**MOKASA PAPER 1:SECTION A**

1. $\sqrt{}(4^2+-20^2) \div \sqrt{}(-1^2+5^2)$ m1

$=\sqrt{\frac{416}{26}}$ m1

=4 A1

2. $(7.32X1O^{-1})^3=392.2x10^{-}3$ M1

$=.3922+4.402$

$=\frac{1}{2x}=4.7942$ M1

2x=.2086

X=.104 A1

3. $\frac{(3x-2a)(4x+3a)}{(3x+2a)(3x-2a)}$ M2

$=\frac{4x+3a}{3x+2a}$ A1

4. a) 2357 A1

b) 2000+300+50+7 M1A1

5. y-x=4

Y+x=14 M1

Y=4+x

4+x+x=14 M1

2x=10 thus x=5 and y=9

=59 A1

6 $2000 \times 40 = 80{,}000 + 1200 = 92000$ B1

$\frac{100}{125} \times 92{,}000 = Ksh.73{,}600$ M1A1

7. $3\,(1 + x) < 5x - 11 < x + 45$

*3 (1 + x) < - 11 < x + 45* = *2x < -14 M1*

*3 + 3x < 5x – 11* = *x > 7*

*5x – 11 < x + 45* = *4x < 56 M1*

*x < 14  7 <x < 14*

*( 8, 9, 10, 11, 12, 13)* *A1*

*8.*

$$\left(\frac{7}{3}\left[\frac{2}{5}of1\frac{2}{3}-\frac{1}{2}\left(\frac{\frac{5}{3}-\frac{5}{2}}{\frac{1}{3}-\frac{19}{27}}\right)^{\frac{1}{2}}+\frac{2}{3}\right]\right)^{\frac{1}{2}}$$

$\left(\frac{7}{3}\left[\frac{2}{3}-\frac{1}{2}\left(-\frac{5}{6}\div-\frac{10}{27}\right)^{\frac{1}{2}}+\frac{2}{3}\right]\right)^{\frac{1}{2}}$ M1

$\left(\frac{7}{3}\left[\frac{2}{3}-\frac{1}{2}\left(\frac{9}{4}\right)^{\frac{1}{2}}+\frac{2}{3}\right]\right)^{\frac{1}{2}}$ M1

$\left(\frac{7}{3}\left[\frac{2}{3}-\frac{3}{4}+\frac{2}{3}\right]\right)^{\frac{1}{2}}$

$\left(\frac{7}{3}\left[\frac{4}{3}-\frac{3}{4}\right]\right)^{\frac{1}{2}}$ M1

$\left(\frac{49}{36}\right)^{\frac{1}{2}}$

$\frac{7}{6}=1\frac{1}{6}$ Answer A1

9.

$$\frac{1000000}{91.80}=10{,}893.25$$

$$10{,}893.25-(190+4500)=6203.25$$

$$6203.25\times91.65=568{,}278.86$$

$$\frac{568{,}527.86}{103.93}=5{,}470.30$$

$$5470.30-2000=3{,}470.30$$ M1 M1 A1

10.

$$s = \frac{40+60+80}{2} = 90$$

$$area = \sqrt{90(90-40)(90-60)(90-80)}$$

$$area = \sqrt{1350000}$$

$$area = 1{,}161.9m^2$$

M1,M1,A1

11 . $4x + x = 180$ M1

$x = 36$

$\frac{360}{36} = n$ M1

$n = 10$ sides A1

12. l.s.f= $\frac{3}{5}$, v.s.f= $\frac{27}{125}$ M1

$\frac{8.1}{v} = \frac{27}{125}$ M1

V=37.5m$^3$ A1

13. Midpoint=(3,4) M1

Gradient of AC=3

Gradient of perpendicular line= $\frac{-1}{3}$ M1

$\frac{y-4}{x-3} = \frac{-1}{3}$

3y+x=5 A1

14 . $\frac{h}{60}$ =tan45,h=60tan45 M1

$\text{Tan}\theta = \frac{60 \tan 45}{240}$ M1

$\Theta = 14.04^0$ A1

15.

$48 = 2^4 x 3$ M1

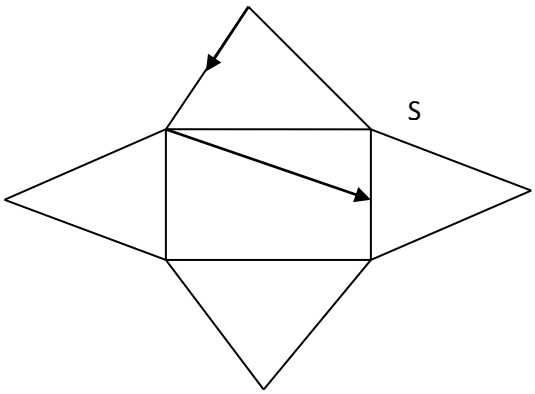
$72 = 2^3 x 3^2$

$1008/2^4 x 3^2 = 7$ M1

Least no is 7x3=21 A1

.

16.



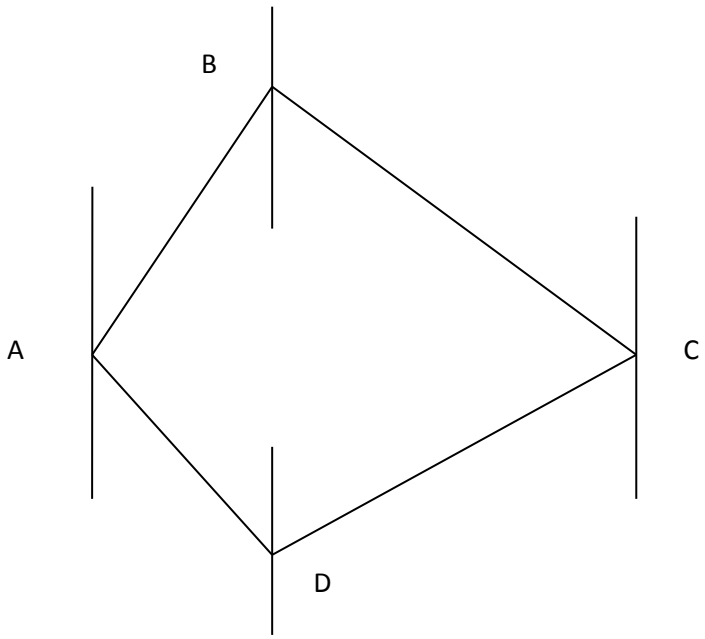

Correct labeling,equal dimensions shown,proper construction M3

Distance=$15+\sqrt{(144+16)}$

=27.649cm A1

**SECTION B**

17




Parallel lines passing A and B/1 mk

B located/1mk

C located/1mk

D located/1mk

b.Ship A from D N35W or $325^0$ A1

ii)Ship D from C ,S55W or $235^0$ A1

c)i) 441km A1

ii)755km A1

d)angle DAC=$6I^0$,angle BCD=$67^0$ ±2 M2

18.

