

MATHEMATICS REVISION GUIDE

MATHEMATICS 1

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 $\cos(2\theta + 120) = \frac{\sqrt{3}}{2}$

(3mks)

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

(3mks)

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

(3mks)

9. Evaluate: $\frac{11/6 \times \frac{3}{4} - 11/12}{\frac{1}{2} \text{ of } 5/6}$

(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

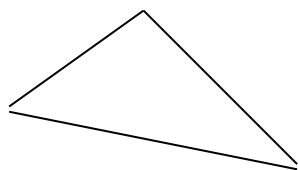
(2 mks)

$$\begin{array}{ccc} 3 & x & 1 \\ 2 & 1 & -1 \end{array} = \frac{2}{y}$$

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

(3mks)

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

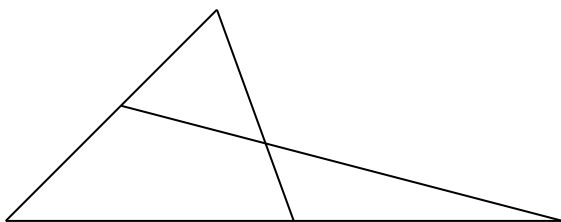


15. A line pass through A (4,3) and B(8,13). Find (6 mks)
- Gradient of the line
 - The magnitude of AB
 - The equation of the perpendicular bisector of AB.
16. A train is moving towards a town with a velocity of 10 m/s. It gains speed and the velocity becomes 34 m/s after 10 minutes . Find its acceleration (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 $\begin{pmatrix} 0 & -2 \\ -2 & 0 \end{pmatrix}$ to obtain its image $A^I B^I C^I D^I$. under a second transformation
- $\begin{pmatrix} 0 & -2 \\ -2 & 0 \end{pmatrix}$
- 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

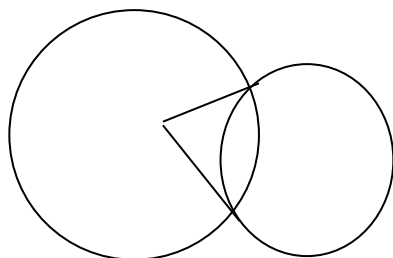
20. In the figure below, $SP = 13.2$ cm, $PQ = 12$ cm, angle $PSR = 80^\circ$ and angle $PQR = 90^\circ$. S and Q are the centres (8mks)

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

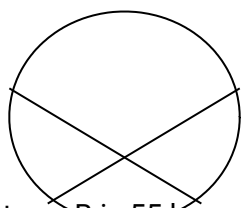


21. In an experiment the two quantities x and y were observed and results tabled as below

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
- Find the times taken to complete the uphill and downhill sections of the course.
 - 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
- Find the length of XB as a fraction
 - Show that $\triangle XAD$ is similar to $\triangle XBC$
 - Given that the area of $\triangle AXD = 6\text{cm}^2$, find the area of $\triangle BXC$
 - Find the value of the ratio

$$\frac{\text{Area of } \triangle AXD}{\text{Area of } \triangle BXC} = \frac{AX \cdot XD}{BX \cdot XC}$$



24. A town B is 55 km on a bearing of 050° . A third town C lies 75 km 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 1 cm 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 I

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	

Logs
+ - v ans (4)

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

$$= 0.06685 \quad 6.6850 \times 10^{-2}$$

2. $2x^2 - 5x + 1 = 0$
 $x^2 - \frac{5}{2}x + \frac{1}{2} = 0$
 $x^2 - \frac{5}{2}x = -\frac{1}{2}$
 $x - \frac{5x}{2} + \frac{5^2}{4} = -\frac{1}{2} + \frac{5^2}{4}$ (m)
 $= x - \frac{5}{4} = -\frac{1}{2} + \frac{25}{16} = \frac{17}{16}$ (3)

$$= x - \frac{5}{4} = \frac{17}{16} = 1.0625$$

$$x - \frac{5}{4} \pm 1.031$$

$$X_1 = -1.031 + 1.25 = 0.2192$$

$$X_2 = 1.031 + 1.25 = 1.281$$

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

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

$$= \text{Shs. } 7800$$

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

4. Let a plate be p and a cup c.
 $3p + 4c = 380 \quad \times 5 \quad 15p + 20c = 1900$

$$4p + 5c = 490 \quad \times 4 \quad \frac{16p + 20c = 1960}{-p \quad -60} \quad (m)$$

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

$$3(60) + 4c = 380$$

$$4c = 380 - 180 = 200 \quad (3)$$

$$c = \text{Shs. } 50$$

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

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 = $v \frac{3000}{25} = 120 \text{ glasses}$

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

7. $P = \frac{k}{Q^2} = \frac{K}{4} \quad (\text{substitution})$
 $K = \frac{4 \times 4}{9} = \frac{16}{9}$
 $P = \frac{16}{9Q^2} \quad \text{when } Q = 4$
 $P = \frac{16}{9 \times 4 \times 4} = \frac{1}{9} \quad (\text{A}) \quad (3)$

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

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

10. Volume of rod = $\pi r^2 h = \frac{22}{7} \times 4 \times 14 = 704 \text{ cm}^3 \quad (\text{m})$
 Volume of each cube = $2 \times 2 \times 2 = 8 \text{ cm}^3 \quad \text{A}$
 No. of cubes = $704 / 8 = 88 \text{ cm}^3 \quad \text{A}$

6

Figs A C B and D C E are similar

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

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

$$10y = 15 + 3y$$

$$7y = 15$$

$$y = 15/7$$

A (4, 3) B(8,13)

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

$$60 = 18 + 3x$$

$$3x = 42$$

$$x = 14$$

(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) Mag AB = $\sqrt{8^2 + 13^2} = \sqrt{64 + 169} = \sqrt{233} = 15.26$

Length = $\sqrt{4^2 + 10^2} = \sqrt{16 + 100} = \sqrt{116} = 10.77$ units

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

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

Eqn is $y = -2/5 x + c$

$$8 = -2/5 \times 6 + c$$

$$40 = -12 + 5c$$

$$52 = 5c$$

$$c = 52/5$$

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

(5 mks)

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

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

$$= 0.04 \text{ m/s}^2$$

(2)

17.

Triangle (8)

AC = 9cm

Circumference Centre

Circle

Perpendicular bisector of AB

P

Q

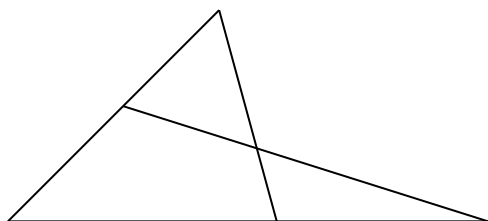
$$18. (b) \quad \begin{array}{ccccc} a & b & 2 & 3 & 5 \\ c & d & 2 & 4 & 2 \end{array} \quad \begin{array}{ccc} 6 & 10 & 12 \\ 10 & 19 & 13 \end{array}$$

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

$$\begin{array}{lcl} 2c + 2d = 10 \times 2 = 4c + 4d = 20 & & 2b = 2 \quad b = 1 \\ 3c + 4d = 19 & & \underline{3c + 4d = 19} \\ & & c = 1 \end{array}$$

$$\begin{array}{lcl} 2(1) + 2d = 10 & & \\ 2d = 8 & & \\ d = 4 & & \end{array} \quad \begin{array}{lcl} \text{Matrix is} & \begin{array}{cc} 2 & 1 \\ 1 & 4 \end{array} & (A) \end{array}$$

19.



$$OC = \frac{5}{3} (31) = 5A$$

$$\begin{array}{lcl} (a) & = AO + OB & MC = MO + OC \\ & = -3a = 4b & = -\frac{5}{8} (4b) + 5 \\ & & = 5A - \frac{5}{2} b \end{array}$$

$$\begin{array}{lcl} (b) MN = 5 Mc & = 3(5a - \frac{5}{2} b) & \\ & = 5sa - \frac{5}{2} sb & \end{array}$$

$$\begin{array}{lcl} MN = BN + BN & & \\ = \frac{3}{8} (4b) + (1-t)(-BA) & & \\ = \frac{3}{8} (4b) + (1-t)(3a - 4b) & & \\ = \frac{3}{2} b + 3ta - 4b + 4tb & & \\ = (3-3t)a + (4t - \frac{5}{2})b & & \end{array}$$

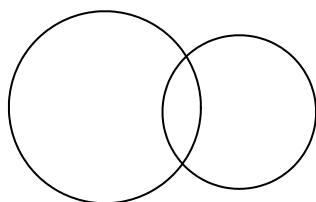
$$\begin{array}{lcl} MN = MN & & \\ = 5sa - \frac{5}{2} sb = (3-3t)a + (4t - \frac{5}{2})b & & \\ = 5a - 3 - 3t & & = 5s + 3t = 3 \\ = -\frac{5}{2} s = 4t - \frac{5}{2} & & \underline{5s + 8t = 5} \\ & & -5t = -2 \quad t = \frac{2}{5} \end{array}$$

$$\begin{aligned}
 5s &= 3 - 3(2/5) \\
 &= 3 - 6/5 = 9/5 \\
 &= 3 - 6/5 = 9/5 \\
 s &= 9/25
 \end{aligned}$$

(i) AN : NB = 2 : 3

(ii) MN : 9 : 16

20.



360

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

a. Area of sector SPR = $80/360 \times 13.2 \times 13.2 \times 3.142$
 $= 121.6$

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

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

(m of area) A(at least one)

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

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

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

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

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

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

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

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

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

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

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

$q = 7.62$

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

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

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

$$\text{at } y = 0.46, 1/y = 2.174$$

$$x = 9.6$$

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

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

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

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

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

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

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

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

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

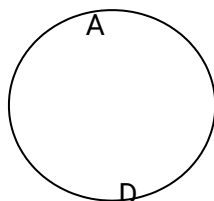
$$\text{speed uphill} = 30 \text{ km/hr, } T = \frac{75}{30} \text{ time} = 2 \frac{1}{2} \text{ hrs}$$

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

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

X	0	4	8	12	16	20
Y	1.0	0.64	0.5	0.4	0.3	0.2
				2	4	8
1/y	1.0	1.56	2.0	2.3	2.9	3.5
				8	4	7

23.



B

C

$$\begin{aligned}
 A \times X \times C &= BX \cdot XD \\
 8 \times 4 &= 6BX \\
 BX &= \frac{8 \times 14^2}{6} = \underline{16}
 \end{aligned}$$

$$\begin{aligned}
 XAD &= XBC \\
 \frac{XA}{XB} &= \frac{8}{16} = \frac{24}{16} = \frac{3}{2} \\
 \frac{XD}{XC} &= \frac{6}{4} = \frac{3}{2}
 \end{aligned}$$

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

SAS holds : they are similar.

$$\begin{aligned}
 \text{LSF} &= 3/2 \quad \text{ASF} = (3/2)^2 = 9/4 \\
 \text{Area } A \times A &= 6\text{cm}^2 \quad \text{Area } B \times C = \frac{6 \times 9}{4} = 27 = \underline{13.5\text{cm}^2}
 \end{aligned}$$

24.

- a) $AD = 50\text{km}$
 $DC = 35\text{km}$
 $BD = 90\text{km}$
 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)

4. A man is employed at a KShs. 4000 salary and a 10% annual increment. Find the total amount of money received in the first five years (4mks)
5. A town A is 56 km from B on a bearing 062° . A third town C is 64 km from B on the bearing of 140° . Find
 (i) The distance of A to C (2mks)
 (ii) The bearing of A from C (3mks)
6. Expand $(x + y)^6$ hence evaluate $(1.02)^6$ to 3d.p. (3mks)
7. Rationalise the denominator in (2mks)

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

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)

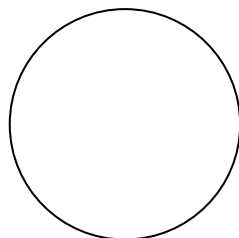
11. Write down the inverse of the matrix $\begin{pmatrix} 2 & 3 \\ 4 & 3 \end{pmatrix}$ hence solve for x and y if

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

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.

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

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

(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

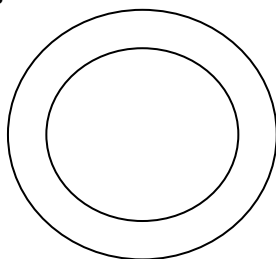
Using an assumed mean of 44.5, calculate

- 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

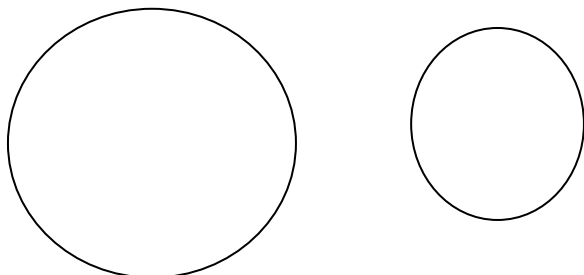
- $2x^2 - x - 4 = 0$
- $2x^2 - 3x - 4 = 0$



19.

- 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)
- Two unbiased dice are thrown. Find the probability of obtaining
 - 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.
- Draw on a cartesian plane, the line $y = x$ and mark points B^1 and D^1
 - Mark the points B and D before reflection
 - 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 .
 - Find the image of D under a rotation, through -90° , Center the origin.

MATHEMATICS I

PART II

MARKING SCHEME.

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

$$= 0.007 \quad (A)$$
2. $y = a/x + bx \quad yx = a + bx^2$
 Either
 $bx^2 - yx + a = 0$

$$x = \frac{y \pm \sqrt{y^2 - 4ab}}{2b} \quad (3)$$
3.
$$\begin{array}{rcl} 2x + 1\text{£} & 10 - x & \text{£} \quad bx \quad -1 \\ 2x + 1\text{£} & 10 - x & 10 - x\text{£} \quad 6x - 1 \\ 3x\text{£} & 9 & 11\text{£} \quad 7x \\ x\text{£} & 3 & x\text{£} \quad 11/7 \\ 11/7\text{£} & x & \text{£} \quad 3 \end{array} \quad (3)$$
4. $a = 4000 \quad r = 110/100 = 1.1 \quad (4000, 4000 + 4000, 4400 + 0/100 (4400-----))$

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

R -1

$$1.1 \log = 0.04139$$

$$\frac{X}{0.20695} = 5$$

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

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

$$A = \frac{4000(0.6105)}{0.1} = \text{Sh. } 2442 = \text{Sh. } 24,420 \quad (A) \quad (4)$$

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) $\frac{b}{\sin B} = \frac{a}{\sin A}$
 $\frac{75.77}{\sin 78} = \frac{64}{\sin A}$
 $\sin A = \frac{64 \times 0.9781}{75.77}$
 $\sin A = 0.08262$
 $A = 55.7^\circ \quad (\text{or } B = 46.3^\circ)$

$$\text{Bearing} = 90 - 28 - 55.7 = 0.06.3^\circ \quad (A)$$

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

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

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

$$= 1.12616$$

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

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

9. Moving averages of order 4

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

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

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

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

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

4
for 7
for > 4

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

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

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

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

$$Y = Mx + C$$

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

$$y = x + c$$

$$8 = 4 + c \quad c = 4$$

$$y = x + 4$$

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

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

(3)

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

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

18

16. $\log x = a$ $\log y = b$
 $\log \frac{x^3}{y} = \log x^3 - \log y$
 $= 3 \log x - \frac{1}{2} \log y$
 $= 8a - \frac{1}{2} ab$

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)
 $10 \sqrt{2.478}$

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

(a) The probability = $\frac{\text{Shaded area}}{\text{Large circle area}}$

Shaded area = $\pi R^2 - \pi r^2$
 $= 22/7 (4^2 - 3^2) \times \frac{1}{2} = 22/7 \times 7 = 22$

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)

$$\begin{aligned} \text{(ii)} \quad P(\text{sum of 8}) &= P((2,6) \text{ or } (3,5) \text{ or } (4,4) \text{ or } (5,3) \text{ or } (6,2)) \\ &= 5/36 \quad (\text{A}) \end{aligned}$$

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

20.

