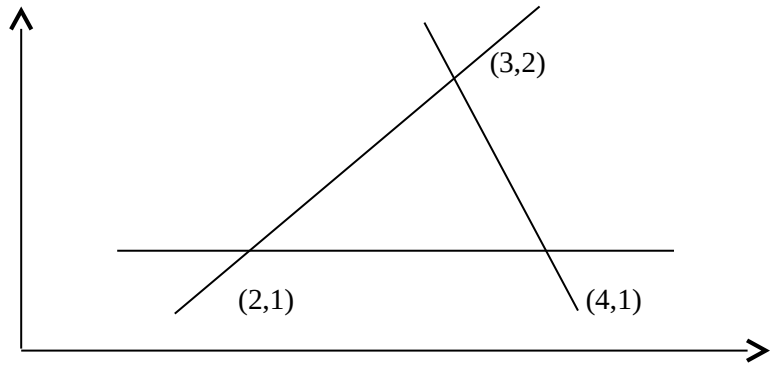
P R

11. A frustrum of height 10cm is cut off from a cone of height 30cm. If the volume of the cone before cutting is $270cm^3$, find the volume of the frustrum. (3 mks)

12. Evaluate $\int_{1}^{2} \left(3x^2 - \frac{1}{4x^2} \right) dx$ (2 mks)

13. If one litre of water has a mass of 1000g, calculate the mass of water that can be held in a rectangular tank measuring 2m by 3m by 1.5m. (give your answer in tonnes). (2 mks)

14. Write down the three inequalities which define the shaded region. (3 mks)



15. The depth of sea in metres was recorded on monthly basis as follows:

Month	March	April	May	June	July
Depth (m)	5.1	4.9	4.7	4.5	4.0

Calculate the three monthly moving averages. (3 mks)

16. A number of women decided to raise sh. 6300 towards a rural project for bee keeping. Each woman had to contribute the same amount. Before the contribution, seven of them withdrew from the project. This meant the remaining had to pay more. If n stands for original number of women, show that the increase in contribution per woman was: $\frac{44100}{n(n-7)}$ (3 mks)

SECTION II: (48 Marks)

17. Find the distance between points A(50^0 S, 25^0 E) and B(50^0 S, 140^0 E) in:
    (i) Km (ii) nm (8 mks)
    (take radius of earth to be 6400km, $\Pi = 3.14$)

18. The distance S in metres, covered by a moving particle after time t in seconds, is given by :
    $S = 2t^3 + 4t^3 - 8t + 3$.
    Find:
    (a) The velocity at :(i) $t = 2$ (ii) $t = 3$
    (b) The instant at which the particle is at rest. (8 mks)

20. A car starts from rest and its velocity is measured every second for six seconds. (see table below).

Time (t)	0	1	2	3	4	5	6

Velocity v(ms^{-1})	0	12	24	35	41	45	47

Use trapezium rule to calculate the distance travelled between t = 1 and t = 6. (8 mks)

21. Using a pair of compass and ruler only, construct triangle ABC such that AB=9cm, BC=14cm and $\angle BAC = 120^0$. Draw a circle such that AB, BC and AC are tangents. What is the radius of this circle? (8 mks)

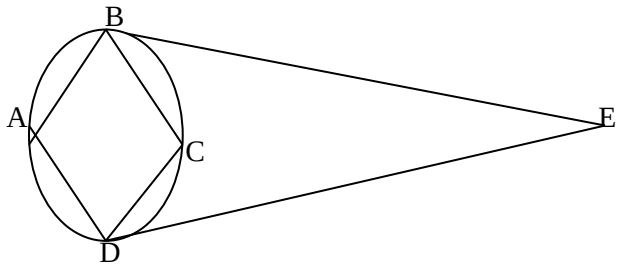
21. The marks scored by 100 students in mathematics test is given in the table below:

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79
No. of students	8	15	15	20	15	14	13

(a) Estimate the median mark. (2 mks)
(b) Using 44.5 as the assumed mean, calculate:-
(i) The mean mark: (2 mks)
(ii) The variance: (2 mks)
(iii) The standard deviation: (2 mks)

22. (a) On the same axes, draw the graphs of : $y = \sin x$; $y = \cos x$
$y = \cos^x + \sin X$ for $0^0 \angle X \angle 360^0$.
(b) Use your graph to deduce
(i) The amplitude
(ii) The period of the wave $y = \cos x + \sin x$.
(c) Use your graph to solve:
$\cos x = -\sin x$ for $0^0 \angle X \angle 360^0$.

23. Given a circle of radius 3 units as shown in the diagram below with its centre at O(-1, 6). If BE and DE are tangents to the circle where E (8,2). Given further that $\angle DAB = 80^0$.



(a) Write down the equation of the circle in the form $ax^2 + bx + cy^2 + dy + e = 0$ where a, b, c, d, e are constants. (2 mks)
(b) Calculate the length DE. (2 mks)
(c) Calculate the value of angle BED. (2 mks)
(d) Calculate the value of angle DCB. (2 mks)

24. A building contractor has to move 150 tonnes of cement to a site 30km away. He has at his disposal 5 lorries. Two of the lorries have a carrying capacity of 12 tonnes each while each of the remaining can carry 7 tonnes. The cost of operating a 7 tonne lorry is sh. 15 per km and that of operating a 12 tonne lorry is sh. 25 per km. The number of trips by the bigger lorries should be more than twice that made by smaller lorries. (8 mks)

(a) Represent all the information above as inequalities.
(b) How should the contractor deploy his fleet in order to minimise the cost of moving the cement? (8 mks)

MATHEMATICS III
PART I
MARKING SCHEME

	SOLUTION	MRK	AWARDING
1.	$\sqrt{7.5625} = 2.75$	1	Method for $\sqrt{7.5625}$ Square root
	$\sqrt[3]{3.375} = \sqrt[3]{3375} \times \sqrt[3]{10^{-3}}$	1	
	$= \sqrt[3]{3^3} \times 5^3 \times 10^{-1} = 3 \times 5 \times 10^{-1} = 1.5$	1	Method for $\sqrt[3]{}$ $\sqrt[3]{}$
	$= \frac{2.75 \times 1.5}{1.5 \times 10} = \frac{2.75}{10} = 0.275$	1 1	Answer
		5	
2.	$T^2y = \sqrt{\frac{k+y}{K}}$	1	Removal of square root
	$T^4y^2k = k+y$ $T^4y^2k - k = y$		
	$K(T^4y^2-1) = y$	1	Rearrangement of terms
	$K = \frac{y}{T^4y^2 - 1}$	1	Answer
		3	
3.	$(x\ 2) \begin{pmatrix} x \\ -2 \end{pmatrix} = (8)$	1	Matrix equation
	$x^2 - 4 = 8$	1	Quadratic equation Answers in any form
	$x = \pm\sqrt{12} = \pm 2\sqrt{3} = \pm 3.464$	1	
		3	
4.	$\frac{r(x^2 - 1)}{2r(x - 1)}$		
	$\frac{r(x^2 - 1)(x^2 + 1)}{2r\,(x - 1)}$	1	Complete factorisation of numerator
	$\frac{r(x - 1)(x + 1)(x^2 + 1)}{2r\,(x - 1)}$	1	Factorisation of denominator
	$= \frac{(x + 1)(x^2 + 1)}{2}$	1	Answer
6		3	
7. 5	$1 = \log_3 3$ $\frac{8 - x}{1+x} = 3$	1	Logarithic expression.
	$-4x = -5$	1	Equation
	$x = \frac{5}{}$	1	Answer

	4		
		3	
6.	Let the centre be (a,b) $\begin{pmatrix} 4.9 \\ -5-b \end{pmatrix} = -1 \begin{pmatrix} 4-a \\ 3-b \end{pmatrix}$ 4-a = -4+9 -5-b = -3+b a = 4 b = -1 centre is (4,-1)	1 1 1	Equation Linear equations Centre
8		3	
9 7.	Y = 4x + 5 Gradient = 4 Gradient of ⊥ line - ¼ $\frac{y+2}{x+3} = \frac{-1}{4}$ 4y + x = -11	1 1	Gradient of ⊥ line. Equation.
10		2	
11 8.	$X = \frac{28}{8} = 3.5$ standard deviation = $\sqrt{\frac{22}{8}} = \sqrt{2.75} = 1.658$	1	Mean

x	3	5	2	1	2	4	6	5	
d	-0.5	1.5	-1.5	-2.5	-1.5	0.5	2..5	1.5	
d^2	0.25	2.25	2.25	6.25	2.25	0.25	6.25	2.25	$\Sigma d^2=2$

d values
d^2 values

Answer

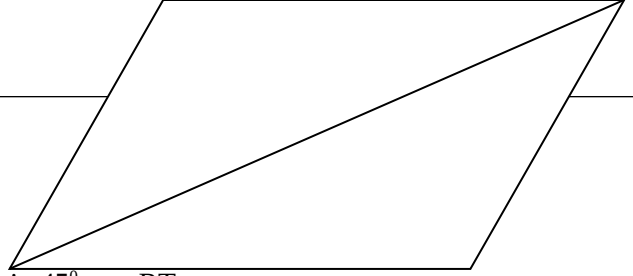
12		4	
13 9.	a = 203 d = 7 L = 294 294 = 203 + 7(n-1) n = 14 S 14 = $\frac{14}{2}$ (203 + 294) = 7 x 497 = 3479	1 1 1 1	For both a and b Equation For n Sum
		4	
10.	$\frac{\text{Sin x}}{\text{Cos x}} = 2 \sin x$		

	$\frac{\text{Sin x}}{\text{Sin x}} = 2\cos x$ $2\cos x = 1$ $\cos x = 0.5$ $x = 60^0, 300^0, -60^0$	1 1 1	Simplification Equation All 3 values
		3	
11.	$(1 +-2x)^4 = 1-8x + 24x^2 - 32x^3 + 16x^4$ $(0.82)^4 = (1 + -2 \times 0.09)^4$ $x = 0.09$ $(0.82)^4 = 1 - 0.72 + 0.1944 - 0.023328 + 0.00119376$ $= 0.35226576$ $\cong 0.35227$ (5 d..p)	1 1 1 1	Expansion Value of x All terms Rounded
		4	
12.	$2 = 5m - 3$ $m = 1$ $\tan\theta = 1 \qquad \theta = 45^0$	 1 1	 Value of m. Angle
		2	
13.	Let the number be xy $3y = x + 14$ $10y + x = 10x + y + 36 = 9y - 9x \Rightarrow 36$ $3y - x = 14$ $\underline{9y - 9x = 36}$ $y = 5$ $x = 1$ the number is 15.	 1 1 1 1	 1st equation 2nd equation method of solving Answer
	S	4	
14.	Let $\angle AOB = \theta$ $\frac{\theta}{360} \times 2 \times \frac{22}{7} \times 7 = 11$ $\theta = 90^0$ Area shaded $= \frac{90}{360} \times \frac{22}{7} \times 7 \times 7 - \frac{1}{2} \times 7 \times 7$ $= \frac{77}{2} - \frac{49}{2}$ $= \frac{28}{2} = 14\text{cm}^2$	 1 1 1	 Value of θ Substitution Answer
		3	
15.	$P(WBb) = \frac{6}{36} \times \frac{15}{35} \times \frac{15}{34}$ $= \frac{15}{476}$	1 1	Method Answer
		2	
16.	Equation inequality $L_1 \quad y = x \qquad y \leq x$	1 1	1 mark for each inequality.

