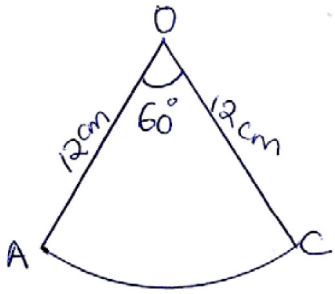
MATHEMATICS REVISION KIT 2019
PAPER 2

SECTION I (50 MARKS) ANSWER ALL QUESTIONS

1. Use mathematical tables to evaluate. (4 marks)

$$\sqrt[3]{\frac{4\cos 60^{o} \times 0.1324^{2}}{5\log 7}}$$

2. Solve for x in the equation (3 marks)
   $\sin(4x - 10)^{o} - \cos(x + 60^{o})^{o} = 0$
3. A radio cassette is offered for sale at shs 8,000 or a deposit of shs. 1,000 and 15 monthly repayments of shs 840. Find the rate of interest compounded monthly that is being charged under hire purchase terms. (4 marks)
4. A colony of insects was found to have 250 insects at the beginning. Thereafter the number of insects doubled every 2 days. Find how many insects there were after 16 days. (3 marks)
5. Under a shear with x-axis invariant a square with vertices A(1,0), B(3,0), C(3,2) and D(1,2) is mapped onto a parallelogram with vertices $A^{1}(1,0)$ $B^{1}(3,0)$, $C^{1}(7,2)$ and $D^{1}(5,2)$. Find the shear matrix. (3 marks)
6. Using a ruler and a pair of compasses only construct a triangle PQR in which QR is 6.6cm, P=3.8cm and PQ = 5.6cm. Locate point x inside triangle PQR which is equidistant from P and R such that angle PXR = 90°. (3 marks)
7. Find the variance and standard deviation of 3, 5, 7, 9, 11 (3 marks)
8. P and Q are two points such that **OP** = **i** + 2**j** + 3**k** and **OQ** = 4**i** + 5**j** – 3**k**. M is a point that divides PQ externally in the ratio 3:2. Find the co-ordinates of M. (3 marks)
9. The sector below has a radius of 12cm and an angle AOC = 60° is folded to form a cone. Find the volume of the cone formed. (4 marks)



10. Find the equation of the normal to the tangent of the curve $y=x^{3} - 3x^{2} + 2x + 1$ at the point where x=3. Leave your answer in the form y=mx + c. (3 marks)
11. Without using mathematical tables or calculator; evaluate: (3 marks)

$$\frac{\cos 135^{o} - \sin 30^{o}}{\sin 135^{o} + \sin 30^{o}}$$

12. Find the midpoint of the straight line joining A (2, 1) and D (6,5). (2 marks)
13. The equation of a circle centre (h, k) is $2x^{2} + 2y - 8x + 5y + 10 = 0$. Find the values of h and k. (3 marks)
14. Make y the subject of the formula given

$$H = \sqrt{\frac{t}{q-y^{2}}}$$

15. If $\frac{1}{a-2} - \frac{1}{a+2} = \frac{c}{a^{2}-b}$ for all values of a , evaluate c and b. (3 marks)
16. X and Y are two variables such that Y is partly constant and partly varies inversely as the square of X. If Y = 3 when X = 2 and Y = 5 when X = 1, find Y when X = 4. (3 marks)

SECTION II

ANSWER ONLY FIVE QUESTIONS IN THIS SECTION IN THE SPACES PROVIDED.

