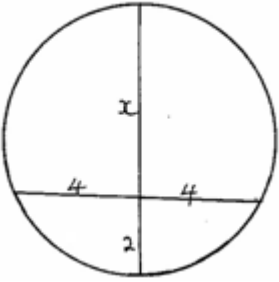


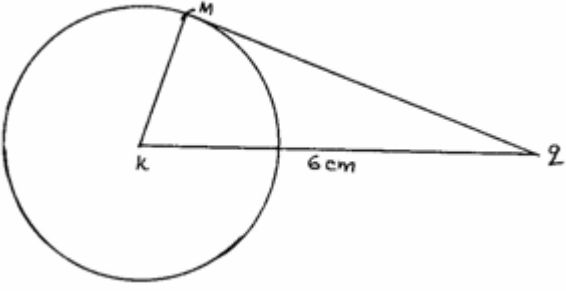
**END TERM 2 2025**

**121/2 – MATHEMATICS**

**MARKING SCHEME PAPER 2**

<p>1.</p>	$2^x = 3$ $x \log 2 = \log 3$ $x = \frac{\log 3}{\log 2} = \frac{0.4771}{0.3010}$ <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>No</th> <th>Log</th> </tr> </thead> <tbody> <tr> <td>0.4771</td> <td>1.6786</td> </tr> <tr> <td>0.3010</td> <td>1.4786</td> </tr> <tr> <td><math>1.585 \times 10^4</math></td> <td>0.2000</td> </tr> </tbody> </table> $x = 1.585$	No	Log	0.4771	1.6786	0.3010	1.4786	$1.585 \times 10^4$	0.2000	<p>M1</p> <p>M1</p> <p>A1</p> <p>3</p>	<p>✓ log for 3 &amp; 2</p> <p>✓ operation of logs</p> <p>✓</p>				
No	Log														
0.4771	1.6786														
0.3010	1.4786														
$1.585 \times 10^4$	0.2000														
<p>2.</p>	$A^2 = \frac{3 + 2x}{5 - 4x}$ $A^2(5 - 4x) = 3 + 2x$ $5A^2 - 4A^2x = 3 + 2x$ $5A^2 - 3 = 2x + 4A^2x$ $5A^2 - 3 = x(2 + 4A^2)$ $x = \frac{5A^2 - 3}{4A^2 + 2}$	<p>M1</p> <p>M1</p> <p>A1</p> <p>3</p>	<p>✓ remove of <math>\sqrt{\quad}</math></p> <p>Bringing like terms together</p>												
<p>3.</p>	<table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Men</th> <th>hrs</th> <th>Land</th> <th>Days</th> </tr> </thead> <tbody> <tr> <td>18</td> <td>8</td> <td>1</td> <td>12</td> </tr> <tr> <td>24</td> <td>12</td> <td><math>\frac{3}{4}</math></td> <td>-</td> </tr> </tbody> </table> <p>Days required =</p> $\frac{18}{24} \times \frac{8}{12} \times \frac{3}{4} \times 12$ $= 4 \frac{1}{2} \text{ days}$	Men	hrs	Land	Days	18	8	1	12	24	12	$\frac{3}{4}$	-	<p>M1</p> <p>M1</p> <p>A1</p> <p>3</p>	
Men	hrs	Land	Days												
18	8	1	12												
24	12	$\frac{3}{4}$	-												
<p>4.</p>	<p>Let Soya be A and millet be B</p> <p>Let the ratio be 1: n</p> <p>1kg of A costs 65/=</p> <p>nkg of B cost 40n/=</p> <p>∴ (1 + n) kg mixture costs (65 + 40n)/=</p> <p>1kg mixture costs</p> $\frac{65 + 40n}{1 + n}$ <p>But 1kg mixture is sold at ksh.60/= making 20% profit</p> $\therefore 60 = \frac{120}{100} \left( \frac{65 + 40n}{1 + n} \right)$ $60(1 + n) = 1.2(65 + 40n)$ $60 + 60n = 78 + 48n$ $12n = 18$ $n = 1.5$	<p>M1</p> <p>M1</p>													

