

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

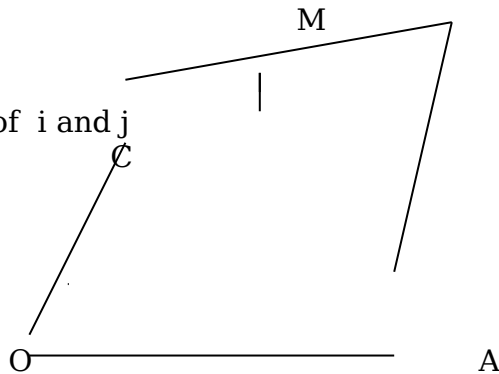
Mks)

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.

terms of i and j

Mks)



In quadrilateral OABC, $OA = 4i - 3j$. $OC = 2i + 7j$

$AB = 3OC$. cm: mB = 2:3. Find in

vector Om

(3

4. By matrix method, solve the equations

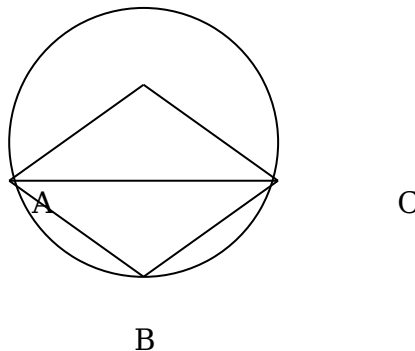
$$5x + 5y = 1$$

$$4y + 3x = 5$$

(3 Mks)

5.

Mks)



In the given circle centre O, $\angle ABC = 126^\circ$.

Calculate $\angle OAC$

(3

6. Solve the equation

$$2(3x - 1)^2 \cdot 9(3x - 1) + 7 = 0$$

(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 $(2 + \frac{1}{2}x)^6$ 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° 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 $\frac{a}{3} - \frac{3a}{5} - 7 = \frac{a}{6} - 2$

(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)

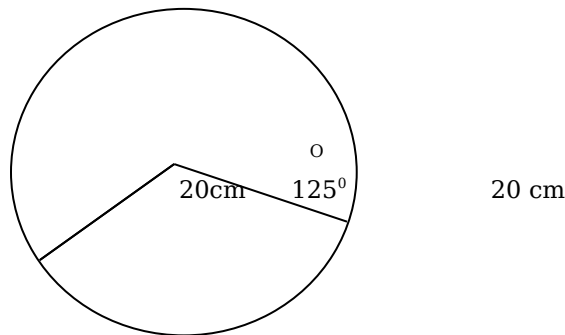
14. The curved surface of a cone is made from the shaded sector on the circle.

Calculate the height of

the cone.

(4

Mks)



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

(3 Mks)

$$z^2 - w^2$$

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

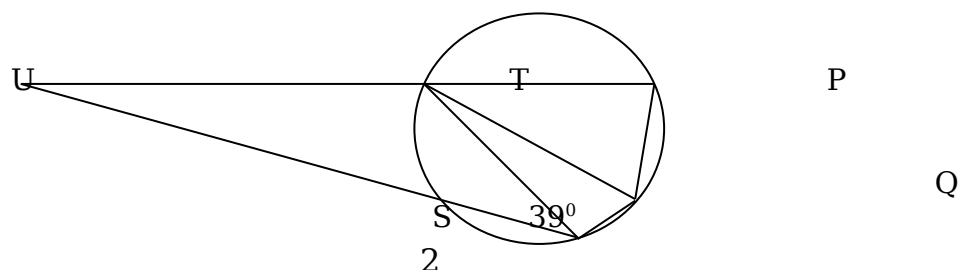
a bearing of 055 from Q. Calculate the distance between P and R.

(3

Mks)

SECTION II (50 MARKS)

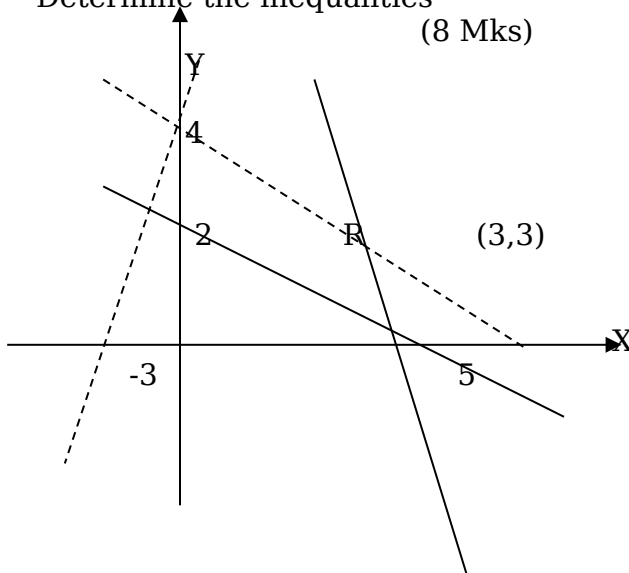
17. In the given circle centre O, $\angle QTP = 46^\circ$, $\angle RQT = 74^\circ$ and $\angle URT = 39^\circ$



Calculate

R

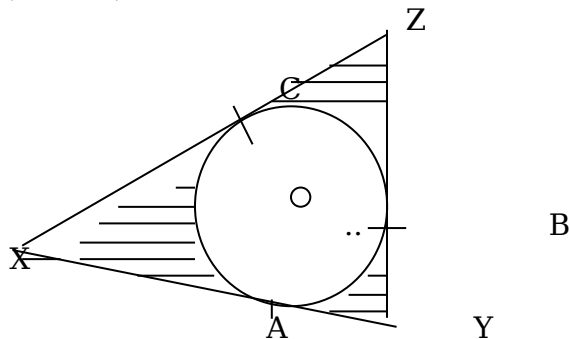
- (a) $\angle RST$ (1 Mk)
(b) $\angle SUT$ (3 Mks)
(c) Obtuse angle ROT (2 Mks)
(d) $\angle PST$ (2 Mks)
18. The exchange rate on March 17th 2000, was as follows: -
1 US\$ = Kshs.74.75
1 French Franc (Fr) = Kshs.11.04
A Kenyan tourist had Kshs.350,000 and decided to proceed to America
(a) How much in dollars did he receive from his Kshs.350,000 in 4 s.f?
(2 Mks)
(b) The tourist spend $\frac{1}{4}$ 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 $y = 5 + 2x - 3x^2$
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 $PQR = 30^\circ$
(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)



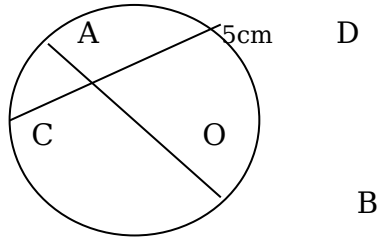
- (a) Calculate, length XA
(2 Mks)
- (b) The shaded area
(6 Mks)
24. Maina bought a car at Kshs.650,000. The value depreciated annually at 15%
- (a) After how long to the nearest 1 decimal place will the value of the car be Kshs.130,000
(4 Mks)
- (b) Calculate the rate of depreciation to the nearest 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 $\left(\frac{32a^{10}}{b^{15}} \right)^{-2/5} \div \left(\frac{9b^4}{4a^6} \right)^{11/2}$
(2 Mks)

2. Use logarithm tables to evaluate $\frac{\sqrt{0.375} \cos 75}{\tan 85.6}$
(4 Mks)

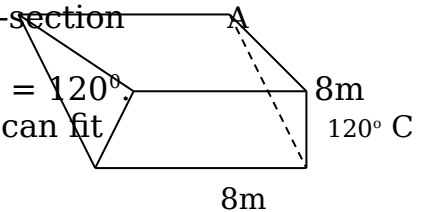
3. The marked price of a shirt is Shs.600. If the shopkeeper gives a discount of 20% off the marked price, he makes a loss of 4%. What was the cost of the shirt?
(3 Mks)
4. The surface area (A) of a closed cylinder is given by $A = 2\pi r^2 + 2\pi rh$ where r is radius and h is height of the cylinder. Make r the subject.
(4 mks)
5. In the circle centre O, chords AB and CD intersect at X. XD = 5 cm
 $XC = \frac{1}{4} r$ 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 q^2 . 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 $\angle ACB = 120^\circ$. 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° . After walking 10m towards the bottom of the flag post, the top is observed at angle of elevation of 40° . 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:

<u>Income in Kshs. p.a</u>	<u>rate of tax %</u>
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 $\frac{2}{5}$ Solving the second correct is $\frac{3}{5}$ if the first is correct and it is $\frac{4}{5}$ if the first was wrong. The chance of the third correct is $\frac{2}{5}$ if the second was correct and it is $\frac{1}{5}$ 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 ΔOAB , $OA = a$, $OB = b$
 $OPAQ$ 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 PQR are $P(-3,1)$, $Q(-1,-2)$, $R(-2,-4)$
- (a) Draw triangle PQR and its image $P^I Q^I R^I$ of PQR under translation $T = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ on the provided grid (2 Mks)
- (b) Under transformation matrix $m = \begin{pmatrix} 4 & 3 \\ 1 & 2 \end{pmatrix}$, $P^I Q^I R^I$ 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 $\Delta P^I Q^I R^I$ is 3.5 cm^2 , find area of the images $P^{II} Q^{II} R^{II}$ (2 Mks)

1. $\frac{171 \times 171 \times 3 \times 10^{-5}}{855 \times 531}$ M1
 $= 2 \times 10^{-6}$ 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 = $2i + 7j + \frac{2}{5}(4i - 3j + 6i + 21j - 2i - 7j)$ M1
 $= 2i + 7j + \frac{2}{5}(8i + 11j)$ 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
 $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$
 $x, 3, y = -1$ A1
3
5. Reflex $\angle AOC = 126 \times 2 = 252^\circ$ B1
 Obtuse $\angle AOC = 360 - 252 = 108^\circ$ B1
 $= \frac{1}{2}(180 - 108)^\circ$
 $= 36^\circ$ B1
3
6. $18x^2 - 39x + 18 = 0$
 $6x^2 - 13x + 6 = 0$ B1✓ equation
 $6x^2 - 9x - 4x + 6 = 0$
 $3x(2x - 3) - 2(2x - 3) = 0$ M1
 $(2x - 3)(3x - 2) = 0$ A1
 $x = \frac{2}{3}$ or $x = 1\frac{1}{2}$ B1
4
7. M : K : O = 4 : 2 : 3 B1✓ ratio
 Maina's = $\frac{4}{9} \times 180$
 $= 80/-$ 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
 $2.4^6 = (2 + \frac{1}{2}(0.8))^6$

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

$$= 179.2$$

$$\cong 179 \text{ to } 3 \text{ s.f.}$$

M1

A1
4

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

$$= {}^{49}/_{100}$$

B1

$$P(\text{at least one fail}) = 1 - P(F^c F^c F^c)$$

$$= 1 - \left({}^{13}/_{20}\right)^3$$

$$= 1 - \frac{2197}{8000}$$

$$= \frac{5803}{8000}$$

M1

M1

A1

4

$$10. \text{grad} = \text{term } 135$$

$$= -1$$

$$y = mx + c$$

$$y = -x + 5$$

B1

B1
2

$$11. \text{Volume} = \frac{2 \times 10,000 \times 10,000 \times 25}{1000 \times 10}$$

$$= 500,000 \text{ Lts}$$

M1√ x section area

M1√ conv. to litres

A1

3

$$12. 10a - 6(3a - 7) = 5(a - 2)$$

$$10a - 18a + 42 = 5a - 10$$

$$-13a = -52$$

$$a = 4$$

M1

M1

A1

3

$$13. 2a + 12d = 2$$

$$2a + 4d = -10$$

$$8d = 12$$

M1

$$d = 1\frac{1}{2}$$

A1

$$a = -8$$

B1

$$S_{21} = {}^{21}/_2 (-16 + 20 \times 3/2)$$

$$= 147$$

M1

A1

5

$$14. 2\pi r = \frac{120}{360} \times \pi \times 40$$

$$r = 6.667 \text{ cm}$$

$$h = \sqrt{400 - 44.44}$$

$$= 18.86 \text{ cm}$$

M1

A1

M1

A1

4

$$15. = \frac{(w(x-z) - y(x-z))(w+z)}{(z-w)(z+w)}$$

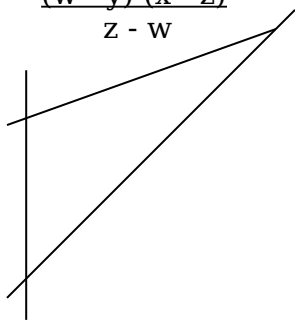
$$= \frac{(w-y)(x-z)(w+z)}{(z-w)(z+w)}$$

$$= \frac{(w-y)(x-z)}{z-w}$$

M1√ factor

M1√ grouping

A1
3



R

16. 25° B1✓ sketch

$Q \quad 125$ $PR = \frac{4 \sin 125}{\sin 25}$ M1

$P \quad 30$ A1

3

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

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

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

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

(c) Reflex $\angle RQT = 180 - 2 \times 16$ B1

$= 180 - 32 = 148^\circ$

Obtuse $\angle ROT = 360 - 148 = 212^\circ$ B1

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

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

8

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

$= \$ 4682$ A1

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

$= \$ 3511.5$ B1

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

$= \text{Fr } 23780$ A1

Expenditure = Fr 16 200

Balance = Fr 7580

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

$= \text{Kshs.}97,024$

Value on departure $= \text{Kshs.}7580 \times 11.04$ B1

both✓ $= \text{Kshs.}83\,683.2$

Difference $= \text{Kshs.}97,024 - 83683.2$

$= \text{Kshs.}13,340.80$ M1

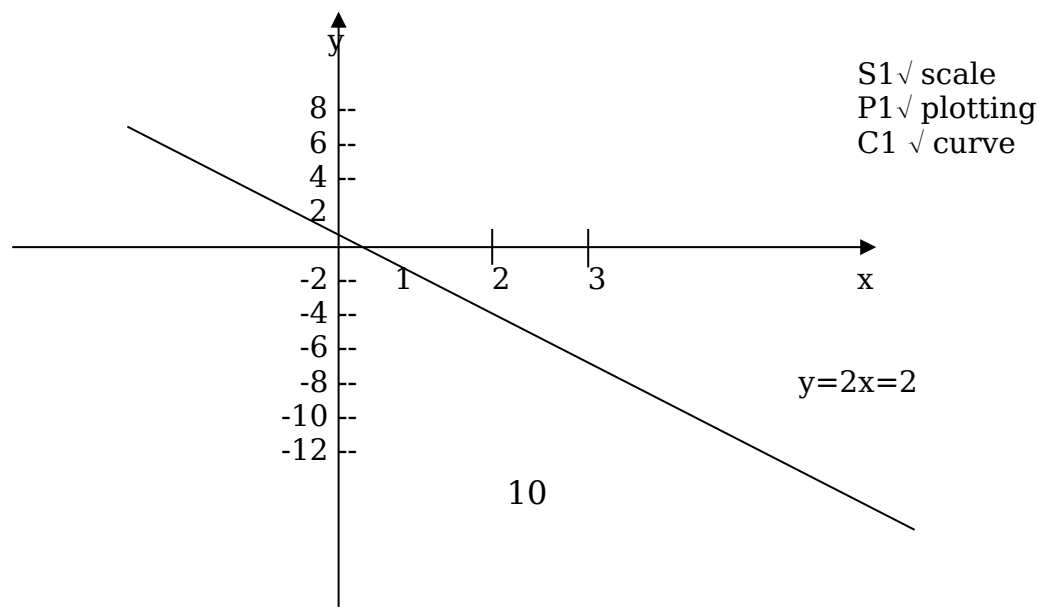
A1

8

19.

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

B1✓values



$$\begin{array}{l} -14 \dots \\ 0.1 \text{ B1} \\ -16 \dots \\ 0.1 \end{array}$$

$$x = -0.53 \pm$$

$$N_x = 1.87 \pm$$

equation

$$y = 5 + 2x - 3x^2 = 2 - 2x$$

MI for

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

$$\frac{\text{AI equation}}{8}$$

B1

$$\begin{array}{l} x = -0.53 \pm 0.1 \\ mx = 1.87 \pm 0.1 \end{array}$$

$$y = 5 + 2x - 3x^2 = 2 - 2x$$

M1 ✓ for

equation

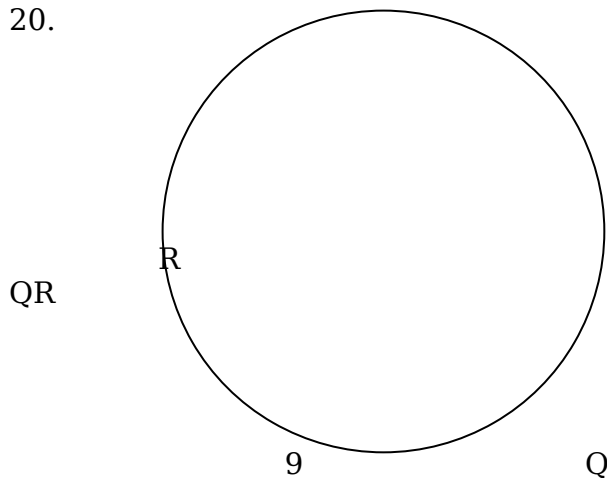
$$\therefore 3x^2 - 4x - 3 = 0$$

MA1 ✓

equation

8

20.



B1 ✓ 30°

B1 ✓ 2 ⊥ PQ,

B1 ✓ 2 ⊥ bisectors

B1 ✓ circle

$$\begin{array}{l} \text{Radius} = 4.2 \pm 0.1 \\ \text{Area of circle} = \frac{22}{7} \times 4.2^2 \\ \quad = 55.44 \pm 3 \text{ cm}^2 \\ \text{Area of } \Delta \text{ PQR} = \frac{1}{2} \times 3.5 \times 7.5 \sin 30^\circ \\ \quad = 6.5625 \text{ cm}^2 \\ \text{Difference} = 55.44 - 6.5625 \\ \quad = 48.88 \text{ cm}^2 \end{array}$$

B1 ✓ radius

M1 ✓ Δ and circle

M1 ✓ sub

A1
8

$$\begin{array}{l} 21. \text{ Line (i) } \frac{y}{2} + \frac{x}{5} = 1 \\ \quad 5y + 2x = 10 \\ \quad 5y + 2x = 10 \end{array}$$

B1 ✓ equation

B1 ✓

inequality

Line (ii) $\frac{y}{4} + \frac{x}{-3} = 1$

$3y = 4x + 12$

$3y < 4x + 12$ or $3y - 4x < 12$

B1✓ equation

B1✓

inequality

Line (iii) $\text{grad} = -\frac{1}{3}$ y $\text{inter} = 4$

$3y + x = 12$ or $3y = -x + 12$

$3y + x < 12$

B1✓ equation

B1✓ inequality

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

$2y + 3x = 15$

$\therefore 2y + 3x \leq 15$

B1✓ equation

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
	$\Sigma f = 60$		$\Sigma fx = 3809$	

B1✓ x column

B1✓ f column

(a) (i) Modal class = 70 - 74
class

B1✓ model

(ii) Median class = 70 - 74

B1✓ median

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

M1

A1

S1✓ scale

B1 ✓ blocks

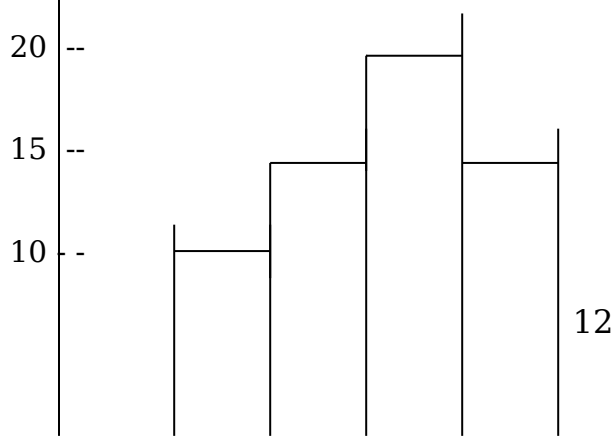
59.5 - 64.5

64.5 - 69.5 e.t.c.