17. The table below shows the number of students who scored marks in mathematics test.

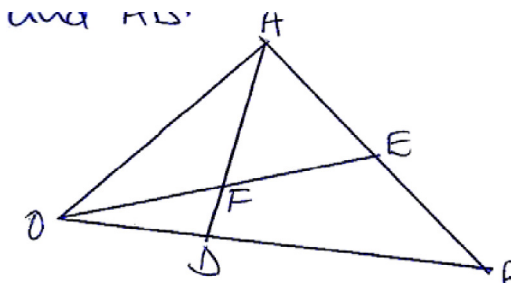
Marks	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Frequency	3	6	10	10	12	17	15	16	7	4

a) Draw a cumulative frequency graph for the data. (4 marks)
b) Use the graph to estimate the median mark. (2 marks)
c) If students who score over 40 marks pass the tests estimate the percentage of the students
   i) who passed (2 marks)
   ii) who failed (2 marks)

18. In a geometrical progression, the sum of the second and third terms is 6; and the sum of the third and fourth terms is -12. Find:
a) (i) The first term (3 marks)
   (ii) The common ration (3 marks)
b) The sum of number of consecutive terms of an arithmetical progression is -19 ½ ; the first term is 16 ½ ; and the common difference is -3. Find the number of terms. (4 marks)

19. a) PQRS is a quadrilateral with vertices p(1, 4) Q(2, 1), R(2, 3) and S(6, 4). On the grid provided plot the quadrilateral (1 mark)
b) Draw $P^1Q^1R^1S^1$ the image of PQRS under a positive quarter turn about the origin and write down its co-ordinates. (3 marks)
c) Draw $P^{11}Q^{11}R^{11}S^{11}$ the image of P1Q1R1S1 under the transformation whose matrix is $\begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$ and write down its co-ordinates. (3 marks)
d) Determine the matrix T of a single transformation that maps PQRS onto $P^{11}Q^{11}R^{11}S^{11}$ (3 marks)

20. In the figure below, E is the midpoint of AB, OD:DB=2:3 and F is the point of intersection of OE and AD.



a) Given that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$, express in terms of a and b
   i) $\overrightarrow{OE}$ (1 mark)
   ii) $\overrightarrow{AD}$ (1 mark)
b) Given further that $\overrightarrow{AF} = t\overrightarrow{AD}$ and $\overrightarrow{OF} = s\overrightarrow{OE}$ where s and t are scalars, find the values of s and t. (5 marks)
c) Show that O, F and E are collinear. (3 marks)

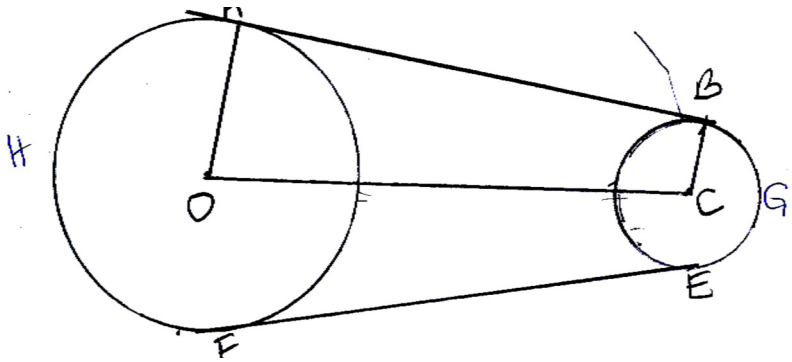
21. The position of two towns P and Q are given to the nearest degrees as P(45°N, 110°W) and Q (45°N, 70°E) Take π= 3.142, Radius of the earth R = 6370km. Find
a) The distance between the two towns along the parallel of latitude in km. (3 marks)
b) The distance between the towns along a parallel of latitude in nautical miles. (3 marks)
c) A plane flew from P to Q taking the shortest distance possible. It took the plane 15 hours to move from P and Q. Calculate it's speed in knots (4 marks)

22. Compete the table below (2 marks)

X°	-180°	-150°	-120°	-90°	-60°	-30°	0°	30°	60°	90°	120°	150°	180°
Y=sin(x+30)°			-1				0.50				0.50		
Y=2cos(x+30)°			0				1.73				-1.73		

b) On the same axes draw the graphs of y= sin(x+30)° and y= 2cos(x+30)°. (5 marks)
c) Use your graphs to solve the equation 2cos(x+30)° – sin(x+30)° = 0 (2 marks)
d) State the amplitude of each wave. (1 mark)

23. Two wheels have radii 20cm and 30cm. Their centres are 70cm apart. A belt, passes tightly round the wheels as shown below.