a)i) capacity of the tank=2.4x2.8x3x1000

=20160L M1

Amount=20160-3600

=16560litres A1

ii) Time taken to fill = $\frac{16560}{0.5}$ M1

$\frac{16560}{0.5x60x60}$ M1

=9hr 12min A1

b) In 1hr,pipe A and B fill $\frac{1}{3}+\frac{1}{6}=\frac{1}{2}$ of the tank M1

in 1hr pipe C empties $\frac{1}{8}$ of the tank M1

the next hour all pipes open ,amount in tank increases by $\frac{1}{2}-\frac{1}{8}=\frac{3}{8}$ M1

time taken to fill the remaining half of the tank is $\frac{1}{2}x\frac{3}{8}=\frac{4}{3}hrs$ M1

total time=1+$\frac{4}{3}=2hrs20\min s$ A1

19.a)i) $\pi r^2=3.142x4.2^2=55.42cm^2$ M1A1

ii) πRL-πrl

L=x+8 M1

$\frac{4.2}{3.5}=\frac{8+x}{x}$ M1

X=40: 3.142x4.2x4.8-(3.142x3.5x40)

$=193.6cm^2$ A1

iii) hemisphere=$2\pi r^2=2x3.142x3.5$ M1

$=77cm^2$ A1

b) total area =55.44+193.6+77=326.04 M1

$l.s.f^2=a.s.f$

$\frac{326.04}{81.51} = \sqrt{4}$ M1

$\frac{4.2}{2} = r$

r=2.1cm A1

20. $\langle DON$ =$20^0$ angle at centre is twice angle at the circumference B1A1

ii)<DNQ=$10^0$ angle between chord and tangent is equal to angle in the alternate segment subtended by the same chord B1A1

iii)<ONA=$60^0$ base angles of an isosceles triangle B1A1

iv)<DBA=$40^0$ angle at the centre <AOD=$80^0$ is twice angle at the circumference. B1A1

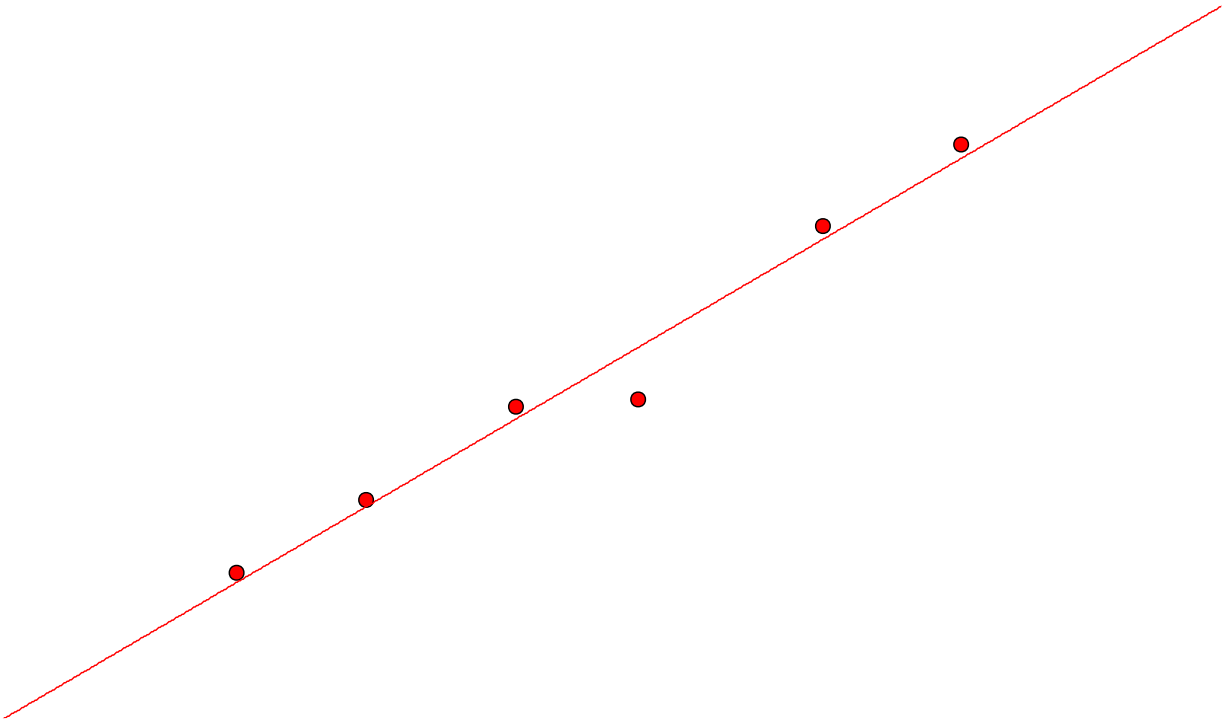
v)<ODN=$80^0$ base angles of an isosceles triangle. B1A1

21.a)logP=nlogQ+logk

b)

| | | | | | | |
|---|---|---|---|---|---|---|
| logP | 0.0792 | 0.1761 | 0.3010 | 0.3118 | 0.5441 | 0.6532 |
| logQ | 0.1987 | 0.3522 | 0.5302 | 0.6758 | 0.8954 | 1.0607 |

T2




P1S1L1

c)logk=-0.06 A1

k=0.871.n=gradient=0.3585 MIA1

d) log3=0.4771

logQ=0.8 M1

Q=6.31 A1

22 $\frac{dh}{dt}$ =v=-6t²+3t+3, $\frac{dv}{dt}$ =a=-12t+3 at t=0,a=3m/s² M1A1

b)i) $\frac{dh}{dt}$ =0, -6t²+3t+3=0 M1

(2t+1)(t-1)=0,t=-$\frac{1}{2}$ or t=1 thus t=1s M1A1

ii) $h=-2t^3+\frac{3}{2}t^2+3t$

at t=1, $h=-2+\frac{3}{2}+3$ M1

=2.5 m M1A1

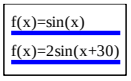
c) $\frac{dv}{dt}=a=-12t+3=0$ M1

t=.25s

$v=-6x0.25^2+3x0.25+3=3.375m/s$ A1

23.