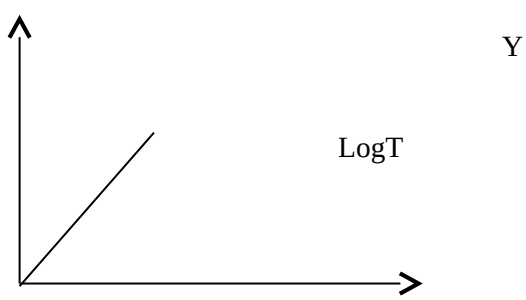
	L_2 $y = -2$ $y \geq -2$ L_3 $2y + 5x = 21$ $2y + 5x < 21$	1 1	Method for obtaining L^3	
	<table><tr><td>X</td><td>-4</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>y</td><td>6</td><td>0</td><td>-4</td><td>-6</td><td>-6</td><td>-4</td><td>0</td><td>6</td><td>14</td></tr></table> (i) roots are x = -3 x = 2 (ii) $y = x^2 + x-6$ $\underline{0 = x^2 + 2x-8}$ $y = -x + 2$ roots are x = -4 x = 2	4	2 1 1 1 1 1	For all correct poin 1 for atleast five co Correct plotting. Scale Smoothness of curve Both roots Linear equation Both roots
			8	
18.	$\frac{h}{h+50} = \frac{15}{40}$ h = 30cm H = 80cm (a) Volume = $\frac{1}{3}\pi \times 40 \times 40 \times 80 - \frac{1}{3}\pi \times 15 \times 15 \times 30$ $= \frac{128000}{3}\pi - \frac{6750}{3}\pi$ $= \frac{121,250}{3}\pi \text{ cm}^3$ (b) $L^2 = 80^2 + 40^2$ $L = 15^2 + 30^2$ $= 6400 + 1600$ $= 225 + 900$ $= 8000$ $= 1125$ $L = 89.44$ cm $L = 33.54$ cm Curved surface area of bucket = $\pi \times 40 \times 89.44$ $\pi \times 15 \times 33.54$ $= 3577.6\pi - 503.1\pi$ $= 3074.5\text{cm}^2$	1 1 1 1 1 1 1 1	Expression Value of H Substitution Volume L L Substitution Area	
		8		

19.

20.	(i) $\angle RPQ = 13^0$ $\angle PQR = 32^0+90^0+24^0 = 146^0$ $\angle PRQ = 180^0 - (146^0 + 13^0)$ $= 21^0$ (ii) $\frac{P}{\sin 13^0} = \frac{7}{\sin 21^0}$ $P = \frac{7 \sin 13^0}{\text{Sin } 21^0}$ $= 4.394\text{km}$ P T (iii) Let PR = q $\frac{q}{\sin 146^0} = \frac{7}{\sin 21^0}$	1 1 1	Fair sketch $\angle PRQ$



			Equation
			Method
	$\sin 45^0 = \frac{RT}{10.92}$		Equation
	$RT = 10.92 \sin 45^0$ $= 7.72$ km (2 d..p)	1	
		1	Distance PR
			Equation
		1	RT
		1	
		1	
		8	
21.	(a) $4x = 9y$	1	Equation
	$2(x+y) = y+44 \Rightarrow 2x + y = 44$	1	Equation
	$4x - 9y = 0$ $\underline{4x + 2y = 88}$ $11y = 88$ $y = 8$	2 1	Method of solving Value y Value x
	$x = 18$	1 1	Method Answer
	(b) $P(RR) = \frac{18}{26} \times \frac{18}{26} = \frac{81}{169}$	1	
		8	
22.	(a) 67,000 Ksh $= \frac{67{,}000}{16.75}$ US dollars	1	Method
	$= 4{,}000$ dollars	1	Answer
	(b) $\frac{2}{5} \times 4{,}000 = 1600$ US dollars	1	Method
	1600 US dollars $= 1600 \times 1340$ $= 2{,}144{,}000$ Italian lire	1	Answer
	(c) Remainder $= 2400$ US dollars $\frac{5}{8} \times 2400 = 1500$ US dollars	1	For 1500
	1500 US dollars $= 1500 \times 1.8$	1	Answer

	= 2700 Deutche marks (d) Remainder = 900 US Dollars 900 US Dollars = 900 x 16.75 Ksh. = 15,075 Ksh.	 1 1	 Method Ksh.
		8	
23.	PM = kPA $= k(r + \frac{1}{2}h)$ $= kr + \frac{1}{2}kh$ PM = PB + BM $\frac{3}{4}h + t\,BQ$ $= \frac{3}{4}h + t(-\frac{3}{4}h + r)$ $= \frac{3}{4}h - \frac{3}{4}t\,h + tr$ $= \frac{3}{4} - \frac{3}{4}t\quad h + tr$ t = k $\frac{3}{4} - \frac{3}{4}t = \frac{1}{2}k$ $\frac{3}{4} - \frac{3}{4}t = \frac{1}{2}t$ $\frac{5}{4}t = \frac{3}{4}$ $t = \frac{3}{4} + \frac{4}{5}$ $= \frac{3}{5}$ $\therefore\ k = \frac{3}{5}$ $\therefore\ PM = \frac{3}{5}r + \frac{3}{10}h$	 1 1 1 1 1 1 1 1 Value of k Value k PM	 PM PM PM simplified Both equations method Value of k Value k PM
		8	
	 Log T = log a + x log b	 1 1	 Plotting Labeling of axis
24.	Log T ⇒ 0.82, 1.25, 1.68, 2.11, 2.54, 2.97, 3.40, 3.84 y – intercept = log a = 0	1 2	Linear All correct logs

	a = 1 gradient = $\frac{3.84 - 0.82}{9 - 2} = \frac{3.02}{7}$ = 0.4315 log b = 0.4315 = 0.4315 b = antilog 0.4315 b = 2.7	1 1 1 **8**	Value of a Method of gradient Value of b

MATHEMATICS III
PART II
MARKING SCHEME

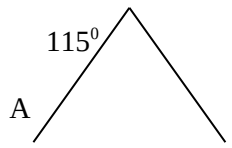
NO.	SOLUTION	MARKS	AWARDING
1.	No | log 8.69 | 0.9390 0.786 | 1.8954 21.72 | 1.3369 | 1.2323 | 1.7067 - 2 $\frac{2}{2} + \frac{1.7067}{2}$ - 1 + 0.8533 0.7134×10^{-1} = 0.07134	M1 M1 A1	✓ reading to 4 s.f Rearranging
		3	
2.	$\frac{4}{(x-2)(x+2)} - \frac{1}{(x-2)}$ $\frac{-x+2}{(x-2(x+2)}$ $\frac{-(x-2)}{(x-2(x+2)}$ $\frac{-1}{x+2}$	M1 M1 A1	
		3	
3.	Re6000 = Ksh. 75000 Spent 5000 Rem 2500 Rem 2500 1.25 Re 2000	M1 M1 A1	
		3	
4.	2x - 1 , 2z + 1 , 2x + 3 6x + 3 = 105	M1 M1	Allow M1 for us of different variable.

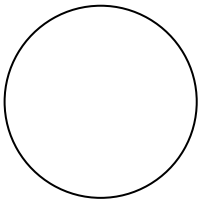
	$6x = 102$ $x = 17$	A1 A1	
		4	
5.	$4 * 1 = \frac{5}{4}$ $2 * 3 = \frac{5}{6}$ $A * 5 = \frac{5}{6}\ \frac{}{4}$ $A + \frac{5}{6} = \frac{5}{4} \times \frac{5A}{6}$ $A + \frac{5}{6} = \frac{25}{24} A$ $A = 20$	M1 M1 A1 **3**	
6.	 $180 - M + 20 + 95 = 180$ $295 - M = 180$ $-M = -115$ $M = 115$	B1 B1 A1	
		3	
7.	$1 + 2x + 60x^2 + 160x^3 +$ $1 + 0.2 + 0.006 + 0.00016$ $= 1.20616$ $= 1.206$	M1 M1 M1 A1 **4**	Only upto term in x^3. Correct substitution Only 4 s.f.
8.	$\begin{pmatrix} 3 & -1 \\ -5 & 2 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ 5 & 3 \end{pmatrix} = I$ $\begin{pmatrix} 6 & -5 \\ -10 & +10 \end{pmatrix} \begin{pmatrix} 3 & -3 \\ -5 & +6 \end{pmatrix}$ $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$	M1 M1 A1	Matrix multiplication gives : $I \quad \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$
		3	
9.	(a) $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} = \frac{2}{5}$ (b) $\left(\frac{2}{3} \times \frac{3}{4} \times \frac{1}{5}\right) + \left(\frac{2}{3} \times \frac{1}{2} \times \frac{4}{5}\right) + \left(\frac{1}{3} \times \frac{3}{4} \times \frac{4}{5}\right)$ $\frac{1}{10} + \frac{4}{15} + \frac{1}{5}$	M1 M1 A1	

	$= \frac{17}{10}$		
		3	
10.	$\angle QCB = 30^0$ $180 - (27 + 30) = 123^0$ $\therefore$ BAC $= 57^0$.	M1	
	OBA $= 37^0$ OAB $= 37^0$	M1	Isosceles triangle.
	AOB $= 106^0$ $\therefore$ ACB $= 53^0$	A1	Angle at centre is twice angle at circumference.
		3	
11.	V = 1 x 3.14 x r^2 x 10 = 270 L.S.F. $\frac{20}{30} = \frac{2}{3}$ V.S.F = $\left(\frac{2}{3}\right)^3 = \frac{8}{27}$ Vol. of cone = $\frac{8}{27}$ x 270 = $80cm^3$ $\therefore$ Vol. Of frusturm = (270 - 80) = $190cm^3$	M1 M1 A1	
		2	
12.	$\left(\frac{3x^3}{3} - \frac{x}{-1}\right)^{-1}$ $\begin{matrix}2\\1\end{matrix}$ $\left(x^3 + \frac{1}{x}\right)^{\begin{matrix}2\\1\end{matrix}}$ $8 + \frac{1}{2} - (1 - 1)$ $\left(8\frac{1}{2} - 2\right) = 6\frac{1}{2}$	M1 A1 **2**	
13.	(2 x 3 x 1.5) volume $9 m^3$ 1L $\equiv$ $1000 cm^3$ 1000 L = $1 m^3$ 9000 L = $9 m^3$ 1000 L = 1 tonne 9000 L = 9 tonnes.	M1 A1	
		2	
14.	$y \geq 1$ (i) $y \leq x - 1$ (ii) $y \leq 5 - x$ (iii)	B1 B1	
		3	

15.	$M_1 = \frac{5.1 + 4.9 + 4.7}{3} = 4.9$ $M_2 = \frac{4.9 + 4.7 + 4.5}{3} = 4.7$ $M_3 = \frac{4.7 + 4.5 + 4.0}{3} = 4.4$	M1 M1 M1	
		3	
16.	Original contribution per woman $= \frac{6300}{N}$ Contribution when 7 withdraw $= \frac{6300}{(n-7)}$ Increase - Diff. $\frac{6300}{n-7} - \frac{6300}{n}$ $\frac{6300n - 6300(n-7)}{n(n-7)}$ $\frac{6300n - 6300 + 44100}{n(n-7)}$ $\frac{44100}{n(n-7)}$	 M1 M1 1 **3**	

SECTION II (48 Marks)

17.	(i)  Centre of circles of latitude 50^0 S. R Cos 50^0 AB = 115 x 2π R Cos 50° $\frac{115}{360}$ x 40192 x 0.6428 = 8252.98 km (ii) Arc AB 60 x 115 Cos 50 nm 60 x 115 x 0.6428 nm 4435 nm	 M1 M1 M1 A1 M1 M1 M1 A1	No. log 60 1.7782 1+5 2.0607 0.6428 1.8080 4435nm ← 3.6469
		8	

