MATHEMATICS REVISION KIT 2019
PAPER 2

SECTION I (50 MARKS)

Answer all the questions from this section

1. Use logarithm tables to evaluate

$$\sqrt[4]{\frac{4.562\ x\ 0.38}{0.82}}$$

Correct to 3 significant figures (4 Marks)

2. Simplify the expression: $(3x - 2y)(2x + 3y)-5xy$ (2 Marks)
Hence factorize your answer (1 Mark)

3. Make y the subject of the formula in

$$a = \sqrt{\frac{cy}{b + y}}$$

4. The first three consecutive terms of a geometric progression are:
2, x and 8. Find the value of x (2 Marks)

5. Given that the matrix $M = \begin{bmatrix} a & 0 \\ 5 & b \end{bmatrix}$

(a) Determine M^2 (2 Marks)

(b) If $M^2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ determine the possible pairs of values of a and b (2 Marks)

6. If (x+y) : (x-y) find the ratio x:y (2 Marks)

7. There are two boxes labeled A and B on a table. Box A contains 5 red balls and 3 white balls, while box B contains 2 red balls and 6 white balls. A box is chosen at a random and two balls are drawn from it, one after the other without replacement. Find the probability that the two balls chosen are of different colours (3 Marks)

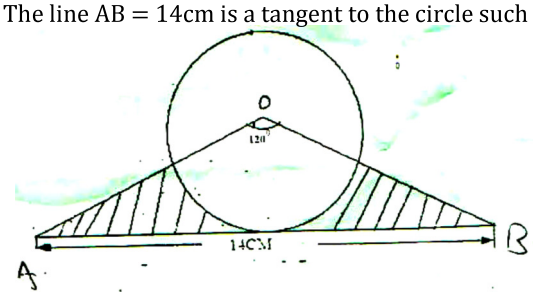
8. A water tank has a capacity of 50 litres. A similar model tank has a capacity of 0.25 litres. If the larger tank has a height of 10cm. Calculate the height of the model tank, to the nearest cm. (3 Marks)

9. Solve for x in (3 Marks)

$$9^x + 3^{2x}\text{-}3 = 51$$

10. Without using a calculator or mathematical tables, express $\frac{\sqrt{3}}{1-Sin\,60^0}$ in surd form and rationalize the denominator (3 Marks)

11. The figure shows a circle centre O. The line AB = 14cm is a tangent to the circle such that OA = OB and $\angle OAB = 120^0$.



Calculate to one decimal place

(a) The radius of the circle (2 Marks)

(b) The total of the shaded parts (2 Marks)

12. Calculate the value of $(2x + 3)dx$ (3 Marks)

13. Three quantities; P, Q and R are such that P varies directly as the square of Q and inversely as the square root of R. If P = 6 when Q = R and R = 25. Find the value of P when Q = 15 and R = 81. (3 Marks)

14. A tea blender buys two grades of tea at Sh. 60 and Sh. 80 per packet. Find the ratio in which she should mix them so that by selling the mixture at Sh. 90, a profit of 20% is realized. (3 Marks)

15. (a) Expand:
$(2 + x)^5$ up to the term containing x^3 (2 Marks)

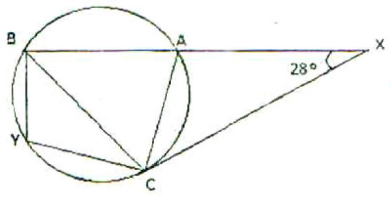
(c) Use the expansion in (a) above to the find the approximate value of (1.99)5 correct to three decimal places. (2 Marks)

16. Obtain the centre and radius of a circle represented by the equation: (3 Marks)
$x^2 + y^2 + 4x - 10y - 7 = 0$

SECTION II (50 MARKS)

Answer any five questions from this section

17. In the figure below XC is a tangent to the circle ABYC at C and Y is the midpoint of arc BC.



If ∠BXC = 280 and ∠BCA = 2∠ACX.

