

FORM 3 END TERM - 2024
JULY/AUGUST 2024
121/2
MATHEMATICS PAPER 2

MARKING SCHEME

1.	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">No</th> <th style="text-align: center;">log</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">2.53^2</td> <td style="text-align: center;">$2 \times 0.4031 = 0.8062$</td> </tr> <tr> <td style="text-align: center;">83.45</td> <td style="text-align: center;">1.9215</td> </tr> <tr> <td style="text-align: center;">$\sqrt{0.4562}$</td> <td style="text-align: center;">2.7277</td> </tr> <tr> <td style="text-align: center;">790.9</td> <td style="text-align: center;">$\frac{6592}{2} = 1.8296$</td> </tr> <tr> <td></td> <td style="text-align: center;">$7.909 \times 10^2 = 2.8981$</td> </tr> </tbody> </table>	No	log	2.53^2	$2 \times 0.4031 = 0.8062$	83.45	1.9215	$\sqrt{0.4562}$	2.7277	790.9	$\frac{6592}{2} = 1.8296$		$7.909 \times 10^2 = 2.8981$		
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2.	$4x^2 - 3x - 6 = 0$ $x^2 - \frac{3}{4}x = \frac{6}{4}$ $\left(x - \frac{3}{8}\right)^2 = \frac{6}{4} + \frac{9}{64}$ $\left(x - \frac{3}{8}\right)^2 = \frac{105}{64}$ $x = \pm \sqrt{\frac{105}{64}} + \frac{3}{8}$ $x = 0.375 \pm 1.2889$ $x = 0.6639 \text{ or } -0.9139$														
3.	$T^2 = \frac{p^2 + h}{m^2} + R$ $T^3 - R = \frac{p^2 + n}{m^2}$ $p^2 = m^2(T^3 - R) - n$ $p = \pm \sqrt{m^2(T^3 - R) - n}$														

<p>4.</p>	$\frac{\sqrt{14(\sqrt{7+\sqrt{2}})} - \sqrt{14(\sqrt{7-\sqrt{2}})}}{7-2}$ $\frac{\sqrt{98+\sqrt{28}} - \sqrt{98-\sqrt{28}}}{5}$ $2\sqrt{\frac{28}{5}}$ $\frac{2 \times 2\sqrt{7}}{5}$ $\frac{4\sqrt{7}}{5}$ $a = \frac{4}{5} = b = 0$		
<p>5.</p>	$102^5(-x)^0 + 5.2^4(-x)^1 + 10.2^3(-x)^2$ $= 32 - 80x + 80x^2$ $(k = x)(32 - 80x + 80x^2) = -8x$ $-80kx + 32x = -8x$ $(-80k + 32)x = -8x$ $-80k = -8 - 32$ $k = \frac{1}{2}$		
<p>6</p>	$-\frac{2}{1} \begin{pmatrix} 3 \\ 4 \\ 6 \end{pmatrix} + \frac{3}{1} \begin{pmatrix} x \\ y \\ 7 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \\ 15 \end{pmatrix}$ $\begin{pmatrix} 3x \\ 3y \\ 37 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \\ 15 \end{pmatrix} - \begin{pmatrix} -6 \\ -8 \\ 12 \end{pmatrix}$ $\begin{pmatrix} 3x \\ 3y \\ 37 \end{pmatrix} = \begin{pmatrix} 6 \\ 9 \\ 3 \end{pmatrix}$ $\begin{pmatrix} x \\ y \\ 7 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix}$		

B is (2,3,1)