<p>5.</p>	 <p> <math>4 \times 4 = 2 \times x</math>  <math>16 = 2x</math>  <math>x = 8</math>                      Diameter = <math>8 + 2</math>  <math>= 10\text{cm}</math>  <math>r = 5\text{cm}</math> </p>	<p>M1</p> <p>M1</p> <p>A1</p>	<p>3</p>
<p>6.</p>	<p> <math>\begin{pmatrix} 2 &amp; 1 \\ 2 &amp; 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 10 \\ 14 \end{pmatrix}</math>  <math>\frac{1}{2} \begin{pmatrix} 2 &amp; -1 \\ -2 &amp; 2 \end{pmatrix} \begin{pmatrix} 2 &amp; 1 \\ 2 &amp; 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}</math>  <math>= \frac{1}{2} \begin{pmatrix} 2 &amp; -1 \\ -2 &amp; 2 \end{pmatrix} \begin{pmatrix} 10 \\ 14 \end{pmatrix}</math>  <math>\begin{pmatrix} 1 &amp; 0 \\ 0 &amp; 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{2} \begin{pmatrix} 6 \\ 8 \end{pmatrix}</math>  <math>\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}</math>  <math>x = 3</math> and <math>y = 4</math> </p>	<p>M1</p> <p>M1</p> <p>A1</p>	<p>3</p>
<p>7.</p>	<p> <math>\text{Log}_2 \frac{x+7}{x-7} = 3</math>  <math>\frac{x+7}{x-7} = 2^3</math>  <math>\frac{x+7}{x-7} = 8</math>  <math>x+7 = 8(x-7)</math>  <math>x+7 = 8x-56</math>  <math>x-8x = -56-7</math>  <math>-7x = -63</math>  <math>x = 9</math> </p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>4</p>

<p>Mathematics Paper 2 8.</p>	<p style="text-align: right;">2</p>  <p style="text-align: center;"><math>Q_m = 5.5 \pm 0.1</math></p>	<p>B1 B1 B1 B1</p> <p style="text-align: center;">3</p>	
<p>9.</p>	<p>Working quotient = <math>\frac{4.6}{2.0} = 2.3</math>  Maximum quotient = <math>\frac{4.65}{1.95} = 2.385</math>  Minimum quotient = <math>\frac{4.55}{2.05} = 2.22</math>  Absolute error = <math>\frac{2.385 - 2.22}{2} = 0.0825</math></p>	<p style="text-align: center;">A1</p>	<p style="text-align: center;">} M1</p>
<p>(b)</p>	<p>Percentage error = <math>\frac{0.0825}{2.3} \times 100 = 3.587\%</math></p>	<p style="text-align: center;">B1</p>	
<p>10.</p>	<p><math>UQ = \frac{3}{4} (9)^{th} = 6.75^{th}</math>  <math>= \frac{23 + 28}{2} = 25.5</math>    <math>LQ = \frac{1}{4} (9)^{th} = 2.25^{th}</math>  <math>= \frac{15 + 16}{2} = 15.5</math></p> <p style="text-align: right;">2</p>	<p style="text-align: center;">M1  M1</p>	
	<p>Quartile deviation = <math>\frac{25.5 - 15.5}{2} = 5</math></p>	<p style="text-align: center;">A1</p>	
<p>11.</p>	<p><math>AC = CB = \chi</math>  <math>\therefore \chi^2 + \chi^2 = 14^2</math>  <math>2\chi^2 = 196</math>  <math>\chi^2 = 98</math>  <math>AC = CB = 9.8994949 = 9.8995\text{cm}</math>    <math>Area = \frac{1}{2} \times 9.8995 \times 9.8995</math>  <math>= \frac{1}{2} \times 98 = 49\text{cm}^2</math></p>		

$$\text{Area shaded} = \left( \frac{22}{7} \times 7 \times 7 \times \frac{1}{2} - 49 \right) \frac{1}{2}$$