a) Calculate the length of AB and FE . (3 marks)
b) Evaluate the angles AOC and BCO. (3 marks)
c) Calculate the total length of the belt A B G E F H A (4 marks)

24. Given the equations: $y=4 -x^2$ and $y=x^2-2x$;
a) Find the co-ordinates of the points where the two curves meet. (2 marks)
b) Find the co-ordinates of points where $y=4 -x^2$ meet:
(i) The x-axis. (1 mark)
(ii) The y-axis (1 mark)
c) Find the co-ordinates of the points where $y=x^2 – 2x$ meet;
(i) The x-axis (1 mark)
(ii) The y-axis (1 mark)
d) Sketch the two curves above on the same axes (1 mark)
e) Find the area enclosed between the curves $y=4-x^2$ and $y=x^2 – 2x$. (3 marks)

MARKING SCHEME

1.

No.	Log
2	0.3010 0.3010
0.1324^2	
5	$\bar{1}.1219 \times 2 = \bar{2}.2438$
Log 7	$\underline{2.5448}$
	$\underline{0}.6990$
	$\underline{1.9270}$ +
	$\underline{0.6260}$
	2.5448
	$\underline{0.6260}$ –
2.024×10^{-1}	$\underline{3.9188}$
	3
0.2024	
	Antilog $\bar{1}.3063$

M1
M1
M1
A1
4

2.

$\sin(4x + 10)^o = \sin(90 - (x + 60)^o$ — M1
$4 \times 10^o = 90 - x - 60^o$ — M1
$4x + x = 20$ — A1
$5x = 20$
$x = 4^o$
3

3.

Amount borrowed = 8000 – 1000 = 7000
Installments = 840 x 15 = 12600 — M1
If r% is the rate per month
Then $12600 = 7000\,(1 + {}^{r}/_{100})^{15}$ — M1
$(1 + {}^{r}/_{100})^{15} = \dfrac{12600}{7000}$
$= 1.8$ — M1
$1 + {}^{r}/_{100} = 15\ 1.8$ or $1.8^{1/15}$
$= 1.0399 = 1.04$
${}^{r}/_{100} = 1.04 - 1$
$= 0.04$ — A1
$r = 4\%$

4.

$a = 250;\ r = 2,\ n = {}^{16}/_{2} + 1 = 9$ — B1
n^{th} term $= 250 \times 28$ — M1
$= 64000$ — A1

Accept use of step by step method.

0	2	4	6	8	10	12
250	500	1000	2000	4000	8000	16000

14	16
32000	64000

5

Let the transformation matrix $T = \begin{matrix} a & c \\ b & d \end{matrix}$

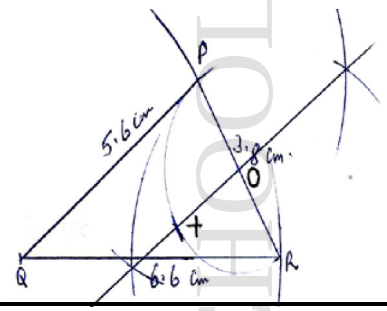
$$\begin{pmatrix} a & c \\ b & d \end{pmatrix}\begin{pmatrix} A & B & C & D \\ 1 & 3 & 3 & 1 \\ 0 & 0 & 2 & 2 \end{pmatrix} = \begin{pmatrix} A^1 & B^1 & C^1 & D^1 \\ 1 & 3 & 7 & 5 \\ 0 & 0 & 2 & 2 \end{pmatrix}$$

$$\begin{pmatrix} a & 3a \\ c & 3c \end{pmatrix}\begin{pmatrix} 3a + 2b \\ 3c + 2d \end{pmatrix}\begin{pmatrix} a+2b \\ c+2d \end{pmatrix} = \begin{pmatrix} 1 & 3 & 7 & 5 \\ 0 & 0 & 2 & 2 \end{pmatrix}$$

$a = 1,\ c = 0$
$3(1) + 2b = 7$
$2b = 4$
$b = 2$
$2d = 2$
$d = 1$

$$T.M = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$$

6.