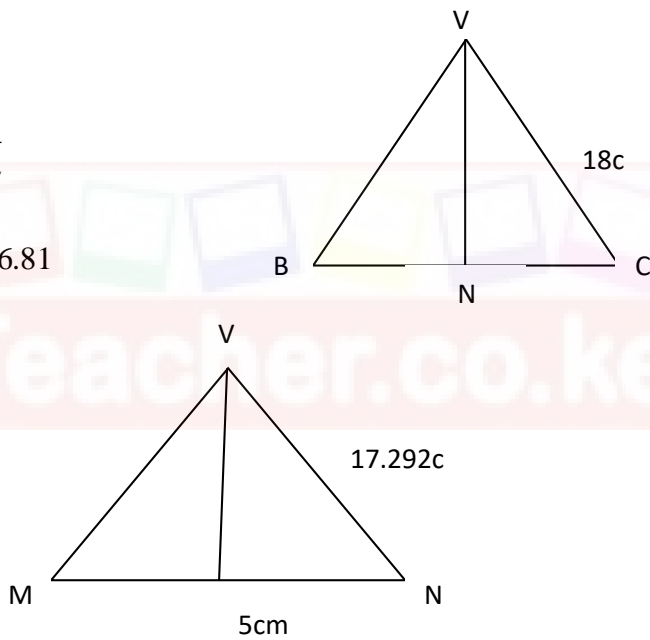
7.	$5 - 4(1 - \sin^2 x) = 4 \sin x$ $5 - 4 + 4 \sin^2 x - 4 \sin x = 0$ $4 \sin^2 x - 4 \sin x + 1 = 0$ $4 \sin^2 x - 2 \sin x - 2 \sin x + 1 = 0$ $2 \sin x(2 \sin x - 1) - 1(2 \sin x - 1) = 0$ $(2 \sin x - 1)(2 \sin x - 1) = 0$ $\sin x = \frac{1}{2}$ $x = 30^\circ$		
8	$\text{max mumArea} = 8.5 \times 5.5$ $= 46.75 \text{cm}^2$ $\text{min imumarea} = 7.5 \times 4.5$ $= 33.75 \text{cm}^2$ $\text{Rel.erro} = \frac{0.5}{8} + \frac{0.5}{5}$ $= 0.1625$		
9	$A \text{ and } C \text{ in } 1 \text{ hr} = \frac{1}{45} + \frac{1}{30} = \frac{1}{8}$ $\text{in } 13 \text{ hrs} = \frac{13}{18}$ $\text{Remainder} = \frac{5}{18}$ $\text{if } B \text{ does } \frac{1}{40} \text{ in } 1 \text{ hr}$ $\frac{5}{18} = \frac{5}{18} \times \frac{40}{1}$ $= 11 \frac{2}{18}$ $= 11 \frac{1}{9} \text{ h}$		
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10.

$$\begin{aligned}
 x + 2y &= -1 \\
 2x + 3y &= 3 \\
 2x + 4y &= -2 \\
 2x + 3y &= 3 \\
 y &= -5 \\
 x &= -9 \\
 \text{centre} &(-9, -5) \\
 (x + 9)^2 + (y + 5)^2 &= 5^2 \\
 x^2 + 18x + 81 + y^2 + 10y + 25 &= 25 \\
 x^2 + y^2 + 18x + 10y + 81 &= 0
 \end{aligned}$$

11.

$$\begin{aligned}
 &\sqrt{18^2 - 5^2} \\
 &= 17.292\text{cm} \\
 \text{NC} &= \frac{\sin \alpha}{17.292} = \frac{5}{17.292} \\
 \alpha &= 16.81^\circ \\
 \angle MUN &= 2 \times 16.81 \\
 &= 33.62^\circ
 \end{aligned}$$



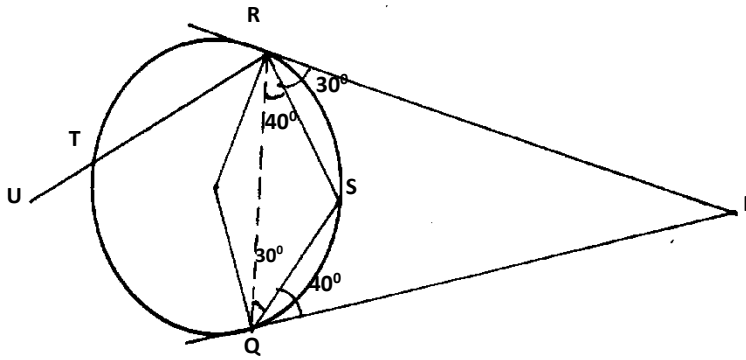
12.

$$\begin{aligned}
 \frac{dy}{dx} &= 3x^2 - 4x + 3 \\
 3(2)^2 - 4(2) + 3 &= 7 \\
 y &= mx + c \\
 M_2 &= -\frac{1}{7}y = -\frac{1}{7}x + C, C = 37 \\
 y &= -\frac{1}{7}x + 37(\text{normal})
 \end{aligned}$$