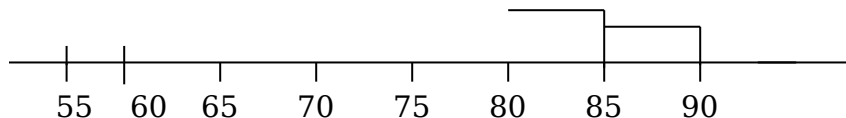
8

(c)

Histogram



5 --



23. (a) $XA = a, YA = 10 - a, YB = 10 - a, CZ = 10 - a = ZB$

$YZ = 10 - a + 12 - a = 8$

$2a = 14$

$a = 7 \text{ cm}$

$\cos X = \frac{100 + 144 - 64}{240}$

the Δ

$= 0.75$

$X = 41.41^\circ$

$\frac{1}{2} X = 20.70^\circ$

M1

A1

M1 $\checkmark$ any angle of

A1 $\checkmark$ $\frac{1}{2}$ of the

angle

$r = OA = 7 \tan 20.7$

B1 $\checkmark$

radius

$= 2.645 \text{ cm}$

Shaded area $= \frac{1}{2} \times 10 \times 12 \sin 41.41 - \frac{22}{7} \times 2.645^2$

M1 $\checkmark$ Δ

& circle

$= 39.69 - 21.99$

$= 17.7 \text{ cm}^2$

A1
8

24. (a) $650,000 (0.85)^n = 130,000$

M1 $\checkmark$

formula

$1.15n = 0.2$

$n = \frac{\log 0.2}{\log 0.85}$

M1 $\checkmark$

$= \frac{1.3010}{1.9294}$

$= -0.6990$

M1

-0.0706

$= 9.9 \text{ years}$

A1

(b) $650,000 (1 - \frac{r}{100})^5 = 325,000$

M1

$(1 - \frac{r}{100})^5 = 0.5$

$1 - \frac{r}{100} = 0.5^{1/5}$

M1

$= 0.8706$

$\frac{r}{100} = 0.1294$

$r = 12.9 \%$

A1

B1

8

MATHEMATICS I
PART II
MARKING SCHEME

SECTION I (50 MARKS)

$$1. = \left(\frac{b^{15}}{32a^{10}} \right)^{2/5} \times \left(\frac{4a^6}{9b^4} \right)^{3/2}$$

$$= \left(\frac{2a^5}{27} \right)$$

M1 ✓ reciprocal

A1
2

2.

No.	Log.
0.375	1.5740 +
cos 75	1.4130
	2.9870 -
tan 85.6	1.1138 -
	<u>3.8732 = 4 + 1.8732</u>
	2 2
	2.9366
	0.0864

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

= Shs.480

Cost Price = x

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

x = Shs.500

B1

M1

A1
3
M1

4. $r^2 + hr = \frac{A}{2\pi}$

$r^2 + hr + (\frac{h}{2})^2 = \frac{A}{2A} + \frac{h}{4}$

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

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

M1

M1

A1

4

5. $(\frac{1}{3}r) (\frac{1}{3}r) = (\frac{1}{4}r) (5)$

$4r^2 - qr = 0$

$r(4r - q) = 0$

$r = 0$

or $r = 2.25$

M1

M1

A1
3

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

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

$= 5 + 6\sqrt{3}$

13

M1

M1

A1
3

7. $P = Kq^2 + c$

$6 = 4k + c$

$16 = 9k + c$

$5k = 10$

$k = 2$

$c = -2$

M1 ✓ subtraction

A1 ✓ k and c

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

$$q = \sqrt{33}$$

$$= \pm 5.745$$

A1
4

8. Volume = $\frac{1}{2} \times 8 \times 8 \sin 120 \times 10$
section

M1 $\checkmark$ area of x-

$$\text{No. of scouts} = \frac{32 \sin 60 \times 10}{2.5}$$

$$= 110.8$$

$$= 110$$

M1 $\checkmark$ volume
M1

A1
3

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

$$= 2$$

B1

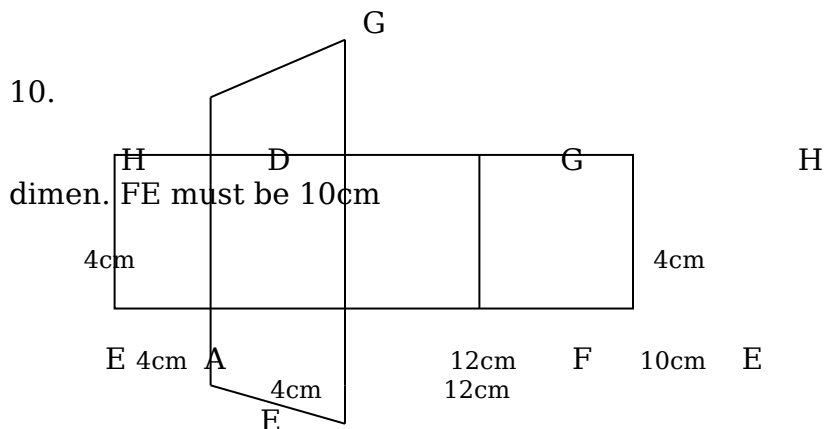
$$\% \text{ error} = \frac{2}{26} \times 100$$

M1

$$= 7.692\%$$

A1
3

10.



B1 $\checkmark$ net

B1 $\checkmark$

B1 $\checkmark$ labelling
3

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

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

A1

M1

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

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

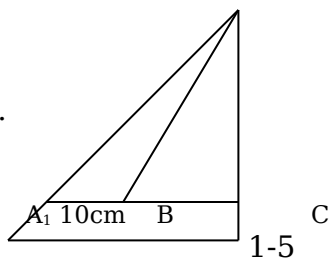
M1

$$= 1.264$$

A1

4

12.



$$BT = 10 \text{ cm}$$

B1

$$CT = 10 \sin 40$$

M1

$$= 6.428 \text{ m}$$

A1

$$h = 6.428 + 1.5$$

$$= 7.928$$

B1

4

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

B1

$$\text{smaller area} = \frac{29}{164} \times 120$$

M1

$$= 67.5 \text{ cm}^2$$

A1
3

14. Relative speed = $(x - 30)\text{km/h}$ B1

$$\frac{2 \text{ km}}{(x - 30)\text{km/h}} = \frac{2 \text{ hrs}}{60}$$
 M1

$$2x - 60 = 120$$

$$x = 90 \text{ km/h}$$
 A1
3
15.
$$\frac{16 \text{ Km/h}}{x \text{ Km}} = \frac{5 \text{ Km/hr}}{(22 - x) \text{ Km}}$$

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

$$5x + 352 - 16x = 220$$
 M1 ✓ x-
multiplication

$$11x = 132$$

$$x = 12 \text{ km}$$
 A1
3
16. AP = $\frac{2}{9} \times 12 = \frac{2^2}{3} \text{ cm}$ B1 ✓ both AP
& AQ
AQ = $\frac{5}{9} \times 12 = \frac{6^2}{3} \text{ cm}$
 $\therefore \text{PQ} = \frac{6^2}{3} - \frac{2^2}{3} = 4 \text{ cm}$ B1 ✓ C.A.O
2
17. Taxable income = $\frac{115}{100} \times 8000$ M1
= Shs.9200 p. m
= Shs.110,400 p.a
Tax dues = $\frac{10}{100} \times 39600 + \frac{15}{100} \times 39600 + \frac{25}{100} \times 31200$ A1
slabs M1 ✓ first 2
= 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) = $\frac{2}{3} \times \frac{3}{5} \times \frac{2}{5}$ M1
= $\frac{12}{125}$ A1
(b) P (2 correct) = $\frac{2}{5} \times \frac{3}{5} \times \frac{3}{5} + \frac{2}{5} \times \frac{2}{5} \times \frac{1}{5} + \frac{3}{5} \times \frac{4}{5} \times \frac{2}{5}$ M1
= $\frac{18}{125} + \frac{4}{125} + \frac{24}{125}$ M1
= $\frac{46}{125}$ A1
(c) P (at least 2 correct)
= P(2 correct or 3 correct)
= $\frac{46}{125} + \frac{12}{125}$ M1
= $\frac{46 + 12}{125}$ M1

	$= \frac{58}{125}$	<u>8</u>	A1
19. Old price/pen = <u>440</u>			
	$\times$		
New price/pen = <u>494</u>			B1√both
expressions			
	$\frac{440}{x} - \frac{494}{x+3} = 1.50$		
	$440(x+3) - 494x = 1.5x^2 + 4.5x$	M1 √ expression	
multiplication		M1√x-	
	$x^2 + 39x - 880 = 0$	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	
	$\therefore x = 16$		
	difference in purchase = 19×1.50	M1	
	$= \text{Shs.}28.50$	<u>A1</u>	
20. (a) $OP = a + \frac{1}{4}(b - a)$		<u>8</u>	
	$= \frac{3}{4}a + \frac{1}{4}b$	M1	A1
(b) $PQ = PO + OQ$			
	$= -\frac{3}{4}a - \frac{1}{4}b + \frac{1}{4}(a - b)$	M1	
	$= -\frac{1}{2}a - \frac{1}{2}b$		A1
(c) $QN = QO + ON$			
	$= \frac{1}{4}(b - a) + \frac{5}{3}b$		M1
	$= \frac{23}{12}b - \frac{1}{4}a$	A1	
(d) $PN = PB + BN$			
	$= \frac{3}{4}(b - a) + \frac{2}{3}b$		M1
	$= \frac{17}{12}b - \frac{3}{4}a$	<u>A1</u>	
21. (a) Volume in 2 days = <u>$22 \times 3.5 \times 3.5 \times 150 \times 20 \times 3600$</u>		<u>8</u>	
x-section			M1 √ area of
	$\frac{7}{2} \times \frac{2}{2} \times 1,000,000$		M1 √ volume
in cm^3			
	$= 103.95 \text{ m}^3$	M1 √ volume in m^3	
(b) $\frac{22}{7} \times r^2 \times 8 = \frac{103.95 \times 15}{2} \times 7$		M1	
	$r^2 = \frac{103.95 \times 15 \times 7}{2 \times 2 \times 8}$		M1
	$= 31.01$		M1
	$r = 5.568 \text{ m}$	<u>A1</u>	
22. (a) Ration of needs for A:B = 5:8		<u>8</u>	
A's share = $\frac{5}{13} \times 16.9 + \frac{1}{2} \times 13.5$			M1
	$= 13.25 \text{ Million}$		A1
B's share = $(13.5 + 16.9) - 13.25$			M1
	$= 13.25$		M1
(a) A's share $\frac{5}{13} \times 16.9 + \frac{39}{50} \times 13.5$			
	$6.5 + 10.53$		
	$= 17.03 \text{ m}$	A1	
B's share = $30.4 - 17.03$			M1

$$= 13.37 \text{ Million}$$

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

L1 ✓ line

$$\log V = n \log E + \log K$$

$$\log K = 0.08$$

$$K = 1.2 \pm 0.01$$

$$N = \frac{0.06}{0.06}$$

$$= 1 \pm 0.1$$

$$\therefore v = 1.2E$$

$$\text{when } E = 0.75, V = 0.9 \pm 0.1$$

B1 ✓ K

B1 ✓ n

B1✓ v

8

24.(a) $T \begin{pmatrix} 3 \\ 4 \end{pmatrix} \text{ PQR} \rightarrow P^I Q^I R^I$
 $P^I (0,5), Q^I (2,2) R^I (1,0)$

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

M1 ✓

A1 ✓

$$P^I (15,10), Q^I (14,6), R^I (4,1)$$

B1✓

(c) Area s.f = det M
 $= 5$

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

$$= 5 \times 3.5$$

$$= 16.5 \text{ cm}^2$$

M1✓

A1

8

MATHEMATICS 2

PART I

SECTION A:

1. Use logarithm tables to evaluate

(4 mks)

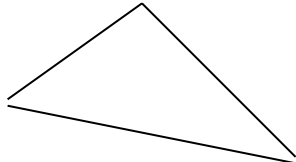
$$\frac{0.0368 \times 43.92}{361.8}$$

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)

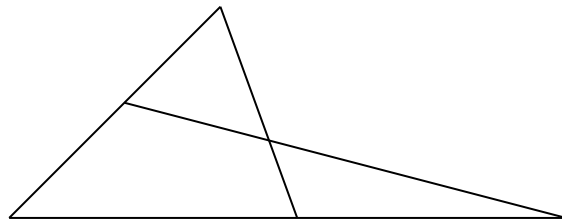
5. A glass of juice of 200 ml content is such that the ratio of undiluted juice to water is 1: 7 Find how many diluted glasses can be made from a container with 3 litres undiluted juice (3mks)
6. Find the value of θ within $0^\circ < \theta < 360^\circ$ if $\cos(2\theta + 120) = \frac{1}{2}$ (3mks)
7. A quantity P varies inversely as Q^2 Given that $P = \frac{4}{9}$ When $Q = 2$, write the equation joining P and Q hence find P when $Q = 4$ (3mks) a
8. A rectangle measures 3.6 cm by 2.8 cm. Find the percentage error in calculating its perimeter. (3mks)
9. Evaluate: $\frac{11/6 \times 3/4 - 11/12}{1/2 \text{ of } 5/6}$ (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)
- $$\begin{pmatrix} 3 & x & 1 \\ 2 & 1 & -1 \end{pmatrix} = \begin{pmatrix} 2 & & \\ & y & \end{pmatrix}$$
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)
- Gradient of the line
 - The magnitude of AB
 - 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 $BC=10\text{cm}$, angle $ABC = 60^\circ$ and $BCA = 45^\circ$
- On the diagram , measure length of AC
 - Draw the circumference of triangle ABC
 - Construct the locus of a set of points which are equidistant from A and B.
 - Hence mark a point P such that $APB = 45^\circ$ and $AP = PB$
 - Mark a point Q such that angle $AQB = 45^\circ$ 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 $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$ 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° , 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 $OC = \frac{5}{3} OA$. M divides OB in the ratio 5:3
- Express AB and MC in terms of a and b
 - By writing MN in two ways, find the ratio in which N divides
 - AB
 - MC

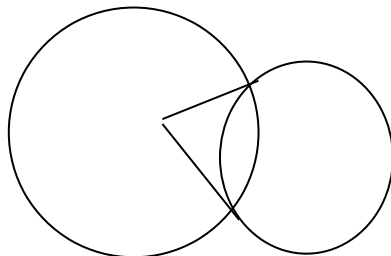
20. In the figure below, $SP = 13.2\text{ cm}$, $PQ = 12\text{ cm}$, angle $PSR = 80^\circ$ and angle $PQR = 90^\circ$. S and Q are the centres
(8mks)

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 cyclist's 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, $XC = 4$ cm and $XD = 6$ cm

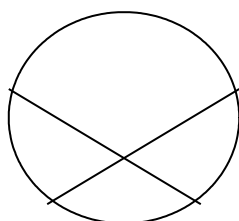
a. Find the length of XB as a fraction

b. Show that $\triangle XAD$ is similar to $\triangle XBC$

c. Given that the area of $\triangle AXD = 6\text{cm}^2$, find the area of $\triangle BXC$

d. Find the value of the ratio

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



24. A town B is 55 km on a bearing of 050° . A third town C lies 75km due south of B. Given that D lies on a bearing of 255° from C and 170° 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	= 3.6502
	0.3682	<u>1.6427</u> +	
		0.2087	
	361.8	2.5585	
		3.6502	
			-4 = <u>1.6502</u> = 2.8251
			Logs + - v ans (4) 2 6.6850 x 10 ⁻²
			= 0.06685

$$\begin{aligned}
 2. \quad & 2x^2 - 5x + 1 = 0 \\
 & x^2 - \frac{5}{2}x + \frac{1}{2} = 0 \\
 & x^2 - \frac{5}{2}x = -\frac{1}{2} \\
 & x - \frac{5x}{2} + \frac{5^2}{4} = -\frac{1}{2} + \frac{5^2}{4} \quad (\text{m}) \\
 & = x - \frac{5}{4} = -\frac{1}{2} + \frac{25}{16} = \frac{17}{16} \quad (3) \\
 & = x - 5/4 = 17/16 = 1.0625 \\
 & x - 5/4 = \pm 1.031 \\
 & X_1 = -1.031 + 1.25 = 0.2192 \\
 & X_2 = 1.031 + 1.25 = 1.281
 \end{aligned}$$

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

$$\begin{aligned}
 A_2 = P + PRT/100 &= \frac{6000 + 15 \times 2}{100} = 6000 + 1800 \\
 &= \text{Shs. } 7800
 \end{aligned}$$

Amount by simple interest is more by Shs. (7800 - 7661.40)
Shs. 138.60

$$\begin{aligned}
 4. \quad & \text{Let a plate be } p \text{ and a cup } c. \\
 & 3p + 4c = 380 \quad \times 5 \quad 15p + 20c = 1900 \\
 & 4p + 5c = 490 \quad \times 4 \quad \underline{16p + 20c = 1960} \\
 & \quad \quad \quad -p \quad -60 \quad (\text{m})
 \end{aligned}$$

$$p = \text{Shs } 60$$

$$\begin{aligned} 3(60) + 4c &= 380 \\ 4c &= 380 - 180 = 2000 \\ c &= \text{Shs. } 50 \end{aligned} \quad (3)$$

$$\text{Plate} = \text{Shs. } 60, \quad \text{Cup} = \text{Shs. } 50 \quad (\text{A both})$$

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

6. $\cos(2\theta + 120) = \frac{3}{2} = 0.866$
 $\cos 30, 330, 390, 690, 750 \dots$
 $2\theta + 120 = 330$
 $2\theta = 210, \theta = 105^\circ$ (3)
 $2\theta = 390 - 120 = 270^\circ, \theta_2 135^\circ$
 $2\theta = 690 - 120 = 570^\circ, \theta_3 285^\circ$ (for 4 ans)
 $\theta_4 = 315^\circ$ (for >2)
 $2\theta = 750 - 120 = 630^\circ,$