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

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

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

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

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

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

$$\begin{aligned} \text{(c)} \quad &= VAO \quad \tan = \frac{9.33}{3.536} = 2.639 \\ VAO &= 69.24^\circ \quad (\text{A}) \end{aligned}$$

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

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

24.

MATHEMATICS II

PART I

SECTION A (52 MARKS)

1. Use tables to evaluate $\sqrt[3]{0.0912^2} + \sqrt{3.152}$ (5mks)
0.1279 x 25.71
2. Simplify $\frac{(a-b)^2}{a^2-b^2}$ (2mks)
3. The gradient function of a curve that passes through point: (-1, -1) is $2x + 3$. Find the equation of the curve. (3mks)
4. Find the value of k for which the matrix $\begin{pmatrix} k & 3 \\ 3 & k \end{pmatrix}$ has no inverse. (2mks)
5. Without using tables, evaluate $\frac{\log 128 - \log 18}{\log 16 - \log 6}$ (3mks)
6. Find the equation of the locus of points equidistant from point L(6,0) and N(-8,4). (3mks)
7. The value of a machine is shs. 415,000. The machine depreciates at a rate of 15% p.a. Find how many years it will take for the value of the machine to be half of the original value. (4mks)
8. Use reciprocal tables to evaluate to 3 d.p. $\frac{2}{0.321} - \frac{1}{n2.2}$ (4mks)
9. Using the trapezium rule, estimate the area bounded by the curve $y = x^2$, the x – axis and the co-ordinates $x = 2$ and $x = 5$ using six strips. (4mks)
10. Solve the equation for $0^\circ \leq \theta \leq 360^\circ$ and $\cos^2 \theta + \frac{1}{2} \cos \theta = 0$ (3mks)

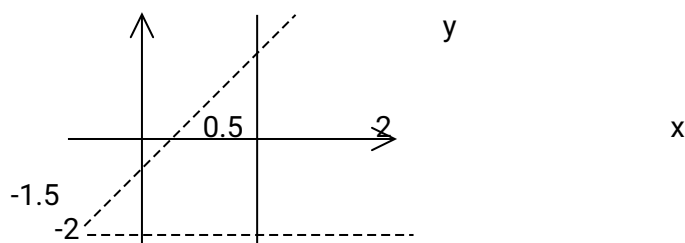
11. Point P divides line MK in the ratio 4:5. Find the co-ordinates of point P if K is point (-6,10) and M is point (3,-8) (3mks)
12. How many multiples of 3 are there between 28 and 300 inclusive. (3mks)
13. The line $y = mx - 1$, where m is a constant, passes through point (3,1). Find the angle the 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)

$$V = \frac{\sqrt[3]{k+x}}{sk-x}$$

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 (8mks)
- (i.) $3x + 2 - x^2 = 0$ (ii) $-x^2 - x = -2$
18. The marks obtained by Form 4 students in Examination were as follows:

Marks	0-9	10-19	20-29	30-39	40-49	50-59
No. of students	2	8	6	7	8	10
Marks	60-69	70-79	80-89	90-99		

No.	of	9	6	3	
Students					

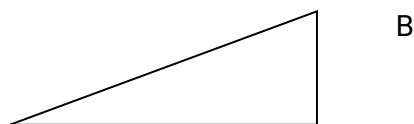
Using 74.5 as the Assumed mean, calculate:

(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) $\underline{RS}$

(ii) $\underline{OS}$

(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

- Use logarithm tables to Evaluate

$$\frac{{}^3\sqrt{36.5 \times 0.02573}}{1.938}$$
 (3mks)
- 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)
- If $K = \frac{(y-c)}{4p}^{1/2}$
 - Make y the subject of the formula. (2mks)
 - Evaluate y, when $K = 5$, $p = 2$ and $c = 2$ (2mks)
- Factorise the equation:
 $x + 1/x = 10/3$ (3mks)
- DA is the tangent to the circle centre O and Radius 10cm. If OD = 16cm, Calculate the area of the shaded Region. (3mks)
- Construct the locus of points P such that the points X and Y are fixed points 6cm apart and $\angle XPY = 60^\circ$. (2mks)
- In the figure below, ABCD is cyclic quadrilateral and BD is diagonal. EADF is a straight line, $\angle CDF = 68^\circ$, $\angle BDC = 45^\circ$ and $\angle BAE = 98^\circ$.

Calculate the size of:

(2mks)

- $\angle ABD$
 - $\angle CBD$
- 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:
 - In nautical miles (nm)
 - In kilometres (km)
 Between the two places along the circle of Latitude:
 - A(30°N , 20°E) and B(30°N , 80°E) (Take Radius of Earth = 6371Km). (2mks)
 - 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 $\int 8x^5 - 3x^3 \, dx$
(4mks)
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	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:
 a) Using a suitable scale draw a diagram to show the positions of Aeroplanes after 2hrs.
 b) Use your graph to determine:
 i) The actual distance between the two aeroplanes.
 ii) The bearing of B from A.
 iii) The bearing of A from B.
22. The Probabilities that it will either rain or not in 30days from now are 0.5 and 0.6 respectively. Find the probability that in 30 days time.
 a) it will either rain and not.
 b) Neither will not take place.
 c) One Event will take place.
23. Calculate the Area of each of the two segments of $y = x(x+1)(x-2)$ cut off by the x axis. (8mks)
24. Find the co-ordinates of the turning point on the curve of $y = x^3 - 3x^2$ and distinguish between them.

MATHEMATICS II

PART I

MARKING SCHEME:

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

$$\sqrt{3.152} = 1.776$$

$$^3\sqrt{1.776 + 0.008317}$$

$$0.1279 \times 25.91$$

$$= ^3\sqrt{1.784317}$$

$$0.1279 \times 25.91$$

$$25.71$$

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

$$\text{Or } 0.8155(6)$$

No.	log
0.1279	0.2514
0.1279	-1.1069
	<u>1.4101 +</u>
	<u>0.5170</u>
	-1.7344
$\times 1/3$	<u>1^{-1}.9115</u>

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

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

$$dx$$

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

$$-1 = 1 - 3 + c$$

$$c = 1$$

$$; \quad \text{E.g } y = x^2 + 3x + 1$$

$$4. K^2 - 9 = 0$$

$$K = \pm 3$$

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

$$\log \left(\frac{16}{6} \right) \log \left(\frac{8}{3} \right)$$

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

$$= 2$$

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

$$\text{Gradient of LN} = 4/-14 = -2/7$$

$$\text{Gradient of } \perp \text{ bisector} = 7/2$$

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

$$x+1$$

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

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

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

$$100$$

$$0.5 = 0.85^n$$

$$\log 0.5 = n \log 0.85$$

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

$$\log 0.85$$

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

$$-1.9294 \quad -0.0706$$

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

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

$$6.230 - 0.005807 = 6.224193$$

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

9.

X	2	2.5	3	3.5	4	4.5	5
y	4	6.25	9	12.2	16	20.2	25

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

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

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

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

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

$$\cos \theta = 0$$

$$\cos \theta = -0.5$$

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

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

$$11. \text{MP} = \frac{4}{9} \text{MK} \quad \left(\text{MK} = \frac{-9}{8} \right) \quad -9$$

$$\text{MP} = \frac{4}{9} \left(\frac{-9}{-18} \right) = \left(\frac{-4}{8} \right) \quad -18$$

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

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

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

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

$$300 - 27 = 3n$$

$$273 = 3n$$

$$91 = n$$

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

$$1 = 3m - 1$$

$$m = 2/3 = 0.6667$$

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

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

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

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

$$\text{CX} \times \text{XK} = \text{XA} \times \text{XN}$$

$$3 \frac{5}{6} \times 3/2 = 3 \times \text{XN}$$

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

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

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

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

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

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

16. (i.) $x = 2 \Rightarrow x \leq 2$
 (ii) $y = -2 \Rightarrow y > -2$
 (iii) pts. (0.5, 0)
 (0, -1.5)
 $m = \frac{-1.5 - 0}{0 - 0.5} = 3$
 Eq. $Y = 3x - 1.5$ $y < 3x - 1.5$

SECTION B

17.

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

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

- (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
	$\Sigma f =$	60	$\Sigma fd =$	-1680		$\Sigma fd^2 =$ 77,600

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

$$= 74.5 - 28 = 46.5$$

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

$$= \sqrt{1283.3 - 784}$$

$$= \sqrt{499.3} = 22.35$$

19. a (i.) $OK = OA + AK = \frac{1}{2}a + \frac{1}{2}b$
 (ii) $OS = \frac{3}{4}OK = \frac{3}{8}a + \frac{3}{8}b$
 (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.

$$KB = 3\text{m} \quad NK = 1.5\text{m} \quad XB = 5\text{m}$$

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

$$\text{let } \angle XKN = \theta$$

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

$$\theta = 67.97(8)^0$$

(ii) In $\triangle XNK$

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

$$\text{In } \triangle SMR; MR = KB = 3\text{m}$$

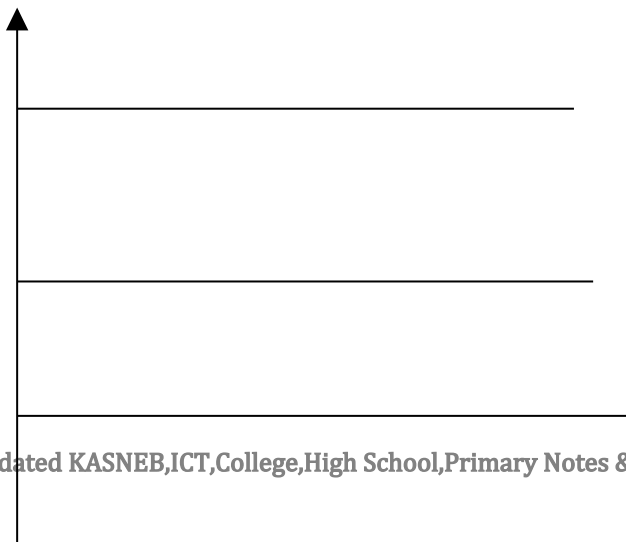
$$SM = XN = 3.708\text{m}$$

$$\text{Let } \angle SRM = \alpha$$

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

$$\alpha = 51.02(3)^0$$

21.



21.

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

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

(b) Between 40.5^0 and 139.5^0

22. $\xrightarrow{\quad\quad\quad 300\text{km}}_{\text{T} \quad \quad \quad \text{S}}$

Let the speed of A be X km/hr

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

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

X

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

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

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

$$\frac{300X + 3000 - 300X}{X^2 + 10X} = \frac{5}{4}$$

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

$$X = 44.25$$

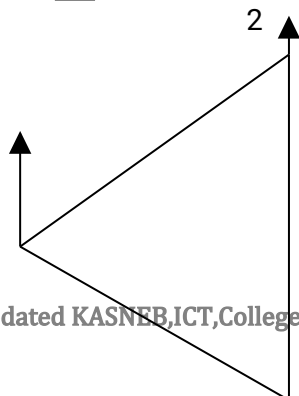
$$X = -54.25 \text{ N/A}$$

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

Distance of A from T is $300 - 55.3 = 244.7 \text{ km}$

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

(b)



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

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

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

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

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

$$= 0.9344$$

$$\alpha = 69.1^\circ$$

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

$$x = y \text{ pts } (6,6) (12,12)$$

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

$$X + y = 15 \text{ pts } (0,15) (8,7)$$

Objective function

$$2400x + 3200y$$

$$(\text{pt } (2,1))$$

$$2400X + 3200y = 8000$$

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

Point that give maximum profit is (12,3)

$\therefore$ maximum profit

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

MATHEMATICS II

PART II

MARKING SCHEME

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

$$-1.6853$$

$$\begin{aligned} \frac{-3}{3} + \frac{2.6853}{3} \\ -1 + 0.8951 \\ 1.273(4) \leftarrow 0.1049 \\ = 1.273(4) \end{aligned}$$

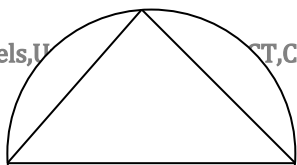
2. Let shirt be sh x,
let blouse be sh. y.
 $5x + 3y = 1750$ (i.)
 $3x + y = 850$ (ii)
mult (ii) by 3
 $9x + 3y = 2550$ (iii)
Subtract (iii) - (i.)
 $-4x = -800$
Subt for x
 $y = 250$
Shirt = sh 200 ; Blouse = sh 250

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

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

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

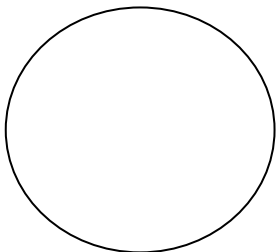
6. $\angle XPY = 60^\circ$
 $\therefore \angle XC_1Y = 120^\circ$
B1 $\therefore \angle C_1XY = \angle C_1YX$
 $= \frac{180^\circ - 120^\circ}{2} = 30^\circ$



sides with C_1X and C_2X

as centres.

2



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

$$ABD = 180$$

$$= 37^0$$

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

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

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

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

$\frac{20160}{3600}$

$\frac{3600}{3600}$

16560 L to fill

0.5 L – 1 sec

16560 L - ?

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

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

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

$\frac{3600}{3600}$

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

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

$a = -0.2$

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

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

12. Area of metal : Material – Cross section.

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

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

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

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

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

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

$= \frac{1}{2} \times 9/36 = 9/72 = \frac{1}{8}$

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

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

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

$\frac{16x^3}{3} - 2/x^3 + C$

15. Area of $\triangle AOB$

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

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

$$\begin{aligned}
 \Sigma x &= \Sigma f = 30 \quad \Sigma fx = 210 \quad 1512 \\
 S.d &= \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \frac{(\Sigma fx)^2}{(\Sigma f)^2}} \\
 &= \sqrt{\frac{1512}{30} - \frac{(210)^2}{30^2}} \\
 &= \sqrt{50.4 - 49} \\
 &= \sqrt{1.4} = 1.183
 \end{aligned}$$

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) $y = \tan^{-1} 5/3.535 = \tan^{-1} 1.414 = 54.7^\circ$
 (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	1.0	0.866	0.50	0

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

x°	0°	30°	60°	90°	120°	150°	180°
$2 \sin(x + 10^\circ)$	0.347	1.28	1.879	1.28	0.347	-0.347	-1.879

Amplitudes for $y = \sin x$ 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

$$\text{Mean} = \frac{\sum xF}{\sum F} = \frac{52 + 54 + \dots + 70}{150}$$

$$\text{Median} = \frac{52 - 0.02}{2} = 51.08$$

class interval 59

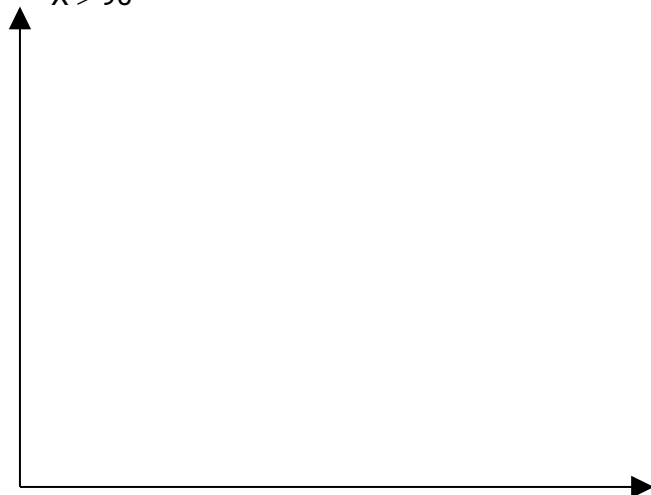
Class interval	mid point	Freg.	c.f
44-48	46	12	12
49-53	51	49	61
54-58	56	64	125
59-63	69	22	147
64-68	66	3	130
69-73	71	1	150

20. $X + Y \leq 1000$

$$X \leq 2Y$$

$$Y < 720$$

$$X > 90$$



21.(a) $1\text{cm} = 200\text{Km/h}$
 $A = 200 \times 7.5 = 1500\text{ Km}$
 $B = 200 \times 9 = 1800\text{Km}.$

(b) (i.) $15.8\text{cm} \times 200$
 $= 3160\text{ Km}.$

(ii) Bearing 224°
 (iii) Bearing 049°

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

(b) $P(R)' \times P(R)$
 $= 0.2$

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

$P(R)' \times P(R)$
 $0.5 \times 0.6 = 0.3$

23. $y = x(x+1)(x-2)$
 $= x^3 - x^2 - 2x$
 $A_1 = \int_{-1}^1 (x^3 - x^2 - 2x) dx$
 $= \left[\frac{1}{4}x^4 - \frac{1}{3}x^3 - x^2 \right]_{-1}^1$
 $= 0 - \left(\frac{1}{4} + \frac{1}{3} - 1 \right) = 5/12$
 $A_2 = \int_0^2 (x^3 - x^2 - 2x) dx$
 $= \left[\frac{1}{4}x^4 - \frac{1}{3}x^3 - x^2 \right]_0^2$
 $= \left(\frac{1}{4} \cdot 16 - \frac{1}{3} \cdot 8 - 4 \right)$
 $= 4 - 8/3 - 4 = -8/3$
 $A_1 = 5/12 = A_2 = 2^{2/3}$ _____

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

Distinguish

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

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

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

$-6 < 0$ – maximum.