| X | 0 | 30 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | 330 | 360 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| sinx | 0 | 0.5 | 1 | 0.87 | 0.5 | 0 | -0.5 | -0.87 | -1 | -0.87 | -0.5 | 0 | |
| 2sin(x+30) | 1 | 1.74 | 1.74 | 1 | 0 | -1 | -1.74 | -2 | -1.74 | -1 | 0 | 1 | T2 |




P1C1S1B1

c) translation $\begin{pmatrix}-30\\0\end{pmatrix}$ then stretch parallel to y-axis stretch factor 2 B1A1

d) $132^0$ and $312^0 \pm 2$ B2

24.A trailer moving at a speed of 80km/h is being overtaken by a car moving at 100km/h in a clear section of a road. Given that the bus is 21m long and the car is 4m long.

a) How much time in seconds) will elapse before the car can completely overtake the bus? (3mks)

$r.s = 100 - 80 = 20km/h$

$\Rightarrow \frac{20 \times 1000}{60 \times 60}$

$\Rightarrow \frac{50}{9} m/s$ M1

$time = \frac{total, dist}{r.s}$

$time = \frac{(4+21)}{50/9}$

$time = 4.5s$ 10

M1

A1

b) How much distance (in metres) will the car travel before it can completely overtake the bus? (2mks)

$$dis\tan ce = time, taken, x, carsspped$$

$$dis\tan ce = 4.5 \times \frac{100 \times 1000}{60 \times 60}$$

$$\Rightarrow 125m$$ A1M1

c) Given that as soon as the car completed overtaking the trailer, a bus heading towards the trailer and the car and moving at a speed of 90km/h became visible to the car driver. It took exactly 18 seconds for the car and the bus to completely by pass each other from the moment they first saw each other.

i. How far was the tail of the bus from the tail of the car at the instance they first saw each other given that the bus is 12 metres long? (3mks)

$$rs = 90 + 100 = 190km/h \Rightarrow \frac{190 \times 1000}{60 \times 60} = \frac{475}{9} m/s$$

$$dis\tan ce = rs \times time \Rightarrow \frac{475}{9} \times 18$$

$$dis\tan ce = rs \times time = 950m$$ A1M1M1

ii. How far a part was the trailer and the bus just immediately after the car and the bus had by passed each other? (2mks)

$$= dis\tan ce, trailer \ \& \ car - length, bus$$

$$= \frac{50}{9} \times 18 - 12M1$$

$$= 88mA1$$

NAME.....Marking.....scheme.....INDEX NO.....ADM NO.....

CANDIDATE'S SIGN.....DATE.....

SCHOOL.....

# MOKASA JOINT EXAMINATIONS

## Kenya Certificate of Secondary Education (K.C.S.E)

**121/2**
**MATHEMATICS**
**PAPER 2**
**MARCH/APRIL 2015**
**TIME: 2 ½ HOURS**

## INSTRUCTIONS TO CANDIDATES.

1) Write **your name** and **index number** in the spaces provided above.
2) Sign and write the date of examination in the spaces provided above.
3) This paper consists of two section **I** and **II**.
4) Answer **ALL** questions in section **I** and only **five** questions from section **II**.
5) Answers and working must be written on the question paper in the spaces provided below each question.
6) Marks may be given for correct working even if the answer is wrong.
7) Non-programmable electronic calculators may be used.

***FOR EXAMINERS' USE ONLY.***

**SECTION I**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | |

**SECTION II**

| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

Grand Total

## SECTION A- 50 MARKS

1. The cost of maize flour and millet flour is Ksh.40 and Khs.52 respectively. Calculate the ratio in which they were mixed if a profit of 15% was made by selling the mixture at Ksh.52.90 per kilogram. (3marks)

B.P $\frac{52.90}{1.15} = 46$.

Let maize flour be $x$
millet " " $y$.

$\frac{40x + 52y}{x+y} = 46$

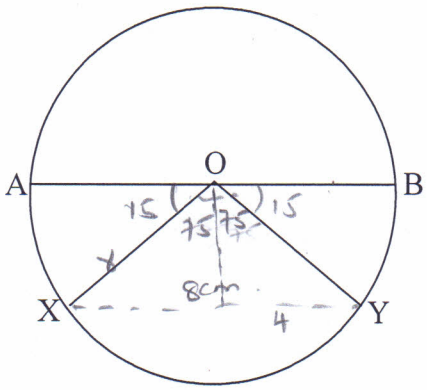
$40x + 52y = 46x + 46y$

$\frac{6y}{6y} = \frac{6x}{6y}$.

$\frac{1}{1} = \frac{x}{y}$

$x : y$
$1 : 1$

2. In the figure below XY= 8cm and O is the centre of the circle




Determine the area of the circle if angle AOX=$15^0$ (3marks)

$\sin 75 = \frac{4}{r}$.

$r = \frac{4}{\sin 75^\circ}$

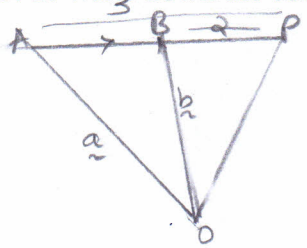
$= 4.1411$

$\pi r^2$

$\frac{22}{7} \times 4.1411^2$

$= 53.8959 cm^2$.

3. **OA=3i+4j-6k** and **OB=2i+3j+k** are two position vectors. P divides a line AB in the ratio 3:-2. Write down the coordinates of P. (3marks)




$\overrightarrow{OP} = -2a + 3b$

$-2\begin{pmatrix}3\\4\\-6\end{pmatrix} + 3\begin{pmatrix}2\\3\\1\end{pmatrix} = \begin{pmatrix}0\\1\\15\end{pmatrix}$

$P(0,1,15)$

4. The table below show tax rates on a certain year

| INCOME (K£ p.a) | Rate (Ksh.per £) |
|---|---|
| 1 – 4200 | 2 |
| 4201 -8000 | 3 |
| 8001 – 12600 | 4 |
| 12601 and above | 5 |

Rose earns a basic salary of ksh. 20,000 per month, she is given allowances amounting to ksh.5000.She is housed by her employer therefore pays a nominal rent of sh. 700 per month and is entitled to a personal relief of Ksh. 1200 per month. Calculate;

i) Her taxable income in Kenya pounds per year. (2mks)

$20{,}000 + \left(\frac{15}{100} \times 20{,}000\right) + 5000 - 700$

$= 27300$

$\frac{27300}{20} \times 12 = K£\ 16380$

ii) Her gross tax per month. (2mks)

$4200 \times 2 = 8400$

$3800 \times 3 = 11400$

$4600 \times 4 = 18400$

$3780 \times 5 = 18900$

$57{,}100$

$\frac{57100}{12}$

$= Sh.\ 4{,}758.33$

5. Rationalize the denominator and simplify (3marks)

$$\frac{\sqrt{3}}{\tan 60 - 1}$$

$= \frac{3}{2} + \frac{\sqrt{3}}{2}$

$\frac{\sqrt{3}}{(\sqrt{3}-1)} \times \frac{(\sqrt{3}+1)}{\sqrt{3}+1}$

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

$\frac{3+\sqrt{3}}{2}$

6. Solve for x in (3mks)

$3\log_3 x + 4 = \log_3 24$

$3\log_3 x + \log_3 81 = \log_3 24$

$x^3 \times 81 = 24$

$x^3 = \frac{24}{81}$

$x^3 = \frac{8}{27}$

$\sqrt[3]{\frac{8}{27}}$

$= \frac{2}{3}$.