$$= 14.0\text{cm}^2$$

M1

A

Mathematics Paper 2

3

12.	$\begin{aligned} \chi + 2y &= -1 \times 2 \\ 2\chi + 3y &= 3 \\ 2\chi + 4y &= -2 \\ \underline{2\chi + 3y} &= \underline{3} \\ y &= -5 \\ \chi &= 9 \quad \text{Centre } (9, -5) \\ (\chi - 9)^2 + (y + 5)^2 &= 7^2 \\ \chi^2 - 18\chi + 81 + y^2 + 10y + 25 &= 49 \\ \chi^2 + y^2 - 18\chi + 10y + 57 &= 0 \end{aligned}$		B1 M1 A1
	4		
13.	$\frac{2.7 \times 204}{300 \times 0.054}$ $\frac{2.7 \times 2.04 \times 1000}{300 \times 0.054 \times 1000}$ $\frac{2.7 \times 2.04}{300 \times 54}$ $= 0.34$	M1  A1 2	
14.	$y^2 = 15^2 + 6^2 - 2 \times 15 \times 6 \cos 112$ $225 + 36 + 180 * 0.3746$ $= 328.428$ $y = \sqrt{328.428}$ $= 18.12$	M1  M1 A1 3	
15.	(a) $(1 + 2\chi)^8 = 1 + 8.2\chi + 28(2\chi)^2 + 56(2\chi)^3$ $= 1 + 16\chi + 112\chi^2 + 448\chi^3$	B1	
	(b) $(1 + 2\chi)^8 = (1.02)^8$ $1 + 2\chi = 1.02$ $2\chi = 0.02$ $\chi = 0.01$ $1 + 16(0.01) + 112(0.01)^2 + 448(0.01)^3$ $= 1 + 0.16 + 0.0112 + 0.000448$ $= 1.171648$ $= 1.172$	M1  A1	

$$16. \quad \text{Det} = \frac{54}{13.5} = 4$$

M1

$$4 = x(x - 2) - (-2x)$$

M1

$$4 = x^2 - 2x + 2x$$

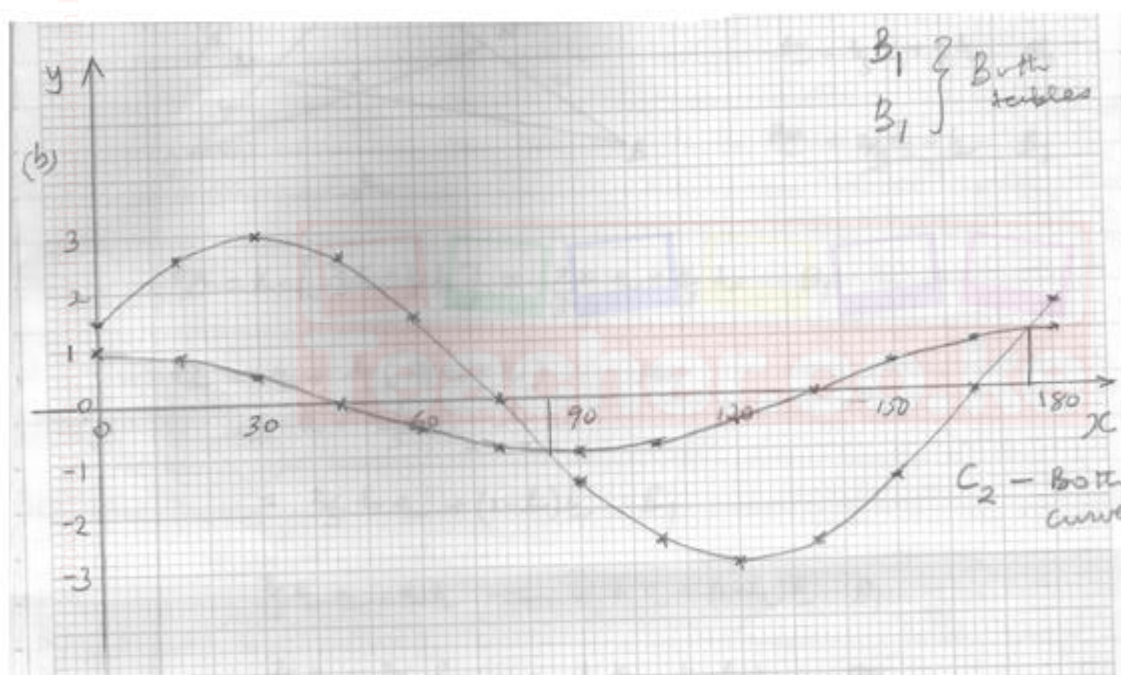
$$\sqrt{4} = x^2$$

$$x = \pm 2$$

A1 do not accept if it is one value

17.