Find, giving reasons for your answer:

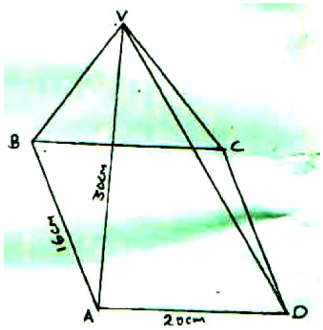
(a) (i) ∠CBA (3 Marks)

(ii) ∠CBY (3 Marks)

(iii) ∠BYC (2 Marks)

(b) Given that AX = 10cm and XC = 12cm, calculate the length of BX (2 Marks)

18. The figure below represents a rectangular based pyramid VABCD. AB = 16cm and AD = 20cm. Point O is vertically below V and VA = 30cm.



Calculate:

(a) The height, VO, of the pyramid (4 Marks)

(b) The angle between the edge VA and the plane ABCD (2 Marks)

(c) The angle between the planes VAB and ABCD. (4 Marks)

19. (a) The eleventh term of an arithmetic progression is four times its second term. The sum of the first seven terms of the same progression is 175.

Find the first term and the common difference of the progression (4 Marks)

(b) Given the series 3 + 9 + 15 + 21 + 27 + ... find the number of the terms that will given a sum of 432 (2 Marks)

(c) A geometric series is such that its first term is 2. Find the two possible common ratios if the sum of its first three terms is 26

20. (a) Complete the table below:

x	-30	0	30	60	90	120	150
$\text{Sin}(x+30)^0$	0		1.7			1.5	
$\sqrt{3}\ \text{Cos}\ x^0$		1.7	1.5		0.0		

(b) On the grid provided, using the same scale and axes, draw a graph of:

$y = 2 \sin (x + 30)^0$ and $y = \sqrt{3}\ \text{Cos}\ x$ for $-30^0 \leq x \leq 1500$ (5 Marks)

(c) Use the graph drawn in (b) above to determine the values of x for which

(i) $2 \text{ Sin } (x + 30)^0 = \sqrt{3}\ \text{Cos}x$ (2 Marks)

(d) Find the difference in amplitudes between $y = 2 \text{ Sin } (x + 300)$ and $y = \sqrt{3}\ \text{Cos}\ x$ (2 Marks)

21. The points A (1,4), B(-2,0) and C (4,-2) of a triangle are mapped onto $A^1(7,4)$, $B^1(x,y)$ and C^1 (10,16) by a transformation $N = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

(a) (i) Matrix N of the transformation (4 Marks)

(ii) Coordinates of B1 (2 Marks)

(b) $A^{II}B^{II}C^{II}$ are the image of $A^1B^1C^1$ under transformation represented by matrix

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

Write down the co-ordinates of $A^{II}B^{II}C^{II}$ (3 Marks)

(c) A transformation N followed by M can be represented by a single transformation K. Determine K (2 Marks)

22. The table below gives marks scored by candidates in a mathematics test.

Marks	1-10	11-20	21-30	31.40	41-50
No. of candidates	5	13	32	27	3

(a) Using an assumed mean of 25.5, calculate the mean mark (4 Marks)

(b) Estimate the median mark (3 Marks)

(c) Calculate the standard deviation of the marks (3 Marks)

23. The positions of three ports in the Indian Ocean are p (40^0N, 30^0W) Q(400N, 20^0E) and R (36^0S, 30^0W) respectively.

(a) Find the distance in nautical miles to the nearest nm between:

(i) Ports p and Q (3 Marks)

(ii) Ports P and R (2 Marks)

(b) A ship left port P on Tuesday 1430 hours and sailed to port Q at 20 knots.

Calculate:

(i) The local time at port Q when the ship left port P (2 Marks)

(ii) The day and time the ship arrived at port Q (3 Marks)

24. Two quantities Q and R are connected by the equation; $Q = KR^n$

The table of values of Q and R is given below.