18.	(a) $V = \frac{ds}{dt} = 6t^2 + 8t - 8$ (i) $t = 2$ $V = 6x4 + 8x2 - 8$ $= 32\ ms^{-1}$ (ii) $t = 3$ $V = 6x9 + 8x3 - 8$ $= 70ms^{-1}$ (b) Particle is at rest when $V = 0$ $6t^2 + 8t - 8 = 0$ $2(3t - 2)(t+2) = 0$ $t = \frac{2}{3}$ $\quad t = -2$ particle is at rest at $t = \frac{2}{3}$ seconds		Do not accept t = -2. Must be stated.
		8	
19.	Area under velocity - time. graph gives distance. $A = \{ h \frac{1}{2} (y_1 + y_6) + y_2 + y_3 + y_4 + y_5)\}$ $= 1 \{ \frac{1}{2} (12+47) + 24 + 35 + 41 + 45)\}$ $= 29.5 + 14.5$ $= 174.5m$	B1 B1 M1 M1 B1 B1 A1	Trapezium rule only accepted. Formula. Substitution into formular.
		8	
20.	Drawing actual Scale 1cm = 2cm  Radius 1cm = 2cm	M1 M1 M1 M1 M1 M1 M1	Bisect $\angle A$ Bisect $\angle B$ Intersection at centre of inscribed circle. Draw circle. Measure radius. Arcs must be clearly shown.
		8	

21.	mean = 44.5 + $\frac{130}{100}$ = 44.5 + 1.3 = 45.8 (b) Variance $\Sigma (x - A)^2 = \frac{2800}{100}$ Σf = 28 S.D. = $\sqrt{28}$ = 5.292	M1 A1 M1 A1 M1 A1	
		8	
22.	y = sin x x 0 60 120 180 240 30 360 sin x 0 0.866 0.866 0 -0.866 -0.866 0 y = cos x x θ 60 120 180 240 300 360 cos x 1 0.5 -0.5 -1.0 -0.5 0.5 1.0 y = cosx + sinx x θ 60 120 180 240 30 360 cosx + sinx 1 1.366 0.366 -1 -1.366 -0.366 1.0 (c) Cos x = - sin x x = 45^0 , 225^0		
	 (i) amplitude = 1.366		

	(ii) Period = 300^0		
23.	(a) $(x+1)^2 + (y-6)^2 = 3^2$ $x^2 + 2x + 1 + y^2 - 12y + 36 = 9$ $x^2 + 2x + y^2 - 12y + 28 = 0$ (b) $\cos 10 = \frac{OD}{DE}$ $DE = \frac{3}{0.9848}$ $DE = 3.046$ (c) Twice $\angle OED$ $10^0 \times 2 = 20^0$ (d) $DAB = 80^0$ $\therefore DCB = 100^0$	M1 A1 M1 A1 M1 A1 M1 A1	Formular $(x-a)^2 + (y-b)^2 = r^2$ Cyclic quad.
		8	
24.	Let number of trips by 12 tonne lorry be x. Let number of trips by 7 tonne lorry be y. (a) $x > 0$; $y > 0$ $24x + 21y \leq 150$ $12 \times 25 \times X + 15 \times 7 \times y \leq 1200$ $300x + 105y \leq 1200$ $x > 2y$ (b) Ref. Graph paper. Minimising: 3 - 12 tonne lorry and 2 - 7 tonne lorries should be deployed.	 B1 B1 B1	

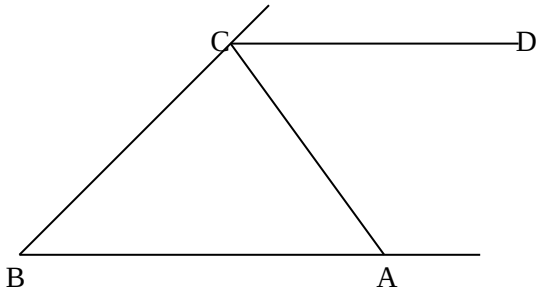
MATHEMATICS IV
PART I

SECTION 1 (52MKS)

1. Evaluate using logarithms $\sqrt[3]{\frac{7.673 - 15.612}{12.3}}$ (4mks)

2. Solve $\frac{x}{3} - \frac{3x - 7}{5} = \frac{x - 2}{5}$ (3mks)

3. In the given figure CD is parallel to BAC, calculate the values of x and y. (3mks)



4. The surface area and volume of a sphere are given by the formulars $S = 4\pi r^2$ and $V = {}^4/_3\ \pi r^3$.
Express V in terms of S only. (3mks)

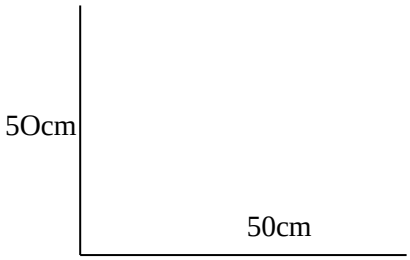
5. A line perpendicular to y = 3-4x passes through (5,2) and intercepts y axis at (0,k)
Find the value of K. (3mks)

6. An alloy is made up of metals P,Q,R, mixed in the ratio 4:1: 5: A blacksmith wants to make 800g of the alloy. He can only get metal P from a metallic ore which contains 20% of it. How many Kgs of the ore does he need. (3mks)

7. The co-ordinate of point A is (2,8) vector $AB = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$ and vector $BC = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ Find the co-ordinate of point C. 3mks)

8. Two buildings are on a flat horizontal ground. The angle of elevation from the top of the shorter building to the top of the taller is 20^0 and the angle of depression from the top of the top of the shorter building to the bottom of the taller is 30^0. If the taller building is 80m, how far apart are they (4mks)

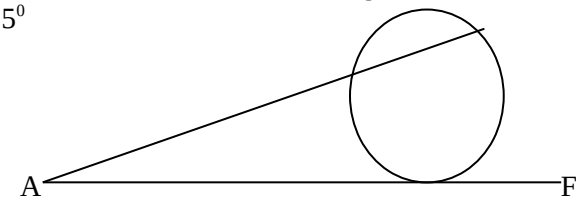
9. The given figure is a quadrant of a piece of paper from a circle of radius 50cm. It is folded along AB and AC to form a cone . Calculate the height of the cone formed. (4mks)



10. Express 3.023 as a fraction (2mks)
11. Point A (1,9), Point B(3,5) and C (7,-3). Prove vectorically that A,B and C are collinear. (4mks)
12. A salesman gets a commission of 4% on sales of upto shs 200,000 and an additional 2% on sales above this. If in January he got shs 12,200 as commission, what were his total sales (4mks)
13. Water flows through a cylindrical pipe of diameter 3.5cm at the rate of 2m/s. How long to the nearest minute does it take to fill a spherical tank of radius 1.4m to the nearest minute? (4mks)
14. Rationalize the denominator in $\frac{\sqrt{3}}{\sqrt{7} - 2}$
Leaving your answer in the form $\frac{\sqrt{a} + \sqrt{b}}{C}$
Where a ,b, and c are integers (3mks)
15. For positive values of x, write the integral solutions of $3 \leq x^2 \leq 35$ (4mks)
16. 8 girls working 5 hours a day take 12 days to drain a pool. How long will 6 girls working 8 hours a day take to drain the pool?(Rate of work is equal) (2mks)

SECTION II (48 mks)

17. In the given circle centre O , A,E,F, is target to the circle at E. Angle FED = 30^0 <DEC = 20^0 and <BC0 = 15^0



Calculate (i) <CBE (3mks)
(ii) <BEA (2mks)
(iii) <EAB (3mks)

18. The sum of the 2nd and third terms of a G.P is $^9/_4$ If the first term is 3,
(a) Write down the first 4 terms of the sequence . (5mks)
(b) Find the sum of the first 5 terms using positive values of the common ratio (r) (3mks)

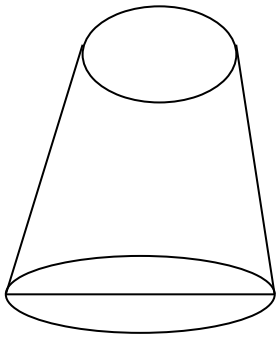
19. E and F are quantities related by a law of the form $E = KF^n$ Where k and n are constants. In an experiment , the following values of E and F were obtained .

E	2	4	6	8
F	16.1	127.8	431.9	1024

Use graphical method to determine the value of k and n (Graph paper provided) (8mks)

20. In the domain $-2 \leq x \leq 4$ draw the graph of $y = 3x^2 + 1 - 2x$ .Use your graph to solve the equation. $6x^2$ 4x + 4 = 0 (graph paper provided) (8mks)
21. A solid sphere of radius 18cm is to be made from a melted copper wire of radius 0.4mm . Calculate the length of wire in metres required to make the sphere. (5mks)
(b) If the density of the wire is $5g/cm^3$. Calculate the mass of the sphere in kg. (3mks)

22. A right cone with slant height of 15cm and base radius 9cm has a smaller cone of height 6cm chopped off to form a frustum. Find the volume of the frustum formed (8mks)



9cm

23. PQRS are vertices of a rectangle centre. Given that P(5,0) and Q and R lie on the line x+5 = 2y, determine
(a) The co-ordinates of Q,R,S, (6mks)
(b) Find the equation of the diagonal SQ (2mks)
24. A tap A takes 3 hours to fill a tank. Tap B takes 5 hours to fill the same tank. A drain tap C takes 4 hours to drain the tank. The three taps were turned on when the tank was empty for 1½ hours. Tap A is then closed. Find how long it takes to drain the tank.
(8mks)

MATHEMATICS IV
PART II

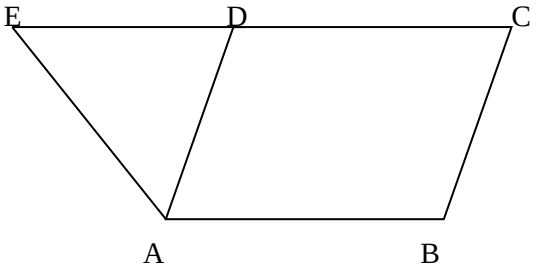
SECTION I (52MKS)

1. Without using mathematical tables, evaluate (3mks)

$$\frac{\sqrt{0.0784 \times 0.27}}{0.1875}$$ *(leave your answer in standard form)*

2. A father is three times as old as his son. In ten years time , the son will be half as old as the father . How old are they now? (3mks)

3. A,B,C,D, is a parallelogram diagram. ADE is an equilateral triangle. AB and CD are 3cm apart. AB = 5cm. Calculate the perimeter of the trapezium ABCE (3mks)



4. Given that a = -2, b = 3 and c = -1, Find the value of $\frac{a^3 - b - 2c^2}{2b^2 - 3a^2c}$ (2mks)

5. The exchange rate in January 2000 was US $ 1 = Ksh 75.60. and UK £1 = Ksh 115.80. A tourist came to Kenya with US $ 5000 and out of it spent ksh.189,000. He changed the balance in UK £ . How many pounds did he receive? (4mks)

6. ABC is a cross – section of a metal bar of uniform cross section 3m long. AB = 8cm and AC = 5cm. Angle BAC = 60^0 . Calculate the total surface area of the bar in M^2. (4mks)

7. The bearing of a school chapel C, from administration block A, is 250^0 and 200m apart. School flag F is 150m away from C and on a bearing of 020^0. Calculate the distance and bearing of A from F. (5mks)
8. A box has 9 black balls and some white balls identical except in colour. The probability of picking a white ball is $^2/_3$
   (i) Find the number of red balls (2mks)
   (ii) If 2 balls are chosen at random without replacement, find the probability that they are of different colour. (2mks)
9. Under an enlargement of linear scale factor 7, the area of a circle becomes $441.\pi$
   Determine the radius of the original circle. (3mks)
10. A circle has radius 14cm to the nearest cm . Determine the limits of its area. (3mks)

