S/N	Working	Marks
1		

No.	Log.	
$10^{0.8043}$	0.8043 +	
$\text{Log } 4.948 = 0.6944$	$\bar{1}.8416$	
	0.6459	$\rightarrow 0.6459$
4.636×10^{-3}	$(\bar{3}.6661) \times \frac{1}{2}$	−
	$\frac{\bar{4}}{2} + \frac{1.6661}{2}$	$\rightarrow \bar{2}.8331$
		1.8128

$10^{0.8124} \times 10^{1} = 6.498 \times 10^{1}$
$= 64.98$

Marks: M1 All correct logs; M1 Addition and Subtraction; M1 Division; A1

2.

$x^2 - 6x + y^2 + 8y = 11$

$x^2 - 6x + (-3)^2 + y^2 + 8y + (4)^2 = 11 + (-3)^2 + (4)^2$ — M1

$(x-3)^2 + (y+4)^2 = 36$

$(x-3)^2 + (y+4)^2 = 6^2$ — M1

Centre $\Rightarrow (3, -4)$
radius — A1

3

$\frac{M+n}{M-n} = \frac{8}{3}$ — M1

$3m + 3n = 8m - 8n$ — M1

$11n = 5M$

$\frac{n}{M} = \frac{5}{11} \Rightarrow M:n = 11:5$ — A1

S/N	Working	Mks
4.	$\text{Log}(x+5) = \text{Log}\,4 - \text{Log}(x+2)$ $\text{Log}(x+5) = \text{Log}\left(\frac{4}{x+2}\right)$	M1
	$\Rightarrow \quad x+5 = \frac{4}{x+2}.$ $(x+5)(x+2) = 4$	M1
	$x^2+2x+5x+10 = 4$ $x^2+7x+6=0$ $x^2+x+6x+6=0$ $x(x+1)+6(x+1)=0$ $(x+6)(x+1)=0$ Either $x+6=0 \Rightarrow x=-6$ OR $x+1=0 \Rightarrow x=-1$	A1
5	$\vec{OA} = \begin{pmatrix}0\\-4\end{pmatrix}$ $\vec{OB} = \begin{pmatrix}2\\-1\end{pmatrix}$ $\vec{OC} = \begin{pmatrix}8\\8\end{pmatrix}$ $\vec{AB} = \vec{OB} - \vec{OA}$ $= \begin{pmatrix}2\\-1\end{pmatrix} - \begin{pmatrix}0\\-4\end{pmatrix} = \begin{pmatrix}2\\3\end{pmatrix}$ $\vec{BC} = \vec{OC} - \vec{OB}$ $= \begin{pmatrix}8\\8\end{pmatrix} - \begin{pmatrix}2\\-1\end{pmatrix} = \begin{pmatrix}6\\9\end{pmatrix}$ $\vec{AB} = k\,\vec{BC}$ $\begin{pmatrix}2\\3\end{pmatrix} = k\begin{pmatrix}6\\9\end{pmatrix}$ $\begin{pmatrix}2\\3\end{pmatrix} = \begin{pmatrix}6k\\9k\end{pmatrix} \Rightarrow$ $2 = 6k$, $k = \frac{1}{3}$ ✓ and $3 = 9k$, $k = \frac{1}{3}$ $\vec{AB} = \frac{1}{3}BC$ Hence A, B and C are Collinear.	
6	$W = k\frac{x^2}{y}$ $80 = k\left(\frac{2^2}{5}\right)$ $\Rightarrow k = \frac{80 \times 5}{4} = 100$ $W = 100\frac{x^2}{y}$	