Q	1.2	1.5	2.0	2.5	3.5	4.5
R	1.58	2.25	3.39	4.74	7.86	11.6

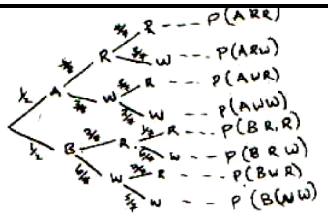
(a) Complete the table of log Q and log r given below; (2 Marks)

Log Q			0.30	0.40			0.65
Log R		0.35		0.68	0.90		

(b) On a grid, draw a suitable line graph to represent the relation $Q = KR^n$. (3 Marks)

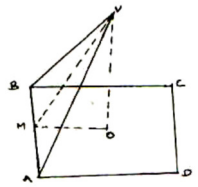
(c) From the graph, determine the values of K and n. (3 Marks)

(d) Hence write down the relationship connecting Q and R. (2 Marks)

1.	NO. | LOG 4.562 | 0.6592 0.38 | 1.5798 | 0.2390 0.82 | T. 9138 | 0.325/ 4 1.2059×10^{-2} | 0.0813 $= 0.012059 \leq 20.01206$	**M1** **M1** **M1** **A1**
2.	$(3x-2y)(2x+3y) - 5xy$ $= 6x^2 + 9xy - 4xy - 6y^2 - 5xy$ $= 6x^2 - 6y^2$ $= 6(x^2 - y^2)$ $= (6)(x+y)(x-y)$	M1 A1 B1
3.	$a^2 = \frac{cy}{b+y}$ $a^2b + a^2y = cy$ $a^2y + cy = a^2b$ $y(a^2 - c) = -a^2b$ $y = \frac{-a^2b}{a^2-c}$	M1 M1 A1
4.	$\frac{X}{2} = \frac{8}{X}$ $x^2 = 16$ $X = 14$	
5.	$M^{2=} \begin{pmatrix} a & 0 \\ 5 & b \end{pmatrix}\begin{pmatrix} a & 0 \\ 5 & b \end{pmatrix}$ $= \begin{pmatrix} a^2 & 0 \\ 5a+5b & b2 \end{pmatrix}$	M1 B1
b	$\begin{pmatrix} a^2 & 0 \\ 5a+5b & b2 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ $a^2 = 1$ $A = +1$ And $b^2 = 1$ $b = +1$	B1 A1
6	$(x+y) : (x-y) = 8:3$ $X+y = 8$ $X = 8-y$ .....(i) $8 - y - y = 3$ $8 - 2y = 3$ $2y = \frac{5}{2}$ $X = 8 - \frac{5}{2}$ $= \frac{11}{2} : -\frac{5}{2} = 11.5$	M1 M1 A1
7	 $p(ARW)+p(AWR)+p(BRW)+p(BWR)$ $=(\frac{1}{2} \times \frac{1}{8} \times \frac{3}{7}) + (\frac{1}{2} \times \frac{3}{8} \times \frac{5}{7}) + (\frac{1}{2} \times \frac{2}{8} \times \frac{6}{7}) + (\frac{1}{2} \times \frac{6}{8} \times \frac{2}{7})$	

	$= \frac{15}{112} + \frac{15}{112} + \frac{12}{112} + \frac{12}{112}$ $= \frac{54}{112}$ or $\frac{27}{56}$	
8.	**v.s.f** $= \frac{vol\ of\ model\ tank}{vol\ of\ w.tank} = \frac{0.25l}{50l} = \frac{1}{200}$ L.s.f $= \sqrt[3]{\frac{1}{200}}$ $= \sqrt[3]{\frac{1}{200}} = \frac{height\ of\ tank}{height\ of\ w.tank} = \frac{x}{100}$ $\left(\frac{x}{100}\right)^3 = \frac{1}{200}$ $X3 = \frac{1}{200} \times 1000000 = 5000$ $X = \sqrt[3]{5000} = 10^3\sqrt{5}$ $=10 \times 1.7321$ $=17.321$ $= 17cm$	M1 M1 A1
9.	$(3^2)^x \times 3^{2x} = 54$ $3^{2x} + 3^{2x} = 54$ $2.3^{2x} = 54$ $3^{2x} = 27$ $3^{2x} = 3^3$ $2x = 3$ $X = \frac{3}{2} = 1.5$	**M1** **M1** **A1**
10	$\frac{2\sqrt{3}(2+\sqrt{3})}{(2-\sqrt{3})-(2+\sqrt{3})}$ $= 4\sqrt{3}+6$	B1 M1 A1
11	$\tan 60 = \frac{7}{r}$ $r = \frac{7}{\tan 60}$	**M1** **A1**
b	**Area of sector** $= \frac{120}{360} \times \frac{22}{7x}$ **Area of triangle** $= \frac{1}{2} \times 7x \times 2$ **Shaded area =**	**M1** **A1**
13	$\frac{pxQ^2}{\sqrt{R}}$ $P = \frac{R.Q2}{\sqrt{R}}$ $6 = \frac{12^2R}{\sqrt{25}}$ $R = \frac{6X5}{144} = \frac{5}{24}$ $P = \frac{5\ Q^2}{24\sqrt{R}}$ $P = \frac{5\ (15^{2})}{24\sqrt{81}} = \frac{5}{24} \times 25 = \frac{125}{24} = 5\frac{5}{24}$	