$\therefore (0,0)$ Max Pt.

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

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

$6 > 0$ hence

Minimum Pt.

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

$(2, -4)$ minimum point.

MATHEMATICS II

PART I

SECTION 1 (52 Marks)

1. Without using tables evaluate:

$$\frac{\sqrt{7.5625} \times \sqrt[3]{3.375}}{15}$$

(5 mks)

2. Make k the subject of the formula.

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

(3 mks)

3. If A = (x, 2) and $xB = \frac{x}{-2}$ 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.

$$\log_3 (8-x) - \log_3 (1+x) = 1$$

(3 mks)

6. Under an enlargement scale factor -1, A(4,3) maps onto A¹ (4,-5). Find the co-ordinates of the centre of enlargement.

(3 mks)

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

(2 mks)

8. Find the standard deviation of the data below:

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

(4 mks)

9. What is the sum of all multiples of 7 between 200 and 300?

(4 mks)

10. Solve the equation.

$$\frac{1}{2} \tan x = \sin x \text{ for } -180^\circ \leq x \leq 360^\circ.$$

(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 mrks)

13. A two digit number is such that 3 times the units digit exceed the tens digit by 14. If the digits are reversed, the

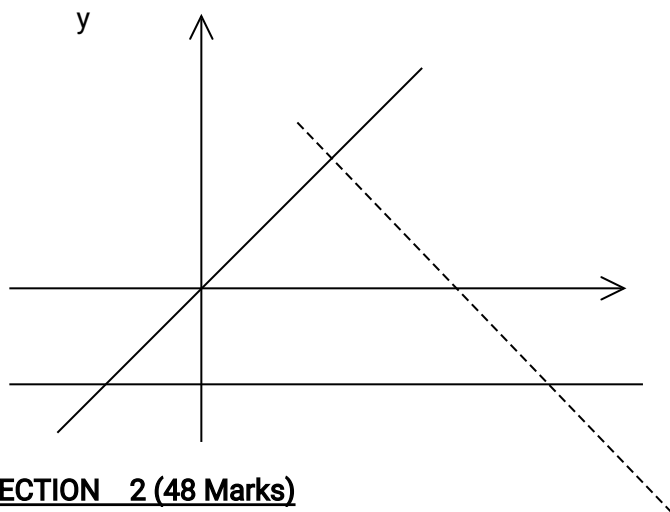
value of the number increases by 36. Find the number

(4 mks)

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

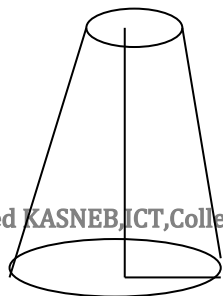
15. A box contains 36 balls, all identical except for colour. 15 of the balls are black, 15 are brown and the rest are white. Three balls are drawn from the box at random, one at a time, without replacement. Find the probability that the balls picked are white, black and brown in that order. (2 mks)

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:-

- The volume of the bucket.
- 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 $-180^\circ \leq \theta \leq 180^\circ$

- From your graph, determine the amplitude of each wave.
- 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:

- $\angle PRQ$.
- The distance QR, between the two ships.
- 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.

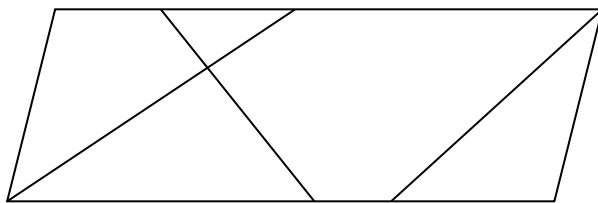
- How many balls of each colour are there in the bag?
- If two balls are drawn out of the bag at random one at a time with replacement what is the probability that the two balls are red? (8 mks)

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:

- How many US dollars did he take out of Kenya?
- How many Italian lire did he spend in Italy?
- How much money, in Deutsche marks did he spend in West Germany?
- 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:

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

2. Simplify completely. (3 mks)

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

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

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

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

$$\text{If } B \quad (2 \quad 3) = 4 \quad 1, \text{ Find } B. \quad (3 \text{ mks})$$

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



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

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

8. Show that x is the inverse of : Y = $\begin{pmatrix} 3 \\ -3 \end{pmatrix} \begin{pmatrix} 1 & -5 \end{pmatrix} \begin{pmatrix} X \\ 2 \end{pmatrix} = \begin{pmatrix} 2 & 1 \\ 5 & 3 \end{pmatrix}$
(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 $\angle BQR = 30^\circ$, $\angle QBC = 27^\circ$, and $\angle OBA = 37^\circ$, find $\angle BAC$ and $\angle ACB$.

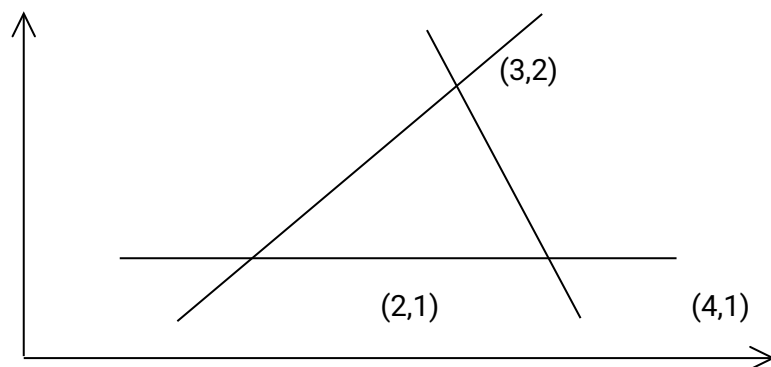


11. A frustrum of height 10cm is cut off from a cone of height 30cm. If the volume of the cone before cutting is 270cm^3 , find the volume of the frustrum. (3 mks)

12. Evaluate $\int_1^0 \frac{(3x^2 - 1) dx}{4x^2}$ (2 mks)

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

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



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

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

Calculate the three monthly moving averages. (3 mks)

16. A number of women decided to raise sh. 6300 towards a rural project for bee keeping. Each woman had to

contribute the same amount. Before the contribution, seven of them withdrew from the project. This meant the remaining had to pay more. If n stands for original number of women, show that the increase in contribution per woman was: 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)

19. 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)

20. 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 : $y = \sin x$; $y = \cos x$

$$y = \cos^x + \sin X \text{ for } 0^\circ \angle X \angle 360^\circ.$$

- (b) Use your graph to deduce

- (i) The amplitude

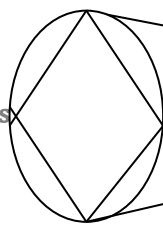
- (ii) The period of the wave $y = \cos x + \sin x$.

- (c) Use your graph to solve:

$$\cos x = -\sin x \text{ for } 0^\circ \angle X \angle 360^\circ.$$

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 $\angle DAB = 80^\circ$.

B



A

E

C

D

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

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

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

MATHEMATICS III**PART I****MARKING SCHEME**

	SOLUTION	MRK	AWARDING
1.	$\sqrt{7.5625} = 2.75$ $\sqrt[3]{3.375} = \sqrt[3]{3375 \times 10^{-3}}$ $= \sqrt[3]{3^3 \times 5^3 \times 10^{-1}} = 3 \times 5 \times 10^{-1} = 1.5$ $= \frac{2.75 \times 1.5}{1.5 \times 10} = \frac{2.75}{10} = 0.275$	1 1 1 1 1	Method for $\sqrt{7.5625}$ Square root Method for $\sqrt[3]{}$ Answer
		5	
2.	$T^2y = \sqrt{k+y}$ K $T^4y^2k = k+y$ $T^4y^2k - k = y$ $K(T^4y^2 - 1) = y$ $K = \frac{y}{T^4y^2 - 1}$	1 1 1	Removal of square root Rearrangement of terms Answer
		3	
3.	$(x \ 2) \begin{pmatrix} \\ \end{pmatrix} x^{-2} = (8)$ $x^2 - 4 = 8$	1 1	Matrix equation Quadratic

	$x = \pm\sqrt{12} = \pm 2\sqrt{3} = \pm 3.464$	1	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	$\frac{1}{8-x} = \log_3 3$ $\frac{8-x}{1+x} = 3$ $-4x = -5$ $x = \frac{5}{4}$	1 1 1	Logarithmic expression. Equation Answer
		3	
6.	Let the centre be (a,b) $\begin{pmatrix} 4-9 \\ -5-b \end{pmatrix} = \begin{pmatrix} 1 \\ 3 \end{pmatrix} \begin{matrix} 4-a \\ 3-b \end{matrix}$ $\begin{matrix} 4-a = -4+9 \\ a = 4 \end{matrix} \quad \begin{matrix} -5-b = -3+b \\ b = -1 \end{matrix}$ centre is (4,-1)	1 1 1	Equation Linear equations Centre
		3	
.	$Y = 4x + 5$ 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	$\bar{X} = \frac{28}{8} = 3.5$ <table><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> 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	$\Sigma d^2 = 22$	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																															
	$a = 203 \quad d = 7 \quad L = 294$ $294 = 203 + 7(n-1)$ $n = 14$ $S_{14} = \frac{14(203 + 294)}{2}$ $= 7 \times 497$ $= 3479$	1 1 1 1	For both a and b Equation For n 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 1	Simplification Equation All 3 values																														
		3																															
11.	$(1+2x)^4 = 1-8x+24x^2-32x^3+16x^4$ $(0.82)^4 = (1-2 \times 0.09)^4$ $x = 0.09$ $(0.82)^4 = 1 - 0.72 + 0.1944 - 0.023328 + 0.00119376$ $= 0.35226576$ $\cong 0.35227 \text{ (5 d..p)}$	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																															

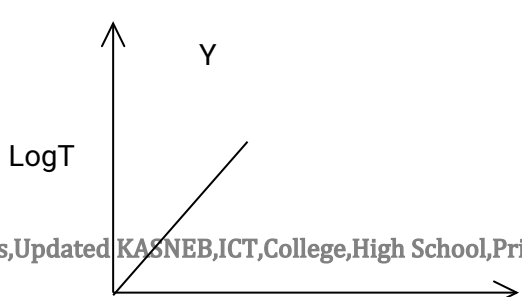
13.	Let the number be xy $3y = x + 14$ $10y + x = 10x + y + 36 \Rightarrow 9y - 9x = 36$ $3y - x = 14$ $9y - 9x = 36$ $y = 5$ $x = 1$ the number is 15.	1 1 1 1	1st equation 2nd equation method of solving Answer
	S	4	
14.	Let $\angle AOB = \theta$ $\frac{\theta}{360} \times 2 \times \frac{22}{7} \times 7 = 11$ $\theta = 90^\circ$ Area shaded = $\frac{90 \times 22 \times 7 \times 7 - 1 \times 7 \times 7}{360} \times 7$ $= \frac{77 - 49}{2} = \frac{28}{2} = 14\text{cm}^2$	1 1 1	Value of θ Substitution Answer
		3	
15.	$P(WBb) = \frac{6 \times 15 \times 15}{36 \times 35 \times 34}$ $= \frac{15}{476}$	1 1	Method Answer
		2	
16.	Equation inequality $L_1 \quad y \leq x$ $L_2 \quad y \geq -2$ $L_3 \quad 2y + 5x = 21$ $5x < 21$	1 1 1 1	1 mark for each inequality. Method for obtaining L^3

	<table><tr><td>X</td><td>-4</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>y</td><td>6</td><td>0</td><td>-4</td><td>-6</td><td>-6</td><td>-4</td><td>0</td><td>6</td><td>14</td></tr></table> (i) roots are x = -3 x = 2 (ii) $y = x^2 + x - 6$ $0 = x^2 + 2x - 8$ $y = -x + 2$ roots are x = -4 x = 2	X	-4	-3	-2	-1	0	1	2	3	4	y	6	0	-4	-6	-6	-4	0	6	14	4	2	For all correct points. 1 for atleast five correct points
X	-4	-3	-2	-1	0	1	2	3	4															
y	6	0	-4	-6	-6	-4	0	6	14															
			1	Correct plotting.																				
			1	Scale																				
			1	Smoothness of curve																				
			1	Both roots																				
			1	Linear equation																				
			1	Both roots																				
			8																					
18.	$\frac{h}{h+50} = \frac{15}{40}$ $h = 30\text{cm}$ $H = 80\text{cm}$ (a) Volume = $\frac{1}{3} \pi \times 40 \times 40 \times 80 - \frac{1}{3} \pi \times 15 \times 15 \times 30$ $= \frac{128000 \pi}{3} - \frac{6750 \pi}{3}$ $= \frac{121,250 \pi}{3} \text{ cm}^3$ (b) $L^2 = 80^2 + 40^2$ $= 15^2 + 30^2$ $= 225 + 900$ $= 1125$ $L = 33.54 \text{ cm}$ 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	Expression																					
		1	Value of H																					
		1	Substitution																					
		1	Volume																					
		1	L																					
		1	L																					
		1	Substitution																					
		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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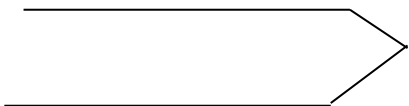
	P T (iii) Let PR = q $\frac{q}{\sin 146^\circ} = \frac{7}{\sin 21^\circ}$ $q = \frac{7 \sin 146^\circ}{\sin 21^\circ}$ $q = 10.92 \text{ km}$ $\sin 45^\circ = \frac{RT}{10.92}$ $RT = 10.92 \sin 45^\circ$ $= 7.72 \text{ km (2 d.p.)}$	Equation Method Equation 1 1 Distance PR Equation RT 1 1 1	
		8	
21.	(a) $4x = 9y$ $2(x+y) = y+44 \Rightarrow 2x + y = 44$ $4x - 9y = 0$ $4x + 2y = 88$ $11y = 88$ $y = 8$ $x = 18$ (b) $P(RR) = \frac{18}{26} \times \frac{18}{26} = \frac{81}{26}$ 169	1 1 2 1 1 1 1	Equation Equation Method of solving Value y Value x Method Answer
		8	
22.	(a) 67,000 Ksh = $\frac{67,000}{16.75}$ US dollars $= 4,000 \text{ dollars}$ (b) $\frac{2}{5} \times 4,000 = 1600$ US dollars $1600 \text{ US dollars} = 1600 \times 1340$	1 1 1 1	Method Answer Method Answer

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

24.	$\log T = \log a + x \log b$ $\log T \Rightarrow 0.82, 1.25, 1.68, 2.11, 2.54, 2.97, 3.40, 3.84$ $y - \text{intercept} = \log a = 0$ $a = 1$ $\text{gradient} = \frac{3.84 - 0.82}{9 - 2} = \frac{3.02}{7} = 0.4315$ $\log b = 0.4315 = 0.4315$ $b = \text{antilog } 0.4315$ $b = 2.7$	1 2 1 1 1 1 8	Linear All correct logs Value of a Method of gradient Value of b
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MATHEMATICS III
PART II
MARKING SCHEME