<p>13.</p>	<p>Let original number be xy</p> $y - x = 2$ $(10y + x) + (10 + y) = 132$ $11x + 11y = 132 \Rightarrow x + y = 12$ $\begin{array}{r} y - x = 2 \\ y + x = 12 \\ \hline 2y = 14 \Rightarrow y = 7 \\ = 14 \Rightarrow x = 5 \end{array}$ <p>$\therefore xy = 57$</p>		
<p>14.</p>	$p = KQ^3 + \frac{m}{Q^2}$ $8k + \frac{m}{4} = 108$ $32K + M = 432$ $27k + \frac{m}{9} = 259$ $243K + m = 2331$ $211K = 1899$ $K = 9, m = 144$ $P = 9x6^3 + \frac{144}{6^2}$ $= 1948$		
<p>15.</p>	$\log_4 y + \frac{1}{\log_4} y = 2$ <p>let $x = \log_4 y$</p> $x + \frac{1}{x} = 2$ $x^2 + 1 = 2x$ $2^2 - 2x + x + 1 = 0$ $(x - 1)(x - 1) = 0$ $x = 1 \text{ or } x = 1$ $x = \log_4 y$ $x = 1$ $Y = 4$		

16.	$xe^{i\theta} - x = 0$ $x(xe^{i\theta} - 1) = 0$ $x = 0 \text{ or}$ $(x-1)(x+1) = 0$ $x = 1 \text{ or } -1$		
17. (a).	<p>Taxable income $30,000 + 10480 = 40,480$</p> <p>In $\\$ = 2024$</p> <p>$435 \times 2 = 870$</p> <p>$435 \times 3 = 1305$</p> <p>$435 \times 4 = 1740$</p> <p>$435 \times 5 = 2175$</p> <p>$284 \times 6 = 1704$</p> <p>Gross tax = 7794</p> <p>(b). Net tax = $7794 - 800$</p> <p>= 6994</p>		
(c).	<p>$870 + 1305 + 1740 + 2175 + (1296 \times 6)$</p> <p>New net tax = $13866 - 800$</p> <p>= 13066</p> <p>Increase in tax = $13066 - 6994$</p> <p>= 6072</p> <p>%age increase = $\frac{6072}{6994} \times 100$</p> <p>= 86.82%</p>		

18



a) $\angle QRS = 40^\circ$ angles in alternate segment

b) $\angle RTQ = \frac{1}{2} (180^\circ - 40^\circ) = 70^\circ$

angle at the centre is twice that subtended at the circumference.

c) $\angle RPQ 180^\circ - (70+70) = 40^\circ$ angle sum of a triangle

d) Reflex $\angle QOR = 360^\circ - 140^\circ = 220^\circ$ angles at a point

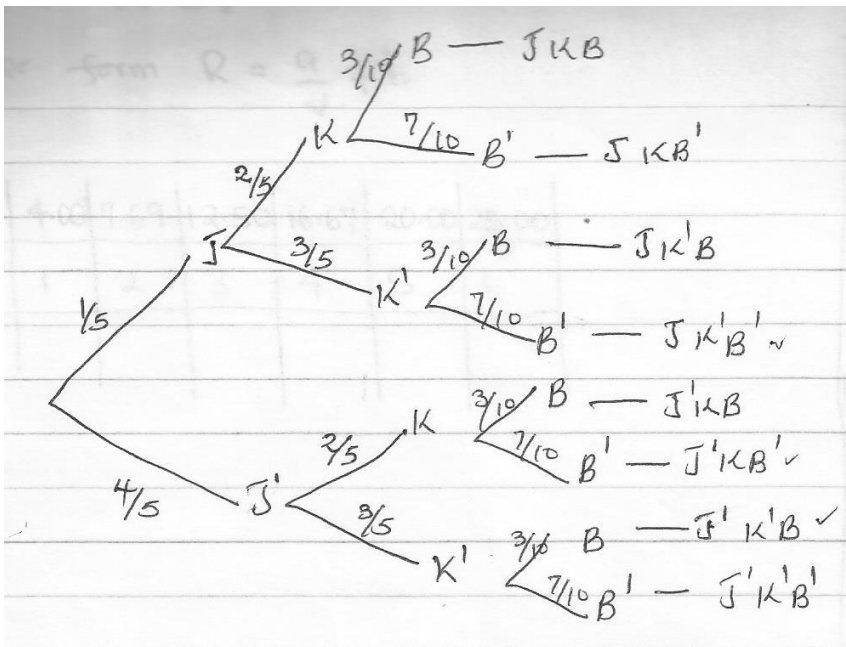
e) $\angle TRO = \frac{(180^\circ - 70^\circ)}{2} = 55^\circ$