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

$$P = \frac{16}{9 \times 4 \times 4} = \frac{1}{9} \quad (\text{A}) \quad (3)$$

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

9. $\frac{1 \frac{1}{6} \times \frac{3}{4} - \frac{11}{12}}{\frac{1}{2} \text{ of } \frac{5}{6}} = \frac{(\frac{7}{6} \times \frac{3}{4}) - \frac{11}{12}}{\frac{1}{2} \text{ of } \frac{5}{6}} = \frac{\frac{7}{8} - \frac{11}{12}}{\frac{5}{12}} = \frac{21 - 22}{5/12}$
 $= \frac{-1/24}{5/12} = \frac{-1}{24} \times \frac{12}{5} = \frac{-1}{10} \quad (3)$

10. Volume of rod = $\pi r^2 h = \frac{22}{7} \times 4 \times 14 = 704 \text{ cm}^3 \quad (\mathbf{m})$
 Volume of each cube = $2 \times 2 \times 2 = 8 \text{ cm}^3 \quad \mathbf{A}$

$$\text{No. of cubes} = 704 / 8 = 88 \text{ cm}^3 \quad \mathbf{A}$$

$$11. \angle AOB = \frac{360}{8} = 45^\circ$$

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

$$h = 4 \times 2.414 \quad \text{A}$$

$$= 9.656 \text{ cm}$$

$$\text{Area of 1 triangle} = \frac{1}{2} \times 8 \times 9.656 \times 8 \text{ cm} = 38.628 \times 8 \quad \text{vm}$$

$$\text{Octagon area} = 38.628 \times 8 \quad \text{m}$$

$$= 309.0 \text{ cm}^2 \quad \text{(A)}$$

$$12. \quad \begin{array}{cccc} 3 & 2 & -1 & 2 \\ & & = & \\ 2 & 1 & -1 & y \end{array}$$

$$\begin{array}{ll} 3 - x = 2 & (1) \quad x = 1 \\ 2 - 1 = y & y = 1 \quad \text{(A)} \end{array} \quad (2)$$

$$13. \quad \begin{array}{l} x^2 + y^2 - 6x + 8y - 11 = 0 \\ x^2 - 6x + (-3)^2 + y^2 + 8y + (4)^2 = 11 + (-3)^2 + (4)^2 \quad \text{(completing the square)} \\ (x - 3)^2 + (y + 4)^2 = 11 + 9 + 16 = 36 \\ (x - 3)^2 + (y + 4)^2 = 6^2 \\ \text{Centre is } (3, -4) \\ \text{Radius} = 6 \text{ units} \quad \text{As} \end{array} \quad (3)$$

14.

$$\begin{array}{l} \text{Figs A C B and D C E are similar} \\ \frac{AB}{DE} = \frac{AC}{DC} = \text{and} \quad \frac{AB}{DE} = \frac{BC}{CE} \end{array}$$

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

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

$$10y = 15 + 3y$$

$$7y = 15$$

$$y = 15/7$$

$$A(4, 3) \quad B(8, 13)$$

$$60 = 18 + 3x$$

$$3x = 42$$

$$x = 14$$

$$y = 15/7 \quad (A)$$

$$A(4, 3) \quad B(8, 13) \quad (3)$$

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

(ii) $\text{Mag AB} = \sqrt{8^2 + 10^2} = \sqrt{164} = 12.81$

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

(iii) Mid point = $\frac{4+8}{2}, \frac{3+13}{2}$
 $= (6, 8)$ (mid point) (5 mks)

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

Eqn is $y = -2/5 x + c$
 $8 = -2/5 \times 6 + c = 40 = -12 + 5c$
 $= c = 52/5$

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

16. Acceleration = $\frac{\text{Change in velocity}}{\text{Time}}$
 $= \frac{(34 - 10)}{60 \times 10} \text{ m/s} = \frac{24 \text{ m/s}}{600}$
 $= 0.04 \text{ m/s}^2 \quad (2)$

17.

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

18. (b)

c	$\frac{a}{d}$	$\frac{b}{2}$	$\frac{2}{4}$	$\frac{3}{2}$	$\frac{5}{10}$	$\frac{6}{19}$	$\frac{10}{13}$	$\frac{12}{13}$
-----	---------------	---------------	---------------	---------------	----------------	----------------	-----------------	-----------------

$$\begin{array}{rcl}
 2a + 2b = 6 & \times 2 & = 4a + 4b = 12 \\
 3a + 4b = 10 & & \underline{3a + 4b = 10} \\
 & & 26
 \end{array}$$

$$a = 2$$

$$4 + 2b = b$$

$$2c + 2d = 10 \times 2 = 4c + 4d = 20$$

$$2b = 2 \quad b = 1$$

$$3c + 4d = 19 \quad \underline{3c + 4d = 19}$$

$$c = 1$$

$$2(1) + 2d = 10$$

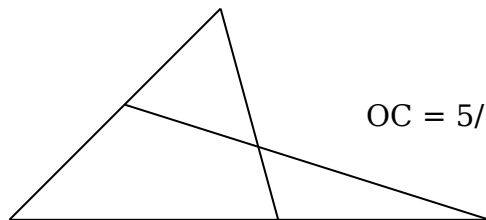
$$2d = 8$$

$$d = 4$$

Matrix is

$$\begin{pmatrix} 2 & 1 \\ 1 & 4 \end{pmatrix} \quad (A)$$

19.



$$OC = 5/3 (31) = 5A$$

$$(a) = AO + OB$$

$$= -3a = 4b$$

$$MC = MO + OC$$

$$= -5/8 (4b) + 5$$

$$= 5A - 5/2 b$$

$$(b) MN = 5 Mc = 3(5a - 5/2 b)$$

$$= 5sa - 5/2 sb$$

$$MN = BN + BN$$

$$= 3/8 (4b) + (1 - t)(-BA)$$

$$= 3/8 (4b) + (1 - t)(3a - 4b)$$

$$= 3/2 b + 3ta - 4b + 4tb$$

$$= (3 - 3t)a + (4t - 5/2)b$$

$$MN = MN$$

$$= 5sa - 5/2 sb = (3 - 3t)a + (4t - 5/2)b$$

$$= 5a = 3 - 3t \quad = 5s + 3t = 3$$

$$= -5/2 s = 4t - 5/2 \quad \vee \quad \underline{5s + 8t = 5}$$

$$-5t = -2 \quad t = 2/5$$

$$5s = 3 - 3(2/5)$$

$$= 3 - 6/5 = 9/5$$

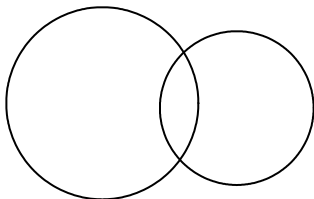
$$= 3 - 6/5 = 9/5$$

$$s = 9/25$$

$$(i) \quad AN : \quad NB = 2 : 3$$

$$(ii) \quad MN : \quad 9 : 16$$

20.



$$\theta \times \pi r^2$$

$$360$$

$$\begin{aligned} \text{a. Area of sector SPR} &= 80/360 \times 13.2 \times 13.2 \times 3.142 \\ &= 121.6 \end{aligned}$$

$$\begin{aligned} \text{Area of triangle SPR} &= \frac{1}{2} \times 13.2 \times 13.2 \times \sin 80 \\ &= 85.8 \text{ cm}^2 \end{aligned}$$

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

(m of area) A(at least one)

$$\begin{aligned} \text{Area of segment} &= 121.6 - 85.8 \\ &= 35.8 \text{ cm}^2 \end{aligned}$$

$$\text{Area of sector QPR} = 90/360 \times 3.142 \times 12 \times 12$$

$$\text{Area of PQR} = \frac{1}{2} \times 12 \times 12 = 72$$

$$\begin{aligned} \text{Area of segment} &= 113.1 - 72 \\ &= 41.1 \text{ cm}^2 \end{aligned}$$

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

$$\begin{aligned} \text{b). Area of quadrilateral} &= \text{Area of PQR} + \text{SPR} \\ &= 85.8 + 72 = 157.8 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of shaded region} &= \text{Area of Quadrilateral} - \text{Area of sector SPR} \\ &= 157.8 - 121.6 \\ &= 36.2 \text{ cm}^2 \end{aligned}$$

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

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

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

$$\begin{aligned} q &= \frac{1}{0.1312} = 7.619 \\ q &= 7.62. \end{aligned}$$

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

$$p = 7.62 \times 0.95 = 7.27$$

$$\text{at } x = 14, y = 2.7$$

$$\begin{aligned} \text{at } y = 0.46, 1/y &= 2.174 \\ x &= 9.6. \end{aligned}$$

$$22. \quad \text{a) Distance} = 75 \text{ km} \quad \text{uphill speed} = v \text{ km/h}$$

$$\text{uphill Time} = 75/v \text{ hrs}$$

$$\text{Downhill speed} = (v + 20) \text{ km/h}$$

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

Takes larger uphill

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

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

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

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

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

$$v = \frac{-20 \pm \sqrt{400 + 6000}}{2} = \frac{-20 \pm \sqrt{6400}}{2}$$

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

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

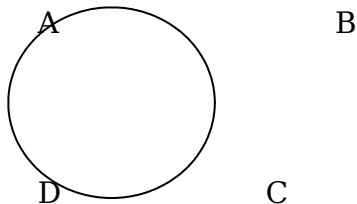
$$\text{speed uphill} = 30 \text{ km/hr, } T = \frac{75}{30} \text{ time} = 2 \frac{1}{2} \text{ hrs}$$

$$\text{speed downhill} = 50 \text{ km/hr Time} = \frac{75}{50} \text{ Time} = 1 \frac{1}{2} \text{ hr}$$

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

X	0	4	8	12	16	20
Y	1.0	0.64	0.5	0.4	0.3	0.2
1/y	1.0	1.56	2.0	2.3	2.9	3.5

23.



$$AX \cdot XC = BX \cdot XD$$

$$8 \times 4 = 6BX$$

$$BX = \frac{8 \times 4}{6} = \frac{16}{3}$$

$$XAD = XBC$$

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

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

$$\angle AXD = \angle BXC \quad (\text{vertically opposite } \angle_s)$$

SAS holds : they are similar.

$$LSF = \frac{3}{2} \quad ASF = \left(\frac{3}{2}\right)^2 = \frac{9}{4}$$

$$\text{Area A x A} = 6 \text{ cm}^2 \quad \text{Area B x C} = \frac{6 \times 9}{4} = 13.5 \text{ cm}^2$$

24.

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

MATHEMATICS I
PART II

SECTION (52 MARKS)

- Without using tables, simplify

$$\frac{1.43 \times 0.091 \times 5.04}{2.86 \times 2.8 \times 11.7}$$
 (3mks)
- Make x the subject of the formula if
 $y = a/x + bx$ (3mks)
- Give the combined solution for the range of x values satisfying the inequality
 $2x + 1 < 10 - x < 6x - 1$ (3mks)
- 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)
- A town A is 56 km from B on a bearing 062° . 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)
- Expand $(x + y)^6$ hence evaluate (1.02) to 3d.p. (3mks)
- Rationalise the denominator in (2mks)

$$\frac{\sqrt{3}}{1 - \sqrt{3}}$$

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

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

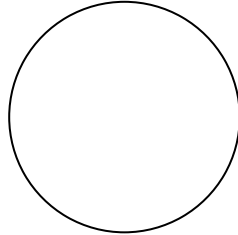
10. Three points are such that A (4, 8), B(8,7), C (16, 5). Show that the three points are collinear
(3mks)

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

$$\begin{aligned} 2x - 3y &= 7 \\ 4x + 3y &= 5 \end{aligned} \quad (3mks)$$

12. Use the table reciprocals to evaluate to 3 s.f. 3mks
 $\frac{1}{7} + \frac{3}{12} + \frac{7}{0.103}$

13.



Given that O is the centre of the circle and OA is parallel to CB, and that angle

$$\angle ABC = 107^\circ, \text{ find}$$

- (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

$$\log \frac{x^3}{y^2}$$

(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

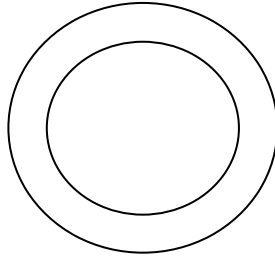
- The mean
- The standard deviation
- Find the median mark

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

State the minimum co-ordinates

b. Solve the equations

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



19.

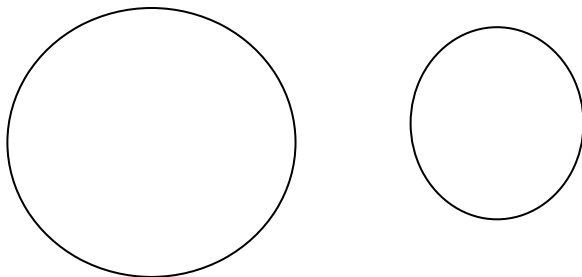
a. Two concentric circles are such that the larger one has a radius of 6cm and the smaller one radius of 4 cm. Find the probability that an item dropped lands on the shaded region 4mks

b. Two unbiased dice are thrown. Find the probability of obtaining (4mks)

- A product of 6
- A sum of 8
- 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 $\angle CBA = 60^\circ$, Find

- BD (Length)
- CD
- 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° to the base. Calculate

- The perpendicular height of the pyramid
- The length of the slant edge VA
- The angle between edge VA and base A B C D
- The area of the face VAB

22. Plot the graphs of $y = \sin x^\circ$ and $y = \cos 2x^\circ$ on the same axes for $-180 \leq x \leq 180^\circ$.

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 $\pi = 3.142$)

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° , Center the origin.

MATHEMATICS I

PART II

MARKING SCHEME.

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

$$= 0.007 \quad (A)$$

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

Either

$$bx^2 - yx + a = 0$$

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

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

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

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

$$x \leq 3 \quad x \leq 11/7$$

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

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

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

$$1.1 \text{ Log} = 0.04139$$

$$\frac{X}{0.20695}$$

$$= \frac{0.1}{1.1 - 1} (4000 (1.1^5 - 1)) \quad (4)$$

$$\frac{4000 (1.6 - 1)}{0.1}$$

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

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

5. (i) $b^2 = a^2 + b^2 - 2ab \cos B$
 $= 64^2 + 56^2 - 2(64)(56) \cos 78$
 $= 4096 + 3136 - 7168 (0.2079)$
 $= 7232 - \text{km } 1490.3$

$$b^2 = 5741.7 = 5.77 \text{ km} \quad (5)$$

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

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

$$\sin A = 0.08262$$

$$A = 55.7^\circ \text{ (or } B = 46.3^\circ)$$

$$\text{Bearing} = 90 - 28 - 55.7$$

$$= 0.06.3^\circ \quad (A)$$

6. $(x + y)^6 = 1(x)^6(y)^0 + 6(x)^5(y)^1 + 15(x)^4(y)^2 + 20x^3y^3 + 15x^2y^4 + 6xy^5 + y^6$
 $(1.02)^6 = (1 + 0.02)^6 x = 1$
 $y = 0.02$

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

$$= 1 + 0.12 + 0.006 + 0.00016$$

$$= 1.12616$$

$$= 1.126 \text{ (to 3 d.p)} \quad (3)$$

7. $\frac{3(1 + 3)}{(1 - 3)(1 + 3)} = \frac{3 + 3}{1 - 3} \frac{3 + v3}{2}$

9. Moving averages of order 4

$$M_1 = \frac{52 + 41 + 43 + 48}{4} = \frac{184}{4} = 46$$

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

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

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

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

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

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

$$4 \quad 4$$

9. $y = 3x + 4$
A(0,4) B (1,7) Object points

$$\begin{array}{cccccc} & A & B & A & B & \\ & 2 & 1 & 0 & 1 & \\ & & & & & 4 \quad 9 \\ & & & & & = \\ & -1 & 2 & 4 & 7 & 8 \quad 13 \\ Y = Mx + C \\ \frac{M = 13 - 8}{9 - 4} = \frac{5}{5} = 1 \end{array}$$

$$\begin{array}{l} y = x + c \\ 8 = 4 + c \quad c = 4 \end{array} \quad y = x + 4$$

10. $AB = \begin{array}{cc} 8 & -4 \\ 7 & -8 \end{array} = \begin{array}{cc} 4 & \\ -1 & \end{array} \quad BC = \begin{array}{cc} 16 & -8 \\ 5 & -7 \end{array} \quad \begin{array}{c} -8 \\ -2 \end{array} \text{ for}$
either

$AB = \frac{1}{2} BC$ and AB and BC share point B.
A,B,C are collinear.