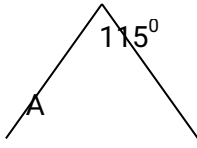
NO.	SOLUTION	MARKS	AWARDING
1.	No $\log$ 8.69 0.9390 0.786 1.8954 21.72 1.3369 1.2323 $1.7067 - 2$ 1.7067 2 $-1 + 0.8533$ $0.7134 \times 10^{-1} = 0.07134$	M1 M1 A1	✓ reading to 4 s.f Rearranging
		3	
2.	$\frac{4}{(x-2)(x+2)}$ $-\frac{1}{(x-2)}$ $\frac{-x+2}{(x-2)(x+2)}$ $\frac{-(x-2)}{(x-2)(x+2)}$	M1 M1	

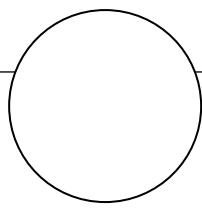
	$\frac{-1}{x+2}$	A1	
		3	
3.	Re6000 = Ksh. 75000 Spent 5000 Rem 2500 Rem 2500 1.25 Re 2000	M1 M1 A1	
		3	
4.	$\begin{aligned} 2x - 1 &, 2z + 1, 2x + 3 \\ 6x + 3 &= 105 \\ 6x &= 102 \\ x &= 17 \end{aligned}$	M1 M1 A1 A1	Allow M1 for us of different variable.
		4	
5.	$\begin{aligned} 4 * 1 &= 5 \\ 2 * 3 &= 5 \\ A * 5 &= 5 \\ A + 5 &= 5 \times 5A \\ A + 5 &= 25A \\ A &= 20 \end{aligned}$	M1 M1 A1 3	
6.	 $\begin{aligned} 180 - M + 20 + 95 &= 180 \\ 295 - M &= 180 \\ -M &= -115 \\ M &= 115 \end{aligned}$	B1 B1 A1	
		3	
7.	$\begin{aligned} 1 + 2x + 60x^2 + 160x^3 + \\ 1 + 0.2 + 0.006 + 0.00016 \\ = 1.20616 \\ = 1.206 \end{aligned}$	M1 M1 M1 A1 4	Only upto term in x^3 . Correct substitution Only 4 s.f.
8.	$\begin{pmatrix} 3 \\ -5 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \end{pmatrix} \begin{pmatrix} 2 \\ 5 \end{pmatrix} \begin{pmatrix} 1 \\ 3 \end{pmatrix} = I$ $\begin{pmatrix} 6 \\ -5 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \end{pmatrix} \begin{pmatrix} 2 \\ 5 \end{pmatrix} \begin{pmatrix} 1 \\ 3 \end{pmatrix} = I$	M1 M1	Matrix multiplication gives : $I \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

	$-10 + 10$ $-5 + 6$ $\begin{pmatrix} 1 & \\ 0 & \end{pmatrix}^0_1$	A1	
		3	
9.	(a) $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} = \frac{2}{5}$ (b) $+ \left\{ \frac{2}{3} \times \frac{3}{4} \times \left(\frac{1}{5} + \right) \right\} \frac{2}{5} \times \left\{ \frac{1}{3} \times \frac{4}{2} \right\}$ $\frac{1}{10} + \frac{4}{15} + \frac{1}{5}$ $= \frac{17}{10}$	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.	$V = \frac{1}{3} \times 3.14 \times r^2 \times 10 = 270$ L.S.F. $\frac{20}{30} = \frac{2}{3}$ V.S.F. $= \frac{2}{3} \times \frac{3}{27} = \frac{8}{27}$ Vol. of cone $= \frac{8}{27} \times 270 = 80\text{cm}^3$ $\therefore \text{Vol. Of frustum} = (270 - 80) = 190\text{cm}^3$	M1 M1 A1	
		2	
12.	$\left(\frac{3x^3}{3} \right) \times \frac{-1}{-1} \times \frac{2}{1}$ $\left(x^3 \right) + \frac{1}{x} \times \frac{2}{1}$	M1	

	$\begin{array}{r} 8 + \frac{1}{2} - (1 - 1) \\ 8\frac{1}{2} - 2 = 6\frac{1}{2} \end{array}$	A1 2	
13.	$(2 \times 3 \times 1.5)$ volume 9 m^3 $1 \text{ L} \equiv 1000 \text{ cm}^3$ $1000 \text{ L} = 1 \text{ m}^3$ $9000 \text{ L} = 9 \text{ m}^3$ $1000 \text{ L} = 1 \text{ tonne}$ $9000 \text{ L} = 9 \text{ tonnes.}$	M1 A1	
		2	
14.	$y \geq 1$ (i) $y \leq x - 1$ (ii) $y \leq 5 - x$ (iii)	B1 B1	
		3	
15.	$M_1 = \frac{5.1 + 4.9 + 4.7}{3} = 4.9$ $M_2 = \frac{4.9 + 4.7 + 4.5}{3} = 4.7$ $M_3 = \frac{4.7 + 4.5 + 4.0}{3} = 4.4$	M1 M1 M1	
		3	
16.	Original contribution per woman = <u>6300</u> N Contribution when 7 withdraw = <u>6300</u> (n-7) Increase - Diff. $\frac{6300}{n-7} - \frac{6300}{n}$ $\frac{6300n - 6300(n-7)}{n(n-7)}$ $\frac{6300n - 6300 + 44100}{n(n-7)}$ $\frac{44100}{n(n-7)}$	M1 M1 1 3	

SECTION II (48 Marks)

17.	(i)  Centre of circles of latitude 50° S. $R \cos 50^\circ$ $AB = 115 \times \frac{2\pi R \cos 50^\circ}{360}$ $= \frac{115}{360} \times 40192 \times 0.6428$ $= 8252.98 \text{ km}$	M1 M1 M1 A1	No. 60 1.7782 1+5 2.0607 ←
-----	--	------------------------------	--



Radius $\frac{1\text{cm}}{2} = 2\text{cm}$

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

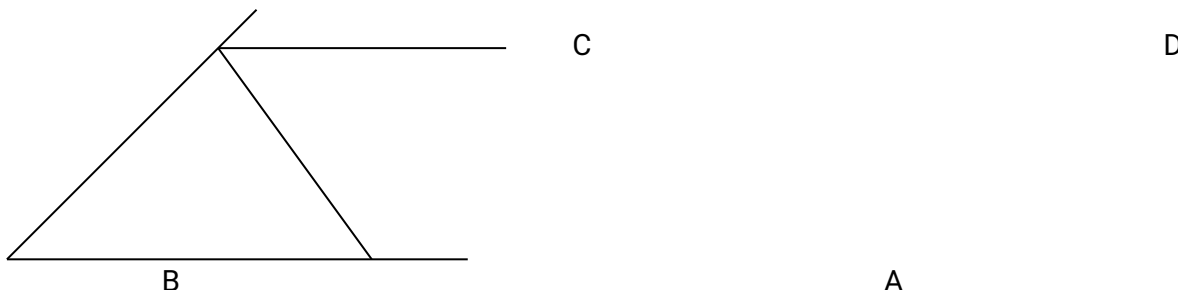
	 (i) amplitude = 1.366 (ii) Period = 300^0		
23.	(a) $(x+1)^2 + (y-6)^2 = 3^2$ $x^2 + 2x + 1 + y^2 - 12y + 36 = 9$ $x^2 + 2x + y^2 - 12y + 28 = 0$ (b) $\cos 10 = \frac{OD}{DE}$ $DE = \underline{3}$ 0.9848 $DE = 3.046$ (c) Twice $\angle OED$ $10^0 \times 2 = 20^0$ (d) $DAB = 80^0$ $\therefore DCB = 100^0$	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	

SECTION 1 (52MKS)

1. Evaluate using logarithms $3\sqrt{7.673 - 15.612}$
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 $\overrightarrow{AB} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$ and vector $\overrightarrow{BC} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ 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 taller building to the bottom of the shorter 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 $\frac{1}{\sqrt{3}}$

$$\sqrt{7-2}$$

Leaving your answer in the form $\frac{a+b\sqrt{c}}{d}$

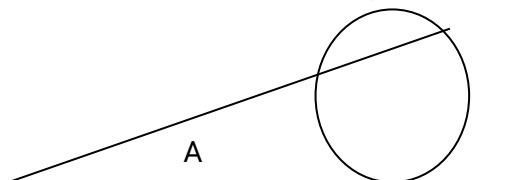
C

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 $\angle BCO = 15^\circ$



F

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

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

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

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)

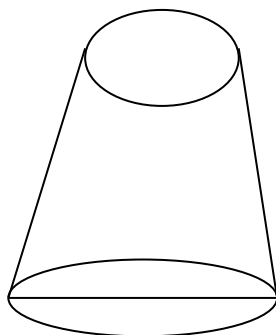
19. E and F are quantities related by a law of the form $E = KF^n$ Where k and n are constants. In an experiment , the following values of E and F were obtained .

E	2	4	6	8
F	1	1	4	1
	6	2	3	0
	.	7	1	2

	1	.	.	4
	8	9		

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)

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

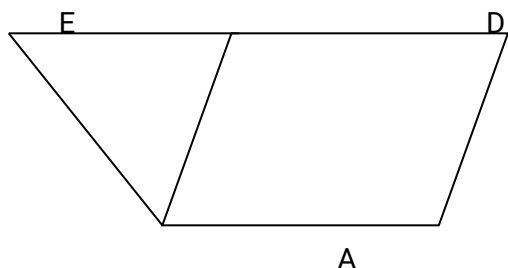
(leave your answer in standard form)

0.1875

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 $\frac{a^3 - b - 2c^2}{3a^2c}$ (2mks)

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

6. ABC is a cross – section of a metal bar of uniform cross section 3m long. AB = 8cm and AC = 5cm. Angle BAC = 60° . 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 $\frac{2}{3}$
- Find the number of red balls (2mks)
 - 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 K£ P.a | Rate (Ksh) £ |
|------------------|--------------|
| 1 - 2100 | 2 |
| 2101 - 4200 | 3 |
| 4201 - 6303 | 5 |
| 6301 - 8400 | 7 |
- (a) Maina earns £ 1800 P.a. How much tax does he pay?
 (2mks)
 (b) Okoth is housed by his employer and therefore 15% is added to salary to make taxable income. He pays nominal rent of Sh.100 p.m His total tax relief is Shs.450. If he earns K£3600 P.a, how much tax does he pay?
 (6mks)
21. In the given figure, OA = a , OB =b, OP: PA =3:2, OQ:QB = 3:2

Q

B

R

O

A

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

(b) Given that $\vec{AR} = h\vec{AB}$ where h is a scalar, write OR in terms h, a. and b

(2mks)

(c) $\vec{PR} = K \vec{PQ}$ 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 $P = \begin{pmatrix} 0 & - \\ 1 & \end{pmatrix}$ 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)

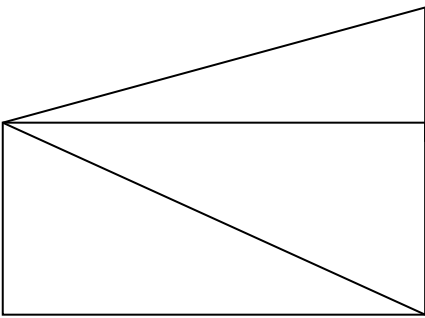
MATHEMATICS IV

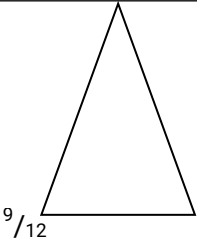
PART 1

MARKING SCHEME

1.	$\sqrt{-\frac{7.939}{12.3}}$ $= \frac{7.939}{12.3}$	B1	Subtraction
	$\begin{array}{r l} \text{No} & \log \\ \hline 7.939 & 0.8998 \\ 12.3 & 1.0899 \end{array}$	B	Logs
	$\frac{7.939}{12.3} = \frac{1.0899}{1.0899} = 1$	M1	Divide by 3
	$\frac{1}{3} = 0.3333$	A1	Ans
	$= -0.8635$	4	

2.	$5x - 3(3x - 7) = 3(x - 2)$ $5x - 9x + 21 = 3x - 6$ $-7x = -27$ $x = 3^{6/7}$	M1 M1 A1 3	Multiplication Removal () Ans
3.	$3x + 5y + x = 180$ $9x = 180$ $x = 20$ $y = 60$	M1 A1 B1 3	Eqn X B
4.	$\frac{3V}{4\pi} \cdot \frac{1}{3} \left(\right) r =$ $\frac{S}{4\pi} \cdot \frac{1}{2} r = -$ $\therefore \frac{3V}{4\pi} \cdot \frac{1}{3} \left(\right) = \frac{S}{4\pi}$ $\frac{3V}{4\pi} = \frac{S}{4\pi}$ $\frac{3}{2} \frac{V}{4\pi} = \frac{4\pi}{3}$ $\frac{S}{4\pi} \cdot \frac{3}{2} V = \frac{4\pi}{3}$	B1 M1 A1 3	Value r Equation Expression
5.	Grad line $= \frac{1}{4}$ $\frac{y-2}{x-5} = \frac{1}{4}$ $y = \frac{1}{4}x + \frac{3}{4}$	M 1 A1 A1 3	Equation Equation K
6.	P in Alloy $= \frac{4}{10} \times 800$ $= 320g$ $= \frac{100 \times 320}{20}$ $= 3.2 \text{ kg}$	B1 M1 A1	P in alloy Expression Ans
7.	B (a,b), $a - 2$ C (x,y) $= 5$	B1	B conduct

	$\begin{pmatrix} .b - 8 \\ x - 8 \\ y - 6 \end{pmatrix} \begin{pmatrix} .a \\ \end{pmatrix} = 8 \quad \begin{matrix} -2 \\ b = 6 \end{matrix} \quad B(8, 6)$ $\begin{pmatrix} x - 8 \\ y - 6 \end{pmatrix} = \frac{3}{4}$ $x = 11, \quad y = 10 \quad c(11, 10)$	M1 A1 3	Formular C
8.	 $\begin{aligned} .h &= x \tan 70 \\ h &= (80 - x) \tan 60 \\ \therefore x \tan 70 &= 80 \tan 60 - x \tan 60 \\ 2.7475x + 1.732x &= 138.6 \\ 4.4796 x &= 138.6 \\ .h &= \frac{138.6}{4.4796} \times \tan 60 \\ &= 53.59 \end{aligned}$	B1 M1 M1 A1 4	Expression for h both Equation Expression for h Ans
9.	$\begin{aligned} 2\pi r &= \frac{90}{360} \times 2\pi \times 50 \\ r &= 12.5 \\ h &= \sqrt{2500 - 156.25} \\ &= \sqrt{2343.75} \\ &= 48.41 \text{ cm} \end{aligned}$	M1 P A1 M1 A1 4	Equation .r expression for h ans
10.	$\begin{aligned} 100n &= 302.323 \\ \frac{n}{99n} &= \frac{3.023}{299.3} \\ n &= \frac{2993}{990} \\ &= 3^{23}/990 \end{aligned}$	M1 A1 4	Equation Ans
11.	$\begin{aligned} AB \begin{pmatrix} \end{pmatrix} &= \begin{matrix} 3-1 \\ 5-9 \\ 2 \\ -4 \end{matrix} \\ BC \begin{pmatrix} \end{pmatrix} &= \begin{matrix} 4 \\ -8 \end{matrix} \\ AB &= \frac{1}{2} BC \\ \therefore AB // BC \\ \text{But B is common} \\ \therefore A, B, C \text{ are collinear.} \end{aligned}$	B1 B1	A B & BC Both