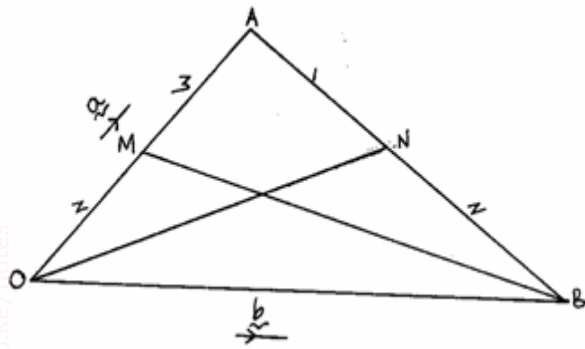
$\chi$	$0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$
$y = 3 \sin(2\chi + 30)^\circ$	1.5	2.60	3	2.60	1.5	0	-1.5	-2.60	-3	-2.60	-1.50	0	1.5
$y = \cos 2\chi$	1	0.866	0.5	0	-0.5	-0.866	-1	-0.866	-0.5	0	0.5	0.866	1



(c)  $3 \sin(2\chi + 30^\circ) = \cos 2\chi^\circ$   $\chi = 84^\circ$  or  $176^\circ$  B2 Both  $\checkmark^1$

- (d)
- (i)  $A = 3$  B1  $\checkmark^1$  value of amplitude.
  - (ii) Period =  $180^\circ$  B2  $\checkmark^1$  period.
  - (iii) Phase difference =  $30^\circ$  B1  $\checkmark^1$  phase diff.

18.



$$\underline{AB} = \underline{b} - \underline{a}$$

B1

$$\underline{ON} = \frac{2}{3}\underline{a} + \frac{1}{3}\underline{b}$$

B1

$$\underline{BM} = \frac{2}{5}\underline{a} - \underline{b}$$

B1

$$\underline{OX} = K\left[\frac{2}{3}\underline{a} + \frac{1}{3}\underline{b}\right] = \frac{2}{3}K\underline{a} + \frac{K}{3}\underline{b}$$

B1

$$\underline{OX} = \underline{b} + h\left(\frac{2}{5}\underline{a} - \underline{b}\right)$$

M1

$$= \underline{b} + \frac{2h}{5}\underline{a} - h\underline{b}$$

$$= \frac{2}{5}h\underline{a} + (1-h)\underline{b}$$

B1

$$\frac{2}{3}K\underline{a} + \frac{K}{3}\underline{b} = \frac{2}{5}h\underline{a} + (1-h)\underline{b}$$

B1

$$\frac{2}{3}K = \frac{2}{5}h \text{ and } \frac{K}{3} = (1-h)$$

$$10K = 6h$$

$$K = 3 - 3h$$

$$10K - 6h = 0$$

$$K + 3h = 3$$

$$10K - 6h = 0$$

$$\underline{K + 3h = 3} \quad (\times 2)$$

$$10K - 6h = 0$$

$$\underline{2K + 6h = 6}$$

$$12K = 6$$

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

$$\therefore 1h = \frac{5}{6}$$

B1

$$\underline{OX : XN = \frac{1}{2} : \frac{1}{2}}$$

$$= 1 : 1$$

B1

19.a) let the price of a cow be x and goat be y

$$8x + 12y = 294000$$

$$9x + 15y = 337500$$

M1

b) writing in matrix form

$$\begin{pmatrix} 8 & 12 \\ 9 & 15 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 294000 \\ 337500 \end{pmatrix}$$