(3)

11. $\begin{array}{cc} 2 & -3 \\ 4 & 3 \end{array} \quad \det. = 6 + 12 = 18$
 $\text{Inv.} = \frac{1}{18} \quad \begin{array}{cc} 3 & 3 \end{array}$
 $\frac{1}{18} \quad \begin{array}{cc} 3 & 3 \end{array} \quad \begin{array}{cc} 2 & -3 \end{array} \quad \begin{array}{cc} 18 & \\ -4 & 2 \end{array} \quad \begin{array}{cc} 3 & 3 \end{array} \quad 7$
 $\begin{array}{cc} -4 & 2 \end{array} \quad \begin{array}{cc} 4 & 2 \end{array} \quad \begin{array}{cc} 2 & y \end{array} \quad \begin{array}{cc} -4 & 2 \end{array} \quad 5$
 $\begin{array}{cc} x & y \end{array} \quad \begin{array}{cc} 18 & \\ 36 & \end{array}$
 $\begin{array}{cc} y & 18 \end{array} \quad \begin{array}{cc} -18 & \end{array} \quad (3)$
 $x = 2, y = -1 \quad (A)$

12. $\frac{1}{7} + \frac{3}{12.4} + \frac{7}{0.103}$
 $\frac{1}{7} + \frac{3}{1.24 \times 10^{-1}} + \frac{7}{1.03 \times 10^{-1}}$
 $\frac{0.1429 + 3(0.8064) + 7 \times 10 (0.9709)}{10}$
 $= 0.1429 + 0.2419 + 67.96$
 $= 70.52 \quad (A) \quad (3)$

$$13. \quad (i) \text{ ADC} = 2x73 \\ = 146^0$$

$$(ii) \text{ OCB} = x = 180 - 146 = 34$$

$$(iii) 360 - 107 - 146 - 34 \\ = 73^0$$

$$14. \quad \text{Tan } 30^0 = y/x \quad y = x \tan 30 \\ \text{Tan } 60^0 = \frac{1000}{X} + y \quad ; \quad y = x \tan 60 - 1000$$

$$X \tan 30^0 = x \tan 60 - 1000$$

$$0.5773 x = 1.732x - 1000$$

$$1.732x - 0.577 = 1000$$

$$1.155x = 1000$$

$$x = \frac{1000}{1.155}$$

$$= 866.0 \text{ m} \quad (A) \quad (4)$$

$$15. \quad 5 \text{ km} \quad \text{Slower speed} = x \text{ km/hr} \\ \text{Time} = 5/x$$

$$\text{Faster} = (x+20) \text{ k/h}$$

$$\text{Time} = 5/x = 20$$

$$T_1 - T_2 = 5/x - 5/x+20 = 30/3600$$

$$\frac{5(x+20)}{x(x+20)} - 5x \frac{1}{120}$$

$$120(5/x + 100 - 5x) = x^2 + 20x \quad (5)$$

$$x^2 + 20x - 12000$$

$$x = \frac{-20 \pm \sqrt{400 + 48000}}{2}$$

$$x = \frac{-20 \pm 220}{2}$$

$$\text{Spd} = 100 \text{ km/h}$$

$$\text{And } x = 120 \text{ km/h} \quad (A)$$

$$16. \quad \text{Log } x = a \text{ log } y = b$$

$$\text{Log } \frac{x^3}{y} = \text{Log } x^3 - \text{log } y^{1/2}$$

$$= 3 \text{ Log } x - 1/2 \text{ Log } y$$

$$= 8a - \frac{1}{2} ab$$

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 = $(1 / 90 \times 10) + 44.5 = 44.5 + 0.111$
 $= 44.610$

(b) Standard deviation = $10 \sqrt{233/90 - (1/90)^2}$
 $10 \sqrt{2.478 - 0.0001}$ (8)
 $10 \sqrt{2.478}$
 $10 \times 1.574 = 15.74$ (A)

(c) Median 45.5th value = $39.5 + (13.5 \times 10 / 26)$
 $39.5 + 5.192$ (A)
 44.69

(a) The probability = $\frac{\text{Shaded area}}{\text{Large circle area}}$
Shaded area = $\pi R^2 - \pi r^2$
 $= 22/7 (4^2 - 3^2) \times \pi = 22/7 \times 7 = 22$
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)

$$(iii) P(\text{same number}) = P(1,1) \text{ or } (2,2) \text{ or } (3,3) \text{ or } (4,4) \text{ or } (5,5) \text{ or } (6,6) \\ 6/36 = 1/6 \quad (A)$$

20.

$$(i) \quad \cos 60^\circ = x/20 \quad x = 20 \times 0.5 = 10 \text{ cm} \\ BD = 12 - 10 = 2 \text{ cm}$$

$$(ii) \quad CD = y \quad \sin 60^\circ = y/20 \quad y = 20 \times 0.8666 \\ CD = 17.32 \text{ cm}$$

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

$$21. (a) \text{ From the diagram, } XO = 5/2 = 2.5 \\ \tan 75^\circ = VO/2.5 \quad \text{v m} \\ VO = 2.5 \times 3.732$$

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

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

$$(c) \quad = VAO \quad \tan = \frac{9.33}{3.536} = 2.639 \\ VAO = 69.24^\circ \quad (A)$$

$$(d) \quad \cos VBA = 2.5/9.98 = 0.2505 \\ VBA = 75.49^\circ \\ \text{Area VBA} = \frac{1}{2} \times 5 \times 4.99 \times \sin 75.45 \quad \text{m (or other perimeter)} \\ = 5 \times 4.99 \times 0.9681 \\ = 24.15 \text{ cm}^2 \quad (A)$$

23. Volume = cross - section Area x L

$$\text{X-sec Area} = (1 \times 25) + (\frac{1}{2} \times 25 \times 2.5)$$

$$= 25 + 31.25 = 56.25 \text{ m}^2$$

$$\text{Volume} = 56.25 \times 12$$

$$= 675 \text{ m}^3$$

Volume passed / sec = cross section area x speed

$$= \pi r^2 \times l = 3.14 \times \frac{9}{100} \times \frac{9}{100} \times 3 \quad (8)$$

$$= 0.07635 \text{ m}^3/\text{sec} \text{ v (M)}$$

Volume emptied in 2 minutes

$$= 0.07635 \times 60 \times 2$$

$$= 9.162 \text{ m}^3 \quad (A)$$

$$1 \text{ m}^3 = 1000 \text{ l}$$

$$= 9.162 \text{ litres}$$

$$= 9160 \text{ litres} \quad (A)$$

24.

MATHEMATICS II
PART I

SECTION A (52 MARKS)

1. Use tables to evaluate $\frac{{}^3\sqrt{0.0912^2} + \sqrt{3.152}}{0.1279 \times 25.71}$ (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 $\begin{pmatrix} k & 3 \\ 3 & k \end{pmatrix}$ 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 $0^\circ \leq \theta \leq 360^\circ$ 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 $FK = 3\text{cm}$, $AX = 3\text{cm}$, $KX = 1.5\text{cm}$ and $AF = 5\text{cm}$, find CX and XN .

(3mks)

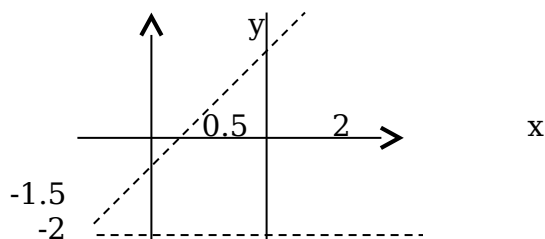
15. Make X the subject of the formula

(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:

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

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

Using 74.5 as the Assumed mean, calculate:

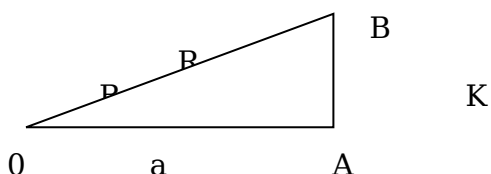
(i) The mean mark

(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 $0^\circ \leq x \leq 180^\circ$, taking intervals of 15°

(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 $1\frac{1}{4}$ 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° . A ship leaves port Q on a bearing of 150° at a speed of 40km/hr to arrive at port R $7\frac{1}{2}$ 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

$${}^3\sqrt{36.5 \times 0.02573}$$

$$1.938$$
 (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:

$$x + \frac{1}{x} = \frac{10}{3}$$
(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)

- $$\angle XPY = 60^\circ. \quad (2\text{mks})$$

Calculate the size of: (2mks)

- a) $\angle ABD$

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)

Calculate the distance:

i) In nautical miles (nm)

ii) In kilometres (km)

Between the two places along the circle of Latitude:

a) A(30°N , 20°E) and B(30°N , 80°E) (Take Radius of Earth = 6371Km).

(2mks)

b) X(50°S , 60°W) and Y(50°S , 20°E) (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 $\int \frac{8x^5 - 3x}{x^2} dx$

(4mks)

$$\mathbf{X}^3$$

15. The figure below represents a circle of radius 14cm with a sector subtending an angle of 60° 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 $y = \sin x^\circ$ and $y = 2\sin (x^\circ + 10^\circ)$ in the domain $0^\circ \leq x^\circ \leq 180^\circ$

- i) Use the graph to find amplitudes of the functions.
- ii) What transformation maps the graph of $y = \sin x^\circ$ onto the graph of : $y = 2\sin (x^\circ + 10^\circ)$.

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	
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° at 750km/h and B flies on bearing of 210° at 900km/h:
- Using a suitable scale draw a diagram to show the positions of Aeroplanes after 2hrs.
 - Use your graph to determine:
 - The actual distance between the two aeroplanes.
 - The bearing of B from A.
 - 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.
- it will either rain and not.
 - Neither will not take place.
 - 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:

$$\begin{aligned}
 1. \quad 0.0912^2 &= (9.12 \times 10^{-2})^2 = 0.008317 \\
 &\quad \sqrt{3.152} = 1.776 \\
 &\quad \sqrt[3]{1.776 + 0.008317} \\
 &\quad \quad 0.1279 \times 25.91
 \end{aligned}$$

$$= 6.224(3d.p)$$

9.

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

$$h = \frac{1}{2}$$

$$\text{Area} = \frac{1}{2} \times \frac{1}{2} [29 + 2(6.25 + 9 + 12.25 + 16 + 20.25 + 25)]$$

$$= \frac{1}{4} [29 + 127.5]$$

$$= \frac{1}{4} \times 156.5 = 39.125 \text{ sq. units.}$$

$$10. \cos \theta (\cos \theta + \frac{1}{2}) = 0$$

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

$$\theta = 90^\circ, 270^\circ \quad \theta = 120^\circ, 240^\circ$$

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

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

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

$$\therefore P \text{ is } (-1, 0)$$

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

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

$$300 = 30 + 3n - 3$$

$$300 - 27 = 3n$$

$$273 = 3n$$

$$91 = n$$

$$13. \quad y = mx - 1$$

$$1 = 3m - 1$$

$$m = \frac{2}{3} = 0.6667$$

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

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

$$FC = \frac{25}{3} = 8 \frac{1}{3} \text{ cm}$$

$$CX = 8 \frac{1}{3} - \frac{9}{2} = \frac{23}{6} = 3 \frac{5}{6} \text{ cm}$$

$$CX \times XK = XA \times XN$$

$$\frac{23}{6} \times \frac{3}{2} = 3 \times XN$$

$$\therefore XN = 1 \frac{11}{12} \text{ cm}$$

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

$$k - x$$

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

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

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

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

$$1 + V^3$$

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

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

$$(iii) \text{pts. } (0.5, 0)$$

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

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

SECTION B

17.

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

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

(ii) $y = -x^2 + 3x + 2$
 $0 = -x^2 - x + 2$
 $y = 4x$ $(-2, -8)$ $(1, 4)$
 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
	$\Sigma f =$	$\Sigma fd =$			$\Sigma fd^2 =$	
	60	-1680			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) $OS = \frac{3}{4}OK = \frac{3}{8}a + \frac{3}{8}b$
 (iii) $RS = RO + OS = \frac{3}{8}a - \frac{9}{40}b$
 (iv) $RA = RO + OA = -\frac{3}{5}b + a$

$$b. RA = a - \frac{3}{5}b \quad RS = \frac{3}{8}a + \frac{9}{40}b$$

$$= \frac{3}{8}(a - \frac{3}{5}b)$$

$$\therefore RS = \frac{3}{8}RA$$

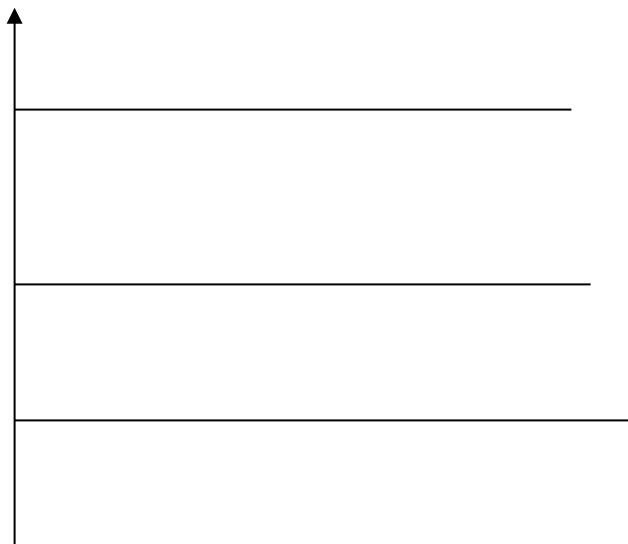
The vectors are parallel and they have a common point R $\therefore$ point R, S and A are collinear

20.

$$\begin{aligned}
 &KB = 3\text{m} \quad NK = 1.5\text{m} \quad XB = 5\text{m} \\
 \text{(i)} \quad &XK = \sqrt{5^2 - 3^2} = \sqrt{16} = 4\text{m} \\
 &\text{let } \angle XKN = \theta \\
 &\cos \theta = \frac{1.5}{4} = 0.375 \\
 &\theta = 67.97(8)^\circ
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii) In } \triangle XNK & \\
 &XN = \sqrt{4^2 - 1.5^2} = \sqrt{13.75} = 3.708 \\
 &\text{In } \triangle SMR; MR = KB = 3\text{m} \\
 &SM = XN = 3.708\text{m} \\
 &\text{Let } \angle SRM = \alpha \\
 &\tan \alpha = \frac{3.708}{3} = 1.236 \\
 &\alpha = 51.02(3)^\circ
 \end{aligned}$$

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	2.0 0	1. 93	1. 73	1. 41	1. 00	0. 52	0.0 0	- 0.52	-1	- 1.41	- 1.73	- 1.9 3	- 2.0 0
Y = sin ½ X	0.0 0	0. 13	0. 26	0. 38	0. 50	0. 61	0.7 1	0.79	0.8 7	0.92	0.97	0. 99	1.0 0

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

(b) Between 40.5° and 139.5°

22. $\xrightarrow{\quad 300\text{km} \quad}$
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

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

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

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

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

$$x = 44.25$$

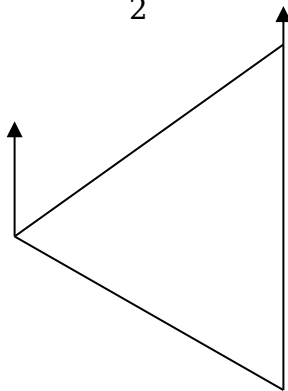
$$X = -54.25 \text{ N/A}$$

(b) Distance covered by A in $1 \frac{1}{4}$ hrs = $44.25 \times \frac{5}{4} = 55.3$ km

Distance of A from T is $300 - 55.3 = 244.7$ km

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

(b)



$$\begin{aligned} PR^2 &= 200^2 + 300^2 - 2 \times 200 \times 300 \cos 70^\circ \\ &= 130,000 - 41040 = 88,960 \end{aligned}$$

$$PR = 298.3 \text{ km}$$

$$\begin{aligned}
 \text{(c) } \frac{298.3}{\sin 70^\circ} &= \frac{300}{\sin \alpha} \\
 \sin \alpha &= \frac{300 \sin 70^\circ}{298.3} \\
 &= 0.9344 \\
 \alpha &= 69.1^\circ
 \end{aligned}$$

Bearing of R from P is
 $40 + 69.1 = 109.1^\circ$

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
 $2400x + 3200y$
 (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

$$\begin{array}{r|l}
 \text{1. No} & \text{log.} \\
 36.5 & 1.5623 \\
 0.02573 & \underline{-2.4104} + \\
 & -1.9727 \\
 1.938 & \underline{0.2874} - \\
 & -1.6853 \\
 \\
 \underline{-3} & + \underline{2.6853} \\
 3 & 3 \\
 -1 & + 0.8951 \\
 1.273(4) & \leftarrow 0.1049 \\
 & = 1.273(4)
 \end{array}$$

2. Let shirt be sh x,
 let blouse be sh. y.

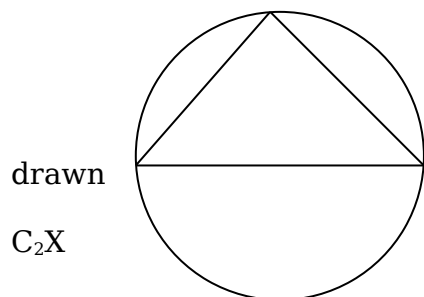
$$\begin{aligned}
5x + 3y &= 1750 \text{ (i.)} \\
3x + y &= 850 \text{ (ii)} \\
\text{mult (ii) by 3} \\
9x + 3y &= 2550 \text{ (iii)} \\
\text{Subtract (iii) - (i.)} \\
-4x &= -800 \\
\text{Subt for x} \\
y &= 250 \\
\text{Shirt} &= \text{sh } 200 ; \text{ Blouse} = \text{sh } 250
\end{aligned}$$

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

$$\begin{aligned}
4. \quad x^2 + 1 - \frac{10x}{3} &= 0 \\
3x^2 - 10x + 3 &= 0 \\
3x(x - 3) - 1(x - 3) &= 0 \\
(3x - 1)(x - 3) &= 0 \\
x &= 1/3 \text{ or } x = 3
\end{aligned}$$

$$\begin{aligned}
5. \text{ Area } \triangle OAD \quad \text{pyth theorem } AD &= 12.49\text{cm} \\
\frac{1}{2} \times 12.49 \times 10 &= 62.45\text{cm}^2 \\
\cos \theta &= 10/16 = 0.625 \\
\theta &= 51.3^\circ \\
\text{Sector } \frac{57.3^\circ}{360} \times 3.14 \times 100 &= \frac{62.5}{40.2} = 22.3
\end{aligned}$$

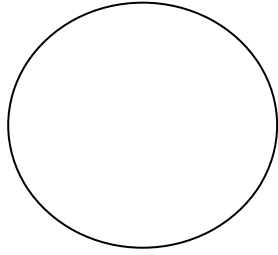
$$\begin{aligned}
6. \quad \angle XPY &= 60^\circ \\
\therefore \angle XC_1Y &= 120^\circ \\
\text{B1} \quad \therefore \angle C_1XY &= \angle C_1YX \\
&= \frac{180^\circ - 120^\circ}{2} = 30^\circ
\end{aligned}$$



Construct 30° angles
at XY to get centres
B1 C₁ and C₂ mojar arcs
2 on both sides with C₁X and
as centres.

7.