S/N	Working	Marks
7.	$\frac{2}{3-\sqrt{7}} - \frac{2}{3+\sqrt{7}} = \frac{2(3+\sqrt{7}) - 2(3-\sqrt{7})}{(3-\sqrt{7})(3+\sqrt{7})}$	M1
	$= \frac{6 + 2\sqrt{7} - 6 + 2\sqrt{7}}{9 + 3\sqrt{7} - 3\sqrt{7} - 7}$	M1
	$= \frac{4\sqrt{7}}{2}$	A1
8.	Coefficient $\rightarrow 1, 5, 10, 10 \rightarrow$	
	$(2+x)^5 = 1(2)^5(x)^0 + 5(2)^4(x)^1 + 10(2)^3(x)^2 + 10(2)^2(x)^3 \ldots$	
	$= 32 + 80x + 80x^2 + 40x^3 \ldots$	M1
	$2 + x = 2.03$ $x = 2.03 - 2$ $x = 0.03$	
	$(2.03)^5 = 32 + 80(0.03) + 80(0.03)^2 + 40(0.03)^3$	M1
	$= 32 + 2.4 + 0.072 + 0.00108$	
	$= 34.47$	A1
9.	$3x + 2y = 840$ $4x + 5y = 1680$	
	$\begin{pmatrix} 3 & 2 \\ 4 & 5 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 840 \\ 1680 \end{pmatrix}$	M1
	$\det = (3 \times 5) - (4 \times 2)$ $= 7$	
	$\frac{1}{7}\begin{pmatrix} 5 & -2 \\ -4 & 3 \end{pmatrix}\begin{pmatrix} 3 & 2 \\ 4 & 5 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{7}\begin{pmatrix} 5 & -2 \\ -4 & 3 \end{pmatrix}\begin{pmatrix} 840 \\ 1680 \end{pmatrix}$	M1
	$\frac{1}{7}\begin{pmatrix} 7 & 0 \\ 0 & 7 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{7}\begin{pmatrix} 840 \\ 1680 \end{pmatrix}$	
	$\begin{pmatrix} 1 & 0 \\ \ldots \end{pmatrix}\begin{pmatrix} x \\ \ldots \end{pmatrix} = \begin{pmatrix} 120 \\ \ldots \end{pmatrix} \Rightarrow x = 120,\ y = 240$	A1

S/N	Working	Marks
10.	$\frac{42x + 21y}{x + y} = Sh\ 39 \times \frac{100}{130}$	M1
	$\frac{42x + 21y}{x + y} = 30$	
	$42x + 21y = 30x + 30y$	M1
	$12x = 9y$	
	$\frac{x}{y} = \frac{9}{12} = \frac{3}{4} \Rightarrow x : y = 3 : 4$	A1
11.	Determinant = Area scale factor.	
	$4x - (2(x-1)) = \frac{30\ cm^2}{5\ cm^2}$	M1
	$4x - 2x + 2 = 6$	M1
	$2x = 4 \Rightarrow x = 2$	A1
12.	(a) $n^{th} = a + (n-1)d$	
	1^{st} $a = -7$	
	2^{nd} $a + d = -4$	
	3^{rd} $a + 2d = -1$	M1 for all the values
	4^{th} $a + 3d = 2$	
	5^{th} $a + 4d = 5$	
	6^{th} $a + 5d = 8$	
	(b) $S_n = \frac{n}{2}[2a + (n-1)d]$	
	$S_{50} = \frac{50}{2}[2(-7) + (50-1)3]$	M1
	$= 25(-14 + 147)$	
	$= 25 \times 133$	
	$= 3325$	A1