14	Let the grades of tea bought be x and y. for sh. 60 and sh. Respectively $=\frac{60+80y}{x+y}$ cost of the mixture 120% = sh. 90 100% =? 90 X $\frac{100}{120}$ = sh. 75 $\frac{60x+80y}{x+y} = 75$ 60x + 80y = 75x + 75 y -15x = 15y $\frac{x}{y}=\frac{1}{3}$ therefore ratio of x:y = 1:3	A1 M1 A1
15.	a) $(2+x)^5 = 2^5x\ 0 + 5.2^4x^1 + 10.2^3x^2 + 10.2^2x^3$ $= 32 + 80x + 80x^2 + 40x^3$	M1 A1
b	(2+x) = 1.99 X – 0.01 $(1.99)^5 = (2 - 0.01)^5$ 32+ 80 (-0.01)+ 80 (- 0.01)² + 40 (- 0.01)³ 32 – 0.8 + 0.008 – 0.00004 =31.20796 = 31. 208	B1 A1
16	$x^2 + 4x + y^2 - 10y = 7$ $x^2 + 4x + \left(\frac{4}{2}\right)^2 + y^2 - 10y + \left(\frac{-10}{2}\right)^2 = 7 + 2^2 + 5^2$ $(x+2)^2 + (y-5)^2 = 36 = 6^2$ centre is (-2,5) radius is 6 units	M1 A1 A1
17	<Acx = <ABC =< s in alt segments x + x+2x + 28 = 180⁰ <s in a triangle 4x = 152 x = 38⁰ <CBA = 38⁰	B1 B1
ii	<CBA = 180 – [38 + 2(38)] <s in triangle = 180 – 114 =66 <BYC = 180 – 66 = 114 ....opp <s. in cyclic quadrilateral <CBY = $\frac{180}{2}$ - 114. Base angles of isosceles triangle = 33⁰	B1 B1
iii	<BYC = 180 – 66 ..op .angles in cyclic quadrilateral. = 114	B1
b.	AX. XB = (cx)² 10(10 +x) = 12² 100+10x = 144 10x = 44 X = 4.4 AB = 4.4 + 10 = 14.4cm.	
18.	 Ac $= \sqrt{20^2 + 16^2}$ $= \sqrt{656}$ = 25.61 AO = ½ (25.61) = 12.81 VO = $\sqrt{30^2 - 12.81^2}$ = 27.13cm	

b.	Tan VAC = $\frac{vo}{Ao}$ VAC = tan $^{-1}\frac{27.13}{12.81}$ = 64.72⁰	M1 A1
c.	 MV = $\sqrt{900 - 64}$ = 28.91 M0 = ½ AD = ½ (20) = 10 cm VMO = $\cos^{-1}$ $\frac{10}{28.91}$ = 69.77⁰	M1 B1
19 a.	T_{11} = a + 10d = T_2 = a+d a +10d = 4(a+d) a+10d = 4a +4d -3a =-6d a = 2d .....(i) $s_7 = \frac{7}{2}[29 + (7-1)d] = 175$ $= \frac{7}{2}(4d + 6d) = 175$ $\frac{7}{2}$ x 10d) = 175 70d = 350 d = 5 a = 2(s) a =10 a=10,d =5.	M1 M1 M1 A1
b.	D =9-3=6 Sn = $\frac{n}{2}$[2x3 + (n -1)6] = 432 n(6+6n-6)=864 6n² = 144 n=±12 n = 12 terms	
21 a.i	$\begin{pmatrix} a & b \\ c & d \end{pmatrix} + \begin{pmatrix} 1 & 4 \\ 4 & -2 \end{pmatrix} = \begin{pmatrix} 7 & 10 \\ 4 & 16 \end{pmatrix}$ A+4b = 7 .....(i) x 4 4a + 16b .....10 (ii) 4a + 16b = 28 $\frac{4a-2b=10}{18b=18}$ b = 1 a = 9-4 = 3 c+4d =4 ..... (iii) x 4 4c – 2d = 16 .....(iv) 4c + 16d = 16 $\frac{4c-2d=16}{20d=0}$ d =0 c =4 $\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 3 & 1 \\ 4 & o \end{pmatrix}$	
ii	$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 & 1 \\ 4 & o \end{pmatrix}\begin{pmatrix} -2 \\ 0 \end{pmatrix} = \begin{pmatrix} -6 \\ -8 \end{pmatrix}$ B¹ =(-6 ,-8)	

