QUICK REVISION

MATHEMATICS

FORM 1-4

Compiled by Top Examiners from National School exams and KCSE past papers

MATHEMATICS 1
PART I

LOGARITHMS

1. Use logarithm tables to evaluate (4 mks)

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

ANS

No.	Log		
			= 3.6502
0.3681	2.5660		
0.3682	1.6427 +		$-4 = \frac{1.6502}{2} = 2.8251$
	0.2087	Logs	
361.8	2.5585	+ - v ans (4)	6.6850×10^{-2}
	3.6502		= 0.06685

QUADRATIC EXRESSIONS

2. Solve for x by completing the square (3mks)

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

ANS

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

$x^2 - \frac{5}{2}x + ½ = 0$

$x^2 - \frac{5}{2}x = {}^{-}½$

$x - \frac{5x}{2} + {\frac{{}^{-}5}{4}}^{2} = {}^{-}½ + {\frac{{}^{-}5}{4}}^{2}$ (m)

$= x - \frac{5}{4} = {}^{-}½ + \frac{25}{16} = \frac{17}{16}$ (3)

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

$x - 5/4 \pm 1.031$

$X_1 = -1.031 = 1.25 = 0.2192$

$X_2 = 1.031 + 1.25 = 1.281$

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)

ANS

Let a plate be p and a cup c.

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

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

$-p \quad -60$ (mks)

p = Shs 60

$3(60) + 4c = 380$

$4c = 380 - 180 = 2000$ (3)

c= Shs. 50

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

COMMERCIAL ARITHMETIC

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)

ANS

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

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

= Shs. 7800

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

Shs. 138.6

COMPOUND PROPORTIONS, RATES AND RATIOS

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)

ANS

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

TRIGONOMETRY

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

ANS

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

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

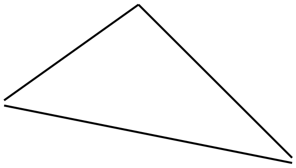
h = 4 x 2.414 A
= 9.650cm
Area of 1 triangle = ½ x 8 x 9.656 x 8 cm = 38.628 x 8 vm
Octagon area = 38.628 x 8 m
= 309.0 cm^2 (A)

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

ANS

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

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



Figs A C B and D C E are similar

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

ANS

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

$60 = 18 + 3x$
$3x = 42$
$x = 14$

$= \frac{10}{3} = \frac{15 + y}{y}$, m
$10y = 15 + 3y$
$7y = 15$

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

FORMULAE AND VARIATIONS

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

ANS

$y = a/x + bx$ $yx = a + bx^2$
Either
$bx^2 – yx + a = 0$

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

ANS

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

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

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)

ANS

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

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

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

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

$\underline{q = 7.62.}$

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

$\underline{p = 7.62 \text{ x } 095 = 7.27}$

at x = 14, y = 2.7

at y = 0.46, 1/y = 2.174

x = 9.6

APPROXIMATION AND ERRORS

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

ANS

The perimeter = (3.6 + 2.8) x 2 = 12.8 cm

Max perimeter = (3.65 + 2.85) x 2 = 23 cm Expressions

% error = $\frac{13 - 12.8}{12.8}$ x 100 **m** = $\frac{0.2}{12.8}$ x 100 (3)

= 1.5620% (A)

FRACTION

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

1/7 + 3/12 + 7/0.103

ANS

1/7 + 3/12.4 + 7/0.103

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

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

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

=70.52 **(A)**

9. Evaluate:

$$\frac{11/6 \text{ x } \frac{3}{4} - 11/12}{\frac{1}{2} \text{ of } 5/6}$$

(3mks)

ANS

$$\frac{1\,1/6 \text{ x } \frac{3}{4} - 11/12}{\frac{1}{2} \text{ of } 5/6} = \frac{(7/6 \text{ x } \frac{3}{4}) -11/12}{\frac{1}{2} \text{ of } 5/6} = \frac{7/8 – 11/12}{5/12} = \frac{21-22}{5/12}$$

$$= \frac{-1/24}{5/12} = \frac{-1}{24} \text{ x } \frac{12}{5} = \frac{-1}{10} \quad (3)$$

1. Without using tables, simplify

$$\frac{1.43 \text{ x } 0.091 \text{ x } 5.04}{2.86 \text{ x } 2.8 \text{ x } 11.7}$$

(3mks

ANS

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

(3)

= 0.007(A)

VOLUME AND CAPACITY

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)

ANS

Volume of rod = Π r^2h = 22/7 x 4 x 14 = 704cm^3 **(m)**

Volume of each cube = 2x2x2 = 8 cm^3 A

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

MATRICES

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

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

ANS

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

3 – x = 2 (1) x = 1 (2)

2 - 1 = y y = 1 (A)

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

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

ANS

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

$2a + 2b = 6 \; x\, 2 \quad = 49 + 4b = 12$
$3a + 4b = 10 \quad \underline{3a + 4b = 10}$
$a = 2 \qquad 4 + 2b = b$

$2c + 2d = 10x2 = 4c + 4d = 20 \qquad 2\,b = 2 \;\; b = 1$
$3c + 4d = 19 \quad \underline{3c + 4d = 19}$
$c = 1$
$2\,(1) + 2d = 10$
$2d = 8$ Matrix is 2 1 (A)
$d = 4$ 1

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

2 1
-1 2

<u>ANS</u>
$y = 3x + 4$
A(0,4) B (1,7) Object points

$$\begin{array}{cccccc} A & B & A & B & & \\ 2 & 1 & 0 & 1 & 4 & 9 \\ & & & & = & \\ -1 & 2 & 4 & 7 & 8 & 13 \end{array}$$

$Y = Mx + C$
$M = \frac{13 - 8}{9-4} = \frac{5}{5} = \frac{1}{1}$

$y = x + c \qquad y = x + 4$
$8 = 4 + c \quad c = 4$

<u>BINOMIAL EXPANSION</u>

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

<u>ANS</u>
$(x + y)^6 = 1\,(x)^6\,(y)^0 + 6\,(x)^5(y)^1 + 15(x)^4\,(y)^2 + 20x^3y^3 + 15x^2y^4 + 6xy^5 + y^6$
$(1.02)^6 = (1 + 0.02)^6 \; x = 1$
$y = 0.02$

$(1.02)^6 = 1 + 6\,(0.02) + 15\,(0.02)^2 + 15(0.02) + 20(0.02)^3 + 15\,(0.02)^4$
$= 1 + 0.12 + 0.006 + 0.00016$
$= 1.12616$
$= 1.126$ (to 3 d.p) (3)

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

<u>ANS</u>
$x^2 + y^2 - 6x + 8y - 11 = 0$
$x^2 - 6x + (-3)^2 + y^2 + 8y + (4)^2 = 11 + (-3)^2 + (4)^2$ (completing the square)
$(x - 3)^2 + (y+4)^2 = 11 + 9 + 16 = 36$
$(x - 3)^2 + (y + 4)^2 = 6^2$

Centre is (3, -4)
Radius = 6 units As (3)

LINEAR EQUATIONS

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

ANS

AB = 8 -4 4 BC = 16 - 8 -8 for either
=
7 -8 -1 5 - 7 -2

AB = ½ BC and AB and BC share point B.
A,B,C are collinear. **(3)**

2 -3

4 3 det. = 6 + 12 = 18
Inv.= $\frac{1}{18}$ 3 3
-4 2

$\frac{1}{18}$ 3 3 2 -3 x $\frac{1}{18}$ 3 3 7
-4 2 4 2 y -4 2 5
x 36
$\frac{1}{18}$
y -18 (3)
x = 2, y = -1 (A)

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

ANS

(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 = 8 -4 4 =
13 -3 10
Length = $\sqrt{4^2 + 10^2} = \sqrt{116}$ = 10.77 units

(iii) Mid point = $\frac{4+8}{2}$, $\frac{3+3}{2}$
= (6, 8) (mid point) (5 mks)
gdt of perpendicular to AB = -ve rec. of 5/2
-2/5
Eqn is y = -2/5 x + c

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

$= c = 52/5$

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

DISTANCE, TIME AND LINEAR MOTION

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)

ANS

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

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

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

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

ANS

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

uphill Time = 75/v hrs

Downhill speed = (+ 20) km/h

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

Takes larger uphill

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

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

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

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

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

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

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

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

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

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

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

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

1/y	1.0	1.56	2.0	2.38	2.94	3.57

GEOMETRIC CONSTRUCTIONS

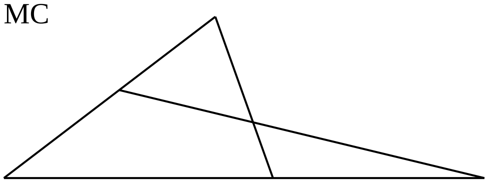
17. Construct without using a protractor the triangle ABC so that BC=10cm, angle ABC = 60^0 and BCA = 45^0
    a. On the diagram , measure length of AC
    b. Draw the circumference of triangle ABC
    c. Construct the locus of a set of points which are equidistant from A and B.
    d. Hence mark a point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

ANS

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

VECTORS

19. In the triangle OAB, OA = 3a , OB = 4b and OC = 5/3 OA. M divides OB in the ratio 5:3
    a. Express AB and MC in terms of a and b
    b. By writing MN in two ways, find the ratio in which N divides
    i. AB
    ii. MC



OC = 5/3 (31) = 5A

ANS

(a) = AO + OB
= -3a = 4b

MC = MO + OC
= -5/8 (4b) + 5
= 5A – 5/2 b

(b) MN = 5 Mc = 3(5a – 5/2 b)
= 5 s a – 5/2 s b

MN = BN + BN
= 3/8 (4 b) + (1 – t) (-BA)
= 3/8 (4 b) + (1 – t)(3a – 4 b)
= 3/2 b + 3 ta –4b + 4tb
= (3-3t) a (4t – 5/2)b

MN = MN
= 5 s a – 5/2 sb = (3-3t)a + (4t – 5/2)b
= 5 a = 3 – 3t = 5s + 3t =3
= -5/2 s = 4t –5/2 v <u>5s + 8t = 5</u>
-5t = -2t = 2/5
5 s = 3 – 3(2/5)
= 3 – 6/5 = 9/5

$= 3 – 6/5 = 9/5$

$s = 9/25$

(i) AN : NB = 2 : 3

(ii) MN : 9 : 16

ANGLE PROPERTIES OF A CIRCLE

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

ANS

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

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

$X \tan 30^0 = x \tan 60 – 1000$

$0.5773 x = 1.732x – 1000$

$1.732x – 0.577 = 1000$

$1.155x = 1000$

$x = \frac{1000}{1.155} = 866.0 \text{ m}$ (A) (4)

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

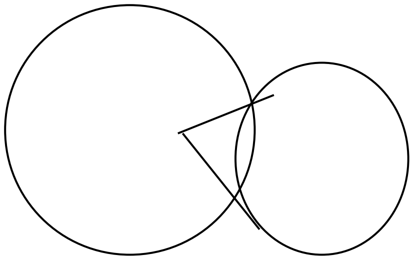
Calculate:

The area of the intersection of the two circles

The area of the quadrilateral S P Q R

The area of the shaded region

ANS



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

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

= 121.6

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

= 85.8 cm^2

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

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

Area of segment = 121.6 – 85.8

= 35.8 cm^2

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

Area of PQR = ½ x 12 x 12 = 72^2

Area of segment = 113.1 – 72

$= 41.1\text{cm}^2$

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

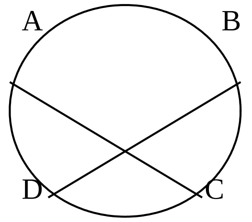
$= 157.8 – 121.6$

$= 36.2\ \text{cm}^2$

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

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

ANS



A x X x C = BX . XD

8 x 4 = 6BX

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

X AD = XBC

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

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

< AXD = BXC (vertically opposite $<_{s)}$)

SAS holds : they are similar.