S/N	Working	Marks
13.	Rate of work.	
	Pipe A $= \frac{1}{3}$ per hr.	
	Pipe B $= \frac{1}{5}$ per hr	
	Pipe C $= \frac{1}{15}$ per hr	
	Rate of work of A and B $= \frac{1}{3} + \frac{1}{5}$	
	$= \frac{8}{15}$ per hr.	M1
	Work done by A and B in 1 hour.	
	Work = Rate x Time	
	$= \frac{8}{15} \times 1 = \frac{8}{15}$	M1
	Remaining Volume $= 1 - \frac{8}{15} = \frac{7}{15}$ ✓	
	Rate of work of all pipes $= \frac{1}{3} + \frac{1}{5} - \frac{1}{15} = \frac{7}{15}$ per hr	M1
	Time taken $= \frac{7}{15} \div \frac{7}{15}$	
	$= 1$ hr.	
	Total time taken to fill = 1hr + 1hr	A1
	= 2hrs.	
14.	$\frac{r}{\sqrt{p^2 - t^2}} = \frac{p}{t}$	
	$\left(\frac{r}{\sqrt{p^2 - t^2}}\right)^2 = \left(\frac{p}{t}\right)^2$	
	$\frac{r^2}{p^2 - t^2} = \frac{p^2}{t^2}$	M1
	$r^2t^2 = p^4 - p^2t^2$	
	$r^2t^2 + p^2t^2 = p^4$	M1
	$t^2(r^2 + p^2) = p^4$	
	$t^2 = \frac{p^4}{r^2 + p^2} \Rightarrow t = \sqrt{\frac{p^4}{r^2 + p^2}}$	A1

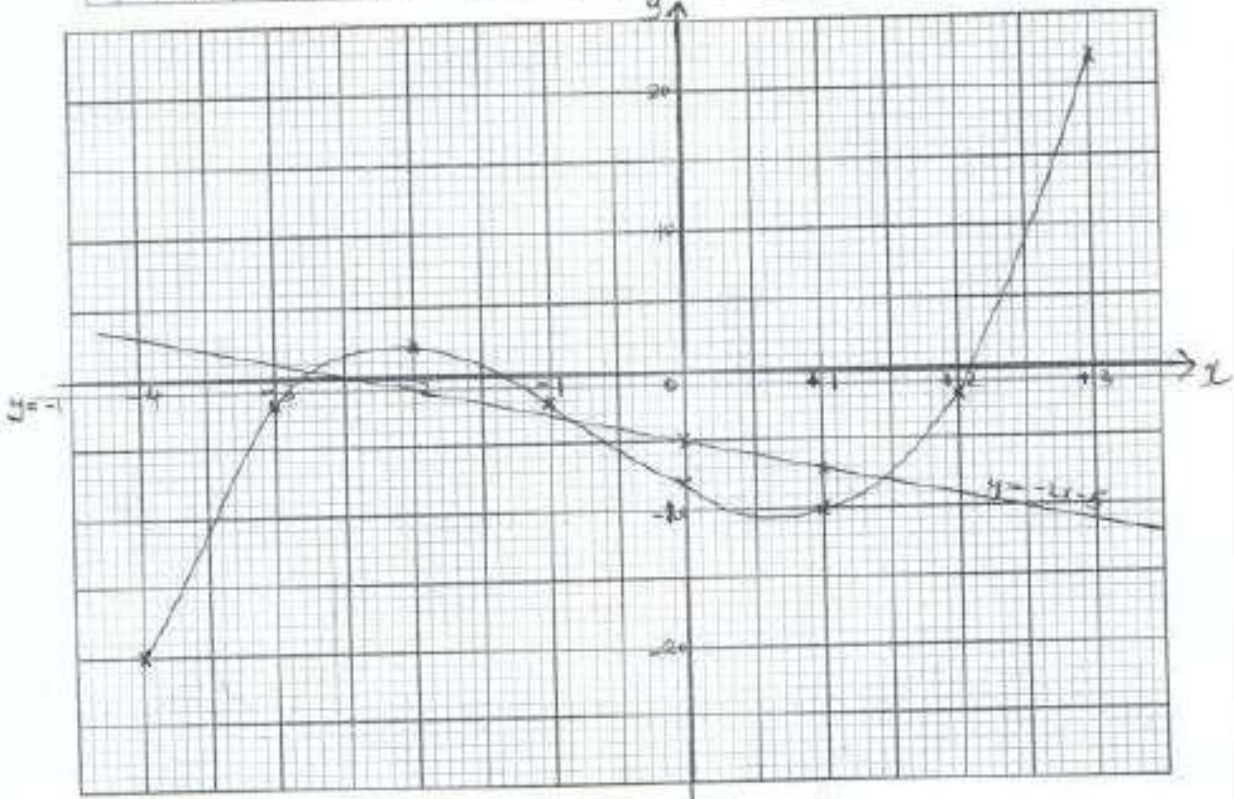
S/N	Working	
15	$AC \cdot BC = PC \cdot QC$	
	$(9+x)x = 9 \times 4$	M1
	$x^2 + 9x = 36$	
	$x^2 + 9x - 36 = 0$	M1
	$x^2 + 12x - 3x - 36 = 0$	
	$x(x+12) - 3(x+12) = 0$	
	$(x-3)(x+12) = 0$	
	Either $x - 3 = 0 \Rightarrow x = 3$ cm	A1
	or $x + 12 = 0 \Rightarrow x = -12$ N/A	
16	$\frac{1}{25.36} = \frac{1}{2.536 \times 10}$	
	$= 0.3943 \times 10^{-1}$	
	$= 0.03943$	M1
	$\frac{1}{1.302} = 0.7680$	M1
	$x = 0.03943 + 3(0.7680)$	
	$= 2.343$	A1