11. Expand $(1 + 2x)^5$ up to the term with x^3. Hence evaluate 2.04^5 to the nearest 3 s.f. (4mks)
12. The nth term of a G.P is given by $5 \times 2^{n-2}$
    (i) Write down the first 3 terms of the G.P (1mk)
    (ii) Calculate the sum of the first 5 terms (2mks)
13. 3 bells ring at intervals of 12min, 18min and 30min respectively. If they rang together at 11.55am, when will they ring together again. (3mks)
14. On a map scale 1:20,000 a rectangular piece of land measures 5cm by 8cm. Calculate its actual area in hectares. (3mks)
15. It costs Maina shs. 13 to buy 3 pencils and 2 rubbers; while Mutiso spent shs.9 to buy one pencil and 2 rubbers. Calculate the cost of a pencil and one rubber (3mks)

16. Three angles of a pentagon are 110^0, 100^0 and 130^0. The other two are 2x and 3x respectively. Find their values . (2mks)

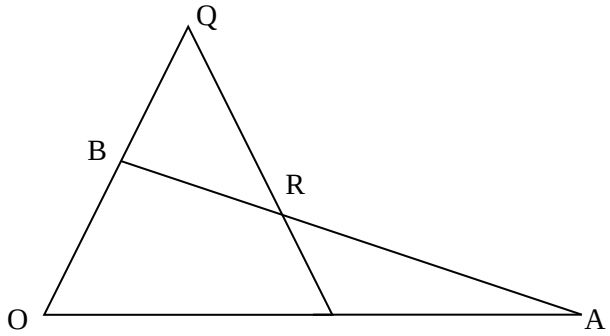
SECTION II (48MKS)

17. Members of a youth club decided to contribute shs 180,000 to start a company. Two members withdrew their membership and each of the remaining member had to pay shs. 24,000 more to meet the same expense. How many members remained? (8mks)
18. A box contains 5 blue and 8 white balls all similar . 3 balls are picked at once. What is the probability that
    (a) The three are white (2mks)
    (b) At least two are blue (3mks)
    (c) Two are white and one is blue (3mks)

19. A rectangular tennis court is 10.5m long and 6m wide. Square tiles of 30cm are fitted on the floor.
    (a) Calculate the number of tiles needed. (2mks)
    (b) Tiles needed for 15 such rooms are packed in cartons containing 20 tiles. How many cartons are there in total? (2mks)
    (c) Each carton costs shs. 800. He spends shs. 100 to transport each 5 cartons. How much would one sell each carton to make 20% profit ? (4mks)
20. The following was Kenya`s income tax table in 1988.

Income in K£ P.a	**Rate (Ksh) £**
1 - 2100	2
2101 - 4200	3
4201 - 6303	5
6301 - 8400	7

    (a) Maina earns **£** 1800 P.a. How much tax does he pay? (2mks)
    (b) Okoth is housed by his employer and therefore 15% is added to salary to make taxable income. He pays nominal rent of Sh.100 p.m His total tax relief is Shs.450. If he earns K**£**3600 P.a, how much tax does he pay? (6mks)
21. In the given figure, OA = a , OB =b, OP: PA =3:2, OQ:QB = 3:2



(a) Write in terms of a and b vector PQ (2mks)

(b) Given that AR = hAB where h is a scalar, write OR in terms h, a. and b (2mks)
(c) PR = K PQ Where K is a scalar, write OR in terms of k, a and b (1mk)
(d) Calculate the value of k and h (3mks)

22. A transformation P = $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ and maps A(1,3) B(4,1) and C(3,3) onto $A^1B^1C^1$. Find the co-ordinates of $A^1B^1C^1$ and plot ABC and $A^1B^1C^1$ on the given grid.
Transformation Q maps $A^1B^1C^1$ onto A^{11}(-6,2) B^{11}(-2,3) and C^{11}(-6,6). Find the matrix Q and plot $A^{11}B^{11}C^{11}$on the same grid. Describe Q fully. (8mks)

23. By use of a ruler and pair of compasses only, construct triangle ABC in which AB = 6cm, BC = 3.5cm and AC = 4.5cm. Escribe circle centre 0 on BC to touch AB and AC produced at P and Q respectively. Calculate the area of the circle. (8mks)

24. The following were marks scored by 40 students in an examination

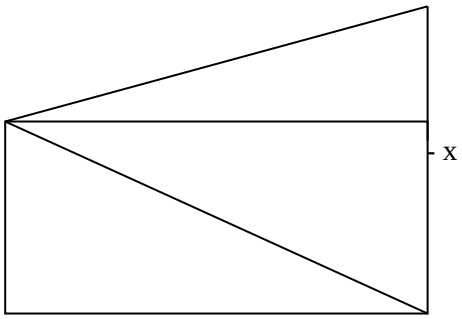
330	334	354	348	337	349	343	335	344	355
392	341	358	375	353	369	353	355	352	362
340	384	316	386	361	323	362	350	390	334
338	355	326	379	349	328	347	321	354	367

(i) Make a frequency table with intervals of 10 with the lowest class starting at 31 (2mks)
(ii) State the modal and median class (2mks)
(iii) Calculate the mean mark using an assumed mean of 355.5 (4mks)

MATHEMATICS IV
PART 1
MARKING SCHEME

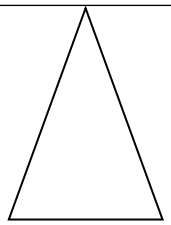
1.	$\sqrt{-\frac{7.939}{12.3}}$ = No | log 7.939 | 0.8998 12.3 | 1.0899 T.8099 $^1/_3$ = $\frac{3 + 2.8099}{3}$ T.9363 = -0.8635	B1 B M1 ***A1*** 4	Subtraction Logs Divide by 3 Ans
2.	5x – 3 (3x –7) = 3(x – 2) 5x – 9x + 21 = 3x – 6 -7x = -27 x = $3^6/_7$	M1 M1 ***A1*** 3	Multiplication Removal ( ) Ans
3.	3x +5y + x = 180 9x = 180 x = 20 y = 60	M1 A1 ***B1*** 3	Eqn X B
4.	. r = $\left(\frac{3v}{4\Pi}\right)^{1/3}$	B1	Value r

$\begin{pmatrix} & \\ & \end{pmatrix}$

	. $r = \sqrt{\frac{S}{4\Pi}}$ $\therefore 3V \times \frac{1}{3} = \frac{S}{4\Pi}^{\frac{1}{2}}$ $\frac{3V}{4\Pi} = \frac{S}{4\Pi}^{\frac{3}{2}}$ $V = \frac{4\Pi}{3} \frac{S}{4\Pi}^{\frac{3}{2}}$	M1 ***A1*** 3	Equation Expression
5. 6.	Grad line $= \frac{1}{4}$ $\frac{y-2}{x-5} = \frac{1}{4}$ $y = \frac{1}{4}x + \frac{3}{4}$ $k = \frac{3}{4}$ P in Alloy $= \frac{4}{10} \times 800$ $= 320g$ $= \frac{100}{20} \times 320$ $= 3.2$ kg	M 1 A1 ***A 1*** 3 B1 M1 ***A 1***	Equation Equation K P in alloy Expression Ans
7.	B (a,b) , C (x ,y) $\begin{pmatrix} a-2 \\ b-8 \end{pmatrix} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$ $a = 8 \quad b = 6 \quad B(8, 6)$ $\begin{pmatrix} x-8 \\ y-6 \end{pmatrix} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ $x = 11, \ y = 10 \ c(11,10)$	B1 M1 ***A1*** 3	B conduct Formular C
8.	 $h = x \tan 70$ $h = (80 - x) \tan 60$ $\therefore \ x \tan 70 = 80 \tan 60 - x \tan 60$ $2.7475x + 1.732x = 138.6$ $4.4796x = 138.6$	B1 M1	Expression for h both Equation

	.h = $\frac{138.6}{4.4796}$ x tan 60 = 53.59	M1 ***A1*** 4	Expression for h Ans
9.	$2\pi r = \frac{90}{360} \times 2\pi \times 50$ r = 12.5 h = √2500 - 156.25 = √2343.75 = 48.41 cm	M1 P A1 M1 ***A1*** 4	Equation .r expression for h ans
10.	100 n = 302.323 n = 3.023 99n = 299.3 n = $\frac{2993}{990}$ = $3\frac{23}{990}$	M1 ***A1*** 4	Equation Ans
11.	AB = $\begin{pmatrix} 3-1 \\ 5-9 \\ 2 \end{pmatrix} = \begin{pmatrix} -4 \\ 4 \\ -8 \end{pmatrix}$ BC = $\begin{pmatrix} -4 \\ 4 \\ -8 \end{pmatrix}$ AB = ½ BC ∴ AB // BC But B is common ∴ A,B,C are collinear.	B1 B1 ***B1*** 3	A B & BC Both Both
12.	4% of 200,000 = 8000/= balance = 4200/= 6% of x = 4200/= x = $\frac{4200 \times 100}{6}$ = 70,000 sales = sh. 270,000	B1 M1 A1 ***B1*** 4	Both Expression Extra sales Ans
13 .	Time = $\frac{\frac{22}{7} \times \frac{3.5}{2} \times \frac{3.5}{2} \times 200}{\frac{22}{7} \times 140 \times 140 \times 140 \times 3600}$ hrs = $\frac{8960}{3600}$ = 2 hrs 29min	M1 M1 M1 ***A1*** 4	Vol tank Vol tank Div x 3600 Tank

14.	$\frac{\sqrt{3}}{\sqrt{7}\sqrt{2}} = \left(\frac{\sqrt{3}}{\sqrt{2}\sqrt{2}}\right)\left(\frac{\sqrt{7}+\sqrt{2}}{\sqrt{7}+\sqrt{2}}\right)$ $= \frac{\sqrt{3}\sqrt{7}+\sqrt{2}}{5}$ $= \frac{\sqrt{21}+\sqrt{6}}{5}$	M1 M1 ***A1*** 3	Multi Expression Ans
15.	$3 \leq x^2 \quad x^2 \leq 35$ $\pm 1.732 \leq x \quad x \leq \pm 5.916$ $1.732 \leq x \leq 5.916$ integral x : 2, 3, 4, 5	B1 B1 B1 ***B1*** 4	Lower limit Upper limit Range Integral values
16.	No of days $= {}^{8}/_{6} \times {}^{5}/_{8} \times 12$ $=$ 10 days	M1 ***A1*** 2	Expression days
17.	(i) $\angle CED = \angle ECD = 30$ $\angle CDE = 180 - 60$ $= 120$ $\angle CBE = 180\text{-}120$ $=60$ (ii) $\angle AEC = 90+30$ $= 120$ $\angle EAB = 180\text{-}(120+45)$ $= 15^0$ (iii) $\angle BEO = 90\text{-}45$ $= 45$	B1 B1 B1 B1 B1 B1 B1 ***B1*** 8	 $\angle A EB = 45^0$ $\angle BEO$
18.	$.ar + ar^2 = {}^{9}/_{4}$ $3r + 3r^2 = {}^{9}/_{4}$ $12r^2 + 12r - 9 = 0$ $4r^2 + 3r - 3 = 0$ $4r^2 + 6r - 2r - 3 = 0$ $(2r - 1)(2r + 3) = 0$ $r = ½$ or $r = -1{}^{1}/_{2}$ $Ss = \frac{3(1-(1/2)^5)}{1-½}$ $= \frac{3(1-{}^{12}/_{32})}{½}$ $= 6({}^{31}/_{32})$ $= 6\,{}^{31}/_{32}$	B1 B1 B1 M1 A1 M1 M1 ***A1*** 8	
19.	*LOG E.* *0.3010* *0.6021* *0.7782* *0.9031* LOG F 1.2068 2.1065 2.6354 3.0103 Log E =n log F + Log K	B1 B1 S1 P1	Log E Log F Scale Plotting