M1

M1

Determinant of the co-efficient matrix is =12

M1

$$\text{Inverse } (1/12) \begin{pmatrix} 15 & -12 \\ -9 & 8 \end{pmatrix}$$

$$-(1/12) \begin{pmatrix} 15 & -12 \\ -9 & 8 \end{pmatrix} \begin{pmatrix} 8 & 12 \\ 9 & 15 \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix} = (1/12) \begin{pmatrix} 15 & -12 \\ -9 & 8 \end{pmatrix} \begin{pmatrix} 294000 \\ 337500 \end{pmatrix}$$

M1

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$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix} = (1/12) \begin{pmatrix} 360000 \\ 54000 \end{pmatrix}$$

$$X = 30000 \quad Y = 4500$$

A1

$$\text{C) I) } (140/100) \times 30000 = 42000$$

$$(145/100) \times 4500 = 6525$$

$$\text{S.P} = (42000 \times 8) + (6525 \times 12) = 414300$$

M1

A1

(II)

$$\text{S.P} = 414300$$

M1

$$\text{B.P} = (30000 \times 8) + (4500 \times 12) = 294000$$

$$\text{PROFIT} = \text{S.P} - \text{B.P}$$

$$414300 - 294000 = 120300$$

A1

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20. Taxable amount =  $\frac{8570}{20} \times 12 + \frac{15}{100} \times \frac{8570}{20} \times 12$   
 = k£ (5142 + 771.3)  
 = k£ 5913.3

1 <sup>st</sup> £ 1500 = 2 x 1500 =	3000	}
2 <sup>nd</sup> £ 1500 = 3 x 1500 =	4500	
3 <sup>rd</sup> £ 1500 = 5 x 1500 =	7500	
Rem. 1413.3 = 7 x 1413.3 =	9893.10	}
Gross tax	24,893.10	
Less relief sh(150 x 12)	1800.00	
	Ksh 23093.10	

WCPS =  $\frac{2}{100} \times 8570 = 171.4 \times 12 = 2056.80$

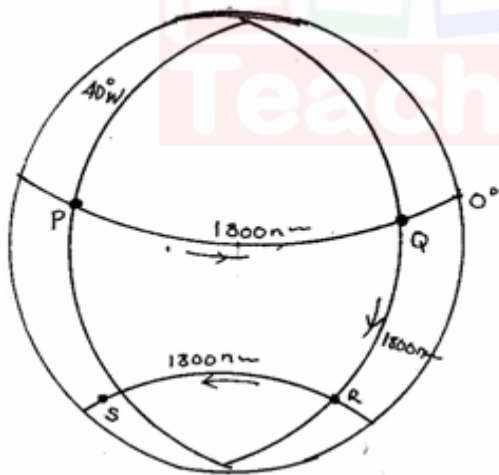
NHIF = 20 x 12 = 240.00  
 Co-op loan = 240 x 12 = 2880.00  
 Tax = ksh. 23093.10  
 Total deduction = ksh 28,569.90

Monthly deduction = ksh 2355.80  
 Net salary = 8570 - 2355.80  
 = ksh. 6214.2

M1  
B1  
M1  
M1  
M1  
A1  
M1  
M1  
A1  
10

Mathematics Paper 2

21.



(a)  $d = 60a$   
 $1800 = 60 \times a$   
 $a = 30^\circ$   
 $\therefore Q$  is  $(0^\circ, 10^\circ W)$   
 $1800 = 60a$   
 $a = 30^\circ$   
 $R$  is  $(30^\circ S, 10^\circ W)$   
 $1800 = 60a \cos \theta$   
 $1800 = 60a \times \cos 30^\circ$   
 $\frac{30}{\cos 30} = a = 34.64^\circ$   
 $B$  is  $(30^\circ S, 44.64^\circ W)$

B1  
B1  
B1  
B1

(b)  $Speed = \frac{5400}{16} = \underline{\underline{337.5 \text{ knots}}}$

M1

$$\text{Time for PQR} = \frac{3600}{337.5} = 10\text{hr } 40\text{ min}$$

$$\begin{aligned} \text{Time for R to S} &= 10\text{hr } 40\text{min} - 2\text{hr} \\ &= \underline{8\text{hr } 40\text{min}} \end{aligned}$$