7. The transformation represented by the matrix $\begin{bmatrix} x-1 & x \\ 1 & 2x \end{bmatrix}$ maps a triangle whose vertices are **A (-1, 2), B (4, 1)** and **C (1,-4)** onto a straight line. Find the possible values of x. (3marks).

$2x(x-1) - x = 0$

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

$2x^2 - 3x = 0$

$x(2x-3) = 0$

$x = 0$

$2x = 3$

$x = \frac{3}{2}$

8. Expand $(2 + \frac{1}{4}x)^6$, hence find the value of $2.025^6$ rounded off to 3 decimal places.(4marks)

1, 6, 15, 20, 15, 6, 1

$1 \cdot 2^6 \cdot (\frac{1}{4}x)^0 + 6 \cdot 2^5 \cdot (\frac{1}{4}x)^1 + 15 \cdot 2^4 \cdot (\frac{1}{4}x)^2 + 20 \cdot 2^3 \cdot (\frac{1}{4}x)^3 + 15 \cdot 2^2 \cdot (\frac{1}{4}x)^4 + 6 \cdot 2^1 \cdot (\frac{1}{4}x)^5$

$+ 1 \cdot 2^0 \cdot (\frac{1}{4}x)^6$

$= 64 + 48x + 15x^2 + \frac{5}{2}x^3 + \frac{15}{64}x^4 + \frac{3}{256}x^5 + \frac{1}{4096}x^6$.

$\frac{1}{4}x = 0.025$

$x = 0.1$

$64 + (48 \times 0.1) + 15(0.1)^2 + \frac{5}{2}(0.1)^3 + \frac{15}{6}(0.1)^4 + \frac{3}{256}(0.1)^5 + \frac{1}{4096}(0.1)^6$

$64 + \frac{24}{5} + \frac{3}{20} + \frac{1}{400} + \frac{1}{4000} + \frac{3}{25600000} + 2.44140625 \times 10^{-10}$

68.9527012

68.953

9. The resistance to the motion of a car is partly constant and partly varies as the square of the speed. At 40km/h$^{-1}$ the resistance and at 60kmh$^{-1}$ it is 730N. What will be the resistance at 70kmh$^{-1}$ (4mks)

resistance - r
speed - s

$r \propto s^2 + c$

$r = ks^2 + c$

$530 = 1600k + c$

$730 = 3600k + c$

$-200 = -2000k$

$k = \frac{-200}{-2000}$

$= \frac{1}{10}$.

$c = 530 - (1600 \times \frac{1}{10})$

$= 370$.

$r = \frac{1}{10}s^2 + 370$.

$r = \frac{1}{10} \times 70^2 + 370$

$= 860$

10. By completing the square, solve for x in the equation $\mathbf{2x^2 - 6 = x}$. (3marks).

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

$\frac{2x^2}{2} - \frac{x}{2} = \frac{6}{2}$.

$x^2 - \frac{x}{2} = 3$

$x^2 - \frac{x}{2} + \frac{1}{16} = 3 + \frac{1}{16}$.

$x^2 - \frac{1}{4}x - \frac{1}{4}x + \frac{1}{16} = \frac{49}{16}$.

$(x - \frac{1}{4})^2 = \frac{49}{16}$.

$x = \pm\sqrt{\frac{49}{16}} + \frac{1}{4}$.

$= \pm\frac{7}{4} + \frac{1}{4}$

$x_1 = 2$.

$x_2 = -1.5$

11. A die has two of its faces numbered 3.Calculate the probability of obtaining a 1or a 3 on a single cast. (3marks)

$P(1) = \frac{1}{6}$

$P(3) = \frac{2}{6}$

$\frac{1}{6} + \frac{2}{6} = \frac{3}{6}$

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

12. Solve the equation $4cos(3x - 10)^0 = -3.0640$ *for* $0^0 \leq x \leq 180^0$ (3mks)

$\frac{4\cos(3x-10)}{4} = \frac{-3.0640}{4}$

$\cos(3x-10) = -0.766$

$3x - 10 = \cos^{-1}(-0.766)$

$3x - 10 = 140^\circ$

$3x - 10 = 140^\circ, 220, 500, 580$

$3x = 150^\circ, 230, 510^\circ, 590^\circ$

$x = 50^\circ, 76.67^\circ, 170^\circ$

$\frac{0.2}{100}, \frac{0.02}{100}$

13. The top of a table is a regular pentagon. Each side of the pentagon measures 40.0 cm. Find the maximum percentage error in calculating the perimeter of the top of the table. (3mks)

Actual perimeter $(40.0 \times 5) = 200$

max perimeter $(40.05 \times 5) = 200.25$

min perimeter $(39.95 \times 5) = 199.75$

$A.E = \frac{\text{max } P - \text{min } P}{2}$

$= \frac{200.25 - 199.75}{2}$

$= 0.25$

% error

$\frac{0.25}{200} \times 100$

$= 0.125\%$

14. The points P(8,4) and Q(2,2) are the ends of a diameter of a circle. Find the equation of the circle. (3marks)

Centre $\left(\frac{8+2}{2}, \frac{4+2}{2}\right)$

$(5,3)$

radius $\begin{pmatrix}8\\4\end{pmatrix} - \begin{pmatrix}5\\3\end{pmatrix} = \begin{pmatrix}3\\1\end{pmatrix}$

$\sqrt{3^2 + 1^2}$

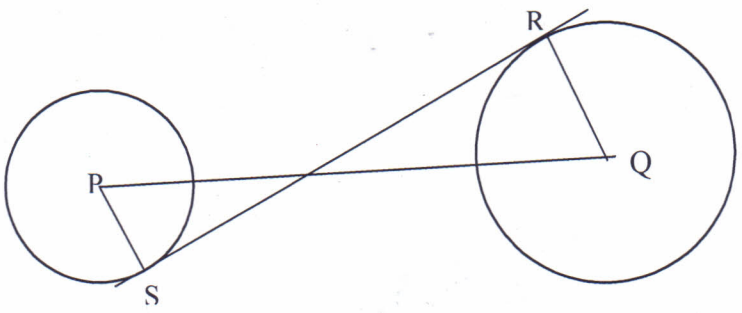
$\sqrt{10}$

$(x-5)^2 + (y-3)^2 = (\sqrt{10})^2$

$(x^2 - 10x + 25) + (y^2 - 6y + 9) = 10$

$x^2 + y^2 - 10x - 6y + 24 = 0$

15. In the diagram below, PQ = 10cm,and the radius of the circle centers P and Q are 2cm and 4cm respectively, calculate the length of the transverse common tangent SR. (3mks)




16. Line $y=\frac{3}{5}x$ is parallel to diameter LM of circle $x^2+y^2+6x-8y=0$. Find the equation of the tangent to the circle at L. (4marks).