B1
B1
B1

7

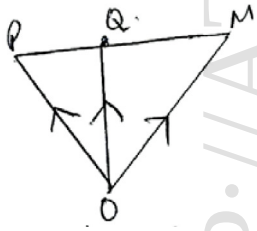
$$\frac{3 + 5 + 7 + 9 + 11}{5} = 7$$

Deviation (x-x)	-4	-2	0	2	4
$(x-x)^2$	16	4	0	4	16

$$\text{Variance} = \frac{\epsilon d^2}{F} = \frac{40}{5} = 8$$

$$\text{s.d} \quad \sqrt{8} = 2.8284$$

8.



Using Ratio theorem

$$OM = \frac{-2}{1}\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} + \frac{3}{1}\begin{pmatrix} 4 \\ 5 \\ -3 \end{pmatrix}$$

$$= \begin{pmatrix} -2 \\ -4 \\ -6 \end{pmatrix} + \begin{pmatrix} 12 \\ 15 \\ -9 \end{pmatrix} = \begin{pmatrix} 10 \\ 11 \\ -15 \end{pmatrix}$$

Coordinates of m (10, 11, -15)

9.

Area of a sector = curve are of a cone.

$60x\ \pi \times 12^2 = \pi r \times 12$

$^1/_6 \times 12 = r$

Radius = 2cm

$h = \sqrt{12^2 - 2^2}$

$= \sqrt{140}$

= 11.83cm

Volume = $^1/_3 \times {}^{22}/_7 \times 2 \times 2 \times 11.83$

= $49.57cm^3$

10

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

Gradient = $3(3)^2 - 6x\,3 + 2 = 11$

Gradient of the normal 1 to line

$M_2 = \frac{-1}{11}$

$Y = 33 - 3(3)^2 + 3 \times 2 + 1$

Y = 7; (x, y) is (3, 7)

Since $m_2 = \frac{-1}{11}$

$\frac{-1}{11} = \frac{y-7}{x-3}$

$y = \frac{-x}{11} + \frac{80}{11}$

11

$\cos 135^o = -\cos(180^o - 135^o)$

$= -\cos 45^o = -\frac{\sqrt{2}}{2}$

$\sin 30^o = ½$

$\sin 135^o = \sin(180^o - 135^o)$

$= \sin 450$

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

$\frac{\cos 135^o - \sin 30^o}{\sin 135^o + \sin 30^o}$

$= \frac{-\frac{\sqrt{2}}{2} - \frac{1}{2}}{\frac{\sqrt{2}}{2} + \frac{1}{2}}$

= -1

12

Mid point of AB = $\left(\frac{2+6}{2}, \frac{1+5}{2}\right)$

$= \left({}^8/_2, {}^6/_2\right)$

= (4, 3)