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

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

SCALE DRAWING

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

ANS

5 km Slower speed = x km/hr

Time = 5/x

Faster = (x+20) k/h

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

$\underline{5\ (x+20)} – 5x \quad \underline{1}$

$x(x+20)\ 120$

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

$x^2 + 20x – 12000$

$x = -\underline{20} \quad \underline{400 + 48000}$

2

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

Spd = 100 km/h

And x = 120 km/h (A)

4

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

(scale 1cm rep 10 km)

From this find,

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

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

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

ANS

a) AD = 50km

DC = 35km

BD = 90km

Bearing is 020^0

Bearing is 134^o (8mks)

5. A town A is 56 km from B on a bearing 062^0. A third town C is 64 km from B on the bearing of 140^o. Find

(i) The distance of A to C (2mks)

(ii) The bearing of A from C (3mks)

ANS

(i) $b^2 = a^2 + b^2 - 2ab \text{ Cos } B$

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

$= 4096 + 3136 - 7168 (0.2079)$

$= 7232$ - km 1490.3

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

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

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

Sin A = 0.08262

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

Bearing = 90 – 28 – 55.7

$= 0.06.3^0$ (A)

LINEAR INEQUALITIES

3. Give the combined solution for the range of x values satisfying the inequality

$2x + 1 < 10 - x < 6x - 1$ (3mks)

ANS

$2x + 1 \leq 10 – x \leq bx -1$

$2x + 1 \leq 10 – x$ $10 –x \leq 6x –1$

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

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

$11/7 \leq x \leq 3$

SEQUENCIES AND SEREIS

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)

ANS

a = 4000 r = 110/100 = 1.1 (4000, 4000 + 4000, 4400 + 0/100 (4400------)

(a and r)

$$Sn = \frac{a(r^{n} – 1)}{R -1}$$

1.1 Log = 0.04139

$\underline{\quad X \ 5}$

0.20695

0.1 (4)

$$= \frac{4000 (1.1^{5} –1)}{1.1 –1} \text{ (any)}$$

$$\frac{4000 (1.6 – 1)}{0.1}$$

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

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

SURDS

7. Rationalise the denominator in (2mks)

$$\frac{\sqrt{3}}{1 – v3}$$

ANS

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

STATISTICS

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)

ANS

Moving averages of order 4

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

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

for 7

for > 4

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

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

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

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

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

ANGLES AND PLANE FIGURES

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

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

ANS

(i) ADC = 2x73

= 146^0

(ii) OCB = x = 180 – 146 = 34

(iii) 360 – 107 – 146 – 34

= $73^{\ 0}$

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

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

ANS

Log x = a log y = b

$\text{Log } \frac{x^3}{y} = \text{Log } x^3 - \log y^{½}$

= 3 Log x – ½ Log y

= 8a – ½ ab

SECTION B

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

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

Using an assumed mean of 44.5, calculate

a. The mean

b. The standard deviation

c. Find the median mark

ANS

.

Marks	Mid point (x)	d = x-44.5	F	E = d/10	Ft	T^2	Ft^2 v
0-9	4.5	-40	2	-4	-8	16	32
10-19	14.5	-30	4	-3	-12	9	36
20-29	24.5	-20	7	-2	-14	4	28
30-39	34.5	-10	19	-1	-19	1	19

40-49	44.5	-0	26	0	0	0	0
50-59	54.5	-10	15	1	15	1	15
60-69	64.5	20	12	2	24	4	48
70-79	74.5	30	5	3	15	9	45
			=90		=1		=223

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

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

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

(a) The probability = Shaded area
Large circle area
Shaded area = $\Pi R^2 - \Pi r^2$
= 22/7 $(4^2 - 3^2)$ v = 22/7 x 7 = 22
Large area = 22/7 x4x4 = 352/7 (A)
Probability = 22 = 22 x 7 = 7
352/7 352 16

(b)

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

(M)

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

(4)

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

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

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

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

ANS

(i) Cos 60 = x/20 x = 20 x 0.5 = 10 cm
BD = 12 – 10 = 2 cm

(ii) CD = y Sin 60 = y/20 y = 20x 0.8666
CD = 17.32 cm

(iii) CHG = 120 reflex = 240^0
CHG = 240/360 x 2 x π x r
= 50.27
DBF = 120^0/360 x 2 x Π x r = 1/3 x 2 x 3.142 x 2
= 4.189 (A)
Length C D E f G H C = 50.27 + 2(17.32) + 4.189
= 89.189 (A)

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

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

ANS

(a) From the diagram, XO = 5/2 = 2.5
Tan 75^0 = VO/2.5 v m
VO = 2.5 x 3.732

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

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

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

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

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

ANS

Volume = cross – section Area x L

X-sec Area = (1 x 25) + (½ x 25 x 2.5)

= 25 + 31.25 = 56. M

Volume = 56.25 x 12

= 675 m^3

Volume passed / sec = cross section area x speed

= Πr^2 x l = 3.14 x 9/100 x 9/100 x 3 (8)

= 0.07635 m^3/sec v (M)

Volume emptied in 2 minutes

= 0.07635 x 60 x 2

= 9.162 m^2 (A)

1 m^3 = 1000 l

= 9.162 litres

= 9160 litres (A)

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

MATHEMATICS II
PART I

1. Use tables to evaluate

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

ANS

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

$\sqrt{3.152} = 1.776$

$$\frac{\sqrt[3]{1.776 + 0.008317}}{0.1279 \times 25.91}$$

$= \frac{\sqrt[3]{1.784317}}{0.1279 \times 25.91}$	No.	log
	1.784	0.2514
	0.1279	-1.1069
25.71	1.4101 +	
	0.5170	
	-1.7344	
	x 1/3	
10^{-1} x 8.155(6)	1^{-1}.9115	
Or 0.8155(6)		

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

ANS

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

3. The gradient function of a curve that passes through point: (-1, -1) is 2x + 3.
Find the equation of the curve. (3mks

ANS

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

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

$-1 = 1 - 3 + c$

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

4. Find the value of k for which the matrix $\begin{pmatrix} k & 3 \\ 3 & k \end{pmatrix}$ has no inverse. (2mks)

ANS

$K^2 - 9 = 0$

$K = \pm 3$

5. Without using tables, evaluate $\dfrac{\log 128 - \log 18}{\log 16 - \log 6}$

ANS

(3mks

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

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

$$= 2$$

6. Find the equation of the locus of points equidistant from point L(6,0) and N(-8,4). (3mks

ANS

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

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

Gradient of ⊥ bisector = 7/2

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

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

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)

ANS

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

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

$0.5 = 0.85^n$

$\log 0.5 = n \log 0.85$

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

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

8. Use reciprocal tables to evaluate to 3 d.p. $\frac{2}{0.321} - \frac{1}{n2.2}$ (4mks

ANS

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

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

$6.230 - 0.005807 = 6.224193$

$= 6.\ 224$(3d.p)

9. 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

ANS

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

$h = ½$

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

$= ¼ [29 + 127.5]$

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

10. Solve the equation for $0^0 \leq \theta \leq 360^0$ and $\cos^2\theta + ½ \cos\theta = 0$ (3mks

ANS

$\cos\theta (\cos\theta + ½) = 0$

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

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

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

11. 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)

ANS

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

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

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

12. How many multiples of 3 are there between 28 and 300 inclusive. (3mks

ANS

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

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

$300 = 30 + 3n - 3$

$300 - 27 = 3n$

$273 = 3n$

$91 = n$

13. 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

ANS

$y = mx – 1$
$1 = 3m – 1$
$m = 2/3 = 0.6667$
$\tan \theta = 0.6667$; $\theta = 33.69^0$

14. In the figure below, AF is a tangent to the circle at point A. Given that FK = 3cm, AX = 3cm, KX = 1.5cm and AF = 5cm, find CX and XN. (3mks)

ANS

$FK \times FC = FA^2$
$FC = 25/3 = 8\,^{1/}3$ cm
$CX = 8^{1/}3 – 9/2 = 23/6 = 3^{5/}6$ cm
$CX \times XK = XA \times XN$
$3^{3/}6 \times 3/2 = 3 \times XN$
$\therefore\ XN = 1^{11/}12$ cm

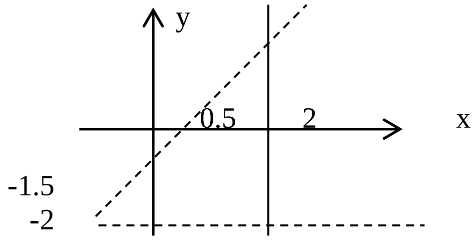
15. Make X the subject of the formula (3mks)

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

ANS

$$V^3 = \frac{k + x}{k – x}$$
$V^3k – V^3x = k + x$
$V^3k – k = x + V^3x$
$V^3k – k = x(1 + v^3)$
$$\frac{V^3k – k}{1 + V^3} = x$$

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



ANS

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

ANS

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) $y = -x^2 + 3x + 2$
$\underline{0 = -x^2 - x + 2}$
$y = 4x$ (-2, -8) (1, 4)
Roots are x = -2, x = 1

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	60-69	70-79	80-89	90-99
No. of students	2	8	6	7	8	10	9	6	3	

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

ANS

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
		Σf = 60	Σfd =	-1680		Σfd^2 = 77,600

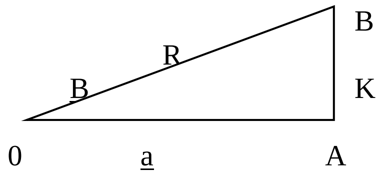
(i) Mean = $74.5 + \frac{-1680}{60}$

$= 74.5 - 28 = \underline{46.5}$

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

$= \sqrt{1283.3 - 784}$
$= \sqrt{499.3} = \underline{22.35}$

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



(a) Express in terms of $\underline{a}$ and $\underline{b}$

(i) $\underline{OK}$ (iii) $\underline{RS}$

(iii) $\underline{OS}$ (iv) $\underline{RA}$

(b) Hence show that R,S and A are collinear. (8mks)

ANS

a (i.) $OK = OA + AK = ½ a + ½ b$

(ii) $OS = ¾ OK = 3/8 a + 3/8 b$

(iii)$RS = RO + OS = 3/8 a – 9/40 b$

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

b. $RA = a – 3/5 b$ $RS = 3/8 a + 9/40 b$

$= 3/8(a – 3/5 b)$

$\therefore RS = 3/8 RA$

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

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

ANS

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

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

let $\angle XKN = \theta$

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

$\theta = 67.97(8)^0$

(ii) In ΔXNK

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

In Δ SMR; MR = KB = 3m

SM = XN = 3.708m

Let $\angle SRM = \alpha$

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

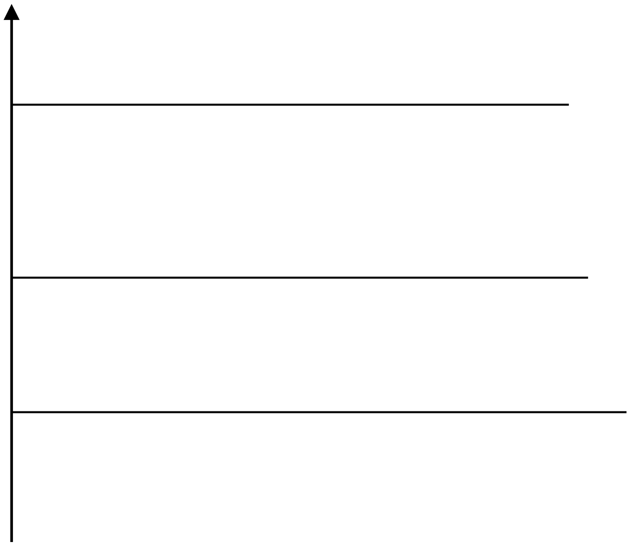
$\alpha = 51.02(3)^0$

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

From the graph, find:

(a) The value of x for which $2\cos x = \sin \frac{1}{2} x$ (1mk)

(b) The range of values of x for which $-1.5 \leq 2\cos x \leq 1.5$ (1mk



ANS

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

(a) Find the average speed of A. (6mks)

(b) How far was A from T when B reached S. (2mks

ANS

$$\overset{300\text{km}}{\overline{T \qquad\qquad\qquad\qquad S}}$$

Let the speed of A be X km/hr

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

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

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

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

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

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

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

$x = 44.25$

$X = -54.25$ N/A

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

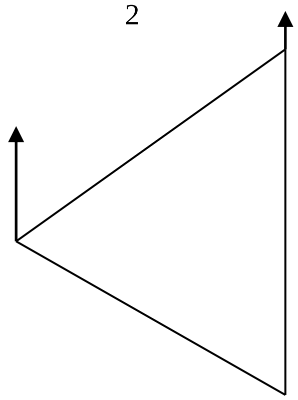
Distance of A from T is 300 – 55.3 = 244.7 km

23. P and Q are two ports 200km apart. The bearing of Q from P is 040^0. A ship leaves port Q on a bearing of 150^0 at a speed of 40km/hr to arrive at port R 7 ½ hrs later. Calculate:
    (a) The distance between ports Q and R. (2mks)
    (b) The distance between ports P and R. (3mks)
    (c) The bearing of port R from port P. (3mks

ANS

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

(b)



$PR^2 = 200^2 + 300^2 - 2 \text{x } 200 \text{ x } 300 \cos 70^0$

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

PR = 298.3 km

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

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

$= 0.9344$

$\alpha = 69.1^0$

Bearing of R from P is

$40 + 69.1 = 109.1^0$

24. 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)

ANS

(i.) $X > y$

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

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

(iii) $X + y \leq 15$

$X > 0$; $y > 0$

Boundaries

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

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

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

Objective function

2400 x 3200y

(pt (2,1)

$2400X + 3200y = 8000$

Search line → $3X + 4y = 10$

Point that give maximum profit is (12,3)

∴ maximum profit

= 2400 x 12 + 3200 x 3 = 38,400 shs.

MATHEMATICS II
PART II

1. Use logarithm tables to Evaluate

$$\sqrt[3]{\frac{36.5 \times 0.02573}{1.938}}$$

(3mks)

ANS

No	log.
36.5	1.5623
0.02573	$\underline{-2.4104 +}$
	-1.9727
1.938	$\underline{0.2874 -}$
	-1.6853

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

-1 + 0.8951

1.273(4) ← 0.1049

= 1.273(4)

2. The cost of 5 shirts and 3 blouses is sh 1750. Martha bought 3 shirts and one blouse for shillings 850. Find the cost of each shirt and each blouse. (3mks)

ANS

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. If $K = \left(\frac{y-c}{4p}\right)^{1/2}$
   a) Make y the subject of the formula. (2mks)
   b) Evaluate y, when K = 5, p = 2 and c = 2 (2mks

   ANS
   (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. Factorise the equation:
   $x + 1/x = 10/3$

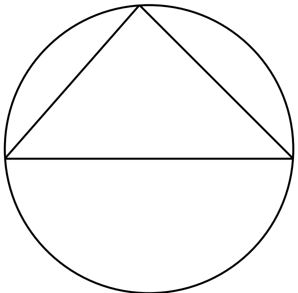
   ANS (3mks)
   $x^2 + 1 - \frac{10x}{3} = 0$
   $3x^2 - 10x + 3 = 0$
   $3x(x - 3) - 1(x - 3) = 0$
   $(3x - 1)(x - 3) = 0$
   $x = 1/3$ or $x = 3$

5. DA is the tangent to the circle centre O and Radius 10cm. If OD = 16cm, Calculate the area of the shaded Region. (3mks)

   ANS
   Area Δ OAD pyth theorem AD =12.49cm
   ½ x 12.49 x 10 = $62.45cm^2$
   $\cos\theta = 10/16 = 0.625$
   $\theta = 51.3^0$
   Sector $\frac{57.3^0}{360} \times 3.14 \times 100$
   $\begin{array}{r} 62.5 \\ \underline{40.2\ -} \\ = 22.3 \end{array}$

6. Construct the locus of points P such that the points X and Y are fixed points 6cm apart and $\angle XPY = 60^0$. (2mks
   ANS

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



Construct 30^0 angles
at XY to get centres
B1 C_1 and C_2 mojar arcs drawn

$\underline{2}$ on both sides with C_1X and C_2X
as centres.

7. In the figure below, ABCD is cyclic quadrilateral and BD is diagonal. EADF is a straight line, CDF = 68^0, BDC = 45^0 and BAE = $98^{0.}$

Calculate the size of: (2mks)

a) ∠ABD b) ∠CBD

DAB = $180^0 – 98^0 = 82^0$
ADB = 180 – (68 + 45) = 67^0
ABD = 180 – (67 + 82)
= 31^0

ANS

(a) $180^0 – (67 + 82)^0 = 31^0$

∠ABD = 31^0

Opp = 180^0

82 + 98 = 180^0

(b) $(180 – 82)^0 = 98^0$

$180^0 - (98^0 – 45^0) =$

∠CBD = 37^0

_ $180 – (98 + 45)^0$
= 37^0

8. Otieno bought a shirt and paid sh 320 after getting a discount of 10%. The shopkeeper made a profit of 20% on the sale. Find the percentage profit the shopkeeper would have made if no discount was allowed? (2mks)

ANS

$\frac{10}{100}$ x 320
Discount = sh 32
Sold at sh 288
If no Discount = ($\frac{320}{288}$ x 20) % = 22.7%

9. Calculate the distance:
i) In nautical miles (nm)
ii) In kilometres (km)
Between the two places along the circle of Latitude:
a) $A(30^0N, 20^0E)$ and $B(30^0N, 80^0E)$ (Take Radius of Earth = 6371Km). (2mks)
b) $X(50^0S, 60^0W)$ and $Y(50^0S, 20^0E)$ (Take Radius of Earth = 6371Km). (2mks)

ANS

. (a) Dist along circle of lat.
Long diff x 60 x cos θ nm
100 x 60 x Cos 50^0
100 x 60 x 0.866
5196nm = $\underline{100}$ x 2πR Cos 50^0

360

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

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

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)

ANS

Vol $= 2.8 \times 2.4 \times 3 = 20.16m^3$
$1m^3 = 1000$ L
$20.16m^3 = 20160$ L

$$\begin{array}{r} 20160 \\ \underline{3600} \\ 16560 \end{array}$$

16560 L to fill
0.5 L – 1 sec
16560 L - ?

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

$\frac{33120}{3600}$ hr $\cong 9.41$ hrs ; $\cong 564.6$ min.

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)

ANS

$1^5 + 5.1^4a + 10.1^3.a^2 + 10.1^2a^3 + 5.1.a^4$
$a = -0.2$
$1 + 5(-0.2) + 10(-0.2)^2 + 10(-0.2)^3 + 5(-0.2)^4$
$1 - 1.0 + 0.4 - 0.08 + 0.008 = 0.3277$ (4d.p)

12. 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)

ANS

Area of metal : Material – Cross section.
$\pi(R^2 - r^2)$
$3.14(21 - 19)$
Vol $6.28cm^2 \times 3400cm$
$= 215.52m^3$

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)

ANS

Possibility space:

.	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8

3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

P(odd) = 3/6 = ½

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

∴ P(odd) and P(sum > 7 but < 10)

= ½ x 9/36 = 9/72 = 1/8

14. Find the following indefinite integral $\int \frac{8x^5 - 3x}{x^3}\ dx$ (4mks)

ANS

$\int(8x^5/x^3 – 3x/x^3)\ d_4$

$\int(8x^2 – 3x^{-2})\ d_4$

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

$16x^3/3 – 2/x^3 + C$

15. The figure below represents a circle of radius 14cm with a sector subtending an angle of 60^0 at the centre.

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

ANS

Area of ∆AOB

½ x 14 x 14 x 0.866 = 84.866cm^2

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

Shaded Area

84.666 - 10.257 = 74.409cm^2

16. 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)

ANS

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

∑x = ∑f=30 ∑fx=210 1512

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

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

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

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

SECTION II .

17. 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)

ANS

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

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

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

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

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

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

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

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

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

ANS

y = Sin x

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

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

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

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

For

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

19. 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.

ANS

c.f	X	F
61	53	12
16		54
93	55	16
103	56	10
11		57
123	58	9
130	59	7
135	60	5
138	61	3
142	62	4
145	63	3
148	64	3
149	65	1
150	70	1

Mean = x + 52 + $\frac{-4}{150}$
52 - 0.02
= <u>51.08</u>
Median = 51.4g.

class interval 59

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

20. 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.

ANS

$X + Y \leq 1000$
$X \leq 2Y$
$Y < 720$
$X > 90$

21. Two aeroplanes, A and B leave airport x at the same time. A flies on a bearing 060^0 at 750km/h and B flies on bearing of 210^0 at 900km/h:
    a) Using a suitable scale draw a diagram to show the positions of Aeroplanes after 2hrs.
    b) Use your graph to determine:
        i) The actual distance between the two aeroplanes.
        ii) The bearing of B from A.
        iii) The bearing of A from B.

ANS

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

(b) (i.) 15.8cm x 200	(ii) Bearing 224^0
= 3160 Km.	(iii) Bearing 049^0

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.

ANS

(a) P(R) x $P(R)^1$	(b) P(R)′ x P(R)	(c) P(R) x P(R’)
= 0.5 x 0.6	0.5 x 0.4	P(R)’ x P(R)
= 0.3	= 0.2	0.5 x 0.6 = 0.3
		0.5 x 0.4 = 0. 2= 0.5

23. Calculate the Area of each of the two segments of y = x(x+1)(x-2) cut off by the x axis. (8mks)

ANS

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

24. Find the co-ordinates of the turning point on the curve of $y = x^3 - 3x^2$ and distinguish between them.

ANS

$y = x^3 - 3x^2$
$\underline{dy} = 3x^2 - 6x$
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) $x = 0 \ \frac{dy^2}{dx^2} = 6x - 6 = -6$
$-6 < 0$ – maximum.
$\therefore (0,0)$ Max Pt.