67°



$$DAB = 180^\circ - 98^\circ = 82^\circ$$

$$ADB = 180 - (67 + 45) =$$

$$ABD = 180 - (67 + 82) = 31^\circ$$

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

$$\angle ABD = 31^\circ$$

$$(b) (180 - 82)^\circ = 98^\circ$$

$$180^\circ - (98^\circ - 45^\circ) =$$

$$\angle CBD = 37^\circ$$

$$\text{Opp} = 180^\circ$$

$$82 + 98 = 180^\circ$$

$$- 180 - (98 + 45)^\circ = 37^\circ$$

$$8. \quad \frac{10}{100} \times 320$$

$$\text{Discount} = \text{sh } 32$$

$$\text{Sold at sh } 288$$

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

$$9. (a) \text{ Dist along circle of lat.}$$

$$\text{Long diff} \times 60 \times \cos \theta \text{ nm}$$

$$100 \times 60 \times \cos 50^\circ$$

$$100 \times 60 \times 0.866$$

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

$$\frac{100}{360} \times 2 \times 3.14 \times 6371 = 5780 \text{ Km}$$

$$(b) 80 \times 60 \cos 50 = 3895 \text{ Km}$$

$$10. \text{ Vol} = 2.8 \times 2.4 \times 3 = 20.16 \text{ m}^3$$

$$1 \text{ m}^3 = 1000 \text{ L}$$

$$20.16 \text{ m}^3 = 20160 \text{ L}$$

$$20160$$

$$\frac{3600}{}$$

$$16560 \text{ L to fill}$$

$$0.5 \text{ L} - 1 \text{ sec}$$

$$16560 \text{ L} - ?$$

$$\frac{165600}{}$$

$$5 \times 3600$$

$$\frac{33120}{3600} \text{ hr}$$

$$\cong 9.41 \text{ hrs} ; \cong 564.6 \text{ min.}$$

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

$$a = -0.2$$

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

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

12. Area of metal : Material - Cross section.

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

$$3.14 (21^2 - 19^2)$$

$$\text{Vol } 6.28\text{cm}^2 \times 3400\text{cm}$$

$$= 215.52\text{m}^3$$

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

$$P(\text{odd}) = 3/6 = 1/2$$

$$P(\text{Sum} > 7 \text{ but } < 10) = 9/36$$

$$\therefore P(\text{odd}) \text{ and } P(\text{sum} > 7 \text{ but } < 10)$$

$$= 1/2 \times 9/36 = 9/72 = 1/8$$

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

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

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

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

15. Area of $\triangle AOB$

$$1/2 \times 14 \times 14 \times 0.866 = 84.866\text{cm}^2$$

$$\text{Area of sector} = \frac{60}{360} \times 3.14 \times 14 \times 14 = 10.257$$

Shaded Area

$$84.666 - 10.257 = 74.409\text{cm}^2$$

- 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

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

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

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

$$= \sqrt{50.4 - 49}$$

$$= \sqrt{1.4} = 1.183$$

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) $\theta = \tan^{-1} 5/5 = \tan^{-1} 1 = 45^\circ$
 (d) $\beta = \tan^{-1} 5/7.071 = \tan^{-1} 0.7071 = 35.3^\circ$
 (e) $\gamma = \tan^{-1} 5/3.535 = \tan^{-1} 1.414 = 54.7^\circ$
 (f) $\angle AGX = 19.4^\circ$

18. $y = \sin x$

x°	0°	30°	60°	90°	120°	150°	180°
$\sin x^\circ$	0	0.50	0.866	1.00	0.866	0.50	0

$y = 2 \sin(x^\circ + 10^\circ)$

x°	0°	30°	60°	90°	120°	150°	180°
$2 \sin(x^\circ + 10^\circ)$	0.3472	1.286	1.8794	1.286	0.3472	-0.3472	-1.286

Amplitudes for $y = \sin x^\circ$ is 1

For

$y = \sin(x+10^\circ)$ 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

$$\begin{aligned} \text{Mean} &= \frac{x}{n} + 52 + \frac{-4}{150} \\ &= 52 - 0.02 \\ &= \underline{51.98} \\ \text{Median} &= 51.4\text{g.} \end{aligned}$$

class interval 59

Class interval	mid point	Fre q.	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

$$\begin{aligned} 20.X + Y &\leq 1000 \\ X &\leq 2Y \\ Y &< 720 \\ X &> 90 \end{aligned}$$

$$21.(a) \quad 1\text{cm} = 200\text{Km/h}$$

$$A = 200 \times 7.5 = 1500 \text{ Km}$$

$$B = 200 \times 9 = 1800\text{Km}.$$

$$(b) (i.) \quad 15.8\text{cm} \times 200$$

$$= 3160 \text{ Km}.$$

$$(ii) \text{ Bearing } 224^{\circ}$$

$$(iii) \text{ Bearing } 049^{\circ}$$

$$22. (a) P(R) \times P(R)^1$$

$$= 0.5 \times 0.6$$

$$= 0.3$$

$$(b) P(R)' \times P(R)$$

$$0.5 \times 0.4$$

$$= 0.2$$

$$(c) P(R) \times P(R')$$

$$P(R)' \times P(R)$$

$$0.5 \times 0.6 = 0.3$$

$$0.5 \times 0.4 = 0.2 = 0.5$$

$$23. y = x(x + 1)(x - 2)$$

$$= x^3 - x^2 - 2x$$

$$A_1 = \int (x^3 - x^2 - 2x) dx$$

$$= \left[\frac{1}{4} x^4 - \frac{1}{3} x^3 \right]_1$$

$$= 0 - \left(\frac{1}{4} + \frac{1}{3} - 1 \right) = 5/12$$

$$A_2 = \int_0^2 (x^3 - x^2 - 2x) dx$$

$$= \left[\frac{1}{4} x^4 - \frac{1}{3} x^3 - x^2 \right]_0^2$$

$$= \left(\frac{1}{4} \cdot 16 - \frac{1}{3} \cdot 8 - 4 \right)$$

$$= 4 - 8/3 - 4 = -8/3$$

$$A_1 = 5/12 = A_2 = 2^{2/3}$$

$$24. y = x^3 - 3x^2$$

$$\frac{dy}{dx} = 3x^2 - 6x$$

At stationary

Points $\frac{dy}{dx} = 0$

$$\text{i.e. } 3x^2 - 6x = 0$$

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

$$x = 0 \text{ or } 2$$

Distinguish

$$\frac{dy}{dx} = 3x^2 - 6x$$

$$\frac{d^2y}{dx^2} = 6x - 6$$

$$(i) \quad x = 0 \quad \frac{d^2y}{dx^2} = 6x - 6 = -6$$

$$-6 < 0 - \text{maximum.}$$

$$\therefore (0,0) \text{ Max Pt.}$$

$$(ii) \quad x = 2$$

$$\frac{d^2y}{dx^2} = 6$$

$$6 > 0 \text{ hence}$$

Minimum Pt.

$$x = 2, y = 8 - 12 = -4$$

$$(2, -4) \text{ minimum point.}$$

MATHEMATICS II

PART I

SECTION 1 (52 Marks)

1. Without using tables evaluate:

- $$\frac{\sqrt{7.5625} \times \sqrt[3]{3.375}}{15} \quad (5 \text{ mks})$$
2. Make k the subject of the formula.

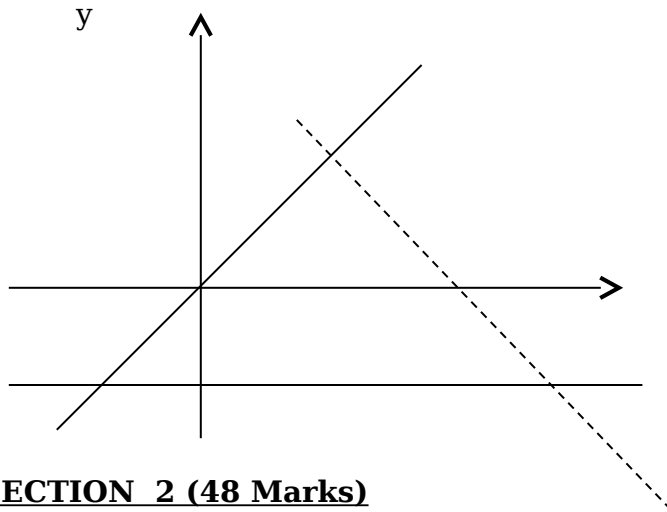
$$y = \frac{1}{T^2} \frac{\sqrt{k+y}}{k}$$
(3 mks)
3. If $A = (x, 2)$ and $xB = -2$ and if $AB = (8)$, find the possible values of x .
(3 mks)
4. Simplify completely.

$$\frac{rx^4 - r}{2xr - 2r}$$
(3 mks)
5. Solve the equation.
 mks) (3

$$\log_3 (8-x) - \log_3 (1+x) = 1$$
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:
 $3, 5, 2, 1, 2, 4, 6, 5$
 mks) (4
9. What is the sum of all multiples of 7 between 200 and 300?
(4 mks)
10. Solve the equation.
 $\frac{1}{2} \tan x = \sin x$ for $-180^\circ \leq x \leq 360^\circ$.
(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 mks)
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 $\pi = \frac{22}{7}$, find the area shaded.
(3 mks)

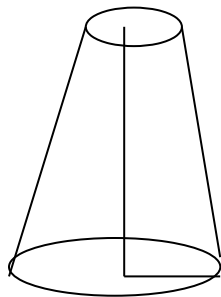
15. A box contains 36 balls, all identical except for colour. 15 of the balls are black, 15 are brown and the rest are white. Three balls are drawn from the box at random, one at a time, without replacement. Find the probability that the balls picked are white, black and brown in that order. (2 mks)

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 $-180^\circ \leq \theta \leq 180^\circ$

(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° . 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° 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 there 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 $\frac{2}{5}$ of his dollars into Italian lire, which he spends in Italy. While in West Germany, he converts $\frac{5}{8}$ 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?

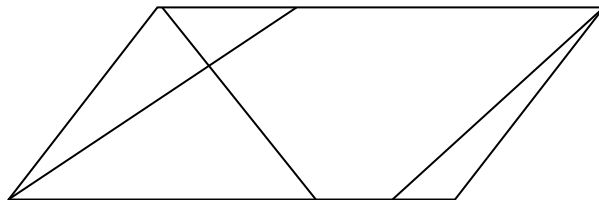
(b) How many Italian lire did he spend in Italy?

(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:

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

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)



$$85^0$$

$$160^0$$

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

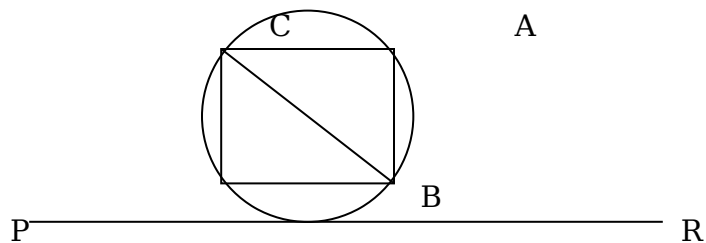
- (b) By putting $x = 0.01$, find the approximate value of $(1.02)^6$ correct to 4 S.F.
(2 mks)

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

9. The probabilities of three candidates K, M and N passing an examination is $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{4}{5}$ 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 $\angle ACB$.



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)

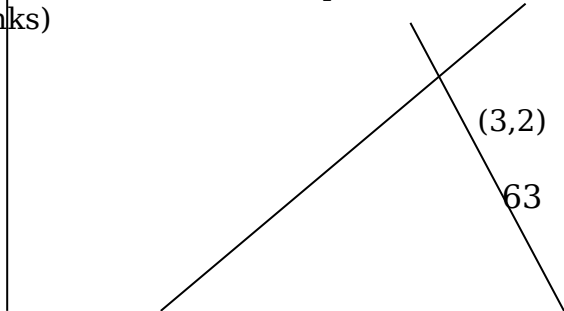
12. Evaluate $\int_0^1 (3x^2 - \frac{1}{4x^2}) dx$ (2 mks)

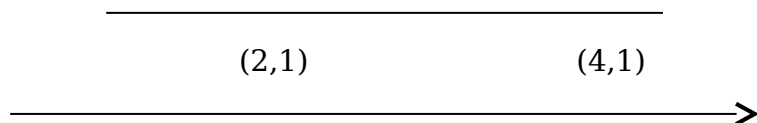
$$\int_0^1 (3x^2 - \frac{1}{4x^2}) dx$$

1

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: 44100

(3 mks)

$$n(n-7)$$

SECTION II: (48 Marks)

17. Find the distance between points A(50° S, 25° E) and B(50° S, 140° 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 $v(\text{ms}^{-1})$	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 $AB = 9\text{cm}$, $BC = 14\text{cm}$ and $\angle BAC = 120^\circ$. 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:-

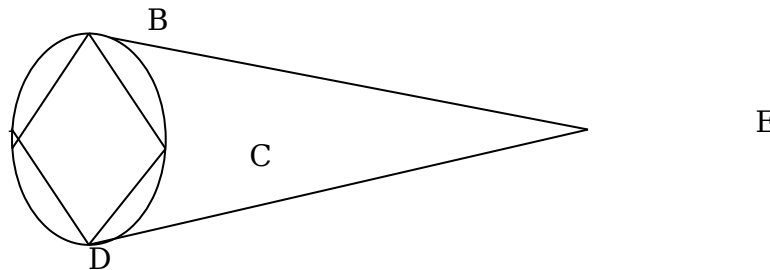
- (i) The mean mark: (2 mks)
- (ii) The variance: (2 mks)
- (iii) The standard deviation: (2 mks)

22.(a) On the same axes, draw the graphs of : $y = \sin x$; $y = \cos x$
 $y = \cos x + \sin x$ for $0^\circ < x < 360^\circ$.

(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 $0^\circ < x < 360^\circ$.

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 $\angle DAB = 80^\circ$.



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

	$\frac{8-x}{1+x} = 3$ $-4x = -5$ $x = \frac{5}{4}$	1 1	expression. Equation Answer																														
		3																															
6.	Let the centre be (a,b) $\begin{pmatrix} 4-9 \\ -5-b \end{pmatrix} = -1 \begin{pmatrix} 4-a \\ 3-b \end{pmatrix}$ $4-a = -4+9 \qquad -5-b = -3+b$ $a = 4 \qquad b = -1$ centre is (4,-1)	1 1 1	Equation Linear equations Centre																														
		3																															
7.	$Y = 4x + 5$ Gradient = 4 Gradient of $\perp$ line - $\frac{1}{4}$ $\frac{y+2}{x+3} = \frac{-1}{4}$ $4y + x = -11$	1 1	Gradient of $\perp$ line. Equation.																														
		2																															
8.	$X = \frac{28}{8} = 3.5$ <table border="1"><tr><td>x</td><td>3</td><td>5</td><td>2</td><td>1</td><td>2</td><td>4</td><td>6</td><td>5</td><td></td></tr><tr><td>d</td><td>-0.5</td><td>1.5</td><td>-1.5</td><td>-2.5</td><td>-1.5</td><td>0.5</td><td>2.5</td><td>1.5</td><td></td></tr><tr><td>d²</td><td>0.25</td><td>2.25</td><td>2.25</td><td>6.25</td><td>2.25</td><td>0.25</td><td>6.25</td><td>2.25</td><td>$\Sigma d^2 = 22$</td></tr></table> $\text{standard deviation} = \sqrt{\frac{22}{8}} = \sqrt{2.75} = 1.658$	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	$\Sigma d^2 = 22$	8 1	Mean d values d ² values Answer
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	$\Sigma d^2 = 22$																								
		4																															
9.	$a = 203 \quad d = 7 \quad L = 294$ $294 = 203 + 7(n-1)$ $n = 14$ $S_{14} = \frac{14}{2} (203 + 294)$	1 1 1	For both a and b Equation For n																														

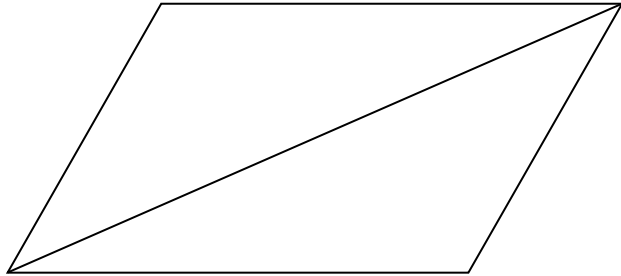
	$= 7 \times 497$ $= 3479$	1	Sum
		4	
10.	$\frac{\sin x}{\cos x} = 2 \sin x$ $\frac{\sin x}{\sin x} = 2 \cos x$ $2 \cos x = 1$ $\cos x = 0.5$ $x = 60^\circ, 300^\circ, -60^\circ$	1 1 1	Simplification Equation All 3 values
		3	
11.	$(1 + 2x)^4 = 1 - 8x + 24x^2 - 32x^3 + 16x^4$ $(0.82)^4 = (1 + -2 \times 0.09)^4$ $x = 0.09$ $(0.82)^4 = 1 - 0.72 + 0.1944 - 0.023328 + 0.00119376$ $= 0.35226576$ $\cong 0.35227$ (5 d.p)	1 1 1 1	Expansion Value of x All terms Rounded
		4	
12.	$2 = 5m - 3$ $m = 1$ $\tan \theta = 1$ $\theta = 45^\circ$	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	1 st equation 2 nd equation method of solving Answer
		4	
	S		
14.	Let $\angle AOB = \theta$ $\frac{\theta}{360} \times 2 \times \frac{22}{7} \times 7 = 11$ $\theta = 90^\circ$ 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.	$P(WBb) = \frac{6}{36} \times \frac{15}{35} \times \frac{15}{34}$	1	Method	
	$= \frac{15}{476}$	1	Answer	
		2		
16.	Equation	inequality	1	1 mark for each inequality. Method for obtaining L^3
	$L_1 \quad y = x$	$y \leq x$	1	
	$L_2 \quad y = -2$	$y \geq -2$	1	
	$L_3 \quad 2y + 5x = 21$	$2y + 5x < 21$	1	
		4	2	For all correct 1 for atleast five
				Correct plotting
				Scale
			1	
			1	Smoothness of curve
			1	Both roots
			1	Linear equation
			1	Both roots
			8	
18.	$\frac{h}{h+50} = \frac{15}{40}$	1	Expression	
	$h = 30\text{cm}$ $H = 80\text{cm}$	1	Value of H	
	(a) Volume = $\frac{1}{3} \pi \times 40 \times 40 \times 80 - \frac{1}{3} \pi \times 15 \times 15 \times 30$	1	Substitution	
	$= \frac{128000}{3} \pi - \frac{6750}{3} \pi$			
	$= \frac{121,250\pi}{3} \text{ cm}^3$	1	Volume	
	(b) $L^2 = 80^2 + 40^2$	1	L	
	$+ 30^2$	1	L	
	$= 6400 + 1600$ $+ 900$ $= 8000$	1	Substitution	

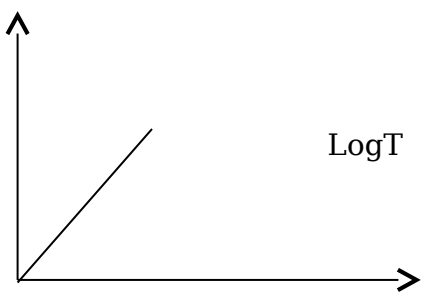
1125	$L = 89.44 \text{ cm}$ $L = 33.54 \text{ cm}$ Curved surface area of bucket = $\pi \times 40 \times 89.44$ $\pi \times 15 \times 33.54$ $= 3577.6\pi - 503.1\pi$ $= 3074.5\text{cm}^2$	1	Area
		8	

19.