	$0 = 3x^2 - 3x - 2$ $y = x + 3$	S1 P1 C1 L1 B1 8	Scale Plotting Smooth curve Line drawn Value of r
21.	$.h = \frac{\frac{3}{4} \pi \times 18 \times 18 \times 18}{\pi \times 0.04 \times 0.04}$ $= \frac{24 \times 18 \times 18 \times 18}{0.04 \times 0.04 \times 100}$ $= 48,600\text{m}$ $\text{density} = \frac{4}{3} \times \frac{22}{7} \times \frac{18 \times 18 \times 18}{1000} \times 15 \text{ kg}$ $= 122.2\text{kg}$	M1 M1 M1 M1 A1 M1 M1 A1 8	N of wire ÷ to length in cm ÷ for length converting to metres length expression for density conversion to kg ans
22.	 $H = \sqrt{15^2 - 9^2}$ $= \sqrt{144}$ $= 12$ $\frac{x}{6} =$ $X =$ $4.5 \text{ Volume} = \frac{1}{3} \times \frac{22}{7} \times (81 \times 12 - 20.25 \times 6)$ $= \frac{22}{21} (972 - 121 \cdot 5)$ $= 891 \text{ cm}^3$	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 $\frac{d-0}{c-5} = -2$ $.d-0 = \frac{1}{2}$	B1 M1	Ans . Expression both correct

	$c+5$			
	$d+2c = 10$		M1	Equation
	$2d - c = 5 \times 2$	-		
	$4d - 2c = 10$			
	$5d = 20$			
	$d = 4$		A1	Ans
	$c = 3$			
	Q (3, 4)			
	$\frac{x+3}{2}, \frac{y+4}{2} = (0,0)$		M1	
	$x = -3, y = -4 \therefore s(-3 -4)$		A1	
			M1	Expression
	(b) $\frac{y-4}{x-3} = \frac{8}{6}$		A1	Equation
	$3y = 8x - 12$		8	

MATHEMATICS IV
PART II
MARKING SCHEME

1.	$\frac{784 \times 27}{187500} =$ $\sqrt{\frac{784 \times 9}{62500}} = \frac{4 \times 7 \times 3}{250}$ $\frac{42}{125} =$ $0.336 =$	M1 M1 A1	Factors for Fraction or equivalent C.A.O
		3	
2.	Father $3x$, r son $= x$ $2(x+10) = 3x+10$ $2x+20 = 3x+10$ $x = 10$ father $= 30$	M1 A1 B1	Expression
		3	
3.	$3 = \sin 60$ $AE = 3$ $\sin 60 = 3.464$ $\text{perimeter} = 5 \times 2 + 3.464 \times 3$ $= 10 + 10.393$ $= 20.39$	M1 A1 B1	Side of a triangle Perimeter
		3	
4.	$a^3 - b - 2c^2 = (-2)^3 - 3 - 2(-1)^2$	M1	Substitution

	$2b^2 - 3a^2c$ $\frac{2(3)^2 - 3(-2)^2(-1)}{18 + 12}$ $= \frac{-8 - 3(-2)}{30}$ $= \frac{-13}{30}$	M1 A1	Signs C.A.O
		3	
5.	Ksh 189,000 = \$ 189,000 75.6 balance = \$ 2500 = \$ 2500 = Kshs. 189,000 Kshs. 189,000 = <u>189,000</u> 115.8 Uk £1632	M1 A1 M1 A1 A1 <u>4</u>	Conversion Conversion
6.	Area of 2 triangles = $2 \left(\frac{1}{2} \times 8 \times 5 \sin 60 \right)$ = $40 \sin 60$ = 40×0.8660 = 34.64 cm^2 Area of rectangle = $300 \times 8 + 300 \times 5 + 300 \times BC$ BC = $\sqrt{64 + 25 - 2 \times 40 \cos 60}$ = $\sqrt{89 - 80 \times 0.5}$ = $\sqrt{89 - 40}$ = $\sqrt{49}$ = 7 Total S.A. = $300(8+5+7) + 34.64$ cm^2 = $6000 + 34.64$ = 6034.64 cm^2	M1 M1 M1 A1	Areas of Δ B.C. expression Area
		4	
7.	$AF^2 = 3^2 + 4^2 - 2 \times 12 \times \cos 50$ = $25 - 24 \times 0.6428$ = $25 - 15.43$ = 9.57 AF = 3.094×50 AF = 154.7m Sin Q = $\frac{200 \sin 50^\circ}{154.7}$ = 0.9904 Q = 82.04° Bearing = 117.96°	M1 A1 M1 A1 B1	Bearing
		5	
8.	(i) No. of white = w $\frac{w}{w+9} = \frac{2}{3}$ $3w = 2w + 18$ w = 18	M1	

	(ii) $p(\text{different colour}) = p(\text{WB N BW})$ $\frac{9}{25} + \frac{9}{27} \times \frac{18}{25} = \frac{2}{3} \times \frac{12}{25}$	A1 M1 A1	
		4	
9.	A.sf $= \frac{1}{49}$ smaller area $= 1 \times 441 \pi$ $\pi r^2 = 9\pi$ $\frac{r^2}{r} = \frac{9}{3}$	M1 M1 A1	
		3	
10.	Largest area $= 22 \times (14.5)^2$ $= 660.8 \text{ cm}^2$ smallest area $= \frac{22}{7} \times (13.5)^2$ $= 572.8$ $572.8 \leq A \leq 660.81$	M1 M1 A1	
		3	
11.	$(1+2x)^5 = 1 + 5(2x) + 10(2x)^2 + 10(2x)^3$ $= 1 + 10x + 40x^2 + 80x^3$ $2.045^5 = 1 + 2(0.52)^5$ $= 1 + 10(0.52) + 40(0.52)^2 + 80(0.52)^3$ $= 1 + 5.2 + 10.82 + 11.25$ $= 28.27$	M1 A1 M1 A1	
		4	
12.	$T_n = 5 \times 2^{n-2}$ (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 $= 2 \times 3 \times 5 = 180 \text{ min}$ $= 3 \text{ hrs}$ 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 $= 200 \times 200 \times 40 \text{ m}^2$ $= \frac{200 \times 200 \times 40}{100 \times 100}$ $= 320 \text{ ha}$	M1 M1 A1	Area in m^2 Area in ha CAO
		3	
15.	$3p + 2r = 13$	M1	

	$\frac{p+2r}{2p} = \frac{9}{4}$ $\frac{p}{r} = \frac{9}{8}$ $\frac{p}{r} = 3.50$	A1 B1	
		3	
16.	$110 + 100 + 130 + 2x + 3x = 540$ $5x = 200$ $x = 40$ $2x, 3x = 80 \text{ and } 120$	M1 A A1 2	
17.	Contribution / person = <u>180,000</u> X New contribution = <u>180,000</u> $\frac{180,000}{x-2} - \frac{180,000}{x} = 24,000$ $180,000x - 180,000(x-2) = 24,000(x-2)x$ $24,000x^2 - 48,000x - 360,000 = 0$ $x^2 - 2x - 15 = 0$ $x^2 - 5x + 3x - 15 = 0$ $x(x-5) + 3(x-5) = 0$ $(x+3)(x-5) = 0$ 3 remaining members = 5-2 = 3	B1 B1 M1 M1 A1 M1 A1 B1	'C' eqn mult eqn factor both ans remaining members
		8	
18.	(a) P(3 white) = $\frac{8}{13} \times \frac{7}{12} \times \frac{6}{11} = \frac{28}{132}$ (b) P(at least 2 blue) = p(WBB or BBW or BWB) or BBB $= \frac{8}{13} \times \frac{5}{12} \times \frac{4}{11} + \frac{5}{13} \times \frac{8}{12} \times \frac{4}{11} + \frac{5}{13} \times \frac{8}{12} \times \frac{4}{11}$ $= \frac{204}{143}$ (c) p(2 white and one blue) = p(WWB or WBW or BWW) $= \frac{8}{13} \times \frac{7}{12} \times \frac{5}{11} + \frac{8}{13} \times \frac{5}{12} \times \frac{7}{11} + \frac{5}{13} \times \frac{8}{12} \times \frac{7}{11}$ $= \frac{3 \times 8 \times 7 \times 5}{13 \times 12 \times 11}$	M1 A1 M1 M1 A1 M1 M1 A1	

	$= \frac{70}{143}$		
		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 = $\frac{700 \times 15}{20}$ = 525 (c) Cost of 525 cartons = $525 \times 100 + 800 \times 525$ + transport = 10,500+420,000 = 430,500 sale price = $\frac{120}{4.30,500} \times 100$ = sh 516,600 s.p of a carton = $\frac{516,600}{525}$ = sh. 984	M1 A1 M1 A1 B1 M1 M1 A1	
		8	
20.	(a) Maina`s tax dues = $1800 \times \frac{10}{100}$ = 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 = $\frac{10}{100} \times 2100$ + $\frac{15}{100} \times 1980$ = 210 + 297 =	M1 A1 M1 A1 M1 M1 A1 B1	1st slab 2nd slab

	507			
	Tax relief	=	270-	
	Tax paid	=	237	
			8	
21.	(a) PQ	=	$-\frac{3}{5}a + \frac{3}{1}b$	B1
		=	$\frac{3}{5}a - \frac{3}{2}b$	M1
	(b) OR	=	$ha + hb$	A1
		=	$a - ha + hb$	M1
		=	$(1-h)a + hb$	A1
	(c) OR	=	$\frac{3}{5}a + k$	M1
	$(\frac{3}{2}b - \frac{3}{5}a)$	=	$(\frac{3}{5} - \frac{3}{5}k)a + 3kb$	A1
	(d)	$1 - h$	= $\frac{3}{5} - \frac{3}{5}k$	B1
	(i)	$3k$	= h	
	(ii)			
	Sub (i)	$1 - 3k$	= $\frac{3}{5} - \frac{3}{5}k$	
		$5 - 15k$	= $3 - 3k$	
		$12k$	= 2	
		k	= $\frac{1}{6}$	
		h	= $\frac{1}{2}$	
			8	
22.	P(ABC) =	$\begin{vmatrix} 0 & -1 & 1 & 4 & 3 \\ -3 & 1 & 0 & 3 & 1 & 3 \end{vmatrix}$	= $\begin{vmatrix} -3 & -1 \\ -6 & -2 \end{vmatrix}$	M1
				A1
	Q(A ¹ B ¹ C ¹) =	$\begin{vmatrix} a & b & c & d \\ -3 & -1 & -3 & 1 & 4 & 3 \end{vmatrix}$	= $\begin{vmatrix} -6 & -2 \\ -6 & -2 \end{vmatrix}$	M1
				M1
	$\Rightarrow -3a + b = -6$	$-3c + d = 2$		
	$-a + 4b = -2 \times 3$	$-c + 4d = 8 \times 3$		
	$-3a + 12b = -6$	$-3c + 12d = 24$		A1
	$11b = 0$			
	$-11d = -22$			
	$b = 0$			B1
	$d = 2$			
	$a = 2$			
	$d = 2$			
	$c = 0$			B1
	Q =	$\begin{vmatrix} 2 & 0 \end{vmatrix}$		

	0 2	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	

SECTION 1 (52 MARKS)

1. Use logarithms to evaluate $\left(\frac{13.6 \cos 40}{63.4} \right)^{0.25}$ (4mks)
2. Solve for x in the equation $(x + 3)^2 - 5(x + 3) = 0$ (2mks)
3. In the triangle ABC, AB = C cm. AC = b cm. $\angle BAD = 30^\circ$ and $\angle ACD = 25^\circ$. Express BC in terms of b and c. (3mks)

4. Find the equation of the normal to the curve $y = 5 + 3x - x^3$ when $x = 2$ in the form $ay + bx = c$ (4mks)
5. Quantity P is partly constant and partly varies inversely as the square of q. $q = 10$ and $p = 5\frac{1}{2}$ when $q = 20$. Write down the law relating p and q hence find p when q is 5. (4mks)
6. Solve the simultaneous equation below in the domain $0 \leq x \leq 360$ and $0 \leq y \leq 360$
 $2 \sin x + \cos y = 3$
 $3 \sin x - 2 \cos y = 1$ (4mks)
7. Express as single factor $\frac{2}{x+2} - \frac{x+2}{x^2+3x+2} + \frac{1}{x+1}$ (3mks)
8. By use of binomial theorem, expand $(2 - \frac{1}{2}x)^5$ up to the third term, hence evaluate $(1.96)^5$ correct to 4 sf. (4mks)
9. Points A(1,4) and B (3,0) form the diameter of a circle. Determine the equation of the circle and write it in the form $ay^2 + bx^2 + cy + dy = p$ where a, b, c, d and p are constants. (4mks)
10. The third term of a GP is 2 and the sixth term is 16. Find the sum of the first 5 terms of the GP. (4mks)
11. Make T the subject of the formulae $\frac{1}{T^2} = \frac{3m}{R} + \frac{2}{N}$ (3mks)
12. Vectors, $a = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$ $b = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$ and $c = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$
13. By expressing a in terms of b and c show that the three vectors are linearly dependent. (3mks)
 A cylindrical tank of base radius 2.1 m and height is a quarter full. Water starts flowing into this tank at 8.30 a.m at the rate of 0.5 litres per second. When will the tank fill up? (3mks)
14. A piece of wood of volume 90cm^3 weighs 54g. Calculate the mass in kilograms of 1.2 m^3 of the wood. (2mks)
15. The value of a plot is now Sh 200,000. It has been appreciating at 10% p.a. Find its value 4 years ago. (3mks)
16. 12 men working 8 hours a day take 10 days to pack 25 cartons. For how many hours should 8 men be working in a day to pack 20 cartons in 18 days? (2mks)

SECTION II (48MARKS)

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

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

Maina earns Sh. 8100 per month and a house allowance of Sh. 2400. He is entitled to a tax relief of Sh.