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

MATHEMATICS I
PART I

<u>SECTION I (50 MARKS)</u>

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

$$\frac{0.0171^2 \text{ X } 3}{855 \text{ X } 0.531}$$ (2 Mks)

ANS

$\frac{171 \text{ X } 171 \text{ X } 3 \text{ X } 10^{-5}}{855 \text{ X } 531}$ M1

$= 2 \text{ X } 10^{-6}$ $\frac{\text{A1}}{2}$

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)

ANS

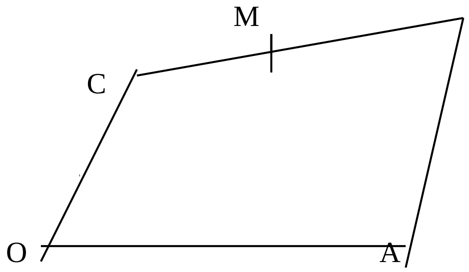
No. of men = $\frac{6 \text{ X } 14 \text{ X } 8 \text{ X } 2500}{2 \text{ X } 5 \text{ X } 2240}$ M1

= 75 A1

Extra men = 75 - 6 = 69 B1

3

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



ANS

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

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

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

3

4. By matrix method, solve the equations

5x + 5y = 1

4y + 3x = 5 (3 Mks)

ANS

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

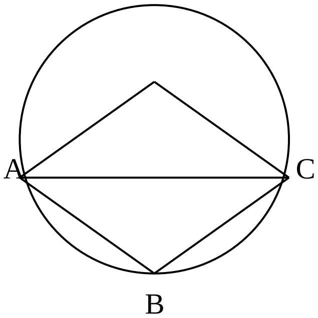
$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} {}^{-1}/_{7} & {}^{5}/_{7} \\ {}^{3}/_{7} & {}^{-2}/_{7} \end{pmatrix} \begin{pmatrix} 1 \\ 5 \end{pmatrix}$$ M1

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

x, 3, y = -1 A1

3

5. In the given circle centre O, ∠ABC = 126^0. Calculate ∠OAC (3 Mks)



ANS

Reflex ∠AOC = 126 x 2 = 252^0 B1

Obtuse ∠AOC = 360 - 252 = 108^0 B1

$= {}^{1}/_{2}\,(180 - 108)^0$
$= 36^0$ $\underline{\text{B1}}$

6. Solve the equation
$2(3x - 1)^2 - 9\,(3x - 1) + 7 = 0$ (4 Mks)

ANS

$18x^2 - 39x + 18 = 0$
$6x^2 - 13x + 6 = 0$ B1√ equation
$6x^2 - 9x - 4x + 6 = 0$
$3x(2x - 3)\,(3x - 2) = 0$ M1
$x = {}^{2}/_{3}$ or A1
$x = 1\tfrac{1}{2}$ $\underline{\text{B1}}$

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)

ANS

M : K : O = 4 : 2 : 3 B1√ ratio
Maina's = 4/9 X 180
= 80/- B1√ Omondi's
Omondi's = 60/- *and Maina's*
Difference = Shs.20/- *$\underline{\text{B1}}$ difference*
$\underline{\underline{3}}$

8. Expand $(2 + {}^{1}/_{2}x)^6$ to the third term. Use your expression to evaluate 2.4^6 correct to 3 s.f (3 Mks)

ANS

$(2 + {}^{1}/_{2}x)^6 = 2^6 + 6(2^5)\,({}^{1}/_{2}x + 15\,(2^4)\,({}^{1}/_{2}\,x)^2$ M1
$= 64 + 96x + 60x^2$ A1
$2.4^6 = (2 + {}^{1}/_{2}\,(0.8))^6$
$= 64 + 96\,(0.8) + 60\,(0.64)$ M1
$= 179.2$
$\cong 179$ to 3 s.f $\underline{\text{A1}}$
$\underline{\underline{4}}$

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)

ANS

$P\,(FF) = {}^{7}/_{20} \times {}^{7}/_{20}$
$= {}^{49}/_{100}$ B1
P (at least one fail) $= 1 - P\,(F^I F^I F^I)$
$= 1 - \left({}^{13}/_{20}\right)^3$ M1
$= 1 - \frac{2197}{8000}$ M1
$= \frac{5803}{8000}$ *$\underline{\text{A1}}$*
$\underline{\underline{4}}$

10. Line y = mx + c makes an angle of 135^0 with the x axis and cuts the y axis at y = 5. Calculate the equation of the line (2 Mks)

ANS

grad = term 135

$= -1$ B1

$y = mx + c$

$y = -x + 5$ $\underline{\text{B1}}$

$\underline{\underline{2}}$

11. During a rainfall of 25mm, how many litres collect on 2 hectares? (3 Mks

ANS

Volume $= \frac{2 \text{ x } 10,000 \text{ x } 10,000}{1000} \text{ x } \frac{25}{10}$ M1√ x section area

M1√ conv. to litres

$= 500,000$ Lts $\underline{\text{A1}}$

$\underline{\underline{3}}$

12. Solve the equation $\frac{a}{3} - \frac{3a - 7}{5} = \frac{a - 2}{6}$ (3 Mks)

ANS

$10a - 6(3a - 7) = 5(a - 2)$ M1

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

$-13a = -52$ M1

$a = 4$ $\underline{\text{A1}}$

$\underline{\underline{3}}$

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)

ANS

$2a + 12d = 2$

$2a + 4d = -10$ M1

$8d = 12$

$d = 1^1/_2$ A1

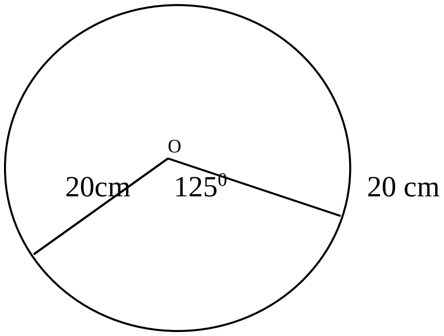
$a = -8$ B1

$S_{21} = {}^{21}/_2 (-16 + 20 \text{ X } 3/2)$ M1

$= 147$ $\underline{\text{A1}}$

$\underline{\underline{5}}$

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



ANS

$2 \pi r = \frac{120}{360} \text{ x } \pi \text{ x } 40$ M1

$r = 6.667$ cm A1

$h = \surd 400 - 44.44$ M1

$= 18.86$ cm $\underline{\text{A1}}$

$\underline{\underline{4}}$

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

ANS

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

$= \underline{(w - y)(x - z)(w + z)}$ M1√ grouping

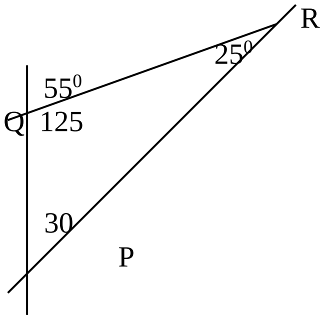
$$= \frac{(z - w)\ (z + w)}{\underline{(w - y)\ (x - z)}} \quad z - w$$

A1

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)

ANS

16.



B1√ sketch

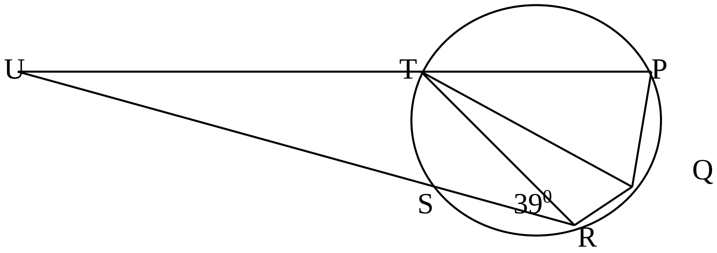
$PR = \frac{\underline{4 \sin 125}}{\text{Sin } 25}$ M1

A1

3

SECTION II (50 MARKS)

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



Calculate

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

ANS

(a)

<RST = $180^0 - 74^0$ = 106^0

B1

(b) < RTQ = $90^0 - 74^0$ = 16^0

B1

< PTR = $46^0 + 16^0$ = 62^0

B1

< SUT = $62^0 - 39^0$ = 23^0

B1

(c) Reflex ∠RQT = 180 - 2 x 16

= 180 - 32 = 148^0

B1

Obtuse ROT = 360 - 148 = 212^0

B1

(d) < PTS = 46 + 180 - 129 = 97^0

B1

< PST = 180 - (97 + 39) = 44^0

B1

18. The exchange rate on March 17th 2000, was as follows: -

1 US$ = Kshs.74.75

1 French Franc (Fr) = Kshs.11.04

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

(a) How much in dollars did he receive from his Kshs.350,000 in 4 s.f? (2 Mks)

(b) The tourist spend ¼ of the amount in America and proceeded to France where he spend Fr 16,200. Calculate his balance in French Francs to 4 s.f (3 Mks)

(c) When he flies back to Kenya, the exchange rate for 1 Fr = Kshs.12.80. How much more in Kshs. does he receive for his balance than he would have got the day he left? (3 Mks)

ANS

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

= $ 4682 A1

(b) Balance = $^3/_4$ x 4682

= $ 3511.5 B1

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

= Fr 23780 A1

Expenditure = Fr 16 200

Balance= Fr 7580

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

= Kshs.97,024

Value on departure = Kshs.7580 X 11.04

= Kshs.83 683.2 } B1 both√

Difference = Kshs.97,024 - 83683.2 M1

= Kshs.13,340.80 A1

8

19. On the provided grid, draw the graph of $y = 5 + 2x - 3x^2$ in the domain $-2 \leq x \leq 3$ (4 Mks)

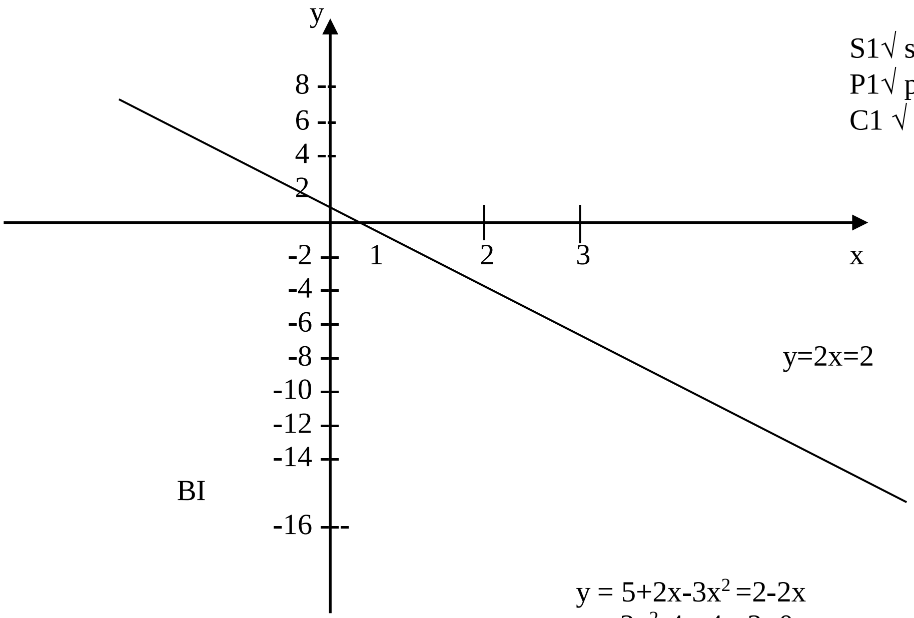
(a) Draw a line through points (0,2) and (1,0) and extend it to intersect with curve y = 5 + 2x – 3 x 2 read the values of x where the curve intersects with the line (2 Mks)

(b) Find the equation whose solution is the values of x in (a) above (2 Mks)

ANS

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

B1√value



S1√ scale
P1√ plotting
C1 √ curve

x =-0.53 +0.1

Nx = 1.87+0.1

$y = 5+2x-3x^2 =2-2x$
$3x^2-4x-4x-3=0$

MI for equation
$\underline{\text{AI equation}}$
8

x = -0.53 ± 0.1
mx = 1.87 ± 0.1

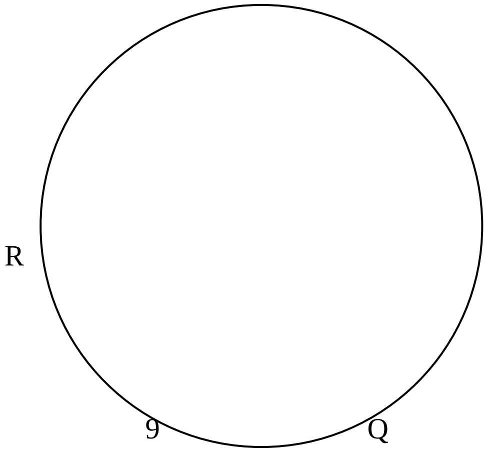
B1

$y = 5 + 2x – 3x^2 = 2 – 2x$
$\therefore$ 3x2 – 4x – 3 = 0

M1 √ for equation
M$\underline{\text{A1}}$ √ equation
$\underline{\underline{8}}$