2

Base angles of isosceles triangle

19

(a)



(JorB)

$$P(JK^1B^1) \text{ or } P(J^1K^1B)$$

$$P\left(\frac{1}{5} \times \frac{3}{5} \times \frac{7}{10}\right) + \left(\frac{4}{5} \times \frac{3}{5} \times \frac{3}{10}\right)$$

$$\frac{21}{250} + \frac{36}{250} = \frac{57}{250}$$

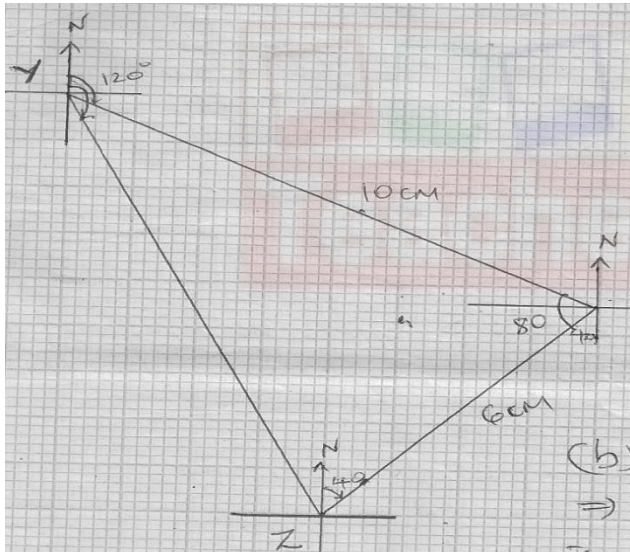
(ii). $P(\text{Allfair}) = \frac{4}{5} \times \frac{3}{5} \times \frac{7}{10} = \frac{42}{125}$

(iii) $P(\text{onlytwofail})$

$$\left(\frac{1}{5} \times \frac{3}{5} \times \frac{7}{10}\right) + \left(\frac{4}{5} \times \frac{2}{5} \times \frac{7}{10}\right) + \left(\frac{4}{5} \times \frac{3}{5} \times \frac{3}{10}\right)$$

$$\frac{21}{250} + \frac{56}{250} + \frac{36}{250} = \frac{113}{250}$$

20.



(a) B1 for x

B1 for y

B1 for Z

(b) (i) $YZ = 9.9 \pm 0.1$

$\Rightarrow 9.9 \times 2 = 19.8 \pm 0.2$

(ii) $40 \pm 1^\circ$

(iii) $158 \pm 1^\circ$

If 1cm^2 rep $2\text{km} \times 2\text{km}$

1cm^2 rep 4km^2

$\therefore 29.544\text{cm}^2$ rep

$\Rightarrow (29.544 \times 4)$

$= 118.176\text{km}^2$

(iv) $\text{Area} = \frac{1}{2} \times 10 \times 6 \times \sin 80^\circ$

$= 29.544\text{cm}^2$

21.

$$\frac{a+6d}{3+3d} = \frac{a+14d}{a+6d}$$

$$a^2 + 12ad + 36d^2 = a^2 + 15ad + ad + 45d^2$$

$$12ad + 36d^2 = 18ad + 45d^2$$

(a). $-6a = ad \dots\dots\dots(i)$

$$3n6 = 3(2a + 5d) = 12$$

$$2a + 5d = 4 \dots\dots\dots(ii)$$

$$a = -3, d = 2$$

(b) $\frac{a+6d}{a+3d} = \frac{a}{3}$

$$= 3$$

(c). $S_n = \frac{3^6 - 1}{3 - 1}$

$$= 364$$

22.

X	-3	-2	-1	0	1	2	3	4
X ²	9	4	1	0	1	4	9	16
2x ²	18	8	2	0	2	8	18	32
-3x	9	6	3	0	-3	-6	-9	-12
-5	-5	-5	-5	-5	-5	-5	-5	-5
y	22	9	0	-5	-6	-3	4	15