	.n = gradient = 2 $\frac{2.4 - 1.4}{0.7 - 0.3} = \frac{12}{4} = 3$ Log k. = 0.3 .k = 1.995 □ 2 □ E = $2F^3$	L1 M1 A1 ***B1*** 8	Line Gradient K
20	.x | -2 | -1 | 0 | 1 | 2 | 3 | 4 .y | 17 | 6 | 1 | 6 | 9 | 22 | 41 .y = 3x 2 - 2x + 1 - 0 = 3x 2 – 3x – 2 y = x + 3	B2 B1 B1 S1 P1 C1 L1 ***B1*** 8	All values At least 5 Line Scale Plotting Smooth curve Line drawn Value of r
21.	.h = $\frac{\frac{3}{4}\pi \times 18 \times 18 \times 18}{\pi \times 0.04 \times 0.04}$ = $\frac{24 \times 18 \times 18 \times 18}{0.4 \times 0.04 \times 100}$ = 48,600m density = $\frac{4}{3} \times \frac{22}{7} \times \frac{18 \times 18 \times 18 \times 15}{1000}$ kg = 122.2kg	M1 M1 M1 M1 A1 M1 M1 ***A1*** 8	N of wire ÷ to length in cm ÷ for length conversing to metres length expression for density conversion to kg ans
22.	 H = $\sqrt{15^2 - 9^2}$ = $\sqrt{144}$ = 12 $\frac{X}{6} = \frac{9}{12}$ X = 4.5 Volume = $\frac{1}{3} \times \frac{22}{7} \times (81 \times 12 - 20.25 \times 6)$	M1 A1 M1 A1 M1 M1	Method Method Radius Small vd Large vol

	$= {}^{22}/_{21}$ (972 – 121 -5) = 891 cm^3	M1 A1 8	Subtraction of vol. Ans
23.	R(-a , b) , Q (c,d), S(x , y) ,P (5,0) PR is diagonal (a) Mid point PR (0,0) $\frac{a + 5}{2} = 0$ .a = -5 $\frac{b- 0}{2} = 0$ b = 0 R (-5,0) Grad PQ = -2 Grad RS = -2 $.\frac{d – 0}{c –5} = -2$ $.\frac{d – 0}{c+5} = ½$ .d+ 2c = 10 2d – c = 5x2 - 4d – 2c = 10 5d = 20 d = 4 c = 3 Q (3, 4) $\frac{x + 3}{2}$, $\frac{y+4}{2}$ = (0,0) x = -3 , y = -4 ∴ s(-3 -4) (b) $\frac{y – 4}{x – 3} = \frac{8}{6}$ 3y = 8x – 12	 B1 M1 M1 A1 M1 A1 M1 A1 8	 Ans . Expression both correct Equation Ans Expression Equation

MATHEMATICS IV
PART II
MARKING SCHEME

1.	784 X 27 = 187500 $\sqrt{\frac{784 \times 9}{62500}} = \frac{4 \times 7 \times 3}{250}$ $= \frac{42}{125}$ = 0.336	 M1 M1 A1	 Factors for Fraction or equivalent C.A.O
		3	
2.	Father 3x , r son = x 2(x +10) = 3x + 10 2x +20 = 3x + 10 x = 10	M1 A1	Expression

	father = 30	B1	
		3	
3.	3 = sin 60 AE AE = 3 Sin 60 = 3.464 perimeter = 5x2 + 3.464 x 3 = 10+10.393 = 20.39	M1 A1 B1	Side of a triangle Perimeter
		3	
4.	$\frac{a^3 - b-2c^2}{2b^2 - 3a^2c} = \frac{(-2)^3 - 3 - 2(-1)^2}{2(3)^2 - 3(-2)^2(-1)}$ $= \frac{-8 - 3-2}{18 + 12}$ $= \frac{-13}{30}$	M1 M1 A1	Substitution Signs C.A.O
		3	
5.	Ksh 189,000 = $ 189,000 75.6 = $ 2500 balance = $ 2500 = Kshs. 189,000 Kshs. 189,000 = $\frac{189,000}{115.8}$ Uk £1632	M1 A1 M1 A1 **A1** 4	Conversion Conversion
6.	Area of 2 triangles = 2 (½ x 8x 5 sin 60) = 40 sin 60 = 40x 0.8660 = 34.64 cm^2 Area of rectangle = 300 x 8 + 300 x 5 +300 x BC BC = √64 +25 – 2 x 40cos 60 = √89 – 80 x 0.5 = √89 – 40 = √49 = 7 Total S.A. = 300 (8+5+7) + 34.64 cm^2 = 6000 + 34.64 = 6034.64 cm^2	M1 M1 M1 A1	Areas of Δ B.C. expression Area
		4	
7.	$AF^2 = 3^2+4^2+-2+12x \cos 50$ = 25 – 24 x 0.6428 = 25-15.43 = 9.57 AF = 3.094 x 50 AF = 154.7m Sin Q = $\frac{200 \sin 50^o}{154.7}$ = 0.9904	M1 A1 M1	

	Q = 82.04^0 Bearing = 117.96^0	A1 B1	Bearing
		5	
8.	(i) No. of white = w $\frac{w}{w+9} = \frac{2}{3}$ 3w = 2w + 18 w = 18 (ii) p(different colour) = p(WB N BW) $= \frac{2}{3} \times \frac{9}{25} + \frac{9}{27} \times \frac{18}{25}$ $= {}^{12}/_{25}$	M1 A1 M1 A1	
		4	
9.	A.sf = $\frac{1}{49}$ smaller area = $\frac{1 \times 441\pi}{49}$ $= 9\pi$ $\pi r^2 = 9\pi$ $r^2 = 9$ r = 3	 M1 M1 A1	
		3	
10.	Largest area = $\frac{22 \times (14.5)^2}{7}$ $= 660.8\ cm^2$ smallest area = $^{22}/_7 \times (13.5)^2$ = 572.8 $572.8 \leq A \leq 660.81$	M1 M1 A1	
		3	
11.	$(1+2x)^5 = 1 + 5(2x) + 10(2x)^2 + 10(2x)^3$ $= 1 + 10x + 40x^2 + 80x^3$ $2.045^5 = 1+2(0.52)^5$ $= 1+10(0.52)+ 40(0.52)^2+80(0.52)^3$ = 1+5.2 + 10.82 + 11.25 = 28.27	M1 A1 M1 A1	
		4	
12.	Tn = $5x\ 2^{n-2}$ (i) $T_1, T_2, T_3 = 2.5, 5, 10$ (ii) $S_5 = \frac{2.5(2^5-1)}{2-1}$ = 2.5 (31) = 77.5	 B1 M1 A1	All terms
		3	
13.	12 = $2^2 \times 3$ 18 = 2×3^2 30 = 2x3x5 Lcm = 22 x 32x 5 = 180 min = 3hrs time they ring together =11.55 +3 = 2.55 p.m	M1 A1 B1	
		3	
14.	Map area = $40cm^2$ Actual area = $200x200x40m^2$	M1 M1	Area in m^2 Area in ha

	$= \frac{200x200x40ha}{100x100}$ $= 320ha$	 A1	 CAO
		3	
15.	$3p + 2r = 13$ $p + 2r = 9$ - $2p = 4$ $p = sh\ 2$ $r = 3.50$	M1 A1 B1	
		3	
16.	$110 + 100+130+2x +3x = 540$ $5x = 200$ $x = 40^0$ $2x , 3x = 80$ and 120^0 res	M1 **A** A1 2	
17.	Contribution / person $= \frac{180,000}{X}$ New contribution $= \frac{180,000}{x-2}$ $\frac{180,000}{x-2} - \frac{180,000}{x} = 24,000$ $180,000x – 180,000x +360,000 = 24,000(x-2)x$ $24,000x^2 - 48,000x – 360,000 =0$ $x^2 - 2x – 15 = 0$ $x^2 – 5x + 3x – 15 = 0$ $x (x – 5)+ 3 (x – 5) = 0$ $(x + 3)(x - 5) = 0$ $x = -3$ or $= 5$ remaining members $= 5-2$ $= 3$	B1 B1 M1 M1 A1 M1 A1 B1	‘C’ eqn mult eqn factor both ans remaining members
		8	
18.	(a) P (3 white) $= \frac{8}{13} \times \frac{7}{12} \times \frac{6}{11} = \frac{28}{143}$ (b) P(at least 2 blue)=p(WBBorBBWorBWB)orBBB $= \frac{8}{13} \times \frac{5}{12} \times \frac{4}{11} + \frac{5}{13} \times \frac{4}{12} \times \frac{8}{11}$ $+ \frac{5}{13} \times \frac{8}{12} \times \frac{4}{11} + \frac{8}{13} \times \frac{7}{12} \times \frac{6}{11}$ $= \frac{204}{429}$ $= \frac{68}{143}$ (c) p(2 white and one blue)= p(WWB or WBW or BWW) $= \frac{8}{13} \times \frac{7}{12} \times \frac{5}{11} + \frac{8}{13} \times \frac{5}{12} \times \frac{7}{11} + \frac{5}{13} \times \frac{8}{12} \times \frac{7}{11}$ $= \frac{3 \times 8 \times 7 \times 5}{13 \times 12 \times 11}$ $= \frac{70}{143}$	M1 A1 M1 M1 A1 M1 M1 A1	
		8	
19.	(a) recourt area $= 10.5 \times 6\ m^2$		

	title area = $0.3 \times 0.3\ m^2$ No of tiles = $\frac{10.5 \times 6}{0.3 \times 0.3}$ = 700 (b) No of cartons = $\frac{700 \times 15}{20}$ = 52.5 (c) Cost of 525 cartons = 525 x 100 + 800 x 525 + transport 5 = 10,500+420,000 = 430,500 sale price = $\frac{120}{100}$ x 4.30,500 = sh 516,600 s.p of a carton = $\frac{516,600}{525}$ = sh. 984	M1 A1 M1 A1 B1 M1 M1 A1	
		8	
20.	(a) Maina`s tax dues = 1800 x $\frac{10}{100}$ = 180 (b) Taxable income = 3600 x $\frac{115}{100}$ – n rent = 36 x 115 – $\frac{100 \times 12}{20}$ = 4140 – 60 = 4080 Tax dues = $\frac{10}{100}$ x 2100 + $\frac{15}{100}$ x 1980 = 210 + 297 = 507 Tax relief = 270- Tax paid = 237	M1 A1 M1 A1 M1 M1 A1 B1	 1st slab 2nd slab
		8	
21.	(a) PQ = $-\frac{3}{5}a + \frac{3}{1}b$ = $\frac{31}{2} - \frac{3}{5}a$ (b) OR = h a + h b = a – ha + hb = (1-h) a + h b (c) OR = $\frac{3}{5}a + k(\frac{31}{2}b - \frac{3}{5}a)$ = $(\frac{3}{5} - \frac{3}{5}k)a + 3k\ b$ (d) $1 - h = \frac{3}{5} - \frac{3}{5}k$ (i) $3k = h$ (ii) Sub (i) $1 - 3k = \frac{3}{5} - \frac{3}{5}k$ $5 - 15k = 3 - 3k$ $12k = 2$ $k = \frac{1}{6}$ $h = \frac{1}{2}$	 B1 M1 A1 M1 A1 M1 A1 B1	