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

ANS

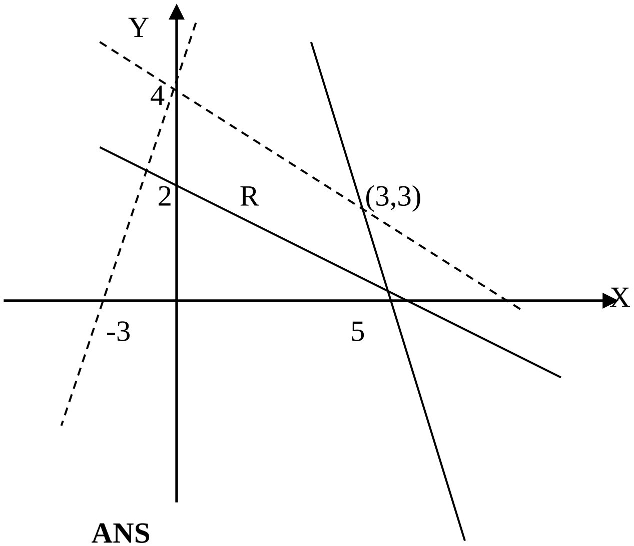


B1 √ 30^0

B1 √ 2 ⊥ PQ, QR
B1 √ 2 ⊥ bisectors
B1 √ circle

Radius = 4.2 ± 0.1 B1√ radius
Area of circle = $^{22}/_{7}$ x 4.22
= 55.44 ± 3 cm2
Area of Δ PQR = $^{1}/_{2}$ x 3.5 x 7.5 sin 30 M1√ Δ and circle
= 6.5625 cm^2
Difference = *55.44 - 6.5625* *M1 √sub*
= 48.88 cm^2 A1 8

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



ANS

Line (i) $^{y}/_{2} + ^{x}/_{5} = 1$
5y + 2x = 10 B1√equation
5y + 2x = 10 B1√ inequality
Line (ii) $^{y}/_{4} + ^{x}/_{-3} = 1$
3y = 4x + 12 B1√ equation
3y < 4x + 12 or 3y - 4x < 12 B1√ inequality
Line (iii) *grad =* $^{-1}/_{3}$ *y inter = 4*
3y + x = 12 or 3y = -x + 12 B1√ equation
3y + x < 12 B1√ inequality
Line (iv) $\frac{y - 3}{x - 3} = \frac{-3}{2}$
2y + 3x = 15 B1√ equation
∴ 2y + 3x ≤ 15 B1√ equation
8

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)

ANS

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

B1√ x column
B1√ f column

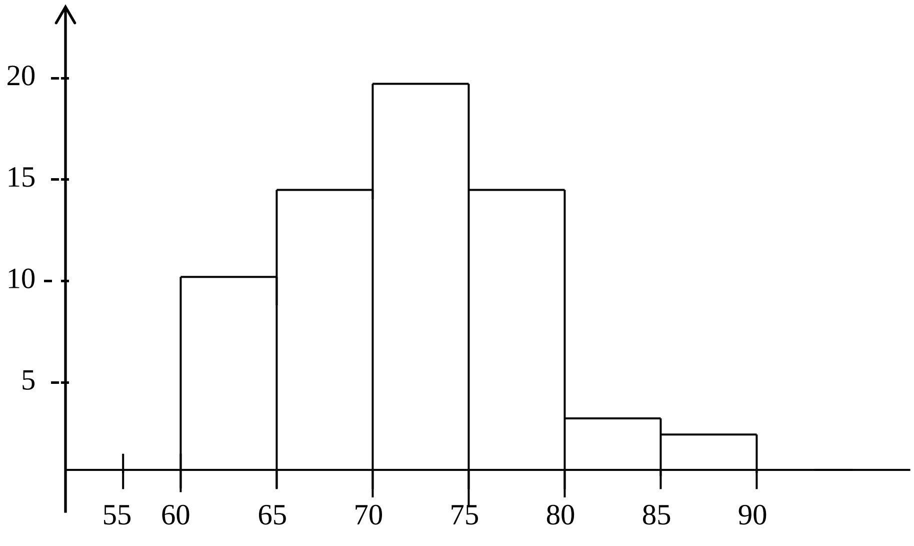
(a) (i) Modal class = 70 - 74 B1√ model class
(ii) Median class = 70 - 74 B1√ median

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

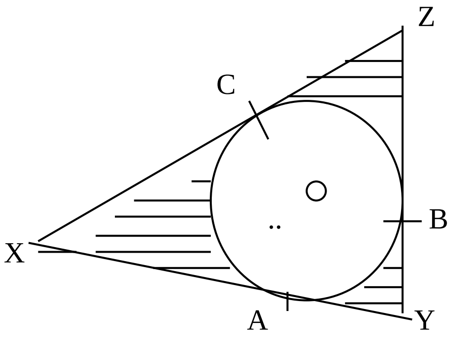
S1√ scale
B1 √ blocks
59.5 - 64.5
64.5 - 69.5 e.t.c.

(c)

Histogram



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)

ANS

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

YZ = 10 - a + 12 - a = 8 M1

2a = 14

a = 7 cm A1

$$\text{Cos X} = \frac{100 + 144 - 64}{240}$$ M1√ any angle of the Δ

= 0.75

$X = 41.41^0$

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

r = OA = 7tan 20.7 B1 √ radius

= 2.645 cm

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

= 39.69 - 21.99

= 17.7 cm^2 A1√

$\underline{\underline{8}}$

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)

ANS

(a) $650,000\ (0.85)^n = 130,000$ M1√ formula

1.15n = 0.2

$$n = \frac{\log 0.2}{\log 0.85}$$ M1√

$$= \frac{\bar{1}.3010}{\bar{1}.9294}$$

$$= \frac{-0.6990}{-0.0706}$$ M1

= 9.9 years A1

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

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

$1 - {}^r/_{100} = 0.5^{1/5}$ M1

= 0.8706

${}^r/_{100} = 0.1294$ A1

r = 12.9 % B1

8

MATHEMATICS 2
PART I

SECTION A:

1. Use logarithm tables to evaluate (4 mks)

$$\frac{0.0368 \text{ x } 43.92}{361.8}$$

ANS

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

Logs

+ - v ans (4)

= 3.6502

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

$6.6850 \text{ x } 10^{-2}$

= 0.06685

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

ANS

$x^2 - \frac{5}{2}x + ½ = 0$

$x^2 - \frac{5}{2}x = {}^-½$

$x - \frac{5x}{2} + \frac{^-5}{4}^2 = {}^-½ + \frac{^-5}{4}^2$ (m)

$= x - \frac{5}{4} = {}^-½ + \frac{25}{16} = \frac{17}{16}$ (3)

= x – 5/4 = 17/16 = 1.0625

x – 5/4 ± 1.031

X_1 = -1.031 = 1.25 = 0.2192

X_2 = 1.031 + 1.25 = 1.281

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)

ANS

$A_1 = P(1 + R/100)^2$ = 6000 x 113/100 x 113/100 = Sh. 7661.40

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

= Shs. 7800

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

Shs. 138.60

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)

ANS

Let a plate be p and a cup c.

$3p + 4c = 380 \ \text{x}\ 5 \qquad 15p + 20c = 1900$

$4p + 5c = 490 \ \text{x}\ 4 \qquad \underline{16p + 20c = 1960}$

$-p \quad -60$ (m)

$p = \text{Shs } 60$

$3(60) + 4c = 380$

$4c = 380 - 180 = 2000$ (3)

$c = \text{Shs. } 50$

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

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)

ANS

Ratio of juice to water = 1 : 7

In 1 glass = 1/8 x 200 = Sh 25

3 litres = 300 ml (undiluted concentrate) (3)

No. of glasses =v $\frac{3000}{25}$ = 120 glasses

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

ANS

$\cos(2\theta + 120) = 3/2 = 0.866$

Cos 30 , 330, 390, 690, 750 ….

2 θ + 120 = 330

$2\theta = 210$, $= 105^0$ (3)

$2\theta = 390 - 120 = 270^0$, $\theta_2\ 135^0$

$2\theta = 690 - 120 = 570^0$, $\theta_3\ 285^0$ (for 4 ans)

$\theta_4 = 315^o$ (for >2)

$2\theta = 750 - 120 = 630^0$,

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)

ANS

$P = \frac{k}{Q^2} \qquad \frac{4}{9} = K/4$ (substitution)

$K = \frac{4 \text{ X } 4}{9} = \frac{16}{9}$

$P = \frac{16}{9Q^2}$ v when Q = 4

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

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

ANS

The perimeter = (3.6 + 2.8) x 2 = 12.8 cm

Max perimeter = (3.65 + 2.85) x 2 = 23 cm Expressions

$\%\ \text{error} = \frac{13 - 12.8}{12.8} \text{ x } 100$ **m** $= \frac{0.2}{12.8} \text{ x } 100$ (3)

$= 1.5620\%$ (A)

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

ANS

$\frac{1\,1/6 \text{ x } \frac{3}{4} - 11/12}{\frac{1}{2} \text{ of } 5/6} = \frac{(7/6 \text{ x } \frac{3}{4}) - 11/12}{\frac{1}{2} \text{ of } 5/6} = \frac{7/8 - 11/12}{5/12} = \frac{21-22}{5/12}$

$= \frac{-1/24}{5/12} = \frac{-1}{24} \text{ x } \frac{12}{5} = \frac{-1}{10}$ (3)

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)

ANS

Volume of rod $= \Pi r^2h = 22/7 \text{ x } 4 \text{ x } 14 = 704\text{cm}^3$ **(m)**

Volume of each cube $= 2\text{x}2\text{x}2 = 8 \text{ cm}^3$ A

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

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

ANS

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

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

$h = 4 \text{ x } 2.414$ A

$= 9.650\text{cm}$

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

Octagon area $= 38.628 \text{ x } 8$ m

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

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

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

ANS

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

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

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

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

ANS

$x^2 + y^2 – 6x + 8y – 11 = 0$

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

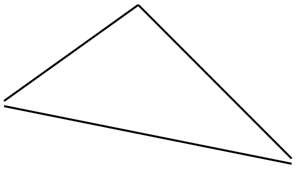
$(x – 3)^2 + (y+4)^2 = 11 + 9 + 16 = 36$

$(x – 3)^2 + (y + 4)^2 = 6^2$

Centre is (3, -4)

Radius = 6 units As (3)

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



ANS

Figs A C B and D C E are similar

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

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

$10y = 15 + 3y$

$7y = 15$

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

$60 = 18 + 3x$

$3x = 42$

$x = 14$

$y = 15/7$ (A) (3)

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

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

ANS

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

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

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

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

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

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

-2/5

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

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

$= c = 52/5$

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

16. 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)

ANS

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

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

$$= 0.04\text{m/s}_{2-}$$ (2mks)

SECTION B:

17. Construct without using a protractor the triangle ABC so that BC=10cm, angle ABC = 60^0 and BCA = 45^0
    a. On the diagram , measure length of AC
    b. Draw the circumference of triangle ABC
    c. Construct the locus of a set of points which are equidistant from A and B.
    d. Hence mark a point P such that APB = 45^0 and AP = PB
    e. Mark a point Q such that angle AQB = 45^0 and AB = AQ (8)