800 p.m. He pays service charge of Sh 150 and contributes Sh 730 to welfare. Calculate Mwangis net salary per month. (8mks)

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

(i) OR (1mk)
(ii) AP (1mk)

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

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

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

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

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

(a) They are of the same colour. (4mks)
(b) At least one is blue (2mks)
(c) At most 2 are red (2mks)

21. Point P($50^\circ N$, $10^\circ W$) 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 $M = \begin{pmatrix} -1 & 0 \\ 0 & -2 \end{pmatrix}$ $A^1B^1C^1D^1$ is mapped onto $A^{11}B^{11}C^{11}D^{11}$. Draw on the given grid

(a) ABCD, $A^1B^1C^1D^1$ and $A^{11}B^{11}C^{11}D^{11}$ (4mks)
(b) If area of ABCD is 8 square units, find area of $A^{11}B^{11}C^{11}D^{11}$. (3mks)
(c) What single transformation matrix maps $A^{11}B^{11}C^{11}D^{11}$ onto $A^1B^1C^1D^1$ (1mk)

MATHEMATICS V

PART II

SECTION 1 (52 Marks)

1. Evaluate without using mathematical tables $(2.744 \times 15^{5/8})^{1/3}$ (3mks)
2. If $4 \leq x \leq 10$ and $6 \leq y \leq 7.5$, calculate the difference between highest and least
 - (i) xy (2mks)
 - (ii) y/x (2mks)
3. A 0.21 m pendulum bob swings in such a way that it is 4cm higher at the top of the swing than at the bottom. Find the length of the arc it forms. (4mks)
4. Matrix $\begin{pmatrix} 1 & 2x \\ x+3 & x^2 \end{pmatrix}$ has 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 $\tan x = \frac{5}{12}$, find the value of $\frac{1}{1 - \sin x}$ $\sin x + 2\cos x$, 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. A 2^2 digit number is such that the tens digit exceeds the unit by two. If the digits are reversed, the number formed

- is smaller than the original by 18. Find the original number. (4mks)
12. Without using logarithm tables, evaluate $\log_5 (2x-1) - 2 + \log_5 4 = \log_5 20$ (3mks)
13. Mumia's sugar costs Sh 52 per kg while imported sugar costs Sh. 40 per kg. In what ratio should I mix the sugar, so that a kilogram sold at Sh. 49.50 gives a profit of 10%. (4mks)
14. The interior angles of a regular polygon are each 172° . Find the number of sides y lie polygon. (2mks)
15. Evaluate $2x = \frac{2}{6.341} + \frac{3}{9.222}$ (2mks)
16. A water current of 20 knots is flowing towards 060° . A ship captain from port A intends to go to port B at a final speed of 40 knots. If to achieve his own aim, he has to steer his ship at a course of 350° . Find the bearing of A from B. (3mks)

SECTION II (48 MARKS)

17. 3 taps, A, B and C can each fill a tank in 50 hrs, 25 hours and 20 hours respectively. The three taps are turned on at 7.30 a.m when the tank is empty for 6 hrs then C is turned off. Tap A is turned off after four hours and 10 minutes, later. When will tap B fill the tank? (8mks)
18. In the domain $-5 \leq x \leq 4$, draw the graph of $y = x^2 + x - 8$. On the same axis, draw the graph of $y + 2x = -2$. Write down the values of x where the two graphs intersect. Write down an equation in x whose roots are the points of intersection of the above graphs. Use your graph to solve. $2x^2 + 3x - 6 = 0$. (8mks)
19. The average weight of school girls was tabulated as below:

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

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

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

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

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

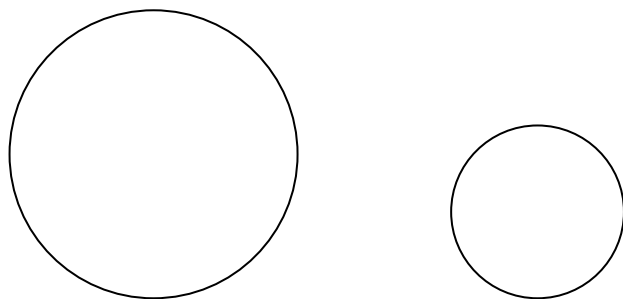
21. The diagram below is a clothing workshop. $\angle ECJ = 30^\circ$ AD, BC, HE, GF are vertical walls. ABHG is horizontal floor. AB = 50m, BH = 20m, AD = 3m

- (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

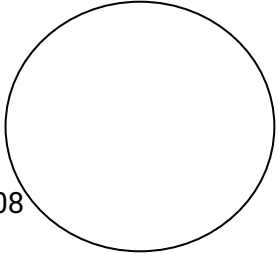
1	SOLUTION	MKS	AWARDING
	No Log 13.6 1.1335 + Cos 40 1.8842 1.0177 - 63.4 1.8021 1.2156 (4 + 3.2156) ^{1/4} 1.8039 Antilog 0.6366	B1 M1 M1 A1	Log + divide by 4 C.A.O
		4	
2.	$(x + 3)(x + 3 - 5) = 0$ $(x + 3)b(x - 2) = 0$ $x = -3$ or $x = 2$	M1 A1	Factors Both answers
3	$BD = C \sin 30 = 0.05$ $CD = b \cos 25$ $= 0.9063b$ $BC = 0.9063b + 0.5 C$	B1 B1 B1	BD in ratio from CD in ratio form Addition
		3	
4	$\frac{dy}{dx} = 3 - 3x^2$ $x = 2$, grad = <u>1</u> 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	$4 \sin x + 2 \cos y = 6$ $3 \sin x - 2 \cos y = 1$ $7 \sin x = 7$ $\sin x = 1$ $X = 90$ $\cos y = 1$ $Y = 0^\circ$	M1 M1 A1 B1	Elim Sub
7	$\frac{2(x+1) - 1(x+2) + x + 2}{(x+2)(x+1)}$	M1	Use of ccm

	$= \frac{2x+2-x-2+x}{(x+2)(x+1)} = \frac{2x+2}{(x+2)(x+1)}$ $= \frac{2}{x+2}$	M1 A1	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	
10	$ar^2 = 2, ar^5 = 16$ $a = \frac{2}{r^2} \therefore \frac{2}{r^2} r^5 = 16$ $2r^3 = 16$ $r^3 = 8$ $r = 2, a = \frac{1}{2}$ $S_5 = \frac{1}{2} (1 - (\frac{1}{2})^5)$ $= 1 - \frac{1}{32}$ $= \frac{31}{32}$	M1 A1 M1 A1	Both Sub CAO
		4	
11	$NR - 3MT^2 = 2RT^2$ $T^2(2R + 3M) = NR$ $T^2 = \frac{NR}{2R + 3M}$ $T = \sqrt{\frac{NR}{2R + 3M}}$	M1 M1 A1	X mult 7^2 ans
		3	
12	$\begin{pmatrix} 2 \\ 2 \end{pmatrix} = m \begin{pmatrix} 2 \\ 0 \end{pmatrix} + n \begin{pmatrix} +n \\ 0 \end{pmatrix}$ $2 = 2m + 6n$ $2 = 0 + 4n$ $n = \frac{1}{2}$ $m = -\frac{1}{2}$ $\therefore a = -\frac{1}{2}b + \frac{1}{2}c$ $\therefore a, b, c$ are linearly dep	M1 A1 B1	
		3	
13	Volume = $\frac{22 \times 2.1 \times 2.1 \times 2 \times \frac{3}{4} m^3}{7}$ Time = $\frac{11 \times 0.3 \times 2.1 \times 3 \times 1,000,000}{500 \times 3600}$ $= 11.55$	M1 M1	

	$= 11.33 \text{ hrs}$ time to fill = 8.03 pm	A1															
		3															
14	Mass = $\frac{54}{90} \times \frac{1.2 \times 1,000,000}{1000}$ $= 720\text{kg}$	M1 A1															
		2															
15	$V_3 = P$ $P(0.9)^3 = 200,000$ $P = \frac{200,000}{0.9^3}$ $= \frac{200,000}{0.729}$ $= \text{Sh } 274,348$	M1 M1 A3															
		3															
16	No of hours = $\frac{8 \times 12 \times 10 \times 20}{8 \times 18 \times 25}$ $= \frac{19200}{3600}$ $= 5\text{hrs}, 20 \text{ min}$	M1 A1															
		2															
17	Taxable income = $8100 + 2400$ $= \text{sh. } 10,500$ $= \text{£}6300$ Tax dues = $\frac{\text{Sh } 1980 \times 2 + 1980 \times 3 + 1980 \times 5 + 3670}{7}$ $= \frac{22320}{12}$ $= \text{Sh } 1860$ net tax = $1860 - 800 \text{ p.m.}$ $= \text{Sh } 1060$ Total deduction = $1060 + 150 + 730$ $= 1940$ Net salary = $10,500 - 1940$ $= \text{Sh } 8560 \text{ p.m.}$	B1 M1 M1 A1 B1 B1 M1 A1	Tax inc 2 2 net tax total dedu.														
		8															
18	OR = $\frac{2}{3}a + \frac{1}{3}b$ or $(\frac{1}{3}(2a + b))$ AP = $\frac{2}{5}b - a$ OY = m OR = $A + n(\frac{2}{5}b - a)$ $\frac{2}{5}mb + ma = (1 - n)a + \frac{2}{5}nb$ $\frac{2}{5}m = \frac{2}{5}n$ $m = n$ $\therefore m = 1 - m$ $2m = 1$ $m = \frac{1}{2} = n$ $\frac{1}{2} \text{ AP} = \text{Ay}$ AY:AP = 1:1	B1 B1 B1 M1 M1 A1 A1 B1	EXP, OY Eqn M = n Sub CAO Ratio														
		8															
19	<table><tr><td>Log x</td><td>1.699</td><td>0</td><td>0.3010</td><td>0.4771</td><td></td><td>1</td></tr><tr><td>Log y</td><td>0.301</td><td>0.9031</td><td>1.5052</td><td></td><td>2.301</td><td>2.9031</td></tr></table>	Log x	1.699	0	0.3010	0.4771		1	Log y	0.301	0.9031	1.5052		2.301	2.9031		
Log x	1.699	0	0.3010	0.4771		1											
Log y	0.301	0.9031	1.5052		2.301	2.9031											

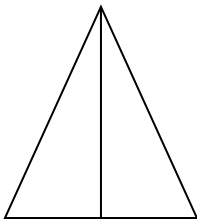
$\log y = n \log x + \log a$ $\log a = 0.9031$ $A = 8$ $\text{Grad} = \frac{1.75 - 0.5}{0.4 + 0.2}$ $= \frac{1.25}{0.6}$ $= 2.08$ $n = 2$ $\therefore y = 8x^2$ $x = 3 \quad y = 8 \times 3^2 = 72$ $y = 200 \quad x = 5$	B1 B1 B1 B1 S1 P1 L1	$\log x$ $\log y$ A N Missing x and y Scale Points Line
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		8	
20	P (same colour) = P (XRRrr or XBB or YXX or YBB)	M1	Any 2

	$= \frac{1}{2} \left(\frac{2}{5} \times \frac{1}{4} + \frac{3}{5} \times \frac{2}{4} \right) \times 2$ $= \frac{2}{20} + \frac{6}{20}$ $= \frac{8}{20}$ $= \frac{2}{5}$ (b) $P(\text{at least 1B}) = 1 - P(\text{non blue})$ $= 1 - P(\text{XRR or YRR})$ $= 1 - \frac{1}{2} \left(\frac{2}{5} \times \frac{1}{4} \right) \times 2$ $= 1 - \frac{1}{10}$ $= \frac{9}{10}$ (c) $P(\text{at most 2 Red}) = 1 - P(\text{BB})$ $= 1 - \frac{1}{2} \left(\frac{3}{5} \times \frac{2}{4} \right)^2$ $= 1 - \frac{6}{20}$ $= \frac{14}{20} \text{ or } \frac{7}{10}$	M1 M1 A1 M1 A1 M1 A1	Any 2 Fraction
		8	
21	(a) $PQ = 1800\text{nm}$ $\theta = \frac{1800}{60 \times 0.6428}$ $= 46.67$ $= 47^\circ$ Q (50°N, 37°E) (b) Time diff = 47×4 $= 3.08$ Time at P = 9.12am (c) $QR = 2700 \text{ nm}$ $x^\circ = \frac{2700}{60}$ $= 45^\circ$ R (85°N, 133°W) 	M1 A1 M1 A1 M1 A1 B1	
		8	
22		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	

24	$\begin{pmatrix} 2 & 2 & 1 & 3 & 3 \\ 1 & 3 & 1 & 1 & 2 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 4 & 8 & 10 & 6 \\ 4 & 6 & 9 & 7 \end{pmatrix} \begin{pmatrix} A^1 B^1 C^1 D^1 \\ A^{11} B^{11} C^{11} \end{pmatrix}$ $\begin{pmatrix} D^{11} \\ -1 \\ 0 \end{pmatrix} \begin{pmatrix} 4 & 8 & 10 & 6 \\ 4 & 6 & 9 & 7 \end{pmatrix} = \begin{pmatrix} -4 & -8 & -10 & -6 \\ -8 & -12 & -18 & -14 \end{pmatrix}$ $NM = \begin{pmatrix} -1 \\ 0 \end{pmatrix} \begin{pmatrix} 2 & 2 \\ 0 & -2 \end{pmatrix} \begin{pmatrix} 1 \\ 3 \end{pmatrix}$ $\begin{pmatrix} -2 \\ 2 \end{pmatrix} \begin{pmatrix} -2 \\ -6 \end{pmatrix}$ (b) $\det = \text{Asf} = 12 - 4 = 8$ Area $A^{11} B^{11} C^{11} D^{11} = 8 \times 8$ $= 64 \text{ U}^2$ (c) Single matrix = Inv N $\begin{pmatrix} 1 & -2 \\ 0 & -1 \end{pmatrix} = \frac{1}{2} \begin{pmatrix} -2 & 0 \\ 0 & -1 \end{pmatrix}$ $\begin{pmatrix} -1 & 0 \\ 0 & -\frac{1}{2} \end{pmatrix}$	B1 B1 B1 M1 A1 B1	Product Product Det Inverse
23	$Ds = 20t - 3t^2 + 8 = 0$ $Dt \quad 3t^2 - 20t - 8 = 0$ $T = 20 \quad \frac{\sqrt{400 + 4 \times 3 \times 8}}{6}$ $t = 7.045 \text{ sec}$ $\text{max vel} = 148.9 - 140.9 - 8 = 0.9 \text{ m/s}$ $\frac{d^2 s}{dt^2} = 6t - 20$ $\text{when } t = 3 \quad a = -2 \text{ m/s}^2$ $6t - 20 = 0$ $6t = 20$ $t = 3 \frac{2}{3} \text{ sec}$	M1 A1 M1 A1 M1 A1 M1 A1	
		6	
		8	

MATHEMATICS V
PART II
MARKING SCHEME

No	Solution	Mks	Awarding
1	$\frac{2744 \times 125}{1000 \times 8}^{1/3}$ $\frac{2744}{1000}^{1/3} \times \frac{5^3}{2^3}^{1/3}$ $\left(\frac{2^3 \times 7^3}{103}\right)^{1/3} \times \frac{5}{2}$ $\frac{2 \times 7}{10} \times \frac{5}{2} = 3.5$	M1 M1 A1	Factor Cube root
		3	
2	(i) Highest – $10 \times 7.5 = 75$ Lowest – $6 \times 4 = 24$ – 51 (ii) Highest = $\frac{7.5}{4} = 1.875$ Lowest = $\frac{6}{10} = \frac{0.600}{10} = 1.275$	M1 A1 M1 A1	Highest Fraction
		4	
3	$\cos \theta = \frac{17}{21} = 0.8095$ $\theta = \cos^{-1} 0.8095$ $= 36.03^\circ$ 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. $\angle MBA = \angle MAC = \frac{180 - \theta}{2}$ base angles of isos 's AMC and 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															

	$90(2n - 4) \times 90 = 172$ n $180n - 360 = 172n$ $180n - 172n = 360$ $8n = 360$ $n = 45$	M1	
		2	
15	$2x = 2. \frac{1}{6.341} + 3. \frac{1}{9.22}$ $2x = 2 \times 0.1578 + 3 \times 0.1085$ $= 0.3154 + 0.3254$ $= 0.6408$ $x = 0.3204$	B1 A1	Tables
		2	
16	Bearing 140° $\sin \theta = \frac{20 \sin 110}{40}$ $= 0.4698$ $= 228.02$ Bearing of A from B = 198.42	M1 A1 B1	
		3	
17	Points that each tap fills in one hour $A = \frac{1}{50}$ $B = \frac{1}{25}$ $C = \frac{1}{20}$ In one hour all taps can fill = $\frac{1}{50} + \frac{1}{25} + \frac{1}{20} = \frac{11}{50}$ 25 $\frac{20}{100}$ 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 25 $\frac{50}{6}$ In $4\frac{1}{6}$ hrs, A and B = $\frac{25 \times 3}{6} + \frac{1}{6}$ 6 50 4 Parts remaining for B to fill = $1 - \frac{33}{50} + \frac{1}{6} = 1 - \frac{91}{100} = \frac{9}{100}$ parts Time taken = $\frac{9}{100} \times \frac{25}{1}$ hrs = $2\frac{1}{4}$ hrs 7.30 am 6.____ hrs 13.30 4.10 5.40pm 2.15 7.55 pm	M1 B1 B1 M1 A1	
		8	
18			

x	-5	-4	-3	-2	1	0	1	2	3	4	-0.5
$y = x^2 + x - 8$	+12	+4	-2	-6	-8	-8	-6	-2	-4	12	-8.25
$Y = -2 - 2x$	8	6	4	2	0	-2	-4	-6	-8	-10	

$$x^2 + x - 8 = -2 - 2x$$

$$y = x^2 + 3x - 6$$

Points of intersection (-4, 1.4)

$$y = x^2 + x - 8 = 2x^2 + 3x - 6$$

$$x^2 + 2x + 2$$

$$y = x^2 + x - 8 \times 2$$

$$2y = 2x^2 + 2x - 16$$

$$0 = 2x^2 + 3x - 6$$

$$2y = -x - 10$$

$$y = -2.6$$

$$Ny = 1.2$$

B1

B1

Eqn
Point of inter

B1

Line eqn

B1

Both

4

19

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

$$= 45.9$$

$$(ii) \text{ Standard deviation} = \sqrt{\frac{3575}{50} - \left(\frac{-55}{50}\right)^2}$$

$$= \sqrt{70.29}$$

$$= 8.3839$$

$$= \sqrt{71.5} - 1.21$$

M1

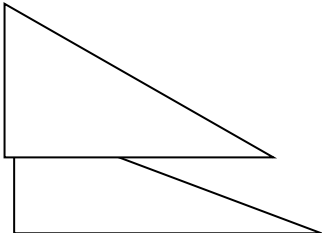
A1

B1

8

20

X	0	15	30	45	60	75	90	105	120	135	150
A cos (x - 15)	.97	1.0	.97	.87	0.71	0.5	0.26	0	-0.26	-0.5	-0.71
Bsin (x + 30)	0.5	.71	.87	.97	1.00	.97	0.87	0.71	0.5	0.26	
Bsin (x + 30)	1.0	1.4	1.7	1.93	2.00	1.9	1.7	1.4	1.00	.52	0.00