13

$X^2 + y^2 - 4x + {}^5/_2y + 5 = 0$

$X^2 + y^2 - 4x + {}^5/_2y = -5$

$X^2 - 4x + 4 + y^2 + {}^5/_2y + {}^{25}/_{16} = -5 + 4 + {}^{25}/_{16}$

$(x-2)^2 + (y + \frac{5}{4})^2 = \frac{9}{16}$

h = 2 ; k = -1.25

14

$H^2 = \frac{t}{q - y^2}$ — M1

$t = H^2q - H^2y^2$ — M1

$y^2 = \frac{H^2q - t}{H^2}$

$y = \pm\sqrt{\frac{H^2q - t}{H^2}}$ — A1

15

$\frac{1}{a-2} - \frac{1}{a+2}$ — M1

$= \frac{a+2 - 1(a-2)}{a^2-4}$

$= \frac{4}{a^2 - 4}$ — M1

Comparing with $\frac{c}{a^2-4}$ — A1

C = 4

b = 4

16

Yk + c where k and c are constants — M1

$3 = k + \frac{c}{4}$

$5 = k + c$

$2 = {}^3/_4c$; $c = {}^8/_3 = 2\,{}^2/_3$

$k = {}^7/_3 = 2\,{}^1/_3$

$k = 2\,{}^1/_3$, $C = 2\,{}^2/_3$

$y = {}^7/_3 + \frac{8}{3x^2}$ — M1

When x = 4, $y = {}^7/_3 + \frac{8}{3(4)^2}$

Y = 2 ½ — A1

17

a) — B1

Class	Frequency	Cumulative Freq. C.F
1 – 10	3	3
11 – 20	6	9
21 – 30	10	19
31 – 40	10	29
41 – 50	12	41
51 – 60	17	58
61 – 70	15	73
71 – 80	16	89
81 – 90	7	96
91 - 100	4	100

B1 B1

b) Median mark the mark scored by the (½ x 100)th student from the graph 56±2 — B1

c) 27 students scored 40 marks and below.

(i) Students who scored 41 marks and above — B1

= 100 – 27= 73

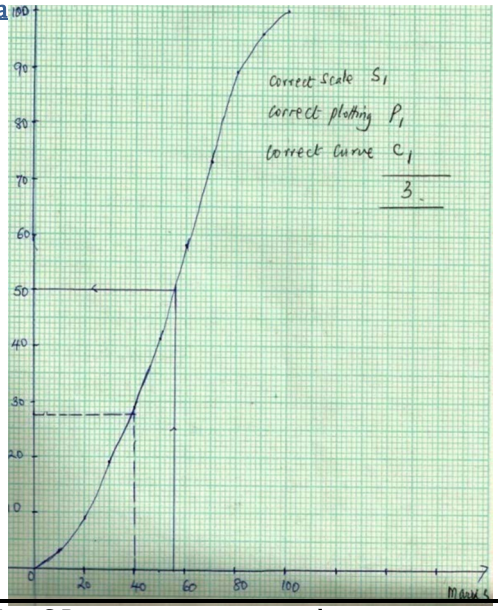
Students who passed = $\frac{73}{100} \times 100$ — B1

(ii) Students who failed — B1

= 100 – 73 = 27%

17

a



18

In a G.P series; a term is given by
ar n-1
2nd term = ar
3rd term = ar2
i) 2nd term + 3rd term = ar + ar2 = 6 — M1
ar(a+r) = 6
$ar^2 + ar^3 = -12$

ar(1+r) = 6
$ar^2(1+r)$ -12 — M1

$\frac{ar(1+r)}{ar^2(1+r)} = \frac{6}{-12}$

$\frac{1}{r} = \frac{-1}{2}$ — A1
r = -2

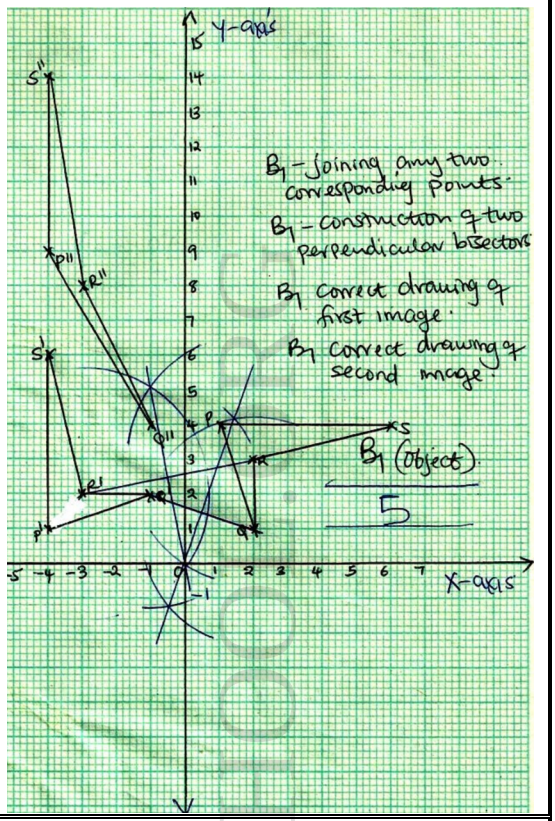
ii) oubsting: r = -2 in ar(1+r) = 6
-2a(1-2) = 6 — M1
2A = 6 = a = 3

b) bm = n{2a + (n – 1) d}

Given sn = -19 ½ ; a = 16 ½ ; d=-3 — M1 A1

$\frac{-39}{2} = \frac{n}{2}\{33 - 3(n-1)\}$ — M1
-39 = n(36-3n)
3n2 – 36n – 39 = 0 — M1
N2 – 12n – 13 = 0
(n-13) (n + 1) = 0 — M1
n =13 or n = -1
Number of term is 13 — A1