b.

$$\begin{pmatrix}2 & -1\\ 1 & 0\end{pmatrix}\begin{pmatrix}7 & -6 & 10\\ 4 & -8 & 16\end{pmatrix}=\begin{pmatrix}10 & 4 & 4\\ 7 & -6 & 10\end{pmatrix}$$

$$\begin{matrix}\\ \\ A1 & B1 & C1\end{matrix}\qquad\begin{matrix}\\ \\ A11 & B11 & C11\end{matrix}$$

A1 (10,7) B11(4,-6) C11 (4,10)

C.

$$\begin{pmatrix}2 & -1\\ 1 & 0\end{pmatrix}\begin{pmatrix}3 & 1\\ 4 & 0\end{pmatrix}=\begin{pmatrix}2 & 2\\ 3 & 1\end{pmatrix}$$

22a

marks	m.p	∑	d	∑d	d2	∑d2	cf
1-10	5.5	5	-20	-100	400	2000	5
11-20	15.5	13	-10	-130	100	1300	18
21-30	25.5	32	0	0	0	0	50
31-40	35.5	27	10	270	100	2700	77
41-50	45.5	3	20	60	400	1200	80
		80		100		7200	

Mean (x) = A + $\frac{\sum fd}{\sum f}$

$25.5+\frac{100}{80}=26.75$

Median = 20.5 + $\frac{40-18 \times 10}{32}$ = 27. 375

M2 = 20.5 + $\frac{41-18 \times 10}{32}$ = 27.6875

:. Median = $\frac{(27.375+27.6878}{2}$ = 27.5312.

S= $\sqrt{\frac{\sum fd2}{\sum f}-\left(\frac{\sum fd}{\sum f}\right)^2}$

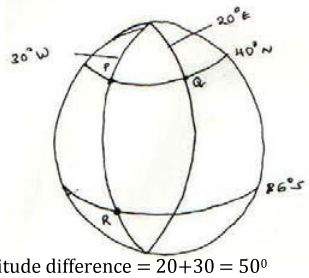
$=\sqrt{\frac{7200}{80}\left(\frac{100}{80}\right)^2}$

$=\sqrt{90-1.5625}$

$=\sqrt{88.437s}$

$=9$

23



a) i) longitude difference = 20+30 = 50^0

1^0 = 60 cos 44^0 nm

50^0 =?

= 50 x 60 cos 44^0nm

= 229.81 = 230nm

ii) latitude difference = 40+36= 76

1^0 = 60nm

76^0 = ?

76 X 60 nm

4560nm

b) i) 1 = 5 mins

50^0 =?

= 4x50

= 200mins = 3hrs, 20mins

Time at Q = 1430 + 3 hrs 20 mins = 1750hrs

ii) Time taken $\frac{230nm}{20nm/h}$

$\frac{230}{20}$ = 11 ½ hrs

Time the port arrived at port Q

= 1750hrs + 11hrs 30mins

= 0630hrs

Day is Wednesday.

24

Loq q	0.08	0.18	0.30	0.40	0.54	0.65
Log R	0.20	0.35	0.53	0.68	0.90	1.1

20

X	-30	0	30	60	90	120	150
2sin(x-30)	0	1.0	1.73	2.00	1.73	1.0	0
3cos x	1.5	1.73	1.5	0.87	0.0	-0.87	-1.5