S/N	Working	Marks
17.	(a) (i) $\vec{AB} = \vec{OB} - \vec{OA}$	
	$= \underset{\sim}{b} - \underset{\sim}{a}$ - - - - - - - - - -	A1
	(ii) $\vec{ON} = \vec{OA} + \vec{AN}$	
	$= \underset{\sim}{a} + \frac{1}{3}(\underset{\sim}{b} - \underset{\sim}{a})$	M1
	$= \underset{\sim}{a} + \frac{1}{3}b - \frac{1}{3}a.$	
	$= \frac{2}{3}\underset{\sim}{a} + \frac{1}{3}\underset{\sim}{b}$ - - - - - - - - - -	A1
	(iii) $\vec{BM} = \vec{OM} - \vec{OB}$	
	$= \frac{2}{5}\underset{\sim}{a} - \underset{\sim}{b}$ - - - - - - - - - -	A1
	(b) $\vec{OX} = k\vec{ON}$	
	$= k\left(\frac{2}{3}\underset{\sim}{a} + \frac{1}{3}\underset{\sim}{b}\right)$	
	$= \frac{2}{3}k\underset{\sim}{a} + \frac{1}{3}k\underset{\sim}{b}$ - - - - - - - - (i)	M1
	$\vec{OX} = \vec{OB} + \vec{BX}$	
	$= \underset{\sim}{b} + h\left(\frac{2}{5}\underset{\sim}{a} - \underset{\sim}{b}\right)$	
	$= \underset{\sim}{b} + \frac{2}{5}h\underset{\sim}{a} - h\underset{\sim}{b}$	
	$= \frac{2}{5}h\underset{\sim}{a} + (1-h)\underset{\sim}{b}$ - - - - (ii)	M1
	$\Rightarrow \frac{2}{3}k\underset{\sim}{a} + \frac{1}{3}k\underset{\sim}{b} = \frac{2}{5}h\underset{\sim}{a} + (1-h)\underset{\sim}{b}$	M1
	$\frac{2}{3}k = \frac{2}{5}h.$	
	$10k = 6h. \Rightarrow 10k - 6h = 0$ - - - - (iii) $5k - 3h = 0$	M1
	$\frac{1}{3}k = 1 - h$	
	$k = 3 - 3h. \Rightarrow k + 3h = 3$ - - - - (iv)	
	$\begin{array}{r} 5k - 3h = 0 \\ k + 3h = 3 \\ \hline 6k \quad = 3 \end{array} \Rightarrow k = \frac{1}{2}$	A1
	$5k = 3h$	

18. Draw the graph of $y = x^3 + 2x^2 - 5x - 8$ for values of x in the range $-4 \leq x \leq 3$

x	-4	-3	-2	-1	0	1	2	3
x^3	64	-27	-8	-1	0	1	8	27
$2x^2$	32	18	8	2	0	2	8	18
$-5x$	20	15	10	5	0	-5	-10	-15
-8	-8	-8	-8	-8	-8	-8	-8	-8
y	-20	-2	2	-2	-8	-10	-2	22