		8	
22.	P(ABC) = 0 - 1 1 4 3 = -3 -1 -3 1 0 3 1 3 1 4 3 A^1 (-3,1)B^1 (-1,4)C^1(-3,3) $Q(A^1B^1C^1)$ = a b -3 –1 -3 = -6 –2 –6 c d 1 4 3 2 8 6 => -3a + b = -6 -3c + d = 2 -a + 4b = -2 x 3 -c + 4d = 8 x 3 <u>- 3a + 12b = -6</u> <u>- 3c + 12d = 24</u> 11b = 0 -11d = -22 b = 0 d = 2 a = 2 <u>d = 2</u> c = 0 Q = 2 0 0 2	M1 A1 M1 M1 A1 B1 B1 B1	A^1 B^1 C^1 L Q A^1 B^1 C^1 drawn A^{ll} B^{II} C^{II} Ploted Destruction
		8	
23.	R = 2.2CM ± 0.1 Area = <u>22</u> x 2.2 x 2-2 7 = 15.21cm^2	B1 B1 B1	

		B1 B1 B1 M1 1 **1** 8	
24.	Ef =40 efd = -80 (ii) model class = 351- 360 modern class = 341 – 350 (iii) mean = 355.5 - 80/40 = 355.5 – 2 = 353.5	B1 B1 M1 A1 B1 B1 B1 B1	
		A1	
		8	

MATHEMATICS V

PART I

SECTION 1 (52 MARKS)

1. Use logarithms to evaluate $\left(\frac{13.6 \cos 40}{63.4}\right)^{0.25}$ (4mks)

2. Solve for x in the equation $(x + 3)^2 - 5(x + 3) = 0$ (2mks)

3. In the triangle ABC, AB = C cm. AC = bcm. $\angle BAD = 30^o$ and $\angle ACD = 25^o$. Express BC in terms of b and c. (3mks)

4. Find the equation of the normal to the curve $y = 5 + 3x - x^3$ when x = 2 in the form $ay + bx = c$ (4mks)

5. Quantity P is partly constant and partly varies inversely as the square of q. q= 10 and p = 5 ½ when q =20. Write down the law relating p and q hence find p when qs is 5. (4mks)

6. Solve the simultaneous equation below in the domain $0 \leq x \leq 360$ and $O \leq y \leq 360$

$$2 \sin x + \cos y = 3$$
$$3 \sin x - 2 \cos y = 1$$ (4mks)

7. Express as single factor $\frac{2}{x + 2} - \frac{x + 2}{x^2 + 3x + 2} + \frac{1}{x + 1}$ (3mks)

8. By use of binomial theorem, expand $(2 - \frac{1}{2}x)^5$ up to the third term, hence evaluate $(1.96)^5$ correct to 4 sf. (4mks)

9. Points A(1,4) and B (3,0) form the diameter of a circle. Determine the equation of the circle and write it in the form $ay^2 + bx^2 + cy + dy = p$ where a, b, c, d and p are constants. (4mks)

10. The third term of a GP is 2 and the sixth term is 16. Find the sum of the first 5 terms of the GP. (4mks)

11. Make T the subject of the formulae $\frac{1}{T^2} - \frac{3m}{R} + \frac{2}{N}$ (3mks)

12. Vectors, $a = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$ $b = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$ and $c = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$

13. By expressing a in terms of b and c show that the three vectors are linearly dependent. (3mks)
A cylindrical tank of base radius 2.1 m and height is a quarter full. Water starts flowing into this tank at 8.30 a.m at the rate of 0.5 litres per second. When will the tank fill up? (3mks)

14. A piece of wood of volume $90cm^3$ weighs 54g. Calculate the mass in kilograms of 1.2 m^3 of the wood. (2mks)

15. The value of a plot is now Sh 200,000. It has been appreciating at 10% p.a. Find its value 4 years ago. (3mks)

16. 12 men working 8 hours a day take 10 days to pack 25 cartons. For how many hours should 8 men be

working in a day to pack 20 cartons in 18 days? (2mks)

SECTION II (48MARKS)

17. The tax slab given below was applicable in Kenya in 1990.

Income in p.a.	rate in sh
1 – 1980	2
1981 – 3960	3
3961 – 5940	5
5941 – 7920	7

Maina earns Sh. 8100 per month and a house allowance of Sh. 2400. He is entitled to a tax relief of Sh. 800 p.m. He pays service charge of Sh 150 and contributes Sh 730 to welfare. Calculate Mwangis net salary per month. (8mks)

18. OAB is a triangle with OA = a , OB = b. R is a point of AB. 2AR = RB. P is on OB such that 3OP = 2PB. OR and AP intersect at Y, OY = m OR and AY = nAP. Where m and n are scalars. Express in terms of a and b.

(i) OR (1mk)

(ii)AP (1mk)

(b) Find the ratio in which Y divides AP (6mks)

19. The table below gives related values of x and y for the equation $y = ax^n$ where a and n are constants

X	0.5	1	2	3		10
Y	2	8	32		200	800

By plotting a suitable straight line graph on the graph provided, determine the values of a and n.

20. Chalk box x has 2 red and 3 blue chalk pieces. Box Y has same number of red and blue pieces. A teacher picks 2 pieces from each box. What is the probability that

(a) They are of the same colour. (4mks)

(b) At least one is blue (2mks)

(c) At most 2 are red (2mks)

21. Point P(50^oN, 10^oW) are on the earth's surface. A plane flies from P due east on a parallel of latitude for 6 hours at 300 knots to port Q.

(a) Determine the position of Q to the nearest degree. (3mks)

(b) If the time at Q when the plane lands is 11.20am what time is it in P. (2mks)

(c) The plane leaves Q at the same speed and flies due north for 9 hours along a longitude to airport R. Determine the position of R. (3mks)

22. Using a ruler a pair of compasses only, construct :

(a) Triangle ABC in which AB = 6cm, AC = 4cm and $\angle$ ABC = 37.5^o. (3mks)

(b) Construct a circle which passes through C and has line AB as tangent to the circle at A. (3mks)

(c) One side of AB opposite to C, construct the locus of point P such that $\angle APB = 90^o$. (2mks)

23. A particle moves in a straight line and its distance is given by $S = 10t^2 - t^3 + 8t$ where S is distance in metres at time t in seconds.

Calculate:

(i) Maximum velocity of the motion. (4mks)

(ii) The acceleration when t = 3 sec. (2mks)

(iii) The time when acceleration is zero. (2mks)

24. A rectangle ABCD has vertices A(1,1) B(3,1), C(3,2) and D(1,2). Under transformation

matrix M = $\begin{matrix} 2 & 2 \\ 1 & 3 \end{matrix}$ ABCD is mapped onto $A^1B^1C^1D^1$

under transformation M = $\begin{matrix} -1 & 0 \\ 0 & -2 \end{matrix}$ $A^1B^1C^1D^1$ is mapped onto $A^{11}B^{11}C^{11}D^{11}$. Draw on the given grid

(a) ABCD, $A^1B^1C^1D^1$ and $A^{11}B^{11}C^{11}D^{11}$ (4mks)

(b) If area of ABCD is 8 square units, find area of $A^{11}B^{11}C^{11}D^{11}$. (3mks)

(c) What single transformation matrix maps $A^{11}B^{11}C^{11}D^{11}$ onto $A^1B^1C^1D^1$ (1mk)

MATHEMATICS V
PART II

SECTION 1 (52 Marks)

1. Evaluate without using mathematical tables $(2.744 \times 15\ ^5/_8)^1/_3$ (3mks)

2. If $4 \leq x \leq 10$ and $6 \leq y \leq 7.5$, calculate the difference between highest and least
   (i) xy (2mks)
   (ii) $^y/_x$ (2mks)
3. A 0.21 m pendulum bob swings in such a way that it is 4cm higher at the top of the swing than at the bottom. Find the length of the arc it forms. (4mks)
4. Matrix $\begin{pmatrix} 1 & 2x \\ x+3 & x^2 \end{pmatrix}$ has on inverse, determine x (3mks)

5. The school globe has radius of 28cm. An insect crawls along a latitude towards the east from A(50°, 155^oE) to a point B 8cm away. Determine the position of B to the nearest degree. (4mks)
6. The diagonals of triangle ABCD intersect at M. AM = BM and CM = DM. Prove that triangles ABM and CDM are Similar. (3mks)

7. Given that $\tan x = {}^5/_{12}$, find the value of $\frac{1 - \sin x}{\sin x + 2\cos x}$, for $0 \leq x \leq 90$ (3mks)

8. Estimate by MID ORDINATE rule the area bounded by the curve $y = x^2 + 2$, the x axis and the lines x = O and x = 5 taking intervals of 1 unit in the x. (3mks)
9. MTX is tangent to the circle at T. AT is parallel to BC. $\angle$ MTC = 55° and $\angle$ XTA = 62°. Calculate $\angle$BAC. (3mks)

10. Clothing index for the years 1994 to 1998 is given below.

Year	1994	1995	1996	1997	1998
Index	125	150	175	185	200

Calculate clothing index using 1995 as base year. (4mks)

11. A^2 digit number is such that the tens digit exceeds the unit by two . If the digits are reversed, the number formed is smaller than the original by 18. Find the original number. (4mks)
12. Without using logarithm tables, evaluate $\log_5 (2x-1) - 2 + \log_5 4 = \log_5 20$ (3mks)

13. Mumia's sugar costs Sh 52 per kg while imported sugar costs Sh. 40 per kg. In what ratio should I mix the sugar, so that a kilogram sold at Sh. 49.50 gives a profit of 10%. (4mks)
14. The interior angles of a regular polygon are each 172°. Find the number of sides y lie polygon. (2mks)
15. Evaluate $2x = \frac{2}{6.341} + \frac{3}{9.222}$ (2mks)
16. A water current of 20 knots is flowing towards 060°. A ship captain from port A intends to go to port B at a final speed of 40 knots. If to achieve his own aim, he has to steer his ship at a course of 350°. Find the bearing of A from B. (3mks)

SECTION II (48 MARKS)

17. 3 taps, A, B and C can each fill a tank in 50 hrs, 25 hours and 20 hours respectively. The three taps are turned on at 7.30 a.m when the tank is empty for 6 hrs then C is turned off. Tap A is turned off after four hours and 10 minutes, later. When will tap B fill the tank? (8mks)

18. In the domain $-5 \leq x \leq 4$, draw the graph of $y = x^2 + x - 8$. On the same axis, draw the graph of $y + 2x = -2$. Write down the values of x where the two graphs intersect. Write down an equation in x whose roots are the points of intersection of the above graphs. Use your graph to solve. $2x^2 + 3x - 6 = 0$.(8mks)

19. The average weight of school girls was tabulated as below:

Weight in Kg	30 – 34	35 – 39	40 – 44	45 – 49	50 – 54	55-59	60-64
No. of Girls	4	10	8	11	8	6	3

(a) State the modal class. (1mk)
(b) Using an assumed mean of 47,
(i) Estimate the mean weight (3mks)
(ii) Calculate the standard deviation. (4mks)

20. The table below shows values of $y = a \cos (x - 15)$ and $y = b \sin (x + 30)$

X	0	15	30	45	60	75	90	105	120	135	150
a Cos(x-5)	0.97				0.71	0.5				-0.5	-0.71
b sin(x+3)	1.00				2.00				1.00		0.00

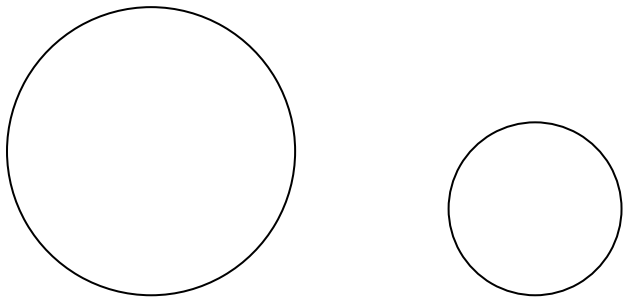
(a) Determine the values of a and b (2mks)
(b) Complete the table (2mks)
(c) On the same axes draw the graphs of y = across(x – 15) and y = b sin(x + 30) (3mks)
(d) Use your graph to solve ½ cos (x – 15) = sin(x + 30) (1mk)

21. The diagram below is a clothing workshop. ∠ ECJ = 30° AD, BC, HE, GF are vertical walls. ABHG is horizontal floor. AB = 50m, BH = 20m, AD=3m

(a) Calculate DE (3mks)
(b) The angle line BF makes with plane ABHG (2mks)
(c) If one person requires minimum $6m^3$ of air, how many people can fit in the workshop (3mks)

22. To transport 100 people and 3500 kg to a wedding a company has type A vehicles which take 10 people and 200kg each and type B which take 6 people and 300kg each. They must not use more than 16 vehicles all together.
(a) Write down 3 inequalities in A and B which are the number of vehicles used and plot them in a graph. (3mks)
(b) What is the smallest number of vehicles he could use. (2mks)
(c) Hire charge for type A is Sh.1000 while hire for type B is Sh.1200 per vehicle. Find the cheapest hire charge for the whole function (3mks)

A circle centre A has radius 8cm and circle centre B has radius 3cm. The two centres are 12cm apart. A thin tight string is tied all round the circles to form interior common tangent. The tangents CD and EF intersect at X.