19



	P^1	Q^1	R^1	S^1		P^{11}	Q^{11}	R^{11}	S^{11}
$\begin{pmatrix}1 & 0\\ -2 & 1\end{pmatrix}$	-4	-1	-3	-4		-4	-1	-3	-4
	1	2	2	6		9	4	8	14

Coordinates P^1 (-4 9): Q^{11}(-1,4)
R^{11}(-3, 8); S^{11}(-4, 14)

d) Let T = $\begin{pmatrix}a & b\\ c & d\end{pmatrix}$

$$\begin{pmatrix}a & b\\ c & d\end{pmatrix}\begin{pmatrix}P & Q & R & S\\ 1 & 2 & 2 & 6\\ 4 & 1 & 3 & 4\end{pmatrix} = \begin{pmatrix}P^{11} & Q^{11} & R^{11} & S^{11}\\ -4 & -1 & -3 & -4\\ 9 & 4 & 8 & 14\end{pmatrix}$$

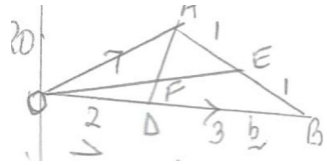
2(a + 4b = -4) = 2a + 8b = -8
2a + b = -1 — 2a + b = -1
7b = -7

a = 0

2(c + 4d = 9) = 2c + 8d = 18
2c + d = 4 — 2c + d = 4
7d = +14
c=1 — d=+2

T= $\begin{pmatrix}0 & -1\\ 1 & 2\end{pmatrix}$

20



a) (i) OE = ½**a** + ½ **b** — B1

AD = -**a** + $^2/_5$**b** — B1

b) **AF** = t **AD** — B1

AF = t(2/5b – a)

AF = O**A** + O**F** — B1

= -**a** + s(½ **a** + ½ **b**) — B1

= (½ s – 1) **a** + ½ s**b**

Equating

$^2/_5$t**b** = t**a** = (½ s – 1) **a** + ½ s**b**

t = 1 – ½ s — B1

$^2/_5$t = ½ s

t = 5s — B1

5s = 1 – ½ s

= s = $^2/_{11}$

t = $^{10}/_{11}$

c) OF = KOE — B1

OF = S(½ a + ½ b) = 2/11(½ a + ½ b)

OE = ½ a + ½ b

2/11 (½ a + ½ b) = K(½ a + ½ b) — B1

K = $^2/_{11}$

O = 2/11 OE

O is common point — B1

O, F and E are collinear points.

21

Angle difference = 110° + 70° = 180°

Distance = $\frac{\theta}{360^o}$ x 2 x л x 6370cos 45

= ½ x 2 x 3.142 x 6370 cos 45

= 3.142 x 6370 x 0.7071

= 14152.28km.

b) Distance in nm = 60α cosθ

= 60 x 180° x cos 45°

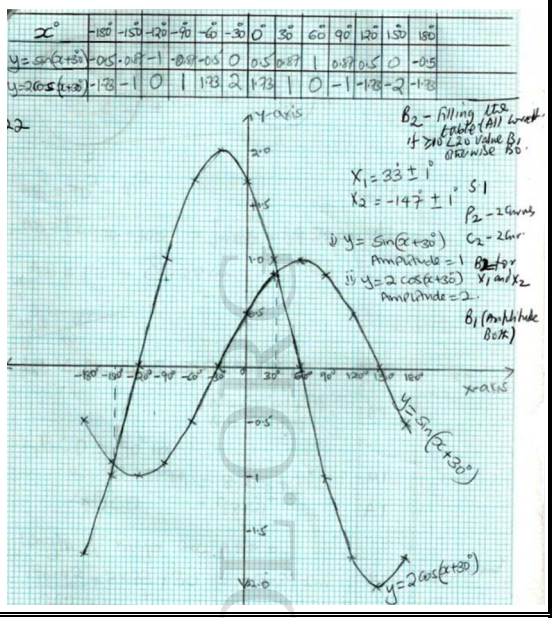
= 7636.68nm.