(5 mks)



By drawing suitable straight line on the same axis, solve the equations.

i) $x^3 + 2x^2 - 5x - 8 = 0$ (1 mk)

Line $y = 0$

$x = -2.8$

$x = -1.4$

$x = 2.1$

ii) $x^3 + 2x^2 - 5x - 7 = 0$ (2 mks)

$$\begin{array}{l} y = x^3 + 2x^2 - 5x - 8 \\ \underline{0 = x^3 + 2x^2 - 5x - 7} \\ y = -1 \end{array}$$

$x = -2.9$ $\quad x = 2.05$

$x = -1.2$

iii) $3 + 3x - 2x^2 - x^3 = 0$ (2 mks)

$$\begin{array}{l} y = x^3 + 2x^2 - 5x - 8 \\ \underline{0 = -x^3 - 2x^2 + 3x + 3} \\ \underline{y = -2x - 5} \end{array}$$

Roots

$x = -2.8$

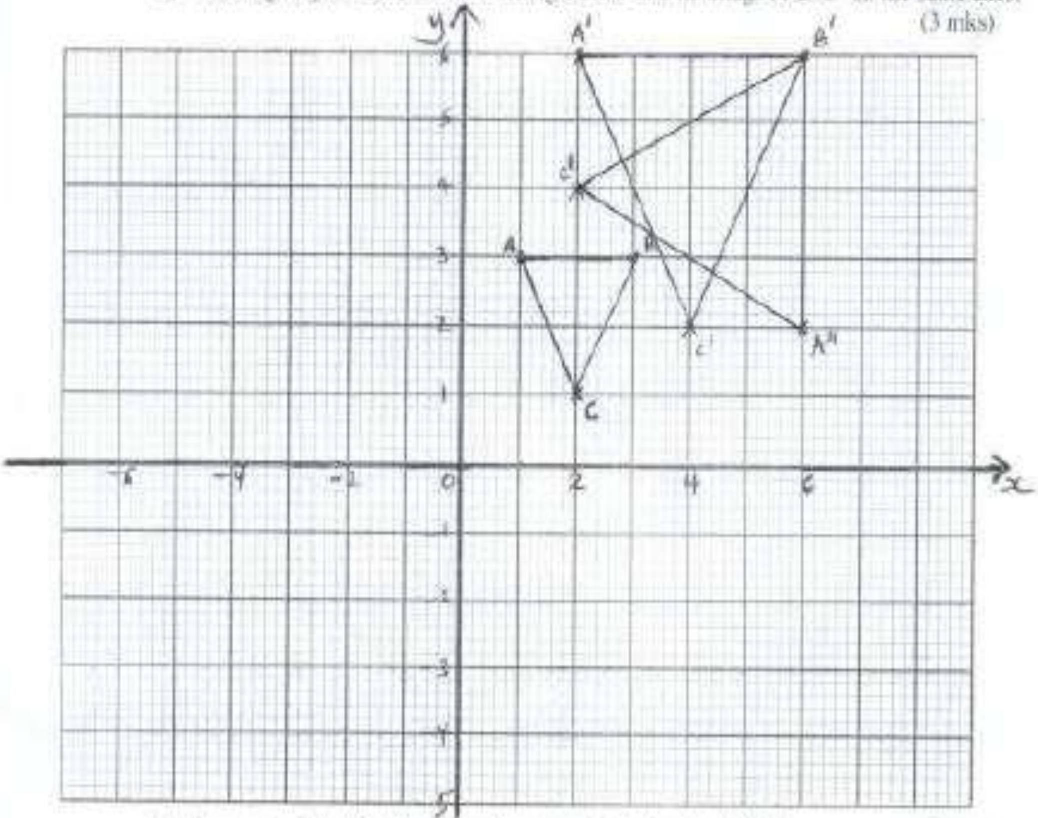
$x = -0.9$

$x = 1.4$

17. (c)	$k = \frac{1}{2}$. $\overrightarrow{OX} = \frac{1}{2}\overrightarrow{OH}$ $\overrightarrow{OX} : \overrightarrow{XH} = 1:1$	A1
19. (e)	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} = \begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$ Inverse of $\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$ $det = 0 - 4$ $= -4$ $\frac{1}{-4}\begin{pmatrix} 0 & -2 \\ -2 & 0 \end{pmatrix} = \begin{pmatrix} 0 & \frac{1}{2} \\ \frac{1}{2} & 0 \end{pmatrix}$	

19. A transformation represents by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ maps A(1, 3), B(3, 3) and C(2, 1) onto A^1B^1 and C^1 respectively.

a) On the grid provided, draw the triangle ABC and its image $A^1B^1C^1$ on the same axes. (3 mks)



b) Hence or otherwise determine the area of the triangle $A^1B^1C^1$ (2 mks)