(a) Calculate AX (2mks)
(b) Calculate the length of the string which goes all round the circles and forms the tangent. (6mks)

24. Airport A is 600km away form airport B and on a bearing of 330°. Wind is blowing at a speed of

40km/h from 200°. A pilot navigates his plane at an air speed of 200km/h from B to A.

(a) Calculate the actual speed of the plane. (3mks)

(b) What course does the pilot take to reach B? (3mks)

(c) How long does the whole journey take? (2mks)

MATHEMATICS V
PART I
MARKING SCHEME

1	SOLUTION	MKS	AWARDING
	No Log 13.6 1.1335 + Cos 40 1.8842 1.0177 - 63.4 1.8021 1. 2156 (4 + 3.2156) $^1/_4$ 1.8039 Antilog 0.6366	 B1 M1 M1 A1	 Log + divide by 4 C.A.O
		4	
2.	(x + 3) (x + 3 – 5) = 0 (x +3)b (x – 2) = 0 x = -3 or x = 2	M1 A1	Factors Both answers
3	BD = C Sin 30 = 0.05 CD = b Cos 25 = 0.9063b ∴ BC = 0.9063b + 0.5 C	B1 B1 B1	BD in ratio from CD in ratio form Addition
		3	
4	$\frac{Dy}{dx} = 3 - 3x^2$ x = 2, grad = $\frac{1}{9}$ Point (2,3) $\frac{y-3}{x-2} = \frac{1}{9}$ 9y – 27 = x – 2 9y – x = 25	B1 B1 M1 A1	Grad equ Grad of normal Eqn Eqn
		4	
5	700 = 100 + n 2200 = 400 + n 1500 = 300m m = 5 n = 200 P = 5 + $\frac{200}{q2}$ When q = 5 P = 13	M1 A1 B1 B2	Equan Both ans Eqn (law) Ans (P)
		4	
6	4 Sin x + 2 cos y = 6 3 Sin x – 2 Cos y = 1 7 sin x = 7 Sin x = 1	M1 M1	Elim Sub

	X = 90 Cos y = 1 Y = 0°	A1 B1	
7	$\frac{2(x+1) - 1(x+2) + x + 2}{(x+2)(x+1)}$ $= \frac{2x + 2 - x - 2 + x = 2}{(x+2)(x+1)}$ $= \frac{2x + 2}{(x+2)(x+1)}$ $= \frac{2}{x+2}$	M1 M1 A1	Use of ccm Substitution Ans
8	$(-2 - ½ x)5 = 2^5 - 5(2)^4(½ x) + 10(2)^3(½ x)^2$ $= 32 - 40x + 20x^2$ $= 32 - 4(0.08) + 20(0.08)^2$ $= 32 - 0.32 + 0.128$ $= 3$	M1 A1 M1 A1	
		4	
9.	Circle centre $C = (\frac{3+1}{2}, \frac{0+4}{2})$ $C(2, 2)$ $R = \sqrt{(2-0)^2 + (2-3)^2}$ $= \sqrt{5}$ $(y-2)^2 + (x-2)^2 = \sqrt{5}$ $y^2 + x^2 - 4y - 4x = 8 + \sqrt{5}$	B1 B1 M1 A1	Centre Radius
		4	
10	$ar^2 = 2,\ ar^5 = 16$ $a = \frac{2}{r^2} \therefore \frac{2r^5}{r^2} = 16$ $2r^3 = 16$ $r^3 = 8$ $r = 2,\ a = ½$ $S_5 = \frac{½(1 - (½)^5)}{½}$ $= 1 - {}^1/_{32}$ $= {}^{31}/_{32}$	M1 A1 M1 A1	 Both Sub CAO
		4	
11	$NR - 3MT^2 = 2RT^2$ $T^2(2R + 3M) = NR$ $T2 = \frac{NR}{2R + 3m}$ $T = \pm\sqrt{\frac{NR}{2R + 3m}}$	M1 M1 A1	X mult 7^2 ans
		3	
12	$\begin{pmatrix}2\\2\end{pmatrix} = m\begin{pmatrix}2\\0\end{pmatrix} + n\begin{pmatrix}6\\4\end{pmatrix}$ $2 = 2m + 6n$ $2 = 0 + 4n$ $n = ½$ $m = -½$ $\therefore a = -½ b + ½ c$ $\therefore$ a b c are linearly dep	M1 A1 B1	
		3	
13	Volume $= \frac{22}{7} \times 2.1 \times 2.1 \times 2 \times ¾\ m^3$	M1	

	Time = $\frac{11 \times 0.3 \times 2.1 \times 3 \times 1,000,000}{500 \times 3600}$ = 11.55 = 11.33 hrs time to fill = 8.03 pm	M1 A1	
		3	
14	Mass = $\frac{54}{90} \times \frac{1.2 \times 1,000,000}{1000}$ = 720kg	M1 A1	
		2	
15	$V_3 = P$ $P(0.9)^3 = 200,000$ $P = \frac{200,000}{0.9^3}$ $= \frac{200,000}{0.729}$ = Sh 274,348	M1 M1 A3	
		3	
16	No of hours = $\frac{8 \times 12 \times 10 \times 20}{8 \times 18 \times 25}$ $= \frac{19200}{3600}$ = 5hrs, 20 min	M1 A1	
		2	
17	Taxable income = 8100 + 2400 = sh. 10,500 = £6300 Tax dues = $\frac{\text{Sh } 1980 \times 2 + 1980 \times 3 + 1980 \times 5 + 3670 \times 7}{12}$ $= \frac{22320}{12}$ = Sh 1860 net tax = 1860 – 800 p.m. = Sh 1060 Total deduction = 1060 + 150 + 730 = 1940 Net salary = 10,500 – 1940 = Sh 8560 p.m.	B1 M1 M1 A1 B1 B1 M1 A1	Tax inc 2 2 net tax total dedu.
		8	
18	OR = $^2/_3$ a + $^1/_3$b or ($^1/_3$ (2a + b) AP = $^2/_5$ b – a OY = m OR = A + n ($^2/_5$b – a) $^2/_5$m b + ma = (1 – n)a + $^2/_5$ n b $^2/_5$m = $^2/_5$n m = n ∴m = 1 – m 2m = 1 m = ½ = n ½ AP = Ay AY:AP = 1:1	B1 B1 B1 M1 M1 A1 A1 B1	 EXP, OY Eqn M = n Sub CAO Ratio
		8	
19			

Log x	1.699	0	0.3010	0.4771		1
Log y	o.301	0.9031	1.5052		2.301	2.9031

	Log y = n log x + log a	B1	Log x
	Log a = 0.9031	B1	Log y
	A = 8		
	Grad = $\frac{1.75 - 0.5}{0.4 + 0.2}$		
	$= \frac{1.25}{0.6}$	B1	A
	= 2.08	B1	N
	n = 2	B1	Missing x and y
	$\therefore y = 8x^2$	S1	Scale
	$x = 3 \quad y = 8 \times 3^2 = 72$	P1	Points
	y = 200 x = 5	L1	Line

		8	
20	P (same colour) = P (XRRrr orXBB or YXX or YBB) = ½ ($^{2}/_{5}$ x ¼ + $^{3}/_{5}$ x $^{2}/_{4}$) x 2	M1 M1	Any 2 Any 2

	$= \frac{2}{20} + \frac{6}{20}$ $= \frac{8}{20}$ $= {}^{2}/_{5}$ (b) P(at least 1B) = 1 – P(non blue) = 1 – P (XRR or YRR) $= 1 - \frac{1}{2}({}^{2}/_{5} \times {}^{1}/_{4}) \times 2$ $= 1 - {}^{1}/_{10}$ $= {}^{9}/_{10}$ (c) P(at most 2 Red) = 1 – P (BB) $= 1 - \frac{1}{2}({}^{3}/_{5} \times {}^{2}/_{4})^{2}$ $= 1 - {}^{6}/_{20}$ $= {}^{14}/_{20}$ or ${}^{7}/_{10}$	M1 A1 M1 A1 M1 A1	Fraction
		8	
21	(a) PQ = 1800nm $\theta = \frac{1800}{60 \times 0.6428}$ = 46.67 = 47° Q (50°N, 37°E) (b) Time diff = $\frac{47 \times 4}{60}$ = 3.08 Time at P = 9.12am (c) QR = 2700 nm $x^{o} = \frac{2700}{60}$ = 45° R (85°N, 133°W)	M1 A1 M1 A1 M1 A1 B1	
		8	
22		B1 B1 B1 B1 B1 B1 B1 B1	Bisector of 150 Bisector 75 AB AC ⊥ at A Bisector AC Circle ∠ AB Locus P with A B excluded
		8	
24	$\begin{pmatrix} 2 & 2 & 1 \\ 3 & 3 & 1 \end{pmatrix} = \begin{pmatrix} A^1B^1 & C^1D^1 \\ 4 & 8 \\ 10 & 6 \end{pmatrix}$	B1	Product

	1 3 1 1 2 2 4 6 9 7 A^{11} B^{11} C^{11} D^{11} -1 0 4 8 10 6 = -4 –8 -10 -6 0 –2 4 6 9 7 -8 -12 -18 -14 NM = -1 0 2 2 0 –2 1 3 = -2 -2 -2 -6 (b) det = Asf = 12 – 4 = 8 Area A^{11} B^{11} C^{11} D^{11} = 8 x 8 = 64 U^2 (c) Single matrix = Inv N = ½ -2 – 0 0 –1 = -1 0 0 - ½	B1 B1 B1 M1 A1 B1	Product Det Inverse
		6	
23	Ds = 20t - $3t^2$ + 8 =0 Dt $3t^2$ – 20t – 8 = 0 T = 20 ± $\sqrt{400 + 4 \times 3 \times 8}$ 6 t = 7.045 sec max vel = 148.9 – 140.9 – 8 = 0.9 m/s $\frac{d^2 s}{dt^2}$ = 6t – 20 when t = 3 a = -2m/s^2 6t – 20 = 0 6t = 20 t = $3\ ^2/_3$ sec	 M1 A1 M1 A1 M1 A1 M1 A1	
		8	