20.	(i) $\angle RPQ = 13^\circ$ $\angle PQR = 32^\circ + 90^\circ + 24^\circ = 146^\circ$ $\angle PRQ = 180^\circ - (146^\circ + 13^\circ)$ $= 21^\circ$ (ii) $\frac{P}{\sin 13^\circ} = \frac{7}{\sin 21^\circ}$ $P = \frac{7 \sin 13^\circ}{\sin 21^\circ}$ $= 4.394 \text{ km}$	1 1 1	Fair sketch $\angle PRQ$
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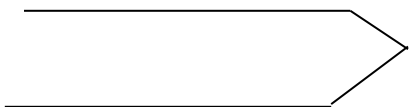
	 (iii) Let PR = q $\frac{q}{\sin 146^\circ} = \frac{7}{\sin 21^\circ}$ $q = \frac{7 \sin 146^\circ}{\sin 21^\circ}$ $q = 10.92 \text{ km}$ $\sin 45^\circ = \frac{RT}{10.92}$ $RT = 10.92 \sin 45^\circ$ $= 7.72 \text{ km (2 d.p.)}$	Equation Method Equation 1 1 Distance PR Equation RT 1 1	
		8	
21.	(a) $4x = 9y$ $2(x+y) = y+44 \Rightarrow 2x + y = 44$ $4x - 9y = 0$ $\underline{4x + 2y = 88}$ $11y = 88$ $y = 8$ $x = 18$ (b) $P(RR) = \frac{18}{26} \times \frac{18}{26} = \frac{81}{169}$	1 1 2 1 1 1 1	Equation Equation Method of solving Value y Value x Method Answer

		8	
22.	(a) $67,000 \text{ Ksh} = \frac{67,000}{16.75} \text{ US dollars}$ $= 4,000 \text{ dollars}$ (b) $\frac{2}{5} \times 4,000 = 1600 \text{ US dollars}$ $1600 \text{ US dollars} = 1600 \times 1340$ $= 2,144,000$ Italian lire (c) Remainder = 2400 US dollars $\frac{5}{8} \times 2400 = 1500 \text{ US dollars}$ $1500 \text{ US dollars} = 1500 \times 1.8$ $= 2700 \text{ Deutsche marks}$ (d) Remainder = 900 US Dollars $900 \text{ US Dollars} = 900 \times 16.75 \text{ Ksh.}$ $= 15,075 \text{ Ksh.}$	1 1 1 1 1 1 1 1	Method Answer Method Answer For 1500 Answer Method Ksh.
		8	
23.	PM = kPA $= k(r + \frac{1}{2}h)$ $= kr + \frac{1}{2}kh$ PM = PB + BM $\frac{3}{4}h + t \text{ BQ}$ $= \frac{3}{4}h + t(-\frac{3}{4}h + r)$ $= \frac{3}{4}h - \frac{3}{4}th + tr$ $= \frac{3}{4} - \frac{3}{4}th + tr$ t = k $\frac{3}{4} - \frac{3}{4}t = \frac{1}{2}k$ $\frac{3}{4} - \frac{3}{4}t = \frac{1}{2}t$ $\frac{5}{4}t = \frac{3}{4}$ $t = \frac{3}{5}$ $\therefore k = \frac{3}{5}$ $\therefore \text{PM} = \frac{3}{5}r + \frac{3}{5}h$	1 1 1 1 1 1 1 1 1	PM PM PM simplified Both equations method Value of k Value k PM

	5	10		
			8	
			1 1	Plotting Labeling of axis
24.	$\text{Log } T = \log a + x \log b$ $\text{Log } T \Rightarrow 0.82, 1.25, 1.68, 2.11, 2.54, 2.97, 3.40, 3.84$ $y - \text{intercept} = \log a = 0$ $a = 1$ $\text{gradient} = \frac{3.84 - 0.82}{9 - 2} = \frac{3.02}{7}$ $= 0.4315$ $\log b = 0.4315 = 0.4315$ $b = \text{antilog } 0.4315$ $b = 2.7$		1 2 1 1 1 8	Linear All correct logs 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	M1	✓ reading to 4 s.f
	0.786	1.8954		
	21.72	<u>1.3369</u>		
		<u>1.2323</u>		
		1.7067 - 2		
		$\frac{2}{2} + \frac{1.7067}{2}$	M1	Rearranging
	- 1 + 0.8533		A1	
	0.7134 x 10 ⁻¹ = 0.07134			
			3	
2.				
	$\frac{4}{(x-2)(x+2)}$	- $\frac{1}{(x-2)}$	M1	
	$\frac{-x+2}{(x-2)(x+2)}$			

	$\frac{-(x-2)}{(x-2)(x+2)}$ $\frac{-1}{x+2}$	M1 A1	
		3	
3.	Re6000 = Ksh. 75000 Spent 5000 Rem 2500 Rem 2500 1.25 Re 2000	M1 M1 A1	
		3	
4.	$2x - 1$, $2z + 1$, $2x + 3$ $6x + 3 = 105$ $6x = 102$ $x = 17$	M1 M1 A1 A1	Allow M1 for us of different variable.
		4	
5.	$4 * 1 = \frac{5}{4}$ $2 * 3 = \frac{5}{6}$ $A * 5 = \frac{5}{6}$ $A + \frac{5}{6} = \frac{5}{4} \times \frac{5A}{6}$ $A + \frac{5}{6} = \frac{25A}{24}$ $A = 20$	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.	$\begin{pmatrix} 3 & -1 \end{pmatrix} \begin{pmatrix} 2 \end{pmatrix} 1 = I$ $\begin{pmatrix} \end{pmatrix} \begin{pmatrix} \end{pmatrix}$	M1	Matrix multiplication gives

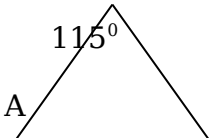
	$\begin{array}{cccc} -5 & 2 & 5 & 3 \\ 6 & -5 & 3 & -3 \\ -10 & +10 & -5 & +6 \end{array}$ $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$	M1 A1	: I $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$
		3	
9.	(a) $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} = \frac{2}{5}$ (b) $\left(\frac{2}{3} \times \frac{3}{4} \times \frac{1}{5} \right) \left(+ \frac{2}{3} \times \frac{1}{2} \times \frac{4}{5} + \frac{1}{3} \right)$ $\times \frac{3}{4} \times \frac{4}{5}$ $\frac{1}{10} + \frac{4}{15} + \frac{1}{5}$ $= \frac{17}{10}$	M1 M1 A1	
		3	
10	$\angle QCB = 30^\circ$ $180 - (27 + 30) = 123^\circ$ $\therefore \angle BAC = 57^\circ$ $\angle OBA = 37^\circ$ $\angle OAB = 37^\circ$ $\angle AOB = 106^\circ$ $\therefore \angle ACB = 53^\circ$	M1 M1 A1	Isosceles triangle. Angle at centre is twice angle at circumference.
		3	
11	$V = 1 \times 3.14 \times r^2 \times 10 = 270$ L.S.F. $\frac{20}{30} = \frac{2}{3}$ V.S.F $= \frac{2}{3}^3 = \frac{8}{27}$ Vol. of cone $= \frac{8}{27} \times 270 = 80\text{cm}^3$ $\therefore$ Vol. Of frustum $= (270 - 80) = 190\text{cm}^3$	M1 M1 A1	
		2	
12	$\left(\frac{3x^3 - 1}{3} \right)^{-1} x^2$ $\left(\frac{3x^3 - 1}{3} \right)^{-1} x^2$		

$\left(\right)$

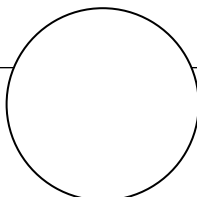
$\left(\right)$

	$x^3 + \frac{1}{x} - 2 = 6\frac{1}{2}$	M1 A1 2	
13	(2 x 3 x 1.5) volume 9 m³ 1L $\equiv$ 1000 cm³ 1000 L = 1 m³ 9000 L = 9 m³ 1000 L = 1 tonne 9000 L = 9 tonnes.	M1 A1	
14	y $\geq$ 1 (i) y $\leq$ x - 1 (ii) y $\leq$ 5 - x (iii)	2 B1 B1	
15	M₁ = $\frac{5.1 + 4.9 + 4.7}{3} = 4.9$ M₂ = $\frac{4.9 + 4.7 + 4.5}{3} = 4.7$ M₃ = $\frac{4.7 + 4.5 + 4.0}{3} = 4.4$	3 M1 M1 M1	
16	Original contribution per woman = $\frac{6300}{N}$ Contribution when 7 withdraw = $\frac{6300}{(n-7)}$ Increase - Diff. $\frac{6300}{n-7} - \frac{6300}{n}$ $\frac{6300n - 6300(n-7)}{n(n-7)}$ $\frac{6300n - 6300 + 44100}{n(n-7)}$ $\frac{44100}{n(n-7)}$	3 M1 M1 1 3	

SECTION II (48 Marks)

17	(i)  Centre of circles of latitude 50° S. R Cos 50° AB = $115 \times 2\pi R \cos 50^\circ$ $\frac{115}{360} \times 40192 \times 0.6428$	M1 M1 M1	No. 60 1+5 0.6428 log 1.7782 2.0607 <u>1.8080</u>
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	$= 8252.98 \text{ km}$ (ii) Arc AB $60 \times 115 \cos 50^\circ$ $60 \times 115 \times 0.6428$ 4435 nm	A1 M1 M1 M1 A1	4435nm 3.6469
		8	
18	(a) $V = \frac{ds}{dt} = 6t^2 + 8t - 8$ (i) $t = 2$ $V = 6 \times 4 + 8 \times 2 - 8$ $= 32 \text{ ms}^{-1}$ (ii) $t = 3$ $V = 6 \times 9 + 8 \times 3 - 8$ $= 70 \text{ ms}^{-1}$ (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. $A = \left\{ \frac{1}{2} (y_1 + y_6) + y_2 + y_3 + y_4 + y_5 \right\}$ $= \frac{1}{2} \{ 12 + 47 \} + 24 + 35 + 41 + 45$ $= 29.5 + 14.5$ $= 174.5 \text{ m}$	B1 B1 M1 M1 B1 B1 A1	Trapezium rule only accepted. Formula. Substitution into formula.
		8	
20	Drawing actual Scale $1 \text{ cm} = 2 \text{ cm}$	M1 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.

	 Radius 1cm = 2cm		
		8	
21.	mean = $44.5 + \frac{130}{100}$ = $44.5 + 1.3$ = 45.8 <		

	 (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	

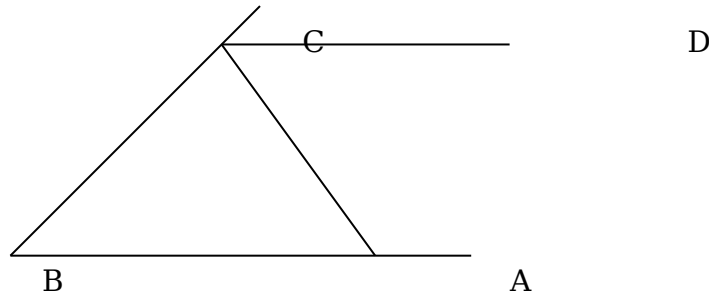
MATHEMATICS IV
PART I

SECTION 1 (52MKS)

1. Evaluate using logarithms $\frac{3\sqrt{7.673 - 15.612}}{12.3}$ (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 $V = \frac{4}{3}\pi r^3$. 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 $\begin{pmatrix} \end{pmatrix} AB = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$ and vector $\begin{pmatrix} \end{pmatrix} BC = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ 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° and the angle of depression from the top of the top of the shorter building to the bottom of the taller is 30° . 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)

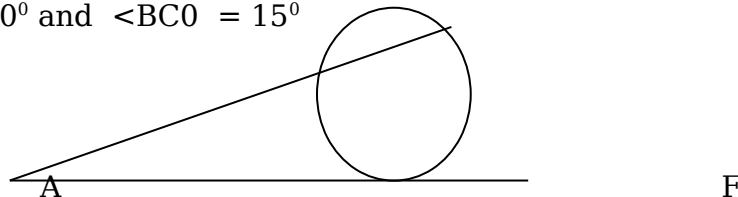
50cm

50cm

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 tangent to the circle at E. Angle FED = 30°
 $\angle DEC = 20^\circ$ and $\angle BCO = 15^\circ$



Calculate (i) $\angle CBE$
(3mks)

(ii) $\angle BEA$
(2mks)

(iii) $\angle EAB$
(3mks)

18. The sum of the 2nd and third terms of a G.P is $\frac{9}{4}$ 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)

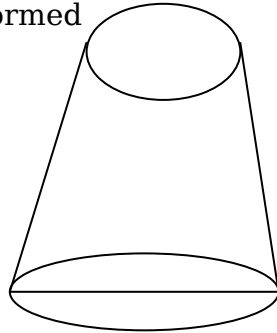
19. E and F are quantities related by a law of the form $E = KF^n$ Where k and n are constants. In an experiment , the following values of E and F were obtained .

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 $1\frac{1}{2}$ hours. Tap A is then closed. Find how long it takes to drain the tank.

(8mks)

MATHEMATICS IV
PART II

SECTION I (52MKS)

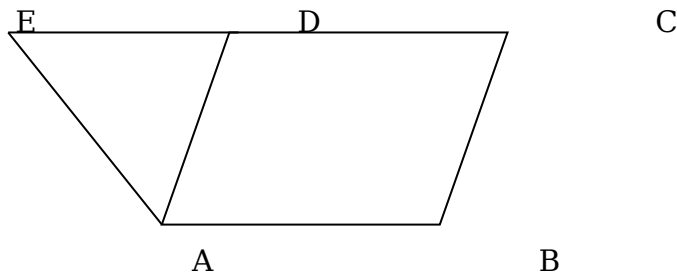
1. Without using mathematical tables, evaluate
(3mks)

$$\frac{\sqrt{0.0784 \times 0.27}}{0.1875}$$

(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)

$$2b^2 - 3a^2c$$

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° . 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° and 200m apart.
 School flag F is 150m away from C and on a bearing of 020° . 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 $\frac{2}{3}$
 (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 441π .
 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 n^{th} 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° , 100° and 130° . 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 Kf 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?

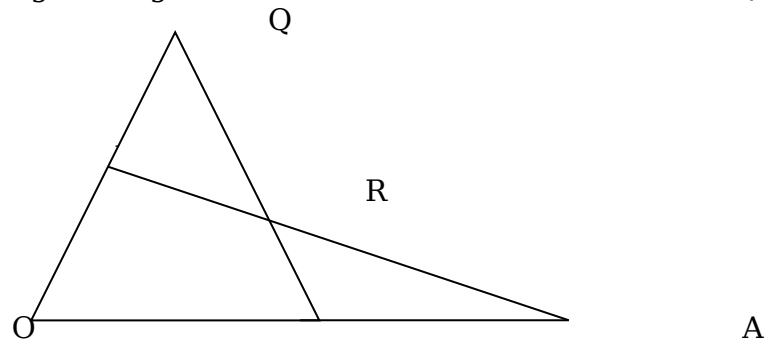
(2mks)

(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 O on BC to touch AB and AC produced at P and Q respectively. Calculate the area of the circle. (8mks)

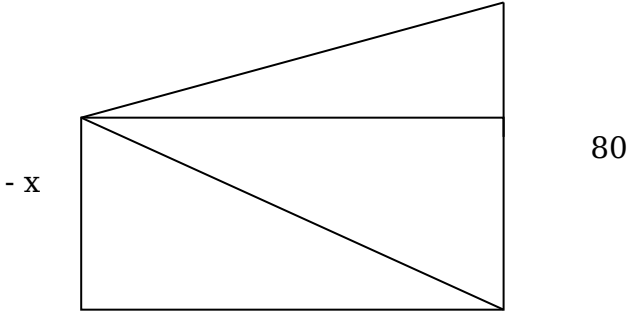
24. The following were marks scored by 40 students in an examination

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)

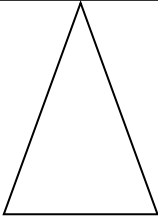
MATHEMATICS IV PART 1 MARKING SCHEME

1.	$\sqrt{-\frac{7.939}{12.3}}$ $= \frac{\log 7.939}{\log 12.3}$ $= \frac{0.8998}{1.0899}$ $= \frac{0.8998}{1.0899} \times \frac{1}{3} = \frac{0.8998}{3.2697}$ $= -0.8635$	B1 B M1 A1 4	Subtraction Logs Divide by 3 Ans
2.	$5x - 3(3x - 7) = 3(x - 2)$ $5x - 9x + 21 = 3x - 6$ $-7x = -27$ $x = \frac{27}{7}$	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.	$r = \frac{3y}{4\pi} \times \frac{1}{3}$	B1	Value r

	$r = \frac{S}{4\pi}^{1/2}$ $\therefore \frac{3V}{4\pi}^{1/3} = \frac{S}{4\pi}^{1/2}$ $\frac{3V}{4\pi} = \frac{S}{4\pi}^{3/2}$ $V = \frac{4\pi}{3} \frac{S}{4\pi}^{3/2}$	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	M1 1 A1 A1 3 B1 M1 A1	Equation Equation K P in alloy Expression Ans
7.	B (a,b), C (x,y) $\begin{pmatrix} a-2 \\ b-8 \end{pmatrix} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$ $a = 8, b = 6$ 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.	 $h = x \tan 70$ $h = (80 - x) \tan 60$	B1	Expression for h

	$\therefore x \tan 70 = 80 \tan 60 - x \tan 60$ $2.7475x + 1.732x = 138.6$ $4.4796x = 138.6$ $.h = \frac{138.6}{4.4796} \times \tan 60$ $= 53.59$	M1 M1 A1 4	both Equation Expression for h Ans
9.	$2\pi r = \frac{90}{360} \times 2\pi \times 50$ $r = 12.5$ $h = \sqrt{2500 - 156.25}$ $= \sqrt{2343.75}$ $= 48.41 \text{ cm}$	M1 P A1 M1 A1 4	Equation .r expression for h ans
10.	$\frac{100n}{n} = \frac{302.323}{3.023}$ $\frac{99n}{n} = \frac{299.3}{1}$ $= \frac{2993}{990}$ $= 3^{23/990}$	M1 A1 4	Equation Ans
11.	$AB \begin{cases} = 3-1 \\ = 5-9 \\ = 2 \end{cases}$ $BC \begin{cases} = 4 \\ = 4 \\ = -8 \end{cases}$ $AB = \frac{1}{2} BC$ $\therefore AB \parallel BC$ But B is common $\therefore A, B, C$ are collinear.	B1 B1 B1 3	A B & BC Both Both
12.	$4\% \text{ of } 200,000 = 8000/=$ $\text{balance} = 4200/=$ $6\% \text{ of } x = 4200/=$ $x = \frac{4200 \times 100}{6}$ $= 70,000$ $\text{sales} = \text{sh. } 270,000$	B1 M1 A1 B1 4	Both Expression Extra sales Ans
13.	$\text{Time} = \frac{22/7 \times 3.5/2 \times 3.5/2 \times 200}{22/7 \times 140 \times 140 \times 140}$ hrs 3600	M1 M1 M1	Vol tank Vol tank Div x 3600