$$\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}\begin{array}{c} \begin{matrix} A & B & C \end{matrix} \\ \begin{pmatrix} 1 & 3 & 2 \\ 3 & 3 & 1 \end{pmatrix} \end{array} = \begin{array}{c} \begin{matrix} A' & B' & C' \end{matrix} \\ \begin{pmatrix} 2 & 6 & 4 \\ 6 & 6 & 2 \end{pmatrix} \end{array}$$

$A'(2,6)$ $B'(6,6)$ $C'(4,2)$

Area of $A'B'C' = \frac{1}{2} \times 4 \times 4$

$= 8$ square units

c) Another transformation represented by the matrix $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ maps $A^1B^1C^1$ onto $A^{11}B^{11}C^{11}$. Plot triangle $A^{11}B^{11}C^{11}$ on the same axes. (2 mks)

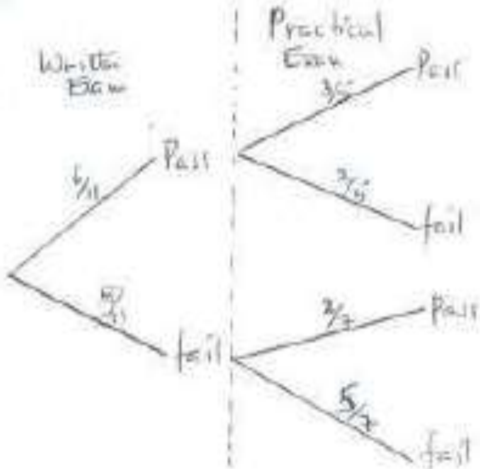
$$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}\begin{array}{c} \begin{matrix} A' & B' & C' \end{matrix} \\ \begin{pmatrix} 2 & 6 & 4 \\ 6 & 6 & 2 \end{pmatrix} \end{array} = \begin{array}{c} \begin{matrix} A'' & B'' & C'' \end{matrix} \\ \begin{pmatrix} 6 & 6 & 2 \\ 2 & 6 & 4 \end{pmatrix} \end{array}$$

$A''(6,2)$ $C''(2,4)$.
$B''(6,6)$

d) Describe the transformation represented by the matrix $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ (1 mk)

Reflection on the mirror line $y = x$.

9

S/N	Working	Mks.
20.	(a) 	M2 (All branches indicated correctly.
	(b) Passes both tests $\frac{6}{11} \times \frac{3}{5} = \frac{18}{55}$	2
	(c) Passes written Exam only. $\frac{6}{11} \times \frac{2}{5} = \frac{12}{55}$	2
	(d) Passes practical Exam only. $\frac{5}{11} \times \frac{2}{7} = \frac{10}{77}$	2
	(e) Fails all tests $\frac{5}{11} \times \frac{5}{7} = \frac{25}{77}$	2