M1

A1

M1

M1

A1

10

22. (a)  $a + d = 8$   
 $a + 4d = 17$   
 $\underline{3d = a}$   
 $d = 3$   
 $\therefore a = 5$

B1

A1

A1

(b)  $2^{\text{nd}} = 8$   
 $10^{\text{th}} = 5 + 9 \times 3 = 32$   
 $42^{\text{nd}} = 5 + 41 \times 3 = 128$   
 $\therefore \text{GP is } 8, 32, 128, \dots$   
 $a = 8$   
 $r = 4$

M1

A1

(Both)

$$n^{\text{th}} \text{ term of G.P} = ar^{n-1}$$

$$\begin{aligned} \therefore 10^{\text{th}} \text{ term} &= 8(4)^9 \\ &= 2097152 \end{aligned}$$

M1

A1

Mathematics Paper 2

9

(c)  $S_n = \frac{a(r^n - 1)}{r - 1}$   
 $S_{10} = \frac{8(4^{10} - 1)}{4 - 1}$   
 $= \frac{8}{3} \times 1048575$   
 $= 2796200$

M1

M1

A1

23. (a)  $a = 3t - 3$   
 $\frac{dv}{dt} = 3t - 3$   
 $\int dv = \int (3t - 3) dt$   
 $V = \frac{3t^2}{2} - 3t + C$   
 $5 = \frac{3 \times 2^2}{2} - 3 \times 2 + C$   
 $5 = 6 - 6 + C$   
 $\Rightarrow C = 5$

(i)  $V = \frac{3t^2}{2} - 3t + 5$   
 When  $t = 4$

$$\begin{aligned} V &= \frac{3 \times 4^2}{2} - 3 \times 4 + 5 \\ &= 24 - 12 + 5 = 17\text{m/s} \end{aligned}$$

M1

 $\checkmark^1$  Equation

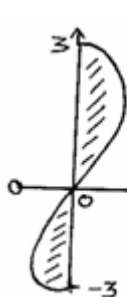
M1

Substitution

A1

(ii)  $V = \frac{ds}{dt} = \frac{3t^2}{2} - 3t + 5$   
 $S = \frac{3T^3}{6} - \frac{3t^2}{2} + 5t + C$  M1 ✓<sup>1</sup> Equation  
 When  $t = 0, S = 0, C = 0$   
 Distance when  $t = 4$   
 $S = \frac{4^3}{2} - \frac{3 \times 4^2}{2} + 5 \times 4$  M1 Substitution  
 $S = 32 - 24 + 20 = 28m$  A1

(b)



$$\text{Area} = \int_{-3}^3 (9y - y^2) dy$$

B1 ✓<sup>1</sup> area with points (0, 3),  
(0, 0) at (0, -3)

$$= \left[ \frac{9y^2}{2} - \frac{y^3}{3} \right]_{-3}^0 + \left[ \frac{9y^2}{2} - \frac{y^3}{3} \right]_0^3$$

M1 ✓<sup>1</sup> integral

$$= (40.5 - 9) + (40.5 - 9)$$

$$= 31.5 + 31.5 = 63 \text{sq units}$$

M1 ✓<sup>1</sup> Substitution  
A1

10

Mathematics Paper 2

10

24.	(a) P(RR) or P(BB)	M1M1M1 A1	For P(RR), P(BB) Addition (correctly)
	$(\frac{6}{9} \times \frac{2}{5}) + (\frac{3}{9} \times \frac{3}{5}) = \frac{4}{15} + \frac{1}{5}$		
	$= \frac{7}{15}$		
	(b) (1) P(RR) or P(RR)		
$= \left( \frac{6}{9} \times \frac{5}{8} \right) + \left( \frac{2}{5} \times \frac{1}{4} \right)$	M1M1		
$= \frac{5}{12} + \frac{1}{10}$	M1		
$= \frac{31}{60}$	A1		
(ii) P(RR) and P(RR)	M1		
$(\frac{6}{9} \times \frac{5}{8}) \times (\frac{2}{5} \times \frac{1}{4})$			
$\frac{5}{12} \times \frac{1}{10}$			
$= \frac{1}{24}$			