ANS

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

18. (a) A quadrilateral ABCD has vertices A(0,2) , B(4,0) , C(6,4) and D(2,3). This is given a transformation by the matrix $\begin{matrix} -2 & 0 \\ 0 & -2 \end{matrix}$ to obtain its image $A^I B^I C^I D^I$. under a second transformation which has a rotation centre (0,0) through -90^0 , the image A^{II} B^{II} C^{II} D^{II} of A^I B^I C^I D^I is obtained. Plot the three figures on a cartesian plane (6mks)
(b) Find the matrix of transformation that maps the triangle ABC where A (2,2) B (3,4) C (5,2) onto A B C where A(6,10) B (10,19) C (12, 13). (2mks)

ANS

(b) $\begin{matrix} a & b \\ c & d \end{matrix} \quad \begin{matrix} 2 & 3 & 5 \\ 2 & 4 & 2 \end{matrix} \quad \begin{matrix} 6 & 10 & 12 \\ 10 & 19 & 13 \end{matrix}$

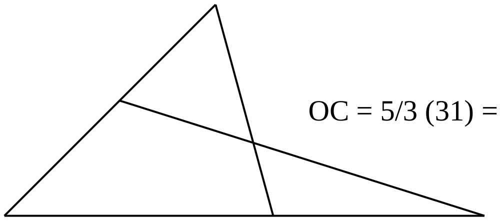
2a +2b = 6 x 2 = 49 + 4b = 12
3a + 4b = 10 $\underline{3a + 4b = 10}$
a = 2 4 + 2b = b

2c + 2d = 10x2 = 4c + 4d = 20 2 b = 2 b = 1
3c + 4d = 19 $\underline{3c + 4d = 19}$
c = 1
2 (1) + 2d = 10
2d = 8 Matrix is $\begin{matrix} 2 & 1 \\ 1 & 4 \end{matrix}$ (A)
d = 4

19. In the triangle OAB, OA = 3a , OB = 4b and OC = 5/3 OA. M divides OB in the ratio 5:3
    a. Express AB and MC in terms of a and b
    b. By writing MN in two ways, find the ratio in which N divides
    i. AB

ii. MC

<u>ANS</u>



OC = 5/3 (31) = 5A

(a) = AO + OB
= -3a = 4b

MC = MO + OC
= -5/8 (4b) + 5
= 5A – 5/2 b

(b) MN = 5 Mc = 3(5a – 5/2 b)
= 5 s a – 5/2 s b

MN = BN + BN
= 3/8 (4 b) + (1 – t) (-BA)
= 3/8 (4 b) + (1 – t)(3a – 4 b)
= 3/2 b + 3 ta –4b + 4tb
= (3-3t) a (4t – 5/2)b

MN = MN
= 5 s a – 5/2 sb = (3-3t)a + (4t – 5/2)b
= 5 a = 3 – 3t = 5s + 3t =3
= -5/2 s = 4t –5/2 v <u>5s + 8t = 5</u>
-5t = -2t = 2/5
5 s = 3 – 3(2/5)
= 3 – 6/5 = 9/5
= 3 – 6/5 = 9/5
s = 9/25

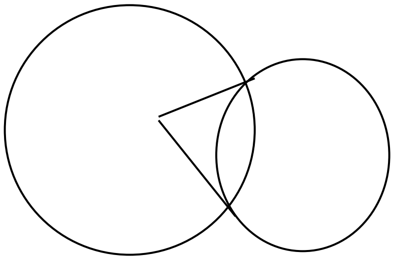
(i) AN : NB = 2 : 3

(ii) MN : 9 : 16

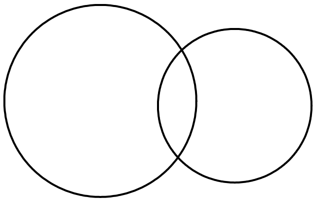
20. In the figure below, SP = 13.2 cm, PQ = 12 cm, angle PSR = 80^{O} and angle PQR = 90^{0}. S and Q are the centres (8mks)

Calculate:

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



ANS



θ x πr^2
360

a. Area of sector SPR = 80/360 x 13.2 x 13.2 x 3.142
= 121.6
Area of triangle SPR ½ x 13.2 x 13.2 x sin 80
= 85.8 cm^2
(m of area of) A (*at least one*)
(m of area) A(*at least one)*
Area of segment = 121.6 – 85.8
= 35.8 cm^2
Area of sector QPR = 90/360 x 3.142 x 12 x12

Area of PQR = ½ x 12 x 12 = 72^2
Area of segment = 113.1 – 72
= 41.1cm^2
Area of intersection = (35.8 + 41.1) = 76.9 cm^2

b). Area of quadrilateral = Area of PQR + SPR
= 85.8 + 72 = 157.8cm^2
Area of shaded region = Area of Quadrilateral – Area of sector SPR
= 157.8 – 121.6
= 36.2 cm^2

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

ANS

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

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

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

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

$\underline{q = 7.62.}$

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

$\underline{p = 7.62 \text{ x } 095 = 7.27}$

at x = 14, y = 2.7

at y = 0.46, 1/y = 2.174

x = 9.6.

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

ANS

Distance = 75km uphill speed = vkm/h

uphill Time = 75/v hrs

Downhill speed = (+ 20) km/h

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

Takes larger uphill

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

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

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

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

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

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

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

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

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

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

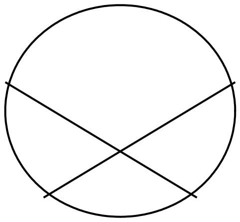
Average speed = $\frac{\text{Total distance}}{\text{Total time}} = \frac{150\text{km}}{4\text{hrs}} = \underline{37.5 \text{ km/ hr}}$

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

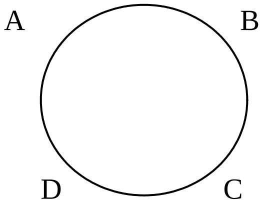
23. In the diagram below, X is the point of intersection of the chords AC and BD of a circle. AX = 8 cm, XC = 4cm and XD = 6 cm

a. Find the length of XB as a fraction
b. Show that XAD is similar to XBC
c. Given that the area of AXD = 6cm^2, find the area of BXC
d. Find the value of the ratio

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



ANS



A x X x C = BX . XD

$8 \times 4 = 6BX$

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

X AD = XBC

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

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

< AXD = BXC (vertically opposite $<_{s)}$)

SAS holds : they are similar.

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

Area A x A = 6cm$_2$ Area B x C = $6 \times \frac{9}{4}$ = 27 = $\underline{13.5\text{cm}^2}$

24. A town B is 55 km on a bearing of 050^0. A third town C lies 75km due south of B. Given that D lies on a bearing of 255^0 from C and 170^0 from A, make an accurate scale drawing to show the positions of the four towns. (3mks)
(scale 1cm rep 10 km)
From this find,
(a) The distance of AD and DC in km (2mks)
(b) The distance and bearing of B from D (2mks)
(c) The bearing of C from A (1mk)

ANS

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

MATHEMATICS I
PART II
SECTION (52 MARKS)

1. Without using tables, simplify

$$\frac{1.43 \times 0.091 \times 5.04}{2.86 \times 2.8 \times 11.7} \qquad (3mks)$$

ANS

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

= 0.007 (A) (3)

2. Make x the subject of the formula if

$y = a/x + bx$ (3mks)

ANS

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

Either

$bx^2 - yx + a = 0$

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

3. Give the combined solution for the range of x values satisfying the inequality

$2x + 1 < 10 - x < 6x - 1$ (3mks)

ANS

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

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

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

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

$11/7 \leq x \leq 3$

4. A 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)

ANS

a = 4000 r = 110/100 = 1.1 (4000, 4000 + 4000, 4400 + 0/100 (4400------)

(a and r)

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

1.1 Log = 0.04139

X 5

0.20695

0.1 (4)

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

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

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

5. A town A is 56 km from B on a bearing 062^0. A third town C is 64 km from B on the bearing of 140^o. Find

(i) The distance of A to C (2mks)

(ii) The bearing of A from C (3mks)

ANS

(i) $b^2 = a^2 + b^2 – 2ab \text{ Cos } B$

$= 64^2 + 56^2 – 2(64)(56) \cos 78$

$= 4096 + 3136 - 7168 (0.2079)$

$= 7232$ - km 1490.3

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

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

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

Sin A = 0.08262

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

Bearing = 90 – 28 – 55.7

$= 0.06.3^0$ (A)

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

ANS

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

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

y = 0.02

7. Rationalise the denominator in (2mks)

$$\frac{\sqrt{3}}{1 – v3}$$

ANS

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

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)

ANS

Moving averages of order 4

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

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

$M_3 = \frac{172– 40 + 38}{4} = \frac{170}{4} = 42.\underline{5}$

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

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

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

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

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

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

ANS

y = 3x + 4

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

$$\begin{array}{cccc} A & B & A & B \\ 2 & 1 & 0 & 1 \\ -1 & 2 & 4 & 7 \end{array} = \begin{matrix} 4 & 9 \\ 8 & 13 \end{matrix}$$

Y = Mx + C

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

y = x+c y = x + 4

8 = 4 + c c = 4

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

ANS (3mks)

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

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

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

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

2x - 3y = 7

4x + 3y +5

ANS (3mks)

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

$$\text{Inv.} = \frac{1}{18} \begin{matrix} 3 & 3 \\ -4 & 2 \end{matrix}$$

$$\frac{1}{18} \begin{matrix} 3 & 3 \\ -4 & 2 \end{matrix} \begin{matrix} 2 & -3 \\ 4 & 2 \end{matrix} \begin{matrix} x \\ y \end{matrix} \quad \frac{1}{18} \begin{matrix} 3 & 3 \\ -4 & 2 \end{matrix} \begin{matrix} 7 \\ 5 \end{matrix}$$

x 36

y $\frac{1}{18}$ -18 (3)
x = 2, y = -1 (A)

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

1/7 + 3/12 + 7/0.103

ANS

1/7 + 3/12.4 + 7/0.103

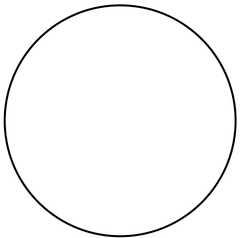
$1/7 + 3/1.24 \times 10^{-1} + 7/1.03 \times 10^{-1}$

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

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

=70.52 **(A)**

13.



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

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

ANS

(i) ADC = 2x73
= 146^0

(ii) OCB = x = 180 – 146 = 34
(iii) 360 – 107 – 146 – 34
= 73^0

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

ANS (4 mks)

Tan 30^0 = y/x y = x tan 30

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

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

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

ANS

5 km Slower speed = x km/hr
Time = 5/x
Faster = (x+20) k/h
Time = 5/x=20 $T_1 - T_2$ = 5/x - 5/x+20 = 30/3600
5 (x+20) –5x 1
x(x+20) 120
120 (5/x + 100 – 5x) = x^2 + 20x (5)
x^2 + 20x – 12000
x = -20 400 + 48000
2
x = -20 ± 220
2
Spd = 100 km/h
And x = 120 km/h (A)

16. If log x = a and log y = b, express in terms of a and b
Log x ^{3}
VY

ANS

Log x = a log y = b
Log x^3 = Log x^3 - log y ^{½}
y
= 3 Log x – ½ Log y
= 8a – ½ ab

(2mks

SECTION B:

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

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

Using an assumed mean of 44.5, calculate

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

ANS

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

=90 =1 =223

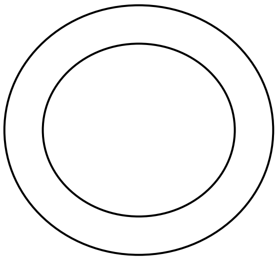
(a) Mean = (1 / 90 x 10) + 44.5 = 44.5 + 0.111
= 44.610

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

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

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

b. Solve the equations
   - i. $2x^2 – x – 4 = 0$
   - ii. $2x^2 – 3x – 4 = 0$



ANS

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

Shaded area = $\Pi R^2 – \Pi r^2$
= $22/7\ (4^2 - 3^2)$ v = 22/7 x 7 = 22
Large area = 22/7 x4x4 = 352/7 (A)
Probability = $\frac{22}{352/7} = 22 \times \frac{7}{352} = \frac{7}{16}$

(b)

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

(M)

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

(4)

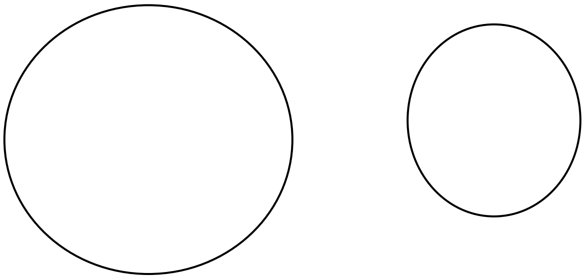
(ii) P (sum of 8) = P((2,6) or (3,5) or (4,4) or (5,3) or (6,2))
= 5/36 (A)

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

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

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

20.