c)Speed = $\frac{\text{Distance in nm}}{\text{time in hours}}$

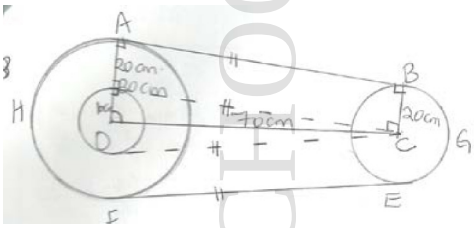
= $\frac{60 \times 90}{15}$

= 360 knots

22



23

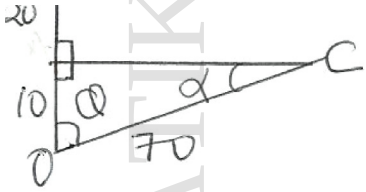


a) $AB^2 = 70^2 - 10^2$

AB = $\sqrt{4900 - 100} = \sqrt{4800}$ = 69.28cm

AB = FE = 69.28cm.

b)



Let ‹ AOC be Q = Cos Q = $\frac{10}{70}$

Q = Cos^{-1} 0.1429

Q = 81.79°

‹BCD = 90° +α

A = 90° – 8179 = 8.213 + 90°

BCO = 98.21°

b) Length of major arc AHF =

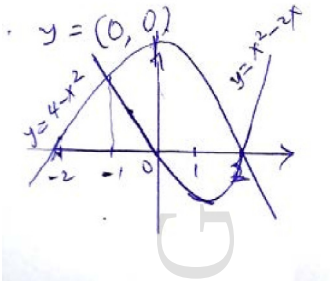
$\frac{196.42}{360}$ x 2 x $\frac{22}{7}$ x 30 = 102.89cm

Length of arc BGE

$\frac{163.58}{360}$ x 2 x $\frac{22}{7}$ x 20 = 57.12cm

TOTAL LENGTH = (69.28 x 2) + 102.89 + 57.12

= 298.6cm

24	The two curves meet when $4 - x^2 = x^2 - 2x$ $= 4 - x^2 - x^2 + 2x = 0$ $2x^2 - 2x - 4 = 0$ $x^2 - x - 2 = 0$ $(x - 2)(x + 1) = 0$ $x = -1$ or $x = +2$ (-1, 3) and (2, 0).	B1B1	c)		B1
b)	At the point where $y = 4 - x^2$ meet (i) x-axis, $y = 0$ $\quad 0 = 4 - x^2$ $= x = \pm 2$	B1	d)	Area $= \int_{-1}^{+} \left\{ (4 - x^2) - (x^2 - 2x) \right\} dx$	M1
	(ii) At the point where the $y = 4 - x^2$ meets the y-axis $x = 0$. $y = 4 - (0)^2 = 4$ (0, 4) $Y = x^2 - 2x$ x-axis; y-axis; $y = 0$ $0 = x^2 - 2y$ $= x(x-2) = 0$ $\quad x = 0$ or $x = 2$ (0,0) or (2,0) $Y = x^2 - 2x$; y-axis; $x = 0$	B1 B1B1		$= \int^{+2} (4 \times 2x - 2x^2)\ dx$ $= \left[4x + x^2 - {}^2/_3 x^3 \right]_{-1}^{+2}$ $(4 \times 2 + 2^2 - {}^2/_3 \times 2^3) - (-4 + 1 + {}^2/_3)$ $= 8 + 4 - 5^1/_3 + 4 - 1^2/_3$ $= 9$	M1 M1