S/N	Working	Mks.
21.	a) Total fare for 1 trip $= 14 \times sh.\ 250$ $= Sh.\ 3500$ Total Amount for two round trips. $sh\ 3500 \times 4$ $= sh.\ 14{,}000$ Net profit $= sh\ 14000 - sh\ 6000$ $= sh.\ 8{,}000$ ✓	
	(b) Total Amount for the whole Month of June $sh\ 8000 \times 25 = sh.\ 200{,}000$ ✓ Profit $= sh.\ 200000 - sh\ 10{,}000$ $= sh.\ 190{,}000$ ✓	
	(c) Amount shared equally $= \frac{40}{100} \times 190000$ $= 76\ 000$ ✓ Each got $= \frac{76\ 000}{3} = sh.\ 25{,}333.$ ✓ Amount shared in ratio of Contribution $\frac{60}{100} \times 190000 = 114\ 000$ Ratio of Contribution Mutua : Muthike : Maruki $6 : 4 : 8$ Muthike $= \frac{4}{18} \times 114\ 000 = 25\ 333.$ Muthike's share $= 25\ 333 + 25333$ $= Sh.\ 50{,}667$	
	(d) Total amount amount Received $= 475000 \times 3$ $= 1425{,}000$ P... $= 1425000 \times 100$	

S/N	Working	Mks
21.	$\sin\theta = \frac{5}{6}$	
	$\theta = \sin^{-1}\left(\frac{5}{6}\right)$	M1
	$= 56.44$ $2\theta = 112.89^\circ$ ✓	A1
	$\sin\alpha = \frac{5}{7}$	
	$\alpha = \sin^{-1}\left(\frac{5}{7}\right)$	M1
	$= 45.58^\circ$ $2\alpha = 91.17^\circ$ ✓	A1
	Area of segment 1 $= \frac{\theta}{360}\pi r^2 - \frac{1}{2}r^2\sin\theta$	
	$= \left(\frac{112.89}{360} \times \frac{22}{7} \times 6^2\right) - \left(\frac{1}{2} \times 6^2 \times \sin 112.89^\circ\right)$	M1 M1
	$= 35.49\,cm^2 - 16.58$	
	$= 18.9\,cm^2$	A1
	Area of segment 2 $= \frac{\alpha}{360}\pi r^2 - \frac{1}{2}r^2\sin\alpha$	
	$= \left(\frac{91.17}{360} \times \frac{22}{7} \times 7^2\right) - \left(\frac{1}{2} \times 7^2 \times \sin 91.17\right)$	M1
	$= 39.0 - 24.49\,cm^2$	
	$= 14.51\,cm^2$	A1
	Area of the shaded R $= 18.9 + 14.51$	
	$= \underline{33.41\,cm^2}$	A1

23.(a) AC = $\sqrt{5^2 + 7^2}$

(b) VO = $\sqrt{13^2 - 4.301^2}$

= 12.27

(c) BD = AC = 8.602

BO = $\frac{1}{2}$x8.602 = 4301

$\angle$VBO = θ

Cos θ = $\frac{4.301}{13}$ = 0.3308

θ = Cos^{-}(0.3308) = 70.68

(d) VM = $\sqrt{MO^2 - VO^2}$ = $\sqrt{2.5^2 + 12.27^2}$

= $\sqrt{156.8029}$

= 12.52

$\angle$VMO = d

Cos d = $\frac{2.5}{12.52}$ = 0.1997

d = Cos-1(0.1997) = 78.48^0

24.(a) DCE = EDF ($\angle$s in alternate segment)

= 42^0

(a) BCE = BDF ($\angle$s in the same segment)

$\frac{180-48}{2}$ = 42^0

= 24^0

(b) DCB = DBF ($\angle$s in alternate segment)

DBF = $\frac{180-48}{2}$ (AB =D)

= 66^0

(c) CED = CBD ($\angle$s in the same segment)

CBD = 180 – (60 + 60)($\angle$s on straight line)

CED = 54^0

(d) BEF = BCD (ext. angle = opp. interior angle)

= 24 + 42

= 66^0