$x^2+6x+y^2-8y=0$

$x^2+6x+9+y^2-8y+16=9+16$,

$(x+3)^2+(y-4)^2=25$

Centre $(-3,4)$

radius $=5$.

Gradient of tangent

$\frac{3}{5}\cdot m_2=-1$

$m_2=-\frac{3}{5}$

$-\frac{3}{5}$, $(x,y)$ $(-3,4)$

$\frac{y-4}{x+3}=-\frac{3}{5}$

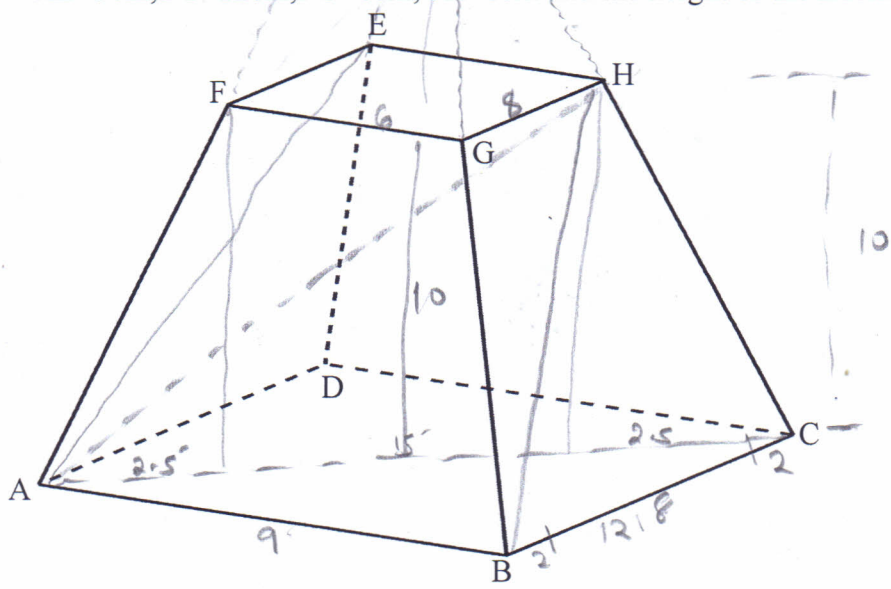
$y-4=-\frac{3}{5}x-\frac{9}{5}$

$y=-\frac{3}{5}x+\frac{11}{5}$.

or $y=-\frac{3}{5}x+2\frac{1}{5}$.

## SECTION B 50 MARKS

17. The figure below shows a frustum ABCDEFGH of a right pyramid such that AB=9cm,BC=12cm,FG=6cm,GH=8cm and the height of the frustum is 10cm.




Find the

a) Height of the pyramid (2mks)

b) Length of

(i) AC (2mks)

(ii)AH (2mks)

c) Calculate the angle between:

i) Line AH and the plane ABCD (2mks)

ii) The planes ABHE and ABCD (2mks)

18. A and B are two points on the latitude $40^0$N. The two points lie on the longitudes $20^0$ W and $100^0$ E respectively.

(a)Calculate:

(i) The distance from A to B along a parallel of latitude. (3 marks)

In Km $\frac{120}{360} \times \frac{22}{7} \times 2 \times 6370 \cos 40$

$= 10,224.13983$ km

In nm $60 \times 120 \cos 40$

$= 5,515.51999$ nm

(ii) The shortest distance from A to B along a great circle. (4 marks)

$\frac{100}{360} \times \frac{22}{7} \times 6370$

$= 5561.1111$ km.

1nm = 1.853km.

? = 5561.1111

$\frac{5561.1111}{1.853}$

$= 3001.1393$ nm.

(b)Two planes P and Q left A for B at 400 knots and 600 knots respectively. If P flew along the great circle and Q along parallel latitude, which one arrived earlier and by how long. Give your answer to the nearest minute (Take R = 6370 km and $\pi = {}^{22}/_{7}$). (3 marks)

P - 400 knots great circle - 3001.1393

Q - 600 knots parallel - 5515.51999.

Time taken by P

$\frac{3001.1393}{400}$ = 7hrs 30mins

$\frac{5515.51999}{600}$ = 9hrs 11mins

P arrived earlier

9hrs 11mins

− 7hrs 30mins

1hr 40

1hrs 40mins

19. The following table shows the distribution of marks obtained by 50 students.

| Marks | 45-49 | 50-54 | 55-59 | 60-64 | 65-69 | 70-74 | 75-79 |
|---|---|---|---|---|---|---|---|
| No of Students | 3 | 9 | 13 | 15 | 5 | 4 | 1 |

a) By using an assumed mean of 62, calculate:

| class | x | f | $t = x - 62$ | ft | $ft^2$ |
|---|---|---|---|---|---|
| 45-49 | 47 | 3 | -15 | -45 | 675 |
| 50-54 | 52 | 9 | -10 | -90 | 900 |
| 55-59 | 57 | 13 | -5 | -65 | 325 |
| 60-64 | 62 | 15 | 0 | 0 | 0 |
| 65-69 | 67 | 5 | 5 | 25 | 125 |
| 70-74 | 72 | 4 | 10 | 40 | 400 |
| 75-79 | 77 | 1 | 15 | 15 | 225 |
| | | $\sum f$ 50 | | $\sum ft$ = -120 | $\sum ft^2$ = 2650. |