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

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

ANS

(i) Cos 60 = x/20 x = 20 x 0.5 = 10 cm
BD = 12 – 10 = 2 cm

(ii) CD = y Sin 60 = y/20 y = 20x 0.8666
CD = 17.32 cm

(iii) CHG = 120 reflex = 240^0
CHG = 240/360 x 2 x π x r
= 50.27
DBF = 120^0/360 x 2 x Π x r = 1/3 x 2 x 3.142 x 2
= 4.189 (A)
Length C D E f G H C = 50.27 + 2(17.32) + 4.189
= 89.189 (A)

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

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

ANS

(a) From the diagram, XO = 5/2 = 2.5
Tan 75^0 = VO/2.5 v m
VO = 2.5 x 3.732

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

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

(c) = VAO Tan = $\frac{9.33}{3.536}$ = 2.639

VAO = 69.24^0 (A)

(d) Cos VBA = = 2.5 /9.98 = 0.2505

VBA = 75.49^0

Area VBA = ½ x 5 x 4.99 x sin 75.45 m (or other perimeter)

= 5 x 4.99 x 0.9681

= 24.15 cm^2 (A)

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

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

ANS

Volume = cross – section Area x L

X-sec Area = (1 x 25) + (½ x 25 x 2.5)

= 25 + 31.25 = 56. M

Volume = 56.25 x 12

= 675 m^3

Volume passed / sec = cross section area x speed

= Π r^2 x l = 3.14 x 9/100 x 9/100 x 3 (8)

= 0.07635 m^3/sec v (M)

Volume emptied in 2 minutes

= 0.07635 x 60 x 2

= 9.162 m^2 (A)

1 m^3 = 1000 l

= 9.162 litres

= 9160 litres (A)

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

MATHEMATICS II
PART II

1. Use logarithm tables to Evaluate

$$\sqrt[3]{\frac{36.5 \times 0.02573}{1.938}}$$

(3mks)

ANS

No	log.
36.5	1.5623
0.02573	$\underline{-2.4104 +}$
	-1.9727
1.938	$\underline{0.2874 -}$
	-1.6853

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

-1 + 0.8951

1.273(4) ← 0.1049

1.273(4)

2. The cost of 5 shirts and 3 blouses is sh 1750. Martha bought 3 shirts and one blouse for shillings 850. Find the cost of each shirt and each blouse. =

ANS

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. If $K = \left(\frac{y-c}{4p}\right)^{1/2}$
   a) Make y the subject of the formula. (2mks)
   b) Evaluate y, when K = 5, p = 2 and c = 2 (2mks)

ANS

(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. Factorise the equation:
   $x + 1/x = 10/3$

ANS

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

5. DA is the tangent to the circle centre O and Radius 10cm. If OD = 16cm, Calculate the area

of the shaded Region.

ANS

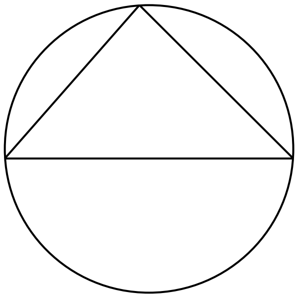
Area Δ OAD pyth theorem AD =12.49cm
½ x 12.49 x 10 = $62.45cm^2$
Cos $\theta = 10/16 = 0.625$
$\theta = 51.3^0$ 62.5
Sector $\frac{57.3^0}{360}$ x 3.14 x 100 $\underline{40.2\ -}$
= 22.3

6. Construct the locus of points P such that the points X and Y are fixed points 6cm apart and $\angle XPY = 60^0$.

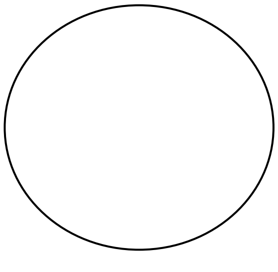
(2mks)

ANS

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



Construct 30^0 angles
at XY to get centres
$\frac{B1}{2}$ C_1 and C_2 mojar arcs drawn
on both sides with C_1X and C_2X
as centres.



7. In the figure below, ABCD is cyclic quadrilateral and BD is diagonal. EADF is a straight line,

CDF = 68^0, BDC = 45^0 and BAE = $98^{0.}$

Calculate the size of: (2mks)

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

ANS

DAB = $180^0 - 98^0 = 82^0$
ADB = 180 – (68 + 45) = 67^0
ABD = 180 – (67 + 82)
= 31^0

(a) $180^0 - (67 + 82)^0 = 31^0$
$\angle$ABD = 31^0
(b) $(180 - 82)^0 = 98^0$
$180^0 - (98^0 - 45^0) =$
$\angle$CBD = 37^0

Opp = 180^0
82 + 98 = 180^0

_ 180 – $(98 + 45)^0$
= 37^0

8. Otieno bought a shirt and paid sh 320 after getting a discount of 10%. The shopkeeper made a profit of 20% on the sale. Find the percentage profit the shopkeeper would have made if no discount was allowed? (2mks)

ANS

$\frac{10}{100}$ x 320 Discount = sh 32
Sold at sh 288
If no Discount = ($\frac{320}{288}$ x 20) % = 22.7%

9. Calculate the distance:
i) In nautical miles (nm)
ii) In kilometres (km)
Between the two places along the circle of Latitude:
a) A(30^0N, 20^0E) and B(30^0N, 80^0E) (Take Radius of Earth = 6371Km). (2mks)
b) X(50^0S, 60^0W) and Y(50^0S, 20^0E) (Take Radius of Earth = 6371Km). (2mks)

ANS

(a) Dist along circle of lat.
Long diff x 60 x cos θ nm
100 x 60 x Cos 50^0
100 x 60 x 0.866
5196nm = $\frac{100}{360}$ x $2\pi R$ Cos 50^0
$\frac{100}{360}$ x 2 x 3.14 x 6371 = 5780Km

(b) 80 x 60 Cos 50 = 3895 Km

10. 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)

ANS

Vol =2.8 x 2.4 x 3 = $20.16m^3$
$1m^3$ = 1000 L
$20.16m^3$ = 20160 L
20160
$\underline{\quad 3600}$
16560 L to fill
0.5 L – 1 sec
16560 L - ?
$\underline{165600}$
5 x 3600
$\underline{33120}$ hr
3600 ≅ 9.41 hrs ; ≅ 564.6 min.

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)

ANS

$1^5 + 5.1^4a + 10.1^3.a^2 + 10.1^2a^3 + 5.1.a^4$
a = -0.2
$1 + 5(-0.2) + 10(-0.2)^2 + 10(-0.2)^3 + 5(-0.2)^4$
1 – 1.0 + 0.4 – 0.08 + 0.008 = 0.3277 (4d.p)

12. 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 (π = 3.14). (4mks)

ANS

Area of metal : Material – Cross section.
$\pi(R^2 – r^2)$
3.14 (21 –19)
Vol $6.28cm^2$ x 3400cm
= $215.52m^3$

13. 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)

ANS

Possibility space:

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

P(odd) = 3/6 = ½
P(Sum > 7 but < 10) = 9 /36
∴ P(odd) and P(sum > 7 but < 10)
= ½ x 9/36 = 9/72 = 1/8

14. Find the following indefinite integral $\int \frac{8x^5 - 3x}{x^3}\, dx$ (4mks)

ANS

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

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

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

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

15. The figure below represents a circle of radius 14cm with a sector subtending an angle of 60^0 at the centre.Find the area of the shaded segment.
(3mks)

ANS

Area of ΔAOB

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

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

Shaded Area

$84.666 - 10.257 = 74.409cm^2$

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)

ANS

Marks	**F**	**Fx**	**fx²**
5	3	15	75
6	8	48	288
7	9	63	441
8	6	48	384
9	4	36	324

$\sum x =$ $\sum f=30$ $\sum fx=210$ 1512

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

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

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

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

SECTION II .

17. 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)

ANS

(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) $\theta = Tan^{-1} 5/5 = Tan^{-1} = 45^0$
(d) $\beta = Tan^{-1} 5/7.071 = Tan^{-1} 0.7071 = 35.3^0$
(e) $y = Tan^{-1} 5/3.535 = Tan^{-1} = 54.7^0$
(f) $\angle AGX = 19.4^0$

18. Draw on the same axes the graphs of $y = Sin\ x^0$ and $y = 2Sin\ (x^0 + 10^0)$ in the domain $0^0 \leq x^0 \leq 180^0$
i) Use the graph to find amplitudes of the functions.
ii) What transformation maps the graph of $y = Sin\ x^0$ onto the graph of : $y = 2Sin\ (x^0 + 10^0)$.

ANS

$y = Sin\ x$

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

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

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

Amplitudes for $y = Sin\ x^0$ is 1
For
$y = Sin(x+10^0)$ is 2.

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.

ANS

c.f	X	F
61	53	12
16		54
93	55	16
103	56	10
11		57
123	58	9
130	59	7
135	60	5
138	61	3
142	62	4
145	63	3
148	64	3
149	65	1
150	70	1

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

52 - 0.02

= <u>51.08</u>

Median = 51.4g.

class interval 59

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

20. 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.

<u>ANS</u>

$X + Y \leq 1000$

$X \leq 2Y$

$Y < 720$

$X > 90$

21. Two aeroplanes, A and B leave airport x at the same time. A flies on a bearing 060^0 at 750km/h and B flies on bearing of 210^0 at 900km/h:
   a) Using a suitable scale draw a diagram to show the positions of Aeroplanes after 2hrs.
   b) Use your graph to determine:
      i) The actual distance between the two aeroplanes.
      ii) The bearing of B from A.
      iii) The bearing of A from B.

ANS

(a) 1cm = 200Km/h

A = 200 x 7.5 = 1500 Km

B = 200 x 9 = 1800Km.

(b) (i.) 15.8cm x 200	(ii) Bearing 224^0
= 3160 Km.	(iii) Bearing 049^0

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.

ANS

(a) $P(R) \times P(R)^1$	(b) $P(R)' \times P(R)$	(c) $P(R) \times P(R')$
$= 0.5 \times 0.6$	0.5×0.4	$P(R)' \times P(R)$
$= 0.3$	$= 0.2$	$0.5 \times 0.6 = 0.3$
		$0.5 \times 0.4 = 0.\ 2 = 0.5$

23. Calculate the Area of each of the two segments of y = x(x+1)(x-2) cut off by the x axis. (8mks)

ANS

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

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

$A_1 = \int(x^3 - x^2 - 2x)\ d_4$

${}^{-1}[\frac{1}{4} x^4 - \frac{1}{3} x^2]_{-1}$

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

$A_2 = {}^2\int(x^3 - x^2 - 2x)\ d_4$

$= {}^0\int \frac{1}{4} x^4 - 1/3\, x^3 - x^2)^{-2}{}_0$

$= (\frac{1}{4} .16 - 1/3 .8 - 8)$

$= 4^{-0} - 8/3 - 4 = - 8/3$

$A_1 = 5/12 = A_2 = 2\,{}^2/_3$

24. Find the co-ordinates of the turning point on the curve of y = $x^3 - 3x^2$ and distinguish between them.

ANS

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

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

At stationary

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

i.e $3x^2 - 6x = 0$

$3x(x - 2) = 0$

$x = 0$ or 2

Distinguish

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

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

dx^2

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

$-6 < 0$ – maximum.