	(a) $a = 1$ $b = 2$ $\frac{1}{2} \cos (x - 15) = \sin (x + 30)$ has no solution in the domain	B1 B1 B1 B1	All All A & b																
		8																	
21	(a) $0 \cos 30 = 20$ $X = \frac{20}{0.866}$ $= 23.09$ $DE = \sqrt{50^2 + 23.09^2}$ $= \sqrt{2500 + 533.36}$ $= \sqrt{3033.36}$ $= 55.076m$ (b) $GB = \sqrt{20^2 + 50^2}$ $= 53.85$ $\tan \theta = \frac{53.85}{14.55}$ $= 0.27019$ $\theta = 15.12^\circ$ 	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) $A + B = 16$ $5A + 3B \geq 50$ $2A + 3B = 35$ (b) 14 vehicles (c) A - 6 vehicles B - 8 Cost = $6 \times 1000 + 8 \times 1200$ $= 6000 + 9600$ $= 15,600/=$ <table border="1" data-bbox="516 1249 901 1423"> <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>		A	B	Total	People	10	6	100	Load	200	300	3500	No. of vehicles			16	B1 B1 B1 M1 A1	In equation 3 Vehicles
	A	B	Total																
People	10	6	100																
Load	200	300	3500																
No. of vehicles			16																
		8																	
23																			

	$\frac{x}{12 - x} = \frac{8}{3}$ $= 8.727$ $\text{FBX} = \frac{3}{3.273} = 0.9166 = 23.57$ $3\text{FBX} = 47.13$ $\text{Reflex } \angle \text{FBD} = 312.87$ $\text{Reflex arc FD} = \frac{312.87}{360} \times 22 \times 6 = 16.39\text{cm}$ $\text{Reflex Arc CE} = \frac{312.87}{360} \times 22 \times 16 = 43.7\text{cm}$ $\text{FE (tangent)} = \sqrt{144 - 121} = \sqrt{23} = 4.796\text{cm}$ $2 \text{ FE} = 9.592$ $\text{Total length} = 9.592 + 4.796 + 43.7 + 16.39 = 74.48 \text{ cm}^2$	M1 A1 M1 A1 M1 A1 M1 A1	
		8	

24

$$(a) \frac{200}{\sin 50} = \frac{40}{\sin \theta}$$

$$\sin \theta = \frac{40 \sin 50}{200}$$

$$= \frac{0.7660}{5}$$

$$= 0.1532$$

$$\theta = 8.81^\circ$$

$$\angle ACB = 180 - (50 + 8.81)^\circ$$

$$= 121.19^\circ$$

$$\frac{x}{\sin 121.19} = \frac{200}{\sin 50}$$

$$x = \frac{200 \times \sin 121.19}{\sin 50}$$

$$= \frac{200 \times 0.855645}{0.7660}$$

$$= 223.36 \text{ Km/h}$$

$$(b) \text{ Course} = 330^\circ - 8.81^\circ$$

$$= 321.19^\circ$$

$$(c) \text{ Time} = \frac{600}{321.19^\circ}$$

$$= 2.686 \text{ hrs}$$

M1

A1

M1

M1

A1

B1

M1

A1

8

MATHEMATICS VI

PART I

SECTION I (52 MARKS)

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

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

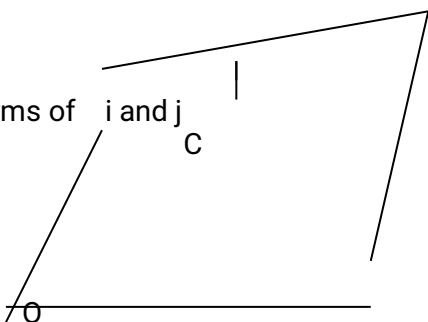
(2 Mks)

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.

Find in terms of i and j



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

M In quadrilateral

$$AB = 3OC, \text{ cm: mB} = 2:3.$$

vector Om (3 Mks)

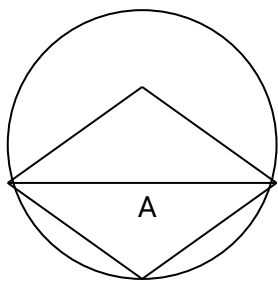
4. By matrix method, solve the equations

$$5x + 5y = 1$$

$$4y + 3x = 5$$

(3 Mks)

5.



$$\angle ABC = 126^\circ.$$

In the given circle centre O,

Calculate $\angle OAC$ (3 Mks)

B

C

6. Solve the equation

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

(4 Mks)

7. Maina, Kamau and Omondi share Shs.180 such that for every one shilling Maina gets, Kamau gets 50 Cts and for every two shillings Kamau gets, Omondi gets three shillings. By how much does Maina's share exceed Omondi's

(3 Mks)

8. Expand $(2 + \frac{1}{2}x)^6$ 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)

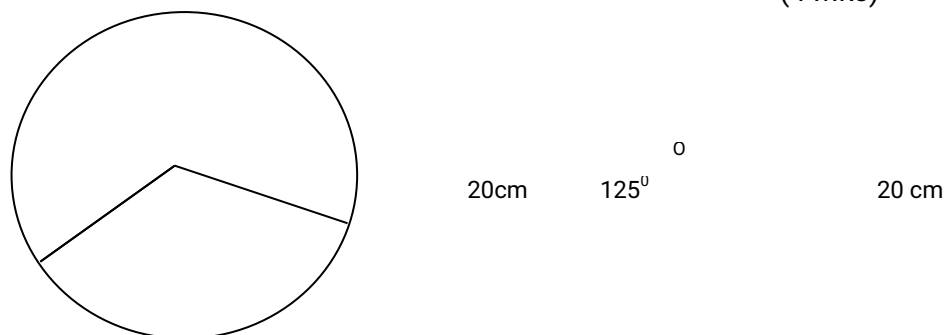
10. Line $y = mx + c$ makes an angle of 135° with the x axis and cuts the y axis at $y = 5$. Calculate the equation of the line

(2 Mks)

11. During a rainfall of 25mm, how many litres collect on 2 hectares?

(3 Mks)

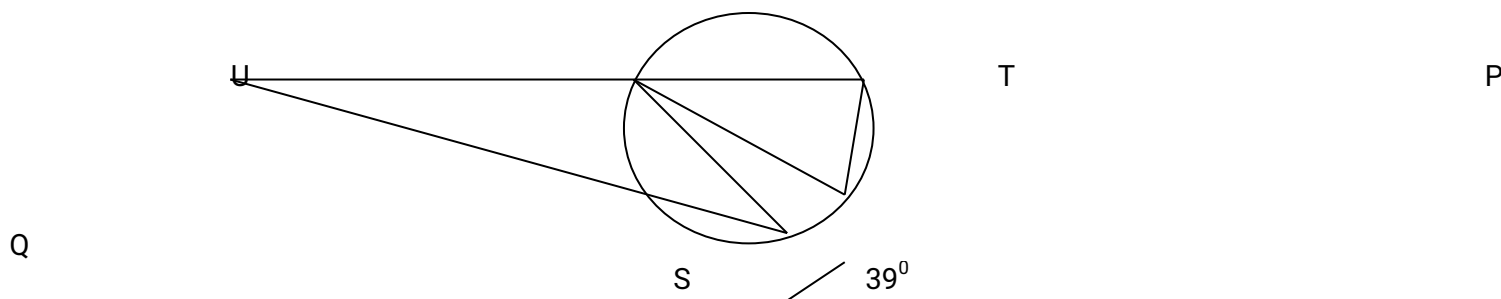
12. Solve the equation $\frac{a-3a-7}{3} = \frac{a-2}{5}$ (3 Mks)
13. The sum of the first 13 terms of an arithmetic progression is 13 and the sum of the first 5 terms is -25. Find the sum of the first 21 terms (5 Mks)
14. The curved surface of a cone is made from the shaded sector on the circle. Calculate the height of the cone. (4 Mks)



15. Simplify $\frac{(wx - xy - wz + yz)(w + z)}{z^2 - w^2}$ (3 Mks)
16. The bearing of Q from P is North and they are 4 km apart. R is on a bearing of 030 from P and on a bearing of 055 from Q. Calculate the distance between P and R. (3 Mks)

SECTION II (48 MARKS)

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



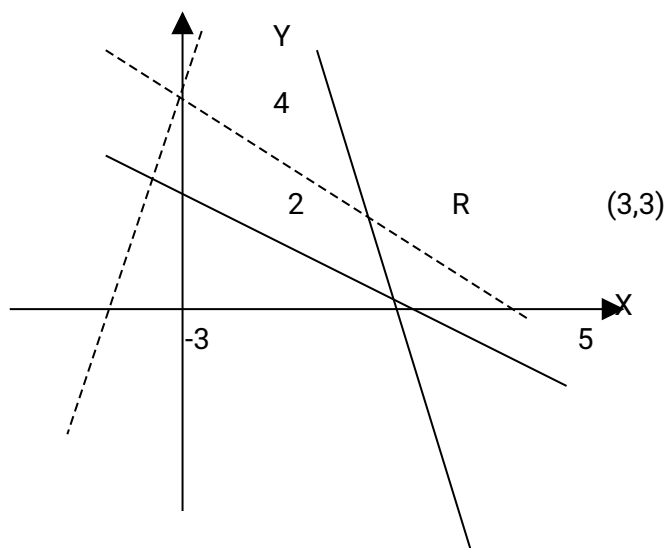
Calculate

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

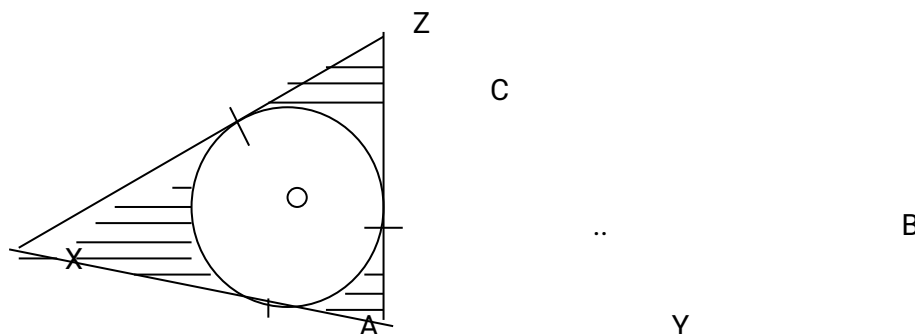
(4 Mks)

(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 VI PART II

SECTION 1 (52 MARKS)

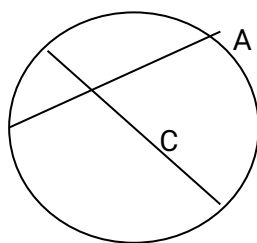
1. Simplify $\left(\frac{32a^{10}}{b^{14}}\right)^{\frac{2}{5} \div \left(\frac{9b^4}{4a^6}\right)^{11/2}}$ (2 Mks)

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)



5cm D

O

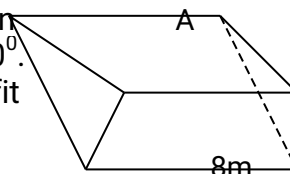
B

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

E in the tent.



8m

120° C

(4 mks)

B

D

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 (48 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
- $\triangle OAB$
- ,
- $OA = a$
- ,
- $OB = b$

OPAQ is a parallelogram.

$ON:NB = 5:2$, $AP:PB = 1:3$

Determine in terms of a and b vectors

- (a) OP (2 Mks)
- (b) PQ (2 Mks)
- (c) QN (2 Mks)
- (d) PN (2 mks)

21. A cylindrical tank connected to a cylindrical pipe of diameter 3.5cm has water flowing at 150 cm per second. If the water flows for 10 hours a day

- (a) Calculate the volume in M^3 added in 2 days (4 ms)
- (b) If the tank has a height of 8 m and it takes 15 days to fill the tank, calculate the base radius of the tank (4 mks)

21. A joint harambee was held for two schools that share a sponsor. School A needed Shs.15 million while School B needed 24 million to complete their projects. The sponsor raised Shs.16.9 million while other guest raised Shs.13.5 million.

- (a) If it was decided that the sponsor's money be shared according to the needs of the school with the rest equally, how much does each school get (5 mks)
- (b) If the sponsor's money was shared according to the schools needs while the rest was in the ratio of students, how much does each school get if school A has 780 students and school B 220 students (3 mks)

23. Voltage
- V
- and resistance
- E
- of an electric current are said to be related by a law of the form

$V = KE^n$ where k and n are constants. The table below shows values of V and E

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

By drawing a suitable linear graph, determine values of k and n hence V when $E = 0.75$ (8mks)

24. The vertices of triangle P,Q,R are P(-3,1), Q (-1,-2), R (-2,-4)

- (a) Draw triangle PQR and its image $P'Q'R'$ of PQR under translation $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$ on the provided grid

- (b) Under transformation matrix $m = \begin{pmatrix} 4 & 3 \\ 1 & 2 \end{pmatrix}$, $P'Q'R'$ is mapped on to $P''Q''R''$. Find the co-ordinates of $P''Q''R''$ and plot it on the given grid (2 Mks)
- (c) If area of $\Delta P'Q'R'$ is 3.5 cm^2 , find area of the images $P''Q''R''$ (4 Mks)
- (c) If area of $\Delta P'Q'R'$ is 3.5 cm^2 , find area of the images $P''Q''R''$ (2 Mks)

MATHEMATICS VI
PART 1
MARKING SCHEME

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. $\begin{pmatrix} 2 \\ 3 \end{pmatrix} \begin{pmatrix} 5 \\ 4 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 1$ M1
 $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}^{-1} \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ M1
 $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3/7 & -2/7 \\ 1/7 & 1/7 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ M1
 $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$ A1
 $x, y = -1$ 3
5. Reflex $\angle AOC = 126 \times 2 = 252^\circ$ B1
 Obtuse $\angle AOC = 360 - 252 = 108^\circ$ B1
 $= \frac{1}{2}(180 - 108)$
 $= 36^\circ$ 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

$$\text{Maina's} = 4/9 \times 180$$

$$= 80/-$$

$$\text{Omondi's} = 60/-$$

$$\text{Difference} = \text{Shs.}20/-$$

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

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

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

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

$$= 179.2$$

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

$$9. P(\text{FF}) = \frac{7}{20} \times \frac{7}{20}$$

$$= \frac{49}{100}$$

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

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

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

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

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

$$= -1$$

$$y = mx + c$$

$$y = -x + 5$$

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

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

10

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

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

$$-13a = -52$$

$$a = 4$$

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

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

$$8d = 12$$

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

$$a = -8$$

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

$$= 147$$

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

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

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

$$= 18.86 \text{ cm}$$

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

B1√ Omondi's

and Maina's

B1 difference

3

M1

A1

M1

A14

B1

M1

M1

A14

B1

B12

M1√ x section area

M1√ conv. to litres

A13

M1

M1

A13

M1

A1

B1

M1

A15

M1

A1

M1

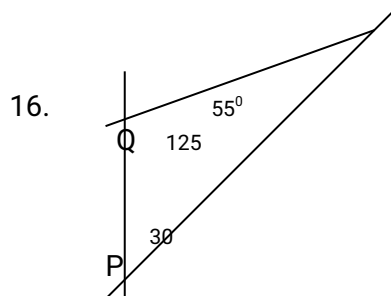
A14

M1√ factor

$$\begin{aligned}
 & (z-w)(z+w) \\
 &= \frac{(w-y)(x-z)(w+z)}{(z-w)(z+w)} \\
 &= \frac{(w-y)(x-z)}{z-w}
 \end{aligned}$$

M1✓ grouping

$$\frac{A1}{3}$$



25°

R

B1✓ sketch

$$PR = \frac{4 \sin 125}{\sin 25}$$

Sin 25

M1

$$\frac{A1}{3}$$

3

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

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

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

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

(c) Reflex $\angle RQT = 180 - 2 \times 16$
 $= 180 - 32 = 148^\circ$

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

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

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

B1

B1

B1

B1

B1

B1

B1

8

(a) Kshs.350,000 = \$ 350,000

74.75

M1

$$= \$ 4682$$

A1

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

$$= \$ 3511.5$$

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

$$= \text{Fr } 23780$$

A1

Expenditure = Fr 16 200

Balance = Fr 7580

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

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

Value on departure = Kshs.7580 X 11.04

$$= \text{Kshs.}83\,683.2$$

Difference = Kshs.97,024 - 83683.2

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

B1 both✓

M1

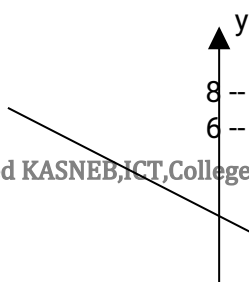
A1

8

19.