	$= \frac{8960}{3600}$ $= 2 \text{ hrs } 29 \text{ min}$	A1 4	Tank
14.	$\frac{\sqrt{3}}{\sqrt{7}\sqrt{2}} \left(= \frac{\sqrt{3}}{\sqrt{2}\sqrt{2}} \left(\frac{\sqrt{7} + \sqrt{2}}{\sqrt{7} + \sqrt{2}} \right) \right)$ $= \frac{\sqrt{3} \sqrt{7} + \sqrt{2}}{5}$ $= \frac{\sqrt{21} + \sqrt{6}}{5}$	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 = $\frac{8}{6} \times \frac{5}{8} \times 12$ = 10 days	M1 A1 2	Expression days
17.	(i) $\angle CED = \angle ECD = 30$ $\angle CDE = 180 - 60$ $= 120$ $\angle CBE = 180 - 120$ $= 60$ (ii) $\angle AEC = 90 + 30$ $= 120$ $\angle EAB = 180 - (120 + 45)$ $= 15^\circ$ (iii) $\angle BEO = 90 - 45$ $= 45$	B1 B1 B1 B1 B1 B1 B1 B1 8	 $\angle AEB = 45^\circ$ $\angle BEO$
18.	$ar + ar^2 = \frac{9}{4}$ $3r + 3r^2 = \frac{9}{4}$ $12r^2 + 12r - 9 = 0$ $4r^2 + 3r - 3 = 0$ $4r^2 + 6r - 2r - 3 = 0$ $(2r - 1)(2r + 3) = 0$ $r = \frac{1}{2} \text{ or } r = -\frac{1}{2}$ $S_s = \frac{3(1 - (1/2)^5)}{1 - 1/2}$ $= \frac{3(1 - 1/32)}{1/2}$ $= 6(31/32)$ $= 6 \cdot 31/32$	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	B1 B1 S1	Log E Log F Scale

22.	 $H = \sqrt{15^2 - 9^2}$ $= \sqrt{144}$ $= 12$ $\frac{x}{6} = \frac{9}{12}$ $x = 4.5$ $\text{Volume} = \frac{1}{3} \times \frac{22}{7} \times (81 \times 12 - 20.25 \times 6)$ $= \frac{22}{21} (972 - 121.5)$ $= 891 \text{ cm}^3$	M1 A1 M1 A1 M1 M1 M1 A1 <u>8</u>	Method Method Radius Small vd Large vol 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 $\frac{d-0}{c-5} = -2$ $\frac{d-0}{c+5} = \frac{1}{2}$ $d+2c = 10$ $2d-c = 5 \times 2$ $4d-2c = 10$ $5d = 20$ $d = 4$ $c = 3$ Q (3, 4) $\frac{x+3}{2}, \frac{y+4}{2} = (0,0)$ $x = -3, y = -4 \therefore s(-3 -4)$ (b) $\frac{y-4}{x-3} = \frac{8}{6}$ $3y = 8x - 12$	B1 M1 M1 A1 M1 A1 M1 A1 <u>8</u>	Ans . Expression both correct Equation Ans Expression Equation

MATHEMATICS IV
PART II
MARKING SCHEME

1.	784 X 27 = 187500		
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	$\frac{\sqrt{784 \times 9}}{62500} = \frac{4 \times 7 \times 3}{250}$ $= \frac{42}{125}$ $= 0.336$	M1 M1 A1	Factors for Fraction or equivalent C.A.O
		3	
2.	Father $3x$, r son $= x$ $2(x + 10) = 3x + 10$ $2x + 20 = 3x + 10$ $x = 10$ father $= 30$	M1 A1 B1	Expression
		3	
3.	$3 = \sin 60$ AE $AE = 3$ $\sin 60$ $= 3.464$ perimeter $= 5 \times 2 + 3.464 \times 3$ $= 10 + 10.393$ $= 20.39$	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 $= \$ 2500$ $= \text{Kshs. } 189,000$ Kshs. 189,000 $= \frac{189,000}{115.8}$ Uk £1632	M1 A1 M1 A1 A1 4	Conversion Conversion
6.	Area of 2 triangles $= 2 (\frac{1}{2} \times 8 \times 5 \sin 60)$ $= 40 \sin 60$ $= 40 \times 0.8660$ $= 34.64 \text{ cm}^2$ Area of rectangle $= 300 \times 8 + 300 \times 5 + 300$ x BC BC $= \sqrt{64 + 25 - 2 \times 40 \cos 60}$ $= \sqrt{89 - 80 \times 0.5}$ $= \sqrt{89 - 40}$ $= \sqrt{49}$ $= 7$	M1 M1 M1	Areas of Δ B.C. expression Area

	$\begin{aligned} \text{Total S.A.} &= 300 (8+5+7) + 34.64 \text{ cm}^2 \\ &= 6000 + 34.64 \\ &= 6034.64 \text{ cm}^2 \end{aligned}$	A1	
		4	
7.	$\begin{aligned} AF^2 &= 3^2+4^2+-2+12x \cos 50 \\ &= 25 - 24 \times 0.6428 \\ &= 25-15.43 \\ &= 9.57 \\ AF &= 3.094 \times 50 \\ AF &= 154.7\text{m} \\ \sin Q &= \frac{200 \sin 50^\circ}{154.7} \\ &= 0.9904 \\ Q &= 82.04^\circ \\ \text{Bearing} &= 117.96^\circ \end{aligned}$	M1 A1 M1 A1 B1	Bearing
		5	
8.	$\begin{aligned} \text{(i) No. of white} &= w \\ \frac{w}{w+9} &= \frac{2}{3} \\ 3w &= 2w + 18 \\ w &= 18 \\ \text{(ii) } p(\text{different colour}) &= p(\text{WB N BW}) \\ &= \frac{2}{3} \times \frac{9}{25} + \frac{9}{27} \times \frac{18}{25} \\ &= \frac{12}{25} \end{aligned}$	M1 A1 M1 A1	
		4	
9.	$\begin{aligned} A.s_f &= \frac{1}{49} \\ \text{smaller area} &= 1 \times 441 \pi \\ &= 9\pi \\ \pi r^2 &= 9\pi \\ r^2 &= 9 \\ r &= 3 \end{aligned}$	M1 M1 A1	
		3	
10.	$\begin{aligned} \text{Largest area} &= \frac{22 \times (14.5)^2}{7} \\ &= 660.8 \text{ cm}^2 \\ \text{smallest area} &= \frac{22}{7} \times (13.5)^2 \\ &= 572.8 \\ 572.8 &\leq A \leq 660.81 \end{aligned}$	M1 M1 A1	
		3	
11.	$\begin{aligned} (1+2x)^5 &= 1 + 5(2x) + 10(2x)^2 + 10(2x)^3 \\ &= 1 + 10x + 40x^2 + 80x^3 \\ 2.045^5 &= 1+2(0.52)^5 \\ &= 1+10(0.52)+40(0.52)^2+80(0.52)^3 \\ &= 1+5.2 + 10.82 + 11.25 \\ &= 28.27 \end{aligned}$	M1 A1 M1 A1	
		4	
12	$T_n = 5x 2^{n-2}$		

.	(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	$12 = 2^2 \times 3$ $18 = 2 \times 3^2$ $30 = 2 \times 3 \times 5$ Lcm $= 22 \times 32 \times 5 = 180 \text{ min}$ $= 3 \text{ hrs}$ time they ring together $= 11.55 + 3 = 2.55 \text{ p.m}$	M1 A1 B1	
		3	
14	Map area $= 40 \text{ cm}^2$ Actual area $= 200 \times 200 \times 40 \text{ m}^2$ $= \frac{200 \times 200 \times 40 \text{ ha}}{100 \times 100}$ $= 320 \text{ ha}$	M1 M1 A1	Area in m^2 Area in ha CAO
		3	
15	$3p + 2r = 13$ $\frac{p + 2r}{2p} = \frac{9}{4}$ $p = \text{sh } 2$ $r = 3.50$	M1 A1 B1	
		3	
16	$110 + 100 + 130 + 2x + 3x = 540$ $5x = 200$ $x = 40^0$ $2x, 3x = 80 \text{ and } 120^0 \text{ res}$	M1 A A1 2	
17	Contribution / person $= \frac{180,000}{x}$ New contribution $= \frac{180,000}{x-2}$ $\frac{180,000}{x-2} - \frac{180,000}{x} = 24,000$ $180,000x - 180,000(x-2) = 24,000(x-2)x$ $24,000x^2 - 48,000x - 360,000 = 0$ $x^2 - 2x - 15 = 0$ $x^2 - 5x + 3x - 15 = 0$ $x(x-5) + 3(x-5) = 0$ $(x+3)(x-5) = 0$ $x = -3$ 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) $P(3 \text{ white}) = \frac{8}{13} \times \frac{7}{12} \times \frac{6}{11} = \frac{28}{143}$ (b) $P(\text{at least 2 blue}) = p(\text{WBB or BBW or BWB or BBB})$ $= \frac{8}{13} \times \frac{5}{12} \times \frac{4}{11} + \frac{5}{13} \times \frac{4}{12} \times \frac{8}{11}$	M1 A1 M1 M1	

	$11 + \frac{5}{13} \times \frac{8}{12} \times \frac{4}{11} + \frac{8}{13} \times \frac{7}{12} \times \frac{6}{11}$ $= \frac{204}{429}$ $= \frac{68}{143}$ (c) p(2 white and one blue) = p(WWB or WBW or BWW) $= \frac{8}{13} \times \frac{7}{12} \times \frac{5}{11} + \frac{8}{13} \times \frac{5}{12} \times \frac{7}{11} + \frac{5}{13} \times \frac{8}{12} \times \frac{7}{11}$ $= \frac{3 \times 8 \times 7 \times 5}{13 \times 12 \times 11}$ $= \frac{70}{143}$	A1 M1 M1 A1	
		8	
19	(a) recourt area = $10.5 \times 6 \text{ m}^2$ title area = $0.3 \times 0.3 \text{ m}^2$ 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 = $525 \times 100 + 800 \times 525$ + transport = $10,500 + 420,000$ $= 430,500$ sale price = $\frac{120}{100} \times 430,500$ $= \text{sh } 516,600$ s.p of a carton = $\frac{516,600}{525}$ $= \text{sh. } 984$	M1 A1 M1 B1 M1 M1 A1	
		8	
20	(a) Maina`s tax dues = $1800 \times \frac{10}{100}$ $= 180$ (b) Taxable income = $3600 \times \frac{115}{100} - \text{n rent}$ $= 36 \times 115 - \frac{100 \times 12}{20}$ $= 4140 - 60$ $= 4080$ Tax dues = $\frac{10}{100} \times 2100 + \frac{15}{100} \times 1980$	M1 A1 M1 A1 M1 M1 A1	1 st slab 2 nd slab

		$\begin{array}{r} 100 \\ = 210 + 297 \\ = 507 \\ \text{Tax relief} \\ = 270 - \\ \text{Tax paid} \\ = 237 \end{array}$	B1	
			8	
21	(a) PQ	$\begin{aligned} &= -\frac{3}{5}a + \frac{3}{1}b \\ &= \frac{31}{2} - \frac{3}{5}a \end{aligned}$	B1	
	(b) OR	$\begin{aligned} &= ha + hb \\ &= a - ha + hb \\ &= (1-h)a + hb \end{aligned}$	M1 A1	
	(c) OR	$\begin{aligned} &= \frac{3}{5}a + k(\frac{31}{2}b - \frac{3}{5}a) \\ &= (\frac{3}{5} - \frac{3}{5}k)a + 3kb \end{aligned}$	M1 A1	
	(d)	$\begin{aligned} 1-h &= \frac{3}{5} - \frac{3}{5}k \quad (i) \\ 3k &= h \quad (ii) \end{aligned}$	M1	
	Sub (i)	$\begin{aligned} 1-3k &= \frac{3}{5} - \frac{3}{5}k \\ 5-15k &= 3-3k \\ 12k &= 2 \\ k &= \frac{1}{6} \\ h &= \frac{1}{2} \end{aligned}$	A1 B1	
			8	
22	P(ABC) =	$\begin{array}{ccc ccc} 0 & -1 & 1 & 4 & 3 & & \\ & 1 & 0 & 3 & 1 & 3 & \\ & & & & & & \end{array} = \begin{array}{ccc} -3 & -1 & -3 \\ 1 & 4 & 3 \end{array}$	M1 A1	A ¹ B ¹ C ¹
	A ¹ (-3,1)B ¹ (-1,4)C ¹ (-3,3)			
	Q(A ¹ B ¹ C ¹) =	$\begin{array}{ccc ccc} a & b & -3 & -1 & -3 & & \\ & c & d & 1 & 4 & 3 & \\ & & & & & & \end{array} = \begin{array}{ccc} -6 & -2 & -6 \\ 2 & 8 & 6 \end{array}$	M1	
	=>	$\begin{aligned} -3a + b &= -6 & -3c + d &= 2 \\ -a + 4b &= -2 \times 3 & -c + 4d &= 8 \times 3 \\ \underline{-3a + 12b} &= \underline{-6} & \underline{-3c + 12d} &= \underline{24} \\ 11b &= 0 & -11d &= -22 \\ b &= 0 & d &= 2 \\ a &= 2 & \underline{d} &= \underline{2} \\ & & c &= 0 \end{aligned}$	M1	
	Q =	$\begin{array}{cc} 2 & 0 \\ 0 & 2 \end{array}$	A1	L Q
			B1	A ¹ B ¹ C ¹ drawn
			B1	A ¹¹ B ¹¹ C ¹¹ Ploted
			B1	Destruction

23	$R = 2.2\text{CM} \pm 0.1$ $\text{Area} = \frac{22}{7} \times 2.2 \times 2.2$ $= 15.21\text{cm}^2$	8 B1 B1 B1 B1 B1 B1 M1 1 1	
		8	
24	$E_f = 40$ $e_{fd} = -80$ (ii) model class = 351- 360 modern class = 341 - 350 (iii) mean = $355.5 - \frac{80}{40}$ = $355.5 - 2$ = 353.5	B1 B1 M1 A1 B1 B1 B1 B1	

		A1	
		8	

MATHEMATICS V
PART I

SECTION 1 (52 MARKS)

- Use logarithms to evaluate $\left(\frac{13.6 \cos 40}{63.4} \right)^{0.25}$ (4mks)
- Solve for x in the equation $(x + 3)^2 - 5(x + 3) = 0$ (2mks)
- In the triangle ABC, AB = C cm. AC = bcm. $\angle BAD = 30^\circ$ and $\angle ACD = 25^\circ$. Express BC in terms of b and c. (3mks)
- Find the equation of the normal to the curve $y = 5 + 3x - x^3$ when $x = 2$ in the form $ay + bx = c$ (4mks)
- Quantity P is partly constant and partly varies inversely as the square of q. $q = 10$ and $p = 5 \frac{1}{2}$ when $q = 20$. Write down the law relating p and q hence find p when q is 5. (4mks)
- Solve the simultaneous equation below in the domain $0 \leq x \leq 360$ and $0 \leq y \leq 360$
$$2 \sin x + \cos y = 3$$

$$3 \sin x - 2 \cos y = 1 \quad (4\text{mks})$$

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($50^\circ N$, $10^\circ W$) 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 $AB = 6\text{cm}$, $AC = 4\text{cm}$ and $\angle ABC = 37.5^\circ$.

(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 $\angle APB = 90^\circ$. (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 $M = \begin{pmatrix} 2 & 2 \\ 1 & 3 \end{pmatrix}$ ABCD is mapped onto $A^1B^1C^1D^1$

under transformation $M = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ $A^1B^1C^1D^1$ is mapped onto $A^{11}B^{11}C^{11}D^{11}$. Draw

on the given grid

0 -2

- (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 an 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° E) 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 $x = 0$ 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. $\angle MTC = 55^\circ$ and $\angle XTA = 62^\circ$. 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. A² 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 $y = a \cos(x - 15)$ and $y = b \sin(x + 30)$ (3mks)
 (d) Use your graph to solve $\frac{1}{2} \cos(x - 15) = \sin(x + 30)$ (1mk)

21. The diagram below is a clothing workshop. $\angle ECJ = 30^\circ$ AD, BC, HE, GF are vertical

walls. ABHG is horizontal floor. AB = 50m, BH = 20m, AD = 3m

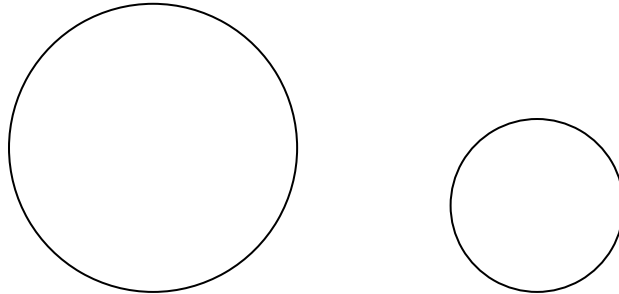
- (a) Calculate DE (3mks)
 (b) The angle line BF makes with plane ABHG (2mks)
 (c) If one person requires minimum 6m^3 of air, how many people can fit in the workshop (3mks)

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 from 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	$BD = C \sin 30 = 0.05$ $CD = b \cos 25$ $= 0.9063b$	B1 B1	BD in ratio from

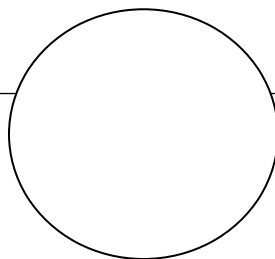
	$\square BC = 0.9063b + 0.5 C$	B1	CD in ratio form Addition
		3	
4	$\frac{Dy}{dx} = 3 - 3x^2$ $x = 2$, grad = $\frac{1}{9}$ Point (2,3) $\frac{y - 3}{x - 2} = \frac{1}{9}$ $9y - 27 = x - 2$ $9y - x = 25$	B1 B1 M1 A1	Grad equ Grad of normal Eqn Eqn
		4	
5	$700 = 100 + n$ $2200 = 400 + n$ $1500 = 300m$ $m = 5$ $n = 200$ $P = 5 + \frac{200}{q^2}$ When $q = 5$ $P = 13$	M1 A1 B1 B2	Equan Both ans Eqn (law) Ans (P)
		4	
6	$4 \sin x + 2 \cos y = 6$ $\frac{3 \sin x - 2 \cos y}{7 \sin x} = \frac{1}{7}$ $\sin x = 1$ $X = 90$ $\cos y = 1$ $Y = 0^\circ$	M1 M1 A1 B1	Elim Sub
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	$(-2 - \frac{1}{2}x)^5 = 2^5 - 5(2)^4(\frac{1}{2}x) + 10(2)^3(\frac{1}{2}x)^2$ $= 32 - 40x + 20x^2$ $= 32 - 4(0.08) + 20(0.08)^2$ $= 32 - 0.32 + 0.128$ $= 3$	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	