(i) The mean (5mks

$\bar{t} = \frac{-120}{50}$

$= -2.4$

$\bar{x} = -2.4 + 62$

$= 59.6$

b) The variance (3mks

$\frac{2650}{50} - (-2.4)^2$

$53 - 5.76$

$47.24$

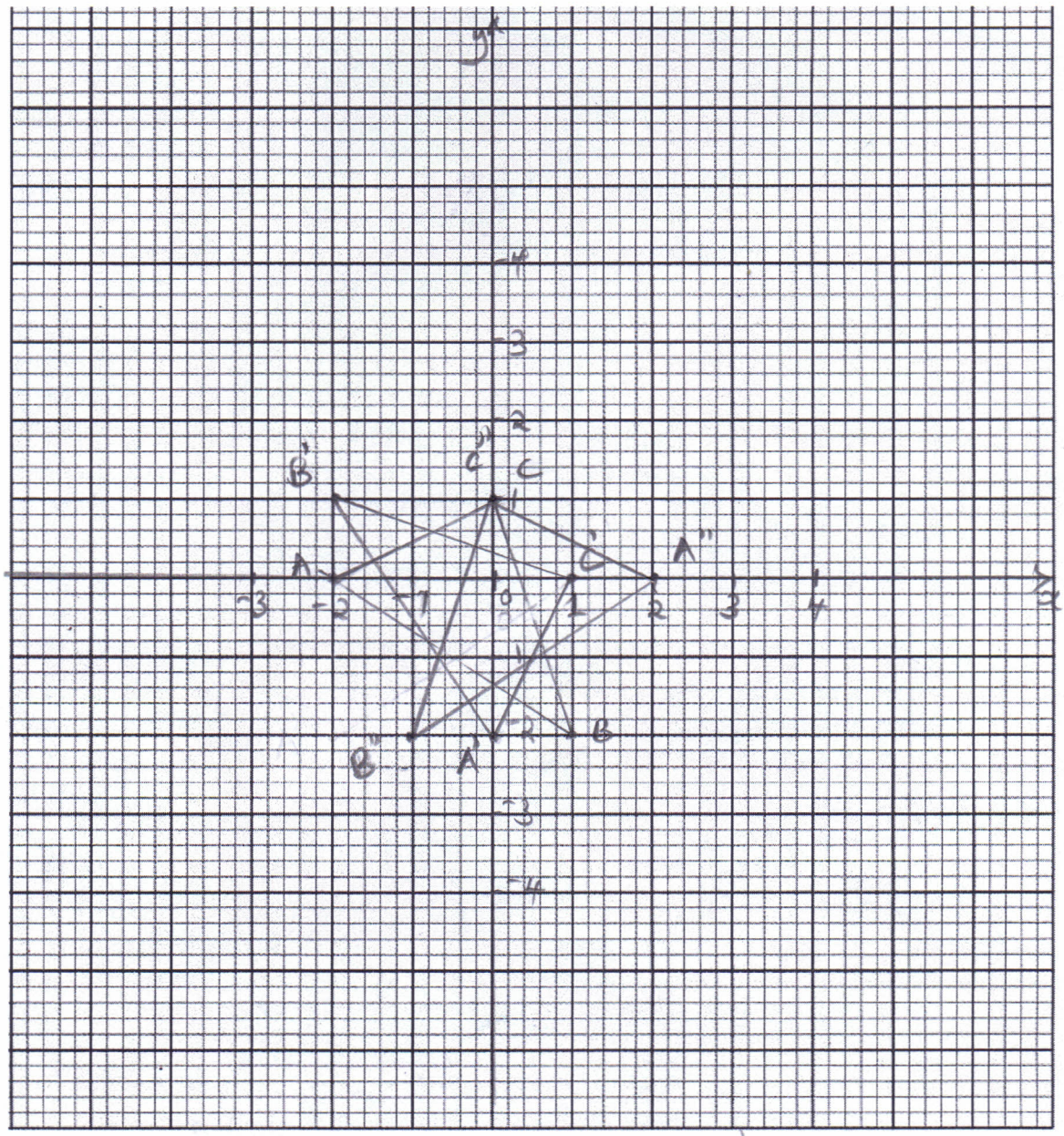
c) The standard deviation (2mks)

$\sqrt{47.24}$

$= 6.8731$

20.Matrix **S** represents a reflection on line y = x, matrix **T** represents a rotation through positive $90^0$ centre (0,0).A triangle whose vertices are A(-2,0), B(1,-2) and C(0,1) is subjected to these transformations, such that :the triangle $A^IB^IC^I$ is the image of ABC under transformation matrix **S** and that $A^{II}B^{II}C^{II}$ is the image of $A^IB^IC^I$ under transformation matrix **T**.

a) Plot the three triangles on the grid provided below. (4marks)




No1

$$T = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \quad S = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

$$\begin{matrix} & A & B & C & & A' & B' & C' \end{matrix}$$
$$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} -2 & 1 & 0 \\ 0 & -2 & 1 \end{bmatrix} = \begin{bmatrix} 0 & -2 & 1 \\ -2 & 1 & 0 \end{bmatrix}$$

$A'(0,-2)$ $B'(-2,1)$ $C'(1,0)$

$$\begin{matrix} & A' & B' & C' & & A'' & B'' & C'' \end{matrix}$$
$$\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 0 & -2 & 1 \\ -2 & 1 & 0 \end{bmatrix} = \begin{bmatrix} 2 & -1 & 0 \\ 0 & -2 & 1 \end{bmatrix}$$

$A''(2,0)$ $B''(-1,-2)$ $C''(0,1)$

TS

$$\begin{bmatrix}0 & -1\\ 1 & 0\end{bmatrix}\begin{bmatrix}0 & 1\\ 1 & 0\end{bmatrix}=\begin{bmatrix}-1 & 0\\ 0 & 1\end{bmatrix}$$

b) Find a single matrix that will map $A^{II}B^{II}C^{II}$ onto ABC. (3marks)

$$\begin{bmatrix}a & c\\ b & d\end{bmatrix}=\begin{matrix}A'' & B'' & C''\end{matrix}\begin{bmatrix}2 & -1 & 0\\ 0 & -2 & 1\end{bmatrix}=\begin{matrix}A & B & C\end{matrix}\begin{bmatrix}-2 & 1 & 0\\ 0 & -2 & 1\end{bmatrix}.$$

$2a=-2 \quad -a-2c=1$

$2b=0 \quad -b-2d=-2$

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

$a=-1$

$-a-2c=1$

$-(-1)-2c=1$

$-2c=0$

$\frac{-2}{-2}=\frac{c}{-2}$

$c=0.$

$2b=0$

$b=0$

$-b-2d=-2$

$0-2d=-2$

$d=1$

$$\begin{bmatrix}-1 & 0\\ 0 & 1\end{bmatrix}$$

c) Describe the matrix in b) above. (1mark)

Reflection in y-axis

$x=0$

d) If triangle ABC is sheared ,shear factor 2 with the y-axis invariant, find the coordinates of the image. (2marks)

$$\begin{bmatrix}1 & 0\\ 2 & 1\end{bmatrix}\begin{matrix}A & B & C\end{matrix}\begin{bmatrix}-2 & 1 & 0\\ 0 & -2 & 1\end{bmatrix}=\begin{matrix}A' & B' & C'\end{matrix}\begin{bmatrix}-2 & 1 & 0\\ -4 & 0 & 1\end{bmatrix}.$$

2 - 2

A'(-2,-4) B'(1,0) C'(0,1).