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

B1✓ values



S1✓ scale

P1✓ plotting

C1✓ curve

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

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

MI for equation
Al equation

8

x = -0.53 ± 0.1

mx = 1.87 ± 0.1

B1

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

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

M1 ✓ for equation

MA1 ✓ equation

8

A circle with center R . A horizontal line segment PQ is drawn below the circle, with P on the left and Q on the right. A vertical line segment $B1$ is drawn from P upwards, intersecting the circle at a point. The text $B1 \sqrt{2} \perp PQ, QR$ is placed near the intersection point.

B1 $\sqrt{30^0}$

B1 $\sqrt{2} \perp$ bisectors
B1 $\sqrt{\text{circle}}$

B1√ radius

$$\begin{aligned}\text{Radius} &= 4.2 \pm 0.1 \\ \text{Area of circle} &= \frac{\pi}{4} \times 4.2^2 \\ &= 55.44 \pm 3 \text{ cm}^2 \\ \text{Area of } \triangle PQR &= \frac{1}{2} \times 3.5 \times 7.5 \sin 30^\circ \\ &= 6.5625 \text{ cm}^2 \\ \text{Difference} &= 55.44 - 6.5625 \\ &= 48.88 \text{ cm}^2\end{aligned}$$

M1 $\sqrt{\Delta}$ and circle

$M1\sqrt{sub}$

A1

8

21. Line (i) $\frac{y}{2} + \frac{x}{5} = 1$

$5y + 2x = 10$

$5y + 2x = 10$

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) $grad = -\frac{1}{3}$ y inter = 4

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

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

B1✓ model class

(ii) Median class = 70 - 74

B1✓ median

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

60

$= 63.48$

M1

A1

S1✓ scale

B1✓ blocks

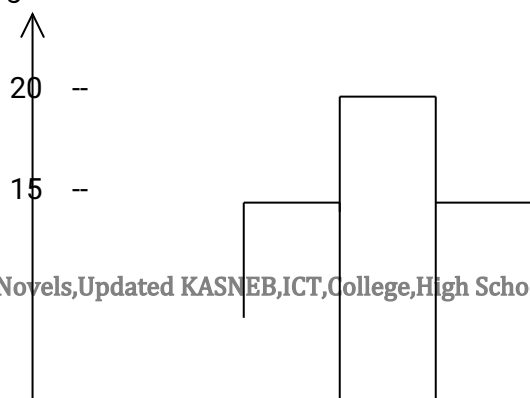
$59.5 - 64.5$

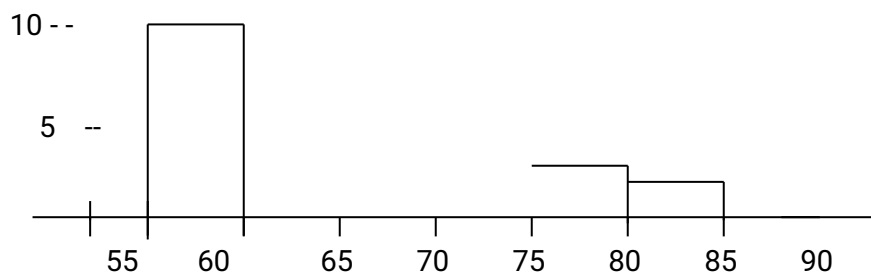
$64.5 - 69.5$ e.t.c.

8

(c)

Histogram





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

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

$$2a = 14$$

$$a = 7 \text{ cm}$$

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

$$= 0.75$$

$$X = 41.41^\circ$$

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

$$r = OA = 7 \tan 20.7$$

$$= 2.645 \text{ cm}$$

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

$$= 39.69 - 21.99$$

$$= 17.7 \text{ cm}^2$$

M1

A1

M1 ✓ any angle of the Δ A1 ✓ $\frac{1}{2}$ of the angle

B1 ✓ radius

M1 ✓ Δ & circle

A1 ✓
8

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

$$1.15n = 0.2$$

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

$$= \frac{1.3010}{1.9294}$$

$$= -0.6990$$

$$-0.0706$$

$$= 9.9 \text{ years}$$

M1 ✓ formula

M1 ✓

M1

A1

M1

M1

A1

B1

8

**MATHEMATICS VI
PART II
MARKING SCHEME**

SECTION I (52 MARKS)

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

M1 √ reciprocal

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

$\frac{A1}{2}$

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 B1

Cost Price = x

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

x = Shs.500 $\frac{A1}{3}$

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

$r^2 + hr + \left(\frac{h}{2}\right)^2 = \frac{A}{2\pi} + \frac{h^2}{4}$ M1

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

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

4

5. $(\frac{1}{3}r) (\frac{1}{3}r) = (\frac{1}{4}r) (5)$ M1

$4r^2 - qr = 0$

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

r = 0

or r = 2.25 $\frac{A1}{3}$

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

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

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

7. $P = Kq^2 + c$

$6 = 4k + c$

$16 = 9k + c$ M1 √ subtraction

$5k = 10$

$k = 2$

$c = -2$ A1 √ k and c

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

q = $\sqrt{33}$

$$= \pm 5.745$$

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

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

$$= 110.8$$

$$= 110$$

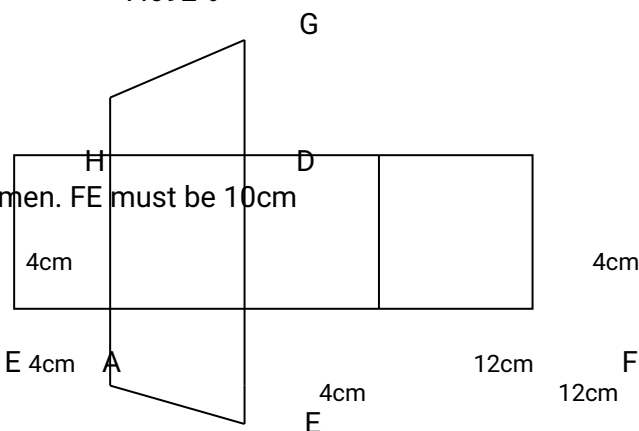
$$9. \text{ Max. error} = \frac{2(8.5 + 5.5) - 2(7.5 + 4.5)}{2}$$

$$= 2$$

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

$$= 7.692\%$$

10.

B1 $\sqrt{\text{dimen. FE must be 10cm}}$ 

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

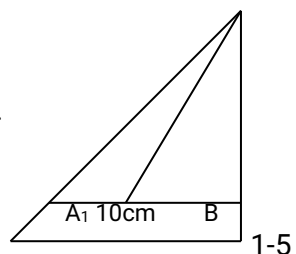
$$= 1 + 12x + 60x^2$$

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

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

$$= 1.264$$

12.



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

$$CT = 10 \sin 40$$

$$= 6.428 \text{ m}$$

$$h = 6.428 + 1.5$$

$$= 7.928$$

$$13. \text{ A.S.F} = \left[40 \right] 5^{2/3} \left[\frac{27}{960} \right]^{2/3} = \frac{9}{64}$$

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

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

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

$$\frac{2 \text{ km}}{2 \text{ hrs}} =$$

$$\frac{A1}{4}$$

$$\frac{4}{4}$$

M1 $\sqrt{\text{area of x-section}}$ M1 $\sqrt{\text{volume}}$

$$\frac{A1}{3}$$

$$\frac{A1}{3}$$

$$\frac{3}{3}$$

$$\frac{A1}{3}$$

$$\frac{3}{3}$$

$$\frac{A1}{3}$$

$$\frac{3}{3}$$

B1 $\sqrt{\text{net}}$ B1 $\sqrt{\text{labelling}}$

$$\frac{3}{3}$$

$$\frac{A1}{4}$$

$$\frac{4}{4}$$

$$\frac{A1}{4}$$

$$\frac{4}{4}$$

$$\frac{4}{4}$$

$$\frac{A1}{4}$$

$$\frac{A1}{4}$$

$$\frac{4}{4}$$

$$\frac{4}{4}$$

$$\frac{4}{4}$$

$$\frac{4}{4}$$

$$\frac{4}{4}$$

$$\frac{4}{4}$$

$$\frac{A1}{4}$$

$$\frac{4}{4}$$

$$\frac{4}{4}$$

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$$\frac{4}{4}$$

$$\frac{4}{4}$$

$$\frac{4}{4}$$

$$\frac{4}{4}$$

$$\frac{4}{4}$$

- $(x - 30) \text{ km/h}$ 60
 $2x - 60 = 120$
 $x = 90 \text{ km/h}$
15. $\begin{array}{|c|c|} \hline 16 \text{ Km/h} & 5 \text{ Km/hr} \\ \hline x \text{ Km} & (22 - x) \text{ Km} \\ \hline \end{array}$
- $\frac{x + 22 - x}{16} = \frac{11}{5}$ 4
 $5x + 352 - 16x = 220$
 $11x = 132$
 $x = 12 \text{ km}$
16. $AP = \frac{2}{9} \times 12 = \frac{2^2}{3} \text{ cm}$
 $AQ = \frac{5}{9} \times 12 = \frac{6^2}{3} \text{ cm}$
 $\therefore PQ = \frac{6^2}{3} - \frac{2^2}{3} = 4 \text{ cm}$
17. Taxable income = $\frac{115}{100} \times 8000$
 $= \text{Shs.} 9200 \text{ p. m}$
 $= \text{Shs.} 110,400 \text{ p.a}$
Tax dues = $\frac{10}{100} \times 39600 + \frac{15}{100} \times 39600 + \frac{25}{100} \times 31200$
 $= 3960 + 5940 + 7800$
 $= \text{Shs.} 17,700 \text{ p.a}$
 $= 1475 \text{ p.m}$
net tax = $1475 - 400$
 $= \text{Shs.} 1075$
Total deductions = $1075 + 130$
 $= \text{Shs.} 1205$
net income = $8000 - 1205$
 $= \text{Shs.} 6795$
18. (a) $P (\text{all correct}) = \frac{2}{3} \times \frac{3}{5} \times \frac{2}{5}$
 $= \frac{12}{125}$
(b) $P (2 \text{ correct}) = \frac{2}{5} \times \frac{3}{5} \times \frac{3}{5} + \frac{2}{5} \times \frac{2}{5} \times \frac{1}{5} + \frac{3}{5} \times \frac{4}{5} \times \frac{2}{5}$
 $= \frac{18}{125} + \frac{4}{125} + \frac{24}{125}$
 $= \frac{46}{125}$
(c) $P (\text{at least 2 correct})$
 $= P(2 \text{ correct or } 3 \text{ correct})$
 $= \frac{46}{125} + \frac{12}{125}$
 $= \frac{46 + 12}{125}$
 $= \frac{58}{125}$
19. Old price/pen = $\frac{440}{x}$

M1

A1
3

M1

M1 $\checkmark$ x-multiplicationA1
3B1 $\checkmark$ both AP & AQB1 $\checkmark$ C.A.O
2

M1

A1

M1 $\checkmark$ first 2 slabsM1 $\checkmark$ last slab

A1

B1 $\checkmark$ net tax

M1

A1
8

M1

A1

M1

M1

A1

M1

M1

125

A18

New price/pen = $\frac{494}{x+3}$

B1 ✓ both expressions

$$\frac{440 - 494}{x} = 1.50$$

$$\frac{440}{x} - \frac{494}{x+3} = 1.50$$

$$440(x+3) - 494x = 1.5x^2 + 4.5x$$

$$x^2 + 39x - 880 = 0$$

$$x^2 + 55x - 16x - 880 = 0$$

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

$$x = -55$$

$$\text{or } x = 16$$

$$\therefore x = 16$$

$$\text{difference in purchase} = 19 \times 1.50 \\ = \text{Shs.}28.50$$

M1 ✓ expression

M1 ✓ x-multiplication

A1 ✓ solvable quad. Eqn

M1 ✓ factors or equivalent

A1 ✓ both values

M1

A1

8

M1

A1

M1

A1

M1

A1

M1

A1

8

20. (a) $OP = a + \frac{1}{4}(b-a)$

$$= \frac{3}{4}a + \frac{1}{4}b$$

(b) $PQ = PO + OQ$

$$= \frac{3}{4}a - \frac{1}{4}b + \frac{1}{4}(a-b)$$

$$= \frac{1}{2}a - \frac{1}{2}b$$

(c) $QN = QO + ON$

$$= \frac{1}{4}(b-a) + \frac{5}{3}b$$

$$= \frac{23}{12}b - \frac{1}{4}a$$

(d) $PN = PB + BN$

$$= \frac{3}{4}(b-a) + \frac{2}{3}b$$

$$= \frac{17}{12}b - \frac{3}{4}a$$

21. (a) Volume in 2 days = $\frac{22 \times 3.5 \times 3.5 \times 150 \times 20 \times 3600}{7 \times 2 \times 2}$

 cm^3

$$= 103.95 \text{ m}^3$$

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

2

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

$$= 31.01$$

$$r = 5.568 \text{ m}$$

M1 ✓ area of x-section
1,000,000

M1 ✓ volume in

M1 ✓ volume in m^3

M1

M1

M1

A1

8

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

$$\text{A's share} = \frac{5}{13} \times 16.9 + \frac{1}{2} \times 13.5$$

$$= 13.25 \text{ Million}$$

$$\text{B's share} = (13.5 + 16.9) - 13.25$$

$$= 13.25$$

(b) $\text{A's share} = \frac{5}{13} \times 16.9 + \frac{39}{50} \times 13.5$

$$6.5 + 10.53$$

$$= 17.03 \text{ m}$$

$$\text{B's share} = 30.4 - 17.03$$

$$= 13.37 \text{ Million}$$

M1

A1

M1

M1

A1

M1

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) $T \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ $PQR \rightarrow P'Q'R'$
 $P' (0,5), Q' (2,2), R' (1,0)$
 $P'' Q'' R''$
 (b) $\begin{pmatrix} 4 \\ 3 \end{pmatrix} \begin{pmatrix} 0 & 2 \\ 1 & 2 \end{pmatrix} 2 \begin{pmatrix} 1 & 1 \\ 5 & 2 & 0 \end{pmatrix} \begin{matrix} 15 & 14 & 4 \\ 10 & 6 & 1 \end{matrix}$

M1 ✓

A1

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

B1 ✓

$$(c) \text{ Area s.f} = \det M$$

$$= 5$$

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

$$= 5 \times 3.5$$

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

M1 ✓

A1
8