1 0	$ar^2 = 2, ar^5 = 16$ $a = \frac{2}{r^2} \therefore \frac{2r^5}{r^2} = 16$ $2r^3 = 16$ $r^3 = 8$ $r = 2, a = \frac{1}{2}$ $S_5 = \frac{\frac{1}{2}(1 - (\frac{1}{2})^5)}{\frac{1}{2}}$ $= 1 - \frac{1}{32}$ $= \frac{31}{32}$	M1 A1 M1 A1	 Both Sub CAO
		4	
1 1	$NR - 3MT^2 = 2RT^2$ $T^2(2R + 3M) = NR$ $T^2 = \frac{NR}{2R + 3M}$ $T = \sqrt{\frac{NR}{2R + 3M}}$	M1 M1 A1	 X mult 7 ² ans
		3	
1 2	$\begin{pmatrix} 2 \\ 2 \end{pmatrix} = m \begin{pmatrix} 2 \\ 0 \end{pmatrix} + n \begin{pmatrix} 6 \\ 4 \end{pmatrix}$ $2 = 2m + 6n$ $2 = 0 + 4n$ $n = \frac{1}{2}$ $m = -\frac{1}{2}$ $\therefore a = -\frac{1}{2}b + \frac{1}{2}c$ $\therefore a, b, c$ are linearly dep	M1 A1 B1	
		3	
1 3	$\text{Volume} = \frac{22}{7} \times 2.1 \times 2.1 \times 2 \times \frac{3}{4} \text{ m}^3$ $\text{Time} = \frac{11 \times 0.3 \times 2.1 \times 3 \times 1,000,000}{500 \times 3600}$ $= 11.55$ $= 11.33 \text{ hrs}$ $\text{time to fill} = 8.03 \text{ pm}$	M1 M1 A1	
		3	
1 4	$\text{Mass} = \frac{54}{90} \times \frac{1.2 \times 1,000,000}{1000}$ $= 720 \text{ kg}$	M1 A1	
		2	
1 5	$V_3 = P$ $P(0.9)^3 = 200,000$ $P = \frac{200,000}{0.9^3}$ $= \frac{200,000}{0.729}$ $= \text{Sh } 274,348$	M1 M1 A3	
		3	
1 6	$\text{No of hours} = \frac{8 \times 12 \times 10 \times 20}{8 \times 18 \times 25}$ $= \frac{19200}{3600}$ $= 5 \text{ hrs, } 20 \text{ min}$	M1 A1	

		2															
1 7	Taxable income = 8100 + 2400 = sh. 10,500 = £6300 Tax dues = <u>Sh 1980 x 2 + 1980 x 3 + 1980 x 5 + 3670 x 7</u> 12 = <u>22320</u> 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															
1 8	OR = $\frac{2}{3}a + \frac{1}{3}b$ or $(\frac{1}{3}(2a + b))$ AP = $\frac{2}{5}b - a$ OY = m OR = A + n ($\frac{2}{5}b - a$) $\frac{2}{5}mb + ma = (1 - n)a + \frac{2}{5}nb$ $\frac{2}{5}m = \frac{2}{5}n$ m = n $\therefore m = 1 - m$ 2m = 1 m = $\frac{1}{2} = n$ $\frac{1}{2}AP = Ay$ AY:AP = 1:1	B1 B1 B1 M1 M1 A1 A1 B1	EXP, OY Eqn M = n Sub CAO Ratio														
		8															
1 9	<table border="1"><tr><td>Log x</td><td>1.699</td><td>0</td><td>0.301</td><td>0.477</td><td></td><td>1</td></tr><tr><td>Log y</td><td>0.301</td><td>0.903</td><td>1.505</td><td></td><td>2.301</td><td>2.903</td></tr></table> Log y = n log x + log a Log a = 0.9031 A = 8 Grad = $\frac{1.75 - 0.5}{0.4 + 0.2}$ = $\frac{1.25}{0.6}$ = 2.08 n = 2 $\therefore y = 8x^2$ x = 3 y = 8 x 3² = 72 y = 200 x = 5	Log x	1.699	0	0.301	0.477		1	Log y	0.301	0.903	1.505		2.301	2.903	B1 B1 B1 B1 B1 S1 P1 L1	Log x Log y A N Missing x and y Scale Points Line
Log x	1.699	0	0.301	0.477		1											
Log y	0.301	0.903	1.505		2.301	2.903											

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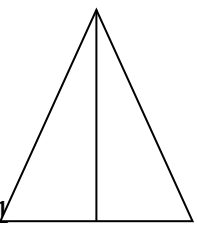
		8	
2 0	P (same colour) = P (XRRrr or XBB or YXX or YBB) $= \frac{1}{2} \left(\frac{2}{5} \times \frac{1}{4} + \frac{3}{5} \times \frac{2}{4} \right) \times 2$ $= \frac{2}{20} + \frac{6}{20}$ $= \frac{8}{20}$ $= \frac{2}{5}$ (b) P(at least 1B) = 1 - P(non blue) $= 1 - P(XRR \text{ or } YRR)$ $= 1 - \frac{1}{2} \left(\frac{2}{5} \times \frac{1}{4} \right) \times 2$ $= 1 - \frac{1}{10}$ $= \frac{9}{10}$ (c) P(at most 2 Red) = 1 - P(BB) $= 1 - \frac{1}{2} \left(\frac{3}{5} \times \frac{2}{4} \right)^2$ $= 1 - \frac{6}{20}$ $= \frac{14}{20} \text{ or } \frac{7}{10}$	M1 M1 M1 A1 M1 A1 M1 A1	Any 2 Any 2 Fraction
		8	
2 1	(a) PQ = 1800nm $\theta = \frac{1800}{60 \times 0.6428}$ $= 46.67$ $= 47^\circ$ Q (50°N, 37°E)	M1 A1	



	(b) Time diff = $\frac{47 \times 4}{60}$ $= 3.08$ Time at P = 9.12am (c) QR = 2700 nm $x^\circ = \frac{2700}{60}$ $= 45^\circ$ R (85°N, 133°W)	M1 A1 M1 A1 B1	
		8	
2 2		B1 B1 B1 B1 B1 B1 B1 B1	Bisector of 150 Bisector 75 AB AC $\perp$ at A Bisector AC Circle $\angle$ AB Locus P with A B excluded
		8	

2 4	$\begin{pmatrix} 2 & 2 & 1 & 3 & 3 \\ 1 & 3 & 1 & 1 & 2 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} A^1 B^1 C^1 D^1 \\ 4 & 8 & 10 & 6 \\ 4 & 6 & 9 & 7 \end{pmatrix}$ $\begin{pmatrix} -1 & 0 \\ 0 & -2 \end{pmatrix} \begin{pmatrix} 4 & 8 & 10 & 6 \\ 4 & 6 & 9 & 7 \end{pmatrix} = \begin{pmatrix} A^{11} B^{11} C^{11} D^{11} \\ -4 & -8 & -10 & -6 \\ -8 & -12 & -18 & -14 \end{pmatrix}$ $NM = \begin{pmatrix} -1 & 0 \\ 0 & -2 \end{pmatrix} \begin{pmatrix} 2 \\ 1 \end{pmatrix}$ $= \begin{pmatrix} -2 \\ -2 \end{pmatrix}$ (b) $\det = Asf = 12 - 4 = 8$ Area $A^{11} B^{11} C^{11} D^{11} = 8 \times 8 = 64 \text{ U}^2$ (c) Single matrix = Inv N $= \frac{1}{2} \begin{pmatrix} -2 & 0 \\ 0 & -1 \end{pmatrix}$ $= \begin{pmatrix} -1 & 0 \\ 0 & -\frac{1}{2} \end{pmatrix}$	B1 B1 B1 M1 A1 B1	Product Product Det Inverse
		6	
2 3	$Ds = 20t - 3t^2 + 8 = 0$ $Dt \quad 3t^2 - 20t - 8 = 0$ $T = 20 \pm \frac{\sqrt{400 + 4 \times 3 \times 8}}{6}$ $t = 7.045 \text{ sec}$ max vel $= 148.9 - 140.9 - 8 = 0.9 \text{ m/s}$ $\frac{d^2 s}{dt^2} = 6t - 20$ when $t = 3 \quad a = -2 \text{ m/s}^2$ $6t - 20 = 0$ $6t = 20$ $t = 3 \frac{2}{3} \text{ sec}$	M1 A1 M1 A1 M1 A1 M1 A1	
		8	

MATHEMATICS V
PART II
MARKING SCHEME

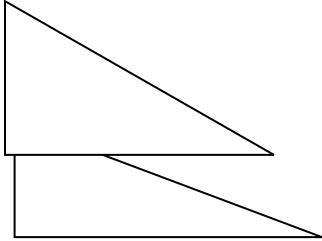
No	Solution	Mks	Awarding
1	$\frac{2744}{1000} \times \frac{125}{8}^{1/3}$ $\frac{2744}{1000}^{1/3} \times \frac{5^3}{2^3}^{1/3}$ $\frac{2^3 \times 7^3}{10^3}^{1/3} \times \frac{5}{2}$ $\frac{2 \times 7}{10} \times \frac{5}{2} = 3.5$	M1 M1 A1	Factor Cube root
		3	
2	(i) Highest - $10 \times 7.5 = 75$ 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	$\cos \theta = \frac{17}{21} = 0.8095$ $\theta = \cos^{-1} 0.8095$ $= 36.03^\circ$ $\text{Arc length} = \frac{72.06}{360} \times 2 \times \frac{22}{7} \times 21$ $= 26.422\text{cm}$ 	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	$8 = \frac{x}{360} \times 2 \times \frac{22}{7} \times 28 \cos 60^\circ$ $8 = \frac{x}{360} \times \frac{44}{7} \times 28 \times 0.5$ $x = \frac{8 \times 360 \times 7}{44 \times 28 \times 0.5}$ $= 32.73^\circ$ $= 33^\circ$	M1 M1 A1 B1	x exp

6	$\angle DMC = \angle AMB$ vert. Opp = θ $\angle MAB = \angle MDC = \frac{180 - \theta}{2}$ BASE Ls of an isosc. $\triangle$ $\angle MBA = \angle MAC = \frac{180 - \theta}{2}$ base angles of isos $\triangle$ $\triangle$'s AMC and $\triangle$ CDM are equiangle $\therefore$ Similar proved	B1 B1 B1													
		3													
7	$\tan x = \frac{5}{12}$ $h = \sqrt{b^2 + 12^2}$ $= \sqrt{25 + 144}$ $= \sqrt{169}$ $= 13$ $\frac{1 - \sin x}{\sin x + 2 \cos x} = \frac{1 - \frac{5}{13}}{\frac{5}{13} + 2 \times \frac{12}{13}}$ $\frac{\frac{12}{13}}{\frac{29}{13}} = \frac{12 \times 13}{13 \times 29} = \frac{12}{29}$	M1 M1 A1	Hypo Sub												
		3													
8	$Y = x^2 + 2$ <table border="1"><tr><td>x</td><td>0.5</td><td>1.5</td><td>2.5</td><td>3.5</td><td>4.5</td></tr><tr><td>y</td><td>2.25</td><td>4.25</td><td>8.25</td><td>14.25</td><td>22.25</td></tr></table> Area = $h (y_1 + y_2 + \dots + y_n)$ $= 1(2.25 + 4.25 + 8.25 + 14.25 + 22.25)$ $= 51.25$ sq units	x	0.5	1.5	2.5	3.5	4.5	y	2.25	4.25	8.25	14.25	22.25	B1 M1 A1	Ordinals
x	0.5	1.5	2.5	3.5	4.5										
y	2.25	4.25	8.25	14.25	22.25										
		3													
9															

	$\angle CBA = 117^\circ$ $\angle ACD = 55$ $\angle BAC = 180 - (117 + 55) = 8^\circ$	B1 B1 B1 3													
10	<table><tr><td>Year</td><td>1994</td><td>1995</td><td>1996</td><td>1997</td><td>1998</td></tr><tr><td>Index</td><td>83.3</td><td>100</td><td>116.</td><td>123.</td><td>133.</td></tr></table>	Year	1994	1995	1996	1997	1998	Index	83.3	100	116.	123.	133.	B1 B1 B1 B1	1994 1996 1997 1998
Year	1994	1995	1996	1997	1998										
Index	83.3	100	116.	123.	133.										
		4													
11.	$Xy = 35$ $y = \frac{35}{x}$ $9x - 9y = -18$ $\text{Sub } x^2 + 2x - 35 = 0$ $x^2 + 7x - 5x - 35 = 0$ $x(x + 7) - 5(x + 7) = 0$ $(x - 5)(x + 7) = 0$ $x = -7$ $x = +5$ $y = 7$ Smaller No. = 57 = 75	B1 M1 A1 B1													
		3													
12	$\log_5 \frac{(2x - 1)}{20} \cdot 4 = \log_5 5^2$ $\frac{4(2x - 1)}{20} = 5^2$ $\frac{2x - 1}{5} = 25$ $2x - 1 = 125$ $2x = 126$ $x = 63$	M1 M1 A1													
		3													
13	$\text{C.P} = \frac{100 \times 49.50}{110}$ = 45/- $52x + 40y = 45$ $x + y$ $45x + 45y = 52x + 40$ $-7x = -54$ $\frac{x}{y} = \frac{5}{7}$ $x : y = 5 : 7$	B1 M1 M1 A1													
		4													
14	$\frac{2n - 4}{n}$ it angle = 172 $\frac{(2n - 4)}{n} \times 90 = 172n$ $90 \frac{(2n - 4)}{n} \times 90 = 172$	Alt. Ext. L = 8° Sides = $\frac{360}{8}$ = 45	M1 A1 M1												

	$180n - 360 = 172n$ $180n - 172n = 360$ $8n = 360$ $n = 45$		
		2	
15	$2x = 2 \times \frac{1}{6.341} + 3 \times \frac{1}{9.22}$ $2x = 2 \times 0.1578 + 3 \times 0.1085$ $= 0.3154 + 0.3254$ $= 0.6408$ $x = 0.3204$	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 $A = \frac{1}{50} \quad B = \frac{1}{25} \quad C = \frac{1}{20}$ In one hour all taps can fill = $\frac{1}{50} + \frac{1}{25} + \frac{1}{20} = \frac{11}{100}$ In 6hrs all can fill = $\frac{11}{100} \times 6 = \frac{33}{50}$ parts taps A and B can fill = $\frac{1}{50} + \frac{1}{25} = \frac{3}{50}$ part in 1 hr In $4\frac{1}{6}$ hrs, A and B = $\frac{25}{6} \times \frac{3}{50} + \frac{1}{4}$ Parts remaining for B to fill = $1 - \frac{33}{50} + \frac{1}{4} = 1 - \frac{91}{100}$ = $\frac{9}{100}$ parts Time taken = $\frac{9}{100} \times \frac{25}{1}$ hrs = $2\frac{1}{4}$ hrs 7.30 am <u>6. hrs</u> 13.30 <u>4.10</u> 5.40pm <u>2.15</u> <u>7.55 pm</u>	M1 B1 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>-0.5</td></tr><tr><td>y = x² + x - 8</td><td>+1 2</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>-8.25</td></tr></table>	x	-5	-4	-3	-2	1	0	1	2	3	4	-0.5	y = x ² + x - 8	+1 2	+4	-2	-6	-8	-8	-6	-2	4	12	-8.25																																	
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	<table><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></tr></table> x² + x - 8 = -2 - 2x y = x² + 3x - 6 Points of intersection (-4, 1.4) y = x² + x - 8 = 2x² + 3x - 6 x² + 2x + 2 y = x² + x - 8 x 2 2y = 2x² + 2x - 16 <u>0 = 2x² + 3x - 6</u> 2y = -x - 10 y = - 2.6 Ny = 1.2	Y = -2 - 2x	8	6	4	2	0	-2	-4	-6	-8	-10		<table><tr><td>B1 B1</td><td>Eqn Point of inter</td></tr><tr><td>B1</td><td>Line eqn</td></tr><tr><td>B1</td><td>Both</td></tr></table>	B1 B1	Eqn Point of inter	B1	Line eqn	B1	Both																																						
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19	<table><tr><td>Class</td><td>X</td><td>T</td><td>D = x - 47</td><td>+d</td><td>Fd²</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> = 45.9 (ii) Standard deviation = $\sqrt{\frac{3575}{50} - \left(\frac{-55}{50}\right)^2}$ = $\sqrt{70.29}$ = 8.3839	Class	X	T	D = x - 47	+d	Fd ²	30 -34	32	4	-15	-60	900	35 - 39	37	10	10	-100	1000	40 - 44	42	8	-5	-40	200	45 -49	47	11	0	0	0	50 - 54	52	8	5	40	200	55 - 59	57	6	10	60	600	60 - 64	62	3	15	45	675			50		-55	3575	<table><tr><td>M1</td></tr><tr><td>A1 B1</td></tr></table>	M1	A1 B1
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	$\frac{1}{2} \cos (x - 15) = \sin (x + 30)$ has no solution in the domain	B1 8																	
21	(a) $O \cos 30 = \frac{20}{X}$ $X = \frac{20}{0.866}$ $= 23.09$ $DE = \sqrt{50^2 + 23.09^2}$ $= \sqrt{2500 + 533.36}$ $= \sqrt{3033.36}$ $= 55.076\text{m}$ (b) $GB = \sqrt{20^2 + 50^2}$ $= 53.85$ $\tan \theta = \frac{14.55}{53.85}$ $= 0.27019$ $\theta = 15.12^\circ$ 	B1 M1 A1 M1 A1 8																	
	(c) Volume of air = $50 \times 20 \times 3 + \frac{1}{2} \times 20 \times 11.55 \times 50$ $= 3000 + 5775$ $= 8775$ No. of people $= \frac{8775}{6}$ $= 1462.5$ ≈ 1462	M1 M1 A1 8																	
22	(a) $A + B \leq 16$ $5A + 3B \geq 50$ $2A + 3B \leq 35$ <table border="1" data-bbox="683 1150 1066 1352"> <thead> <tr> <th></th><th>A</th><th>B</th><th>Total</th></tr> </thead> <tbody> <tr> <td>People</td><td>10</td><td>6</td><td>100</td></tr> <tr> <td>Load</td><td>200</td><td>300</td><td>3500</td></tr> <tr> <td>No. of vehicles</td><td></td><td></td><td>16</td></tr> </tbody> </table> (b) 14 vehicles (c) A - 6 vehicles B - 8 Cost = $6 \times 1000 + 8 \times 1200$ $= 6000 + 9600$ $= 15,600/=$		A	B	Total	People	10	6	100	Load	200	300	3500	No. of vehicles			16	B1 B1 B1 M1 A1 8	In equation 3 Vehicles
	A	B	Total																
People	10	6	100																
Load	200	300	3500																
No. of vehicles			16																
23																			

[illegible]

	(b) $\frac{200}{\sin 50} = \frac{40}{\sin \theta}$ $\sin \theta = \frac{40 \sin 50}{200}$ $= \frac{0.7660}{5}$ $= 0.1532$ $\theta = 8.81^\circ$ $\angle ACB = 180 - (50 + 8.81)^\circ$ $= 121.19^\circ$ $\frac{x}{\sin 121.19} = \frac{200}{\sin 50}$ $x = \frac{200 \times \sin 121.19}{\sin 50}$ $= \frac{200 \times 0.855645}{0.7660}$ $= 223.36 \text{ Km/h}$ (b) Course $= 330^\circ - 8.81^\circ$ $= 321.19^\circ$ (c) Time $= \frac{600}{321.19^\circ}$ $= 2.686 \text{ hrs}$	M1 A1 M1 M1 A1 B1 M1 A1 8	
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