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

(ii) $x = 2$

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

$6 > 0$ hence

Minimum Pt.

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

$(2, -4)$ minimum point.

.

$\underline{\underline{8}}$

MATHEMATICS VI
PART II
SECTION 1 (52 MARKS)

1. Simplify $\left(\frac{32a^{10}}{b^{15}}\right)^{-2/5} \div \left(\frac{9b^4}{4a^6}\right)^{11/2}$ (2 Mks)

ANS

$= \frac{b^{15}}{32a^{10}}{}^{2/5} \times \frac{4a^6}{9b^4}{}^{3/2}$ M1√ reciprocal

$= \left(\frac{2a^5}{27}\right)$ A1 $\underline{\underline{2}}$

2. Use logarithm tables to evaluate

$$\frac{\sqrt{0.375 \cos 75}}{\tan 85.6}$$

(4 Mks)

ANS

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

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)

ANS

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

= Shs.480 B1

Cost Price = x

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

$x = $ Shs.500 A1

3

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)

ANS

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

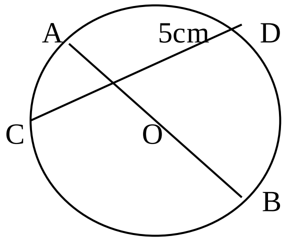
$r^2 + hr + ({}^{h}/_{2})^2 = {}^{A}/_{2A} + {}^{h}/_{4}$ M1

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

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

4

5. In the circle centre O, chords AB and CD intersect at X. XD = 5 cm
XC = 1/4 r where r is radius. AX:XO = 1:2 Calculate radius of the circle. (3 mks)



ANS

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

$4r^2 - qr = 0$

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

$r = 0$

or $r = 2.25$ A1

3

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

ANS

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

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

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

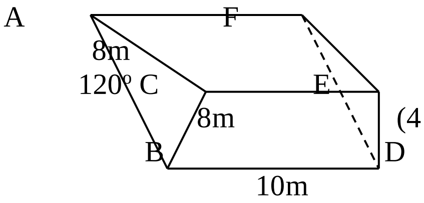
3

7. P is partly constant and partly varies as q2. When q = 2, P = 6 and when q = 3, P = 16. Find q when P = 64 (4 mks)

ANS

$P = Kq^2 + c$
$6 = 4k + c$
$\underline{16 = 9k + c}$ M1 √ subtraction
$5k = 10$
$k = 2$
$c = -2$ A1 √ k and c
$P = 64 \quad 2q^2 = 66$
$q = \sqrt{33}$
$= \pm 5.745$ $\underline{\text{A1}}$
$\underline{\underline{4}}$

8. The figure on the side is a tent of uniform cross-section ABC. AC = 8m, BC = 8m, BD = 10m and (ACB = 120^0. If a scout needs 2.5 m^3 of air, how many scouts can fit in the tent. (4 mks)



ANS

Volume = $^1/_2$ X 8 X 8 sin 120 X 10 M1 √ area of x-section
No. of scouts = $\frac{32 \sin 60 X 10}{2.5}$ *M1 √volume*
M1
$= 110.8$
$= 110$ $\underline{\text{A1}}$
$\underline{\underline{3}}$

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)

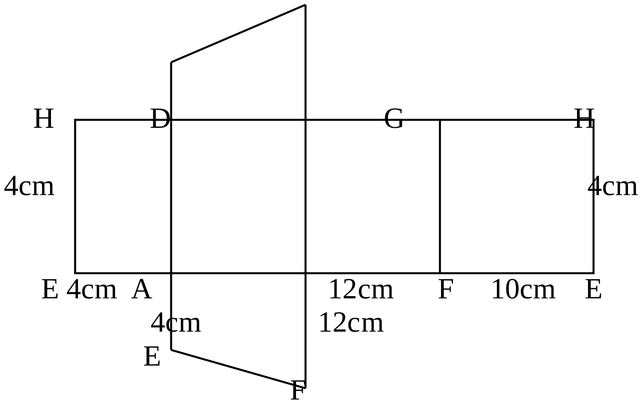
ANS

Max. error = $\frac{2(8.5 + 5.5) - 2(7.5 + 4.5)}{2}$
$= 2$ B1
% error = $^2/_{26}$ X 100 M1
$= 7.692\%$ $\underline{\text{A1}}$

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

3

ANS



B1 √ net

B1 √ dimen. FE must be 10cm

B1 √ labelling

3

11. Expand $(1 + 2x)^6$ to the 3rd term hence evaluate $(1.04)^6$ (4 mks)

ANS

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

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

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

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

$= 1.264$ A1

4

12. The eye of a scout is 1.5m above a horizontal ground. He observes the top of a flag post at an angle of elevation of 20^0. After walking 10m towards the bottom of the flag post, the top is observed at angle of elevation of 40^0. Calculate the height of the flag post (4 mks)

ANS

A_1 10cm B C

1-5

BT = 10 cm B1

CT = 10 sin 40 M1

= 6.428 m A1

h = 6.428 + 1.5

= 7.928 B1

4

13. A 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)

ANS

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

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

= 67.5 cm^2 A1

3

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)

ANS

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

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

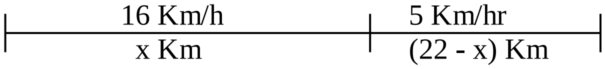
$2x - 60 = 120$

$x = 90$ km/h A1

3

15. Okoth traveled 22 km in $2^3/_4$ 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)

ANS



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

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

$11x = 132$

$x = 12$ km A1

3

16. 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)

ANS

AP = $^2/_9 \times 12 = 2^2/_3$ cm B1 √ both AP & AQ

AQ = $^5/_9 \times 12 = 6^2/_3$ *cm*

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

2

SECTION B (48 MARKS)

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

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

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

ANS

Taxable income = ${}^{115}/_{100} \times 8000$ M1

= Shs.9200 p. m

= Shs.110,400 p.a A1

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

= 3960 + 5940 + 7800 M1 √ last slab

= Shs.17,700 p.a

= 1475 p.m A1

net tax = 1475 - 400

= Shs.1075 B1 √ net tax

Total deductions = 1075 + 130

= Shs.1205

net income = 8000 - 1205 M1

= Shs.6795 A1

8

18. The probability Kioko solves correctly the first sum in a quiz is ${}^{2}/_{5}$ Solving the second correct is ${}^{3}/_{5}$ if the first is correct and it is ${}^{4}/_{5}$ if the first was wrong. The chance of the third correct is ${}^{2}/_{5}$ if the second was correct and it is ${}^{1}/_{5}$ if the second was wrong. Find the probability that

(a) All the three are correct (2 Mks)

(b) Two out of three are correct (3 Mks)

(c) At least two are correct (3 Mks)

ANS

.

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

= ${}^{12}/_{125}$ A1

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

M1

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

= ${}^{46}/_{125}$ A1

(c) P (at least 2 correct)

= P(2 correct or 3 correct)

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

$= \frac{46 + 12}{125}$ M1

$= \frac{58}{125}$ A1

8

19. 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)

ANS

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

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

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

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

$x^2 + 39x - 880 = 0$ A1 √ solvable quad. Eqn
$x^2 + 55x - 16x - 880 = 0$ M1 √ factors or equivalent
$(x - 16)(x + 55) = 0$
$x = -55$
or $x = 16$ A1 √ both values
$\therefore\ x = 16$
difference in purchase = 19 X 1.50 M1
= Shs.28.50 A1
8

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

ANS

. (a) $OP = a + {}^{1}/_{4}(b - a)$ M1
$= {}^{3}/_{4}a + {}^{1}/_{4}b$ A1
(b) $PQ = PO + OQ$
$= -{}^{3}/_{4}a - {}^{1}/_{4}b + {}^{1}/_{4}(a - b)$ M1
$= -{}^{1}/_{2}a - {}^{1}/_{2}b$ A1
(c) $QN = QO + ON$
$= {}^{1}/_{4}(b - a) + {}^{5}/_{3}b$ M1
$= {}^{23}/_{12}b - {}^{1}/_{4}a$ A1
(d) $PN = PB + BN$
$= {}^{3}/_{4}(b - a) + {}^{2}/_{3}b$ M1
$= {}^{17}/_{12}b - {}^{3}/_{4}a$ A1
8

21. A 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)

ANS

. (a) Volume in 2 days $= \frac{22}{7} \times \frac{3.5}{2} \times \frac{3.5}{2} \times \frac{150 \times 20 \times 3600}{1{,}000{,}000}$ M1 √ area of x-section
M1 √ volume in cm^3
$= 103.95\ m^3$ M1 √ volume in m^3
(b) $\frac{22}{7} \times r^2 \times 8 = \frac{103.95 \times 15}{2} \times 7$ M1

$r^2 = \frac{103.95 \times 15 \times 7}{2 \times 2\ 2x\ 8}$ M1
$= 31.01$ M1
$r = 5.568\ m$ A1
8

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

(a) If it was decided that the sponsor's money be shared according to the needs of the school with the rest equally, how much does each school get (5 mks)

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

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

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

= 13.25 Million A1

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

= 13.25 M1

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

6.5 + 10.53

= 17.03 m A1

B's share = 30.4 - 17.03 M1

= 13.37 Million <u>A1</u>

<u>8</u>

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)

<u>ANS</u>

Log V = n Log E = log k

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

B1√ log V all points

B1√ log E all points

S1 √ scale

P1√ plotting

Log V = n log E + log K L1 √ line

Log K = 0.08

K = 1.2 ± 0.01 B1 √ K

N = $^{0.06}/_{0.06}$ B1 √ n

= <u>1 ± 0.1</u>

∴ v = 1.2E <u>B1</u>√ v

when E = 0.75, V = 0.9 ± 0.1 <u>8</u>

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

(a) Draw triangle PQR and its image $P^IQ^IR^I$ of PQR under translation T = $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ on the provided grid (2 Mks)

(b) Under transformation matrix m = $\begin{pmatrix} 4 & 3 \\ 1 & 2 \end{pmatrix}$, $P^IQ^IR^I$ is mapped on to $P^{II}Q^{II}R^{II}$. Find the co-ordinates of $P^{II}Q^{II}R^{II}$ and plot it on the given grid (4 Mks)

(c) If area of $\Delta P^IQ^IR^I$ is 3.5 cm^2, find area of the images $P^{II}Q^{II}R^{II}$ (2 Mks)

ANS

(a) T $\begin{pmatrix}3\\4\\ \end{pmatrix}$ $PQR \rightarrow P^IQ^IR^I$

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

P^I Q^I R^I P^{II} Q^{II} R^{II}

(b) $\begin{pmatrix}4 & 3\\1 & 2\end{pmatrix}\begin{pmatrix}0 & 2 & 1\\5 & 2 & 0\end{pmatrix} = \begin{pmatrix}15 & 14 & 4\\10 & 6 & 1\end{pmatrix}$ M1 √ A1 √

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

(c) Area s.f = det M

= 5

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

= 5 X 3.5 M1√

= 16.5 cm^2 A1

8