MATHEMATICS V
PART II
MARKING SCHEME

No	Solution	Mks	Awarding
1	$\frac{2744}{1000} \times \frac{125}{8}^{1/3}$ $\frac{2744}{1000}^{1/3} \times \frac{5^3}{2^3}^{1/3}$ $\left(\frac{2^3 \times 7^3}{103}\right)^{1/3} \times \frac{5}{2}$ $\frac{2 \times 7}{10} \times \frac{5}{2} = 3.5$	 M1 M1 A1	 Factor Cube root
		3	
2	(i) Highest – $10 \times 7.5 = 75$ Lowest – $6 \times 4 = \frac{24}{51}$ – (ii) Highest = $\frac{7.5}{4} = 1.875$ Lowest = $\frac{6}{10} = \frac{0.600}{1.275}$	M1 A1 M1 A1	Highest Fraction

		4	
3	Cos θ = $\frac{17}{21}$ = 0.8095 θ = Cos 0.8095 = 36.03º Arc length = $\frac{72.06}{360}$ x 2 x $\frac{22}{7}$ x 21 = 26.422cm	M1 A1 M1 A1	θ
		4	
4	$x^2 - 2x(x+3) = 0$ $x^2 - 2x^2 - 6x = 0$ $-x^2 - 6x = 0$ either x = 0 or x = 6	M1 M1 A1	Equ Factor Both A
		3	
5	8 = $\frac{x}{360}$ x 2 x $\frac{22}{7}$ x 28 Cos 60º 8 = $\frac{x}{360}$ x $\frac{44}{7}$ x 28 x 0.5 x = $\frac{8 \times 360 \times 7}{44 \times 28 \times 0.5}$ = 32.73º = 33º	M1 M1 A1 B1	 x exp
6	∠DMC = ∠ AMB vert. Opp = θ ∠MAB = ∠ MDC = $\frac{180 - \theta}{2}$ BASE Ls of an isosc. □ ∠ MBA = ∠ MAC $\frac{180 - \theta}{2}$ base angles of isos □ □'s AMC and □ CDM are equiangle ∴ Similar proved	B1 B1 B1	
		3	
7	Tan x = $^5/_{12}$ h = $\sqrt{b^2 + 12^2}$ = $\sqrt{25 + 144}$ = $\sqrt{169}$ = 13		

	$\frac{1 - \sin x}{\sin x + 2 \cos x} = \frac{1 - 5}{{}^{5}/_{13} + 2 \times {}^{12}/_{13}}$ ${}^{12}/_{13} = 12 \times \frac{13}{29} = \frac{12}{29}$ ${}^{29}/_{13}$ 13 29 29	M1 M1 A1	Hypo Sub
		3	
8	$Y = x^2 + 2$ x | 0.5 | 1.5 | 2.5 | 3.5 | 4.5 y | 2.25 | 4.25 | 8.25 | 14.25 | 22.25 Area = $h (y_1, = y_2 + \ldots\ldots..y_n)$ $= 1(2.225 + 4.25 + 8.25 + 14.25 + 22.25)$ = 51.25 sq units	B1 M1 A1	Ordinals
		3	
9	$\angle CBA = 117^o$ $\angle ACD = 55$ $\angle BAC = 180 - (117 + 55) = 8^o$	B1 B1 B1 3	
10	Year | 1994 | 1995 | 1996 | 1997 | 1998 Index | 83.3 | 100 | 116.6 | 123.3 | 133.3	B1 B1 B1 B1	1994 1996 1997 1998
		4	
11.	$Xy = 35$ $y = {}^{35}/_{x}$ $9x - 9y = -18$ Sub $x^2 + 2x - 35 = 0$ $x^2 + 7x - 5x - 35 = 0$ $x(x + 7) - 5(x + 7) = 0$ $(x - 5)(x + 7) = 0$ $x = -7$ $x = +5$ $y = 7$ Smaller No. = 57 = 75	B1 M1 A1 B1	
		3	

12	$\log_5 \frac{(2x-1)}{20} 4 = \log_5 5^2$ $4\frac{(2x-1)}{20} = 5^2$ $\frac{2x-1}{5} = 25$ $2x - 1 = 125$ $2x = 126$ $x = 63$	M1 M1 A1	
		3	
13	C.P $= \frac{100 \times 49.50}{110}$ $= 45/-$ $\frac{52x + 40y}{x + y} = 45$ $45x + 45y = 52x + 40$ $-7x = -54$ $^x/_y = {}^5/_7$ $x : y = 5 : 7$	 B1 M1 M1 A1	
		4	
14	$\frac{2n-4}{n}$ it angle $= 172$ $\frac{(2n-4)}{n} \times 90 = 172n$ $90 \frac{(2n-4)}{n} \times 90 = 172$ $180\,n - 360 = 172n$ $180n - 172n = 360$ $8n = 360$ $n = 45$ ***Alt***. Ext. L $= 8^o$ Sides $= \frac{360}{8}$ $= 45$	M1 A1 M1	
		2	
15	$2x = 2.\ \frac{1}{6.341} + 3.\ \frac{1}{9.22}$ $2x = 2 \times 0.1578 + 3 \times 0.1085$ $= 0.3154 + 0.3254$ $= 0.6408$ $x = 0.3204$	 B1 A1	Tables
		2	
16	Bearing 140° $\sin\theta = \frac{20 \sin 110}{40}$ $= 0.4698$ $= 228.02$ Bearing of A from B $= 198.42$	M1 A1 B1	
		3	
17	Points that each tap fills in one hour $A = \frac{1}{50}$ $B = \frac{1}{25}$ $C - \frac{1}{20}$ In one hour all taps can fill $= \frac{1}{50} + \frac{1}{25} + \frac{1}{20} = \frac{11}{100}$ In 6hrs all can fill $= \frac{11}{100} \times 6 = \frac{33}{100}$ parts	 M1 B1	

	100 50 taps A and B can fill = = 1 + 1 = 3 part in 1 hr 50 25 50 In 4 1 hrs, A and B = 25 x 3 + 1 6 6 50 4 Parts remaining for B to fill = 1 – 33 + 1 = 1 - 91 = 9 parts 50 4 100 100 Time taken = 9 x 25 hrs = 2 ¼ hrs 100 1 7.30 am 6. hrs 13.30 4.10 5.40pm 2.15 7.55 pm	B1 B1 M1 A1	
		8	
18	<table><tr><td>x</td><td>-5</td><td>-4</td><td>-3</td><td>-2</td><td>1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td></td><td>-0.5</td></tr><tr><td>$y = x^2 + x - 8$</td><td>+12</td><td>+4</td><td>-2</td><td>-6</td><td>-8</td><td>-8</td><td>-6</td><td>-2</td><td>4</td><td>12</td><td></td><td>-8.25</td></tr><tr><td>Y = -2 – 2x</td><td>8</td><td>6</td><td>4</td><td>2</td><td>0</td><td>-2</td><td>-4</td><td>-6</td><td>-8</td><td>-10</td><td></td><td></td></tr></table> $x^2 + x – 8 = -2 – 2x$ $y = x^2 + 3x – 6$ Points of intersection (-4, 1.4) $y = x^2 + x – 8 = 2x^2 + 3x – 6$ $x^2 + 2x + 2$ $y = x^2 + x – 8 \times 2$ $2y = 2x^2 + 2x – 16$ $0 = 2x^2 + 3x – 6$ $2y = -x - 10$ $y = - 2.6$ $Ny = 1.2$	 B1 B1 B1 B1	 Eqn Point of inter Line eqn Both
		4	
19	<table><tr><td>Class</td><td>X</td><td>T</td><td>D = x – 47</td><td>+d</td><td>Fd^2</td></tr><tr><td>30 –34</td><td>32</td><td>4</td><td>-15</td><td>-60</td><td>900</td></tr><tr><td>35 – 39</td><td>37</td><td>10</td><td>10</td><td>-100</td><td>1000</td></tr><tr><td>40 – 44</td><td>42</td><td>8</td><td>-5</td><td>-40</td><td>200</td></tr><tr><td>45 –49</td><td>47</td><td>11</td><td>0</td><td>0</td><td>0</td></tr><tr><td>50 – 54</td><td>52</td><td>8</td><td>5</td><td>40</td><td>200</td></tr><tr><td>55 – 59</td><td>57</td><td>6</td><td>10</td><td>60</td><td>600</td></tr><tr><td>60 – 64</td><td>62</td><td>3</td><td>15</td><td>45</td><td>675</td></tr><tr><td></td><td></td><td>50</td><td></td><td>-55</td><td>3575</td></tr></table>		

	50 = 47 – 1.1 = 45.9 (ii) Standard deviation = $\sqrt{\frac{3575}{50} - \left(\frac{-55}{50}\right)^2}$ = $\sqrt{71.5 - 1.21}$ = $\sqrt{70.29}$ = 8.3839	M1 A1 B1	fd^2
		8	
20			

X	0	`15	30	45	60	75	90	105	120	135	150
A cos (x – 15)	.97	1.0	.97	.87	0.71	0.5	0.26	0	-0.26	-0.5	-0.71
Bsin (x +30)	0.5	.71	.87	.97	1.00	.97	0.87	0.71	0.5	0.26	
Bsin (x + 30)	1.0	1.4	1.7	1.93	2.00	1.9	1.7	1.4	1.00	.52	0.00

(a) a = 1 b = 2 ½ cos (x – 15) = Sin (x + 30) has no solution in the domain	B1 B1 B1 B1	All All A & b
	8	
21 (a) O Cos 30 = $\frac{20}{X}$ X = $\frac{20}{0.866}$ = 23.09 DE = $\sqrt{50^2 + 23.09^2}$ = $\sqrt{2500 + 533.36}$ = $\sqrt{3033.36}$ = 55.076m (b) GB = $\sqrt{20^2 + 50^2}$ = 53.85 Tan θ = $\frac{14.55}{53.85}$ = 0.27019 θ = 15.12°	B1 M1 A1 M1 A1	
	8	
(c) Volume of air = 50 x 20 x 3 + ½ x 20 x 11.55 x 50 = 3000 + 5775 = 8775 No. of people = $\frac{8775}{6}$ = 1462.5 ≈ 1462	M1 M1 A1	
	8	
22 (a) A + B ≤ 16 5A + 3B ≥ 50		

	A	B	Total
People	10	6	100
Load	200	300	3500
No.of vehicles			16

	2A + 3B 35	B1	In equation 3
	(b) 14 vehicles	B1	Vehicles
	(c) A - 6 vehicles B - 8 Cost = 6 x 1000 + 8 x 1200 = 6000 + 9600 = 15,600/=	B1 M1 A1	
		8	
23	$\frac{x}{12-x} = \frac{8}{3}$ = 8.727 FBX = $\frac{3}{3.273}$ = 0.9166 = 23.57 3FBX = 47.13 Reflex ∠ FBD = 312.87 Reflex arc FD = $\frac{312.87}{360} \times \frac{22}{7} \times 6$ = 16.39cm Reflex Arc CE = $\frac{312.87}{360} \times \frac{22}{7} \times 16$ = 43.7cm FE (tangent) = $\sqrt{144 - 121}$ = $\sqrt{23}$ = 4.796cm	 M1 A1 M1 A1 M1	

	2 FE = 9.592 Total length = 9.592 + 4.796 + 43.7 + 16.39 = 74.48 cm^2	 A1 M1 A1	
		8	
24	(b) $\frac{200}{\sin 50} = \frac{40}{\sin \theta}$ $\sin \theta = \frac{40 \sin 50}{200}$ $= \frac{0.7660}{5}$ $= 0.1532$ $\theta = 8.81^o$ $\angle ACB = 180 - (50 + 8.81)^o$ $= 121.19^o$ $\frac{x}{\sin 121.19} = \frac{200}{\sin 50}$ $x = 200 \times \sin 121.19$	M1 A1 M1 M1	

	Sin 50 = 200 x 0.855645 0.7660 = 223.36Km/h (b) Course = $330^{o} - 8.81^{o}$ $= 321.19^{o}$ (c) Time = 600 321.19^{o} = 2.686 hrs	A1 B1 M1 A1 8	