a) $y = 2x^2 - 5x - 5$
 $0 = 2x^2 - 5x - 5$

$Y=0$

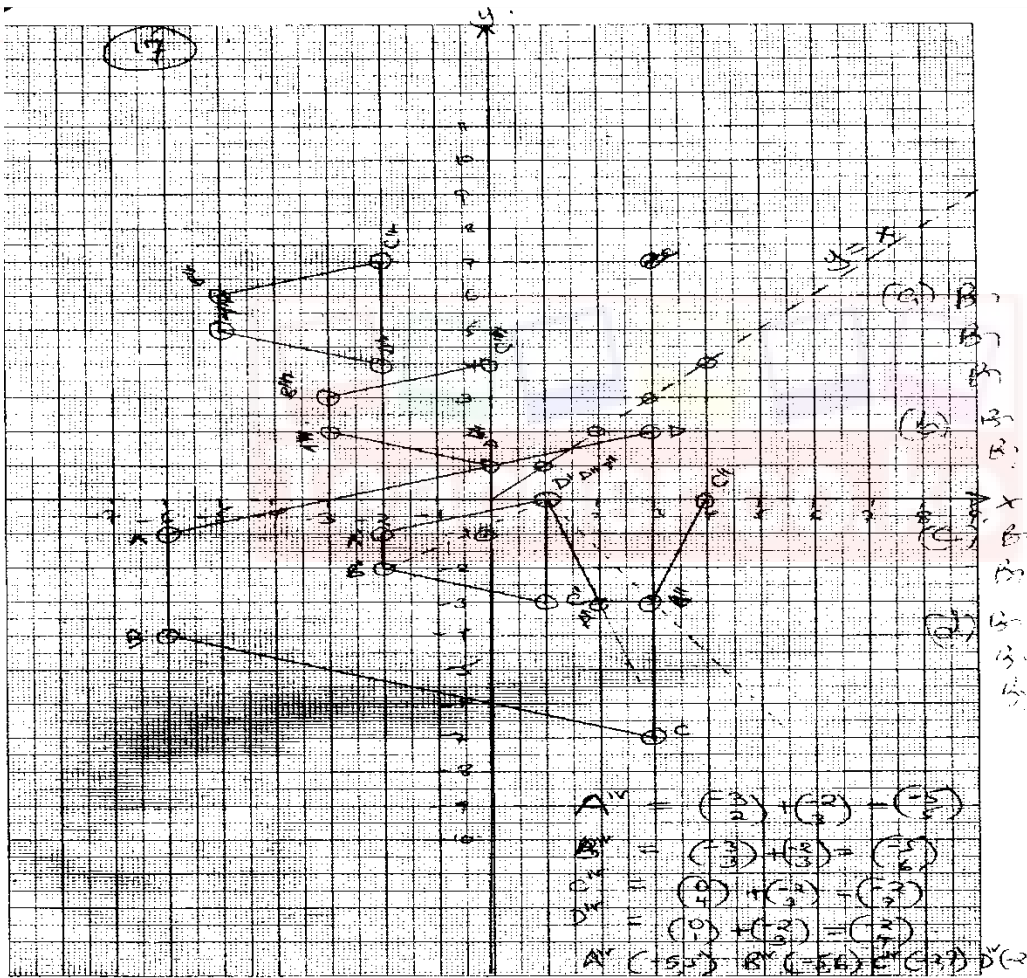
$X=-1$ or $x = 2.5$

b) $y = 2x^2 - 3x - 5$
 $0 = 2x^2 - 5x - 3$

$Y = 2x-2$

$X = -0.5$ or $x = 3$

23.



24. $V.S.F = \frac{4096}{1728}$

$$L.S.F = \frac{3\sqrt[3]{4096}}{1728} = \frac{16}{12} = \frac{4}{3}$$

$$A.S.F = \left(\frac{4}{3}\right)^2 = 16/9$$

a) $\frac{16}{9}x \frac{x}{112}$

Curved S.A of larger container

$$9x = 16 \times 112$$

$$x = \frac{16 \times 112}{9} = 199 \frac{1}{9} \text{ cm}^2$$

$$= \frac{1792 \text{ cm}^2}{9}$$

$$\frac{22}{7} \times 14xH = \frac{1792}{9}$$

$$H = \frac{1792}{9} \times \frac{7}{308} = 4.525$$

b) Volume of hemisphere = $\frac{4}{3} \times \frac{1}{2} \times \frac{22}{7} \times 6^3 = \frac{19008}{42}$

$$= 452.57$$

$$\frac{1}{3} \pi r^2 h$$

$$= \frac{1}{3} \times \frac{22}{7} \times 6^2 \times 9$$

$$= 339.429$$

Total volume of solid = 452.57 + 339.429

$$= 791.999 \text{ cm}^3$$