21. Sigei's Flower Achievers Company has 36 hectares of land. The company decides to prepare the land for planting wheat and maize. The labour cost of planting maize is Ksh. 300 per hectare while it costs Ksh 900 to plant a hectare of wheat. Maize takes 3 labourers per hectare while wheat takes 6 labourers per hectare. They hired 72 laboures and spent Ksh. 15,000 for labour costs. The company hopes to make a profit of Ksh 2,000 per hectare of maize and Ksh 4,500 per hectare of wheat. *let the number of hectares for maize be x*

*let the number of hectares for wheat be y*

(a) Write down inequalities representing the above information (3mks

(i) $x+y\leq 36$

(ii) $300x+900y\leq 15{,}000$

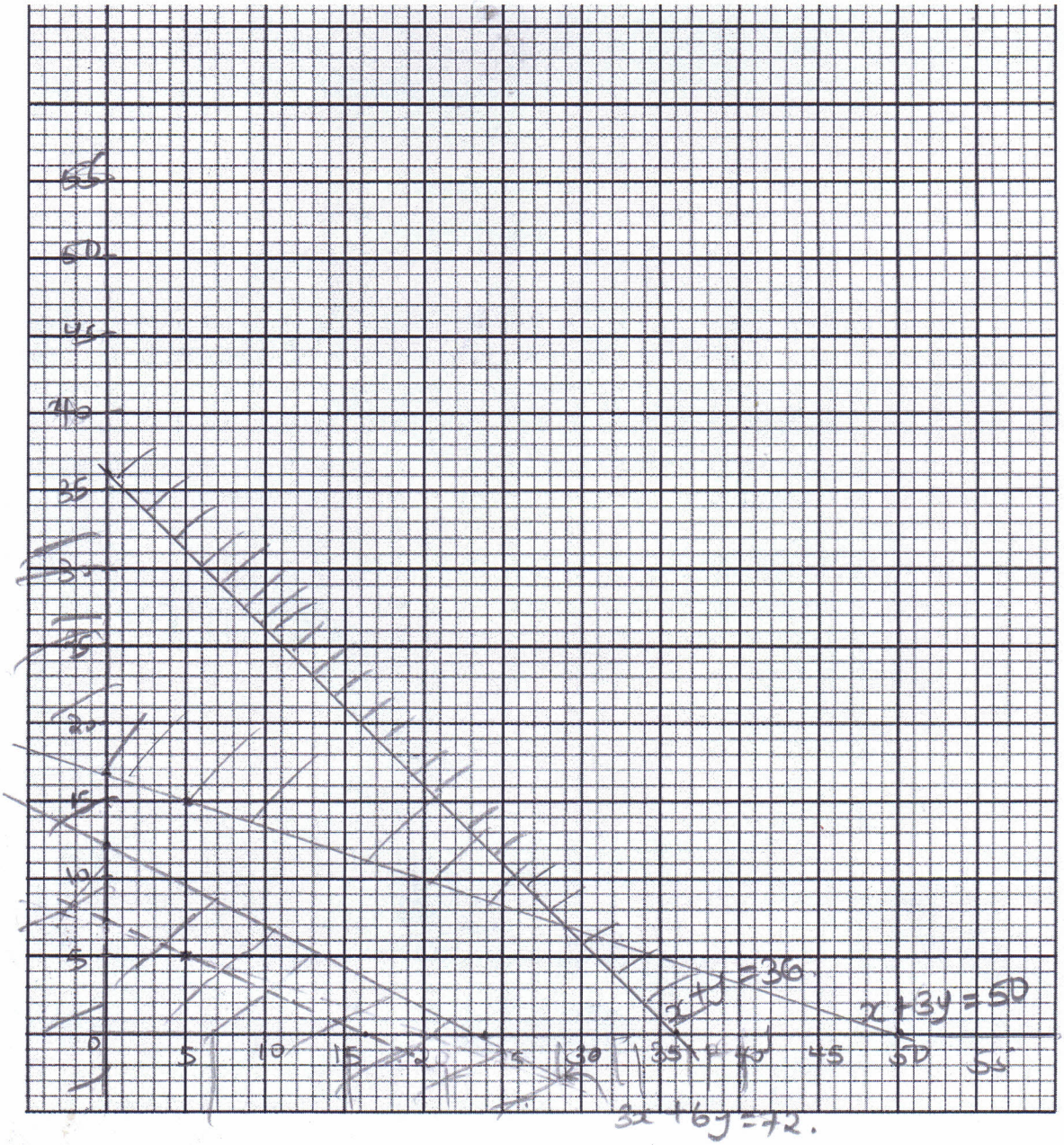
$x+3y\leq 50$

(iii) $3x+6y\geq 72$

$y\geq 0$

$x\geq 0$

(b) On the grid provided, draw the inequalities by shading unwanted regions (4mks)




c)Use the graph to:

(i) determine the number of hectares of maize and wheat that should be prepared in order for the company to maximize profit (2mks)

Objective function $2000x + 4500y = K$

search line $2000x + 4500y = 32,500$

$20x + 45y = 325$

(29,7)

29 hectares of maize

7 hectares of wheat.

(ii) Calculate the maximum profit (1mk)

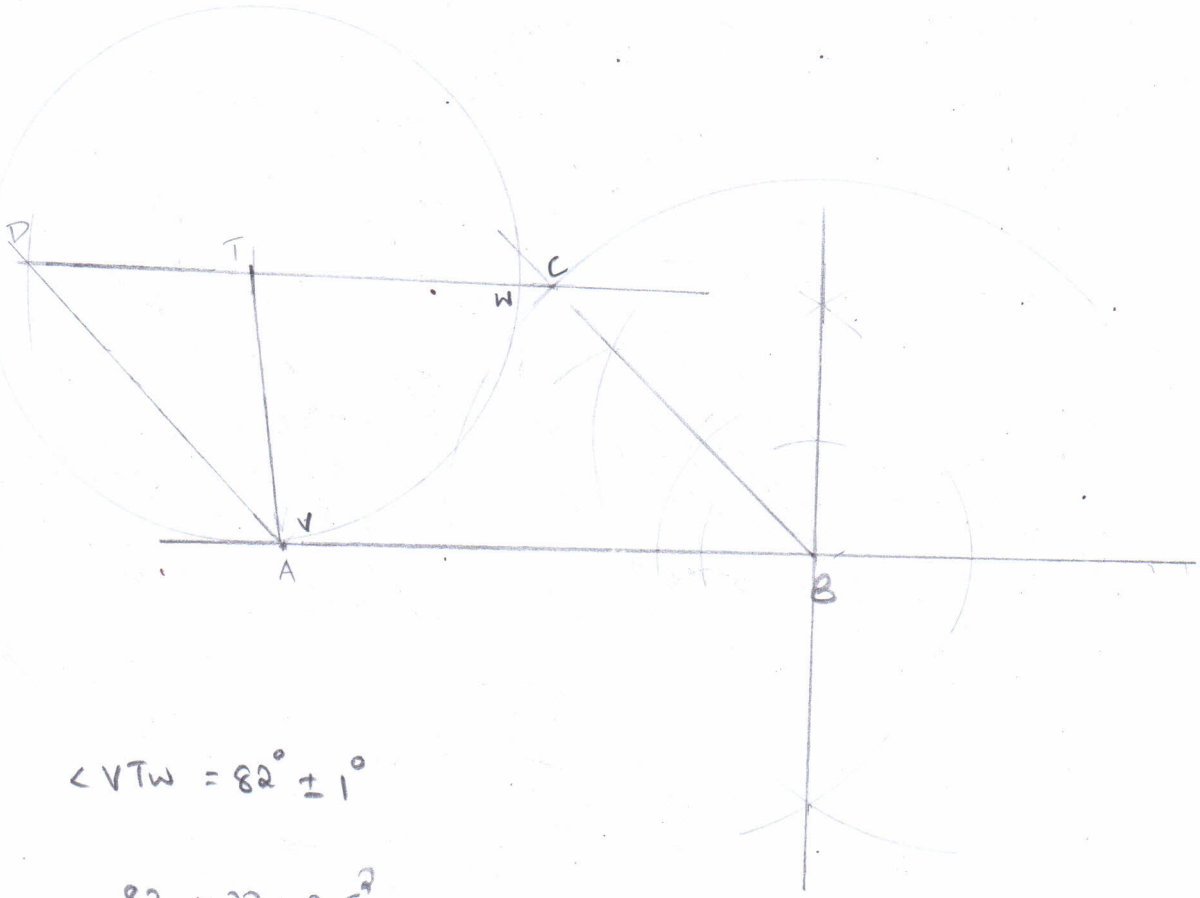
$(29 \times 300) + (900 \times 7)$

Sh. 15 000.

22.a) Using a ruler and a pair of compasses only, construct parallelogram ABCD in which AB=7cm, BC=5cm and angle CBA=45°. (4marks)

b) From a point T, 3cm from D on DC, construct the locus of a point Q, 3.5cm from T to intersect AD and DC at V and W respectively. Measure angle VTW. (4 marks)

c) Find the area of the minor sector TVW in $cm^2$ (2 marks)




$\angle VTW = 82^\circ \pm 1^\circ$

$\frac{82}{360} \times \frac{22}{7} \times 3.5^2$

$8.7694\ cm^2$

23. The thirteenth term of an arithmetic progression is 27.Given that the seventh term equals to three times the second term, find

a) The first term and the common difference of the progression. (4marks)

$a+(n-1)d$

$2^{nd}$ - $a+d$.

$7^{th}$ - $a+6d$

$13^{th}$ - $a+12d$

$a+6d = 3(a+d)$

$a+6d = 3a+3d$

$-2a = -3d$.

$a = 1.5d$

$a+12d = 27$

$1.5d+12d = 27$

$13.5d = 27$

$d = 2$.

$a = 1.5 \times 2$.

$= 3$

b) The sum of the first three even numbered terms of the progression. (3marks)

$a+(n-1)d$

$a = 3$

$d = 2$

3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23

None.

c) It's given that $(b-\frac{9}{4})$, b and (b+3.375) are the $2^{nd}$, $3^{rd}$ and $4^{th}$ terms of a geometric progression. Determine the value of b. (3marks)

$\left(b-\frac{9}{4}\right)$ b, $(b+3.375)$

$\frac{b}{\left(b-\frac{9}{4}\right)} = \frac{(b+3.375)}{b}$

$b^2 = \left(b-\frac{9}{4}\right)\left(b+\frac{27}{8}\right)$.

$b^2 = b^2 + \frac{27}{8}b - \frac{9}{4}b - \frac{243}{32}$.

$\frac{9}{8}b = \frac{243}{32}$

$b = \frac{243}{32} \times \frac{8}{9}$

$= 6.75$.

$= 6\frac{3}{4}$

24. The equation of a curve is given by $y = 11x - x^2$

(a) Determine coordinates of the stationary point. (3mks)

$y = 11x - x^2$.

$\frac{dy}{dx} = 11 - 2x$

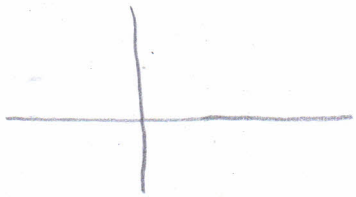
$11 - 2x = 0$.

$x = 5.5$

$y = 11(5.5) - (5.5^2)$

$= 30.25$

$(5.5, 30.25)$



b) By integration, determine the actual area bounded by the curve $y = 11x - x^2$ and the line $y = 2x$ (4mks)

$11x - x^2 = 2x$.

$x^2 + 2x - 11x = 0$.

$x^2 - 9x = 0$.

$x(x - 9) = 0$.

$x = 0$

$(x - 9) = 0$.

$x = 9$.

$\int_0^9 (11x - x^2) - \int_0^9 2x$

$\left[\frac{11x^2}{2} - \frac{x^3}{3} + c\right]_0^9 - \left[x^2 + c\right]_0^9$

$(445.5 - 243) - 81$

$121.5$ sq. units

c) Find the equation of the normal to the curve at $x = 2$ (3mks)

When $x = 2$ $y = (11 \times 2) - 2^2$

$= 18$

$(2, 18)$

Gradient of tangent.

$y = 11x - x^2$

$\frac{dy}{dx} = 11 - 2x$.

at $x = 2$

$11 - 4$

$= 7$.

Gradient of normal

$m_1 \cdot m_2 = -1$

$7 \times m_2 = -1$

$m_2 = -\frac{1}{7}$.

eqn.

$\frac{y - 18}{x - 2} = -\frac{1}{7}$.

$y - 18 = -\frac{1}{7}x + \frac{2}{7}$.

$y = -\frac{1}{7}x + 18\frac{2}{7}$.

$y = -\frac{1}{7}x + \frac{128}{7}$.