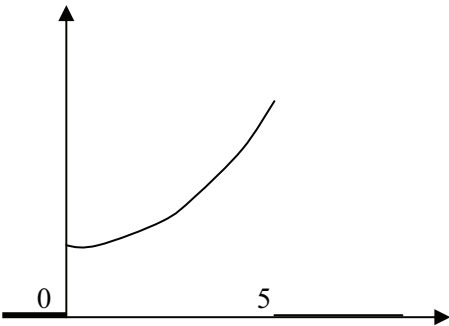


Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE AS/A LEVEL – May/June 2010	9709	71

1	(i) 1/12	B1 [1]	Accept 0.0833
	(ii) trains arrive every 12 minutes	B1 [1]	must have 'every 12 minutes'
2	(i) 0.145 = 87 / n n = 600	B1 M1 A1 [3]	correct mid-point equating their mid-point with 87 / n correct answer
	(ii) $0.0321 = z \times \sqrt{\frac{0.145(1-0.145)}{600}}$  $z = 2.233 \quad \Phi(z) = 0.9872$  width of CI is $1 - 2 \times (1 - 0.9872)$  $\alpha = 97.4\%$	B1  M1 M1 A1  [4]	0.0321 seen or implied  Equating half-width with $z \times \sqrt{\frac{pq}{n}}$ Correct method to find width of CI Correct answer
3	(i) $z = \frac{2.55 - 2.62}{0.3/\sqrt{45}} = -1.565$  $P(z > -1.565) = 0.941$	M1 M1 A1 [3]	Standardising no cc Dividing 0.3 by $\sqrt{45}$ as denominator Correct answer (Accept equivalent method using totals)
	(ii) rejection region is $m < a_1$ and $m > a_2$  where $\frac{a_1 - 2.62}{0.3/\sqrt{30}} = -1.645$ and $\frac{a_2 - 2.62}{0.3/\sqrt{30}} = 1.645$  $m < 2.53$ and $m > 2.71$	B1  M1 M1 A1 [4]	$\pm 1.645$ seen  one correct unsimplified equation of correct form second unsimplified equation of correct form (or clear use of 1-tail test and $\pm 1.282$ used) correct answer

Page 5	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE AS/A LEVEL – May/June 2010	9709	71

<p>4 (i) <math>Mr - 5Mrs \sim N(512 - 5 \times 89, 62^2 + 25 \times 7.4^2)</math>  <math>\sim N(67, 5213)</math></p> $P(Mr > 5 Mrs) = P(Mr - 5 Mrs > 0)$ $= P\left(z > \frac{0 - 67}{\sqrt{5213}}\right)$ $= P(z > -0.9280)$ $= 0.823$	<p>B1 B1  M1 M1  A1 [5]</p>	<p>Correct unsimplified mean Correct unsimplified variance  Using distribution <math>Mr - 5 Mrs</math> Standardising and using tables  Correct answer</p>
<p>(ii) <math>Mr + Mrs \sim N(601, 62^2 + 7.4^2)</math></p> $E[5/8(Mr + Mrs)] = 376 \text{ miles}$ $\text{Var}[5/8(Mr + Mrs)] = \frac{25}{64} \times 3898.76$ $= 1520$ $\text{sd} = 39.0 \text{ miles}$	<p>B1  B1   B1 [3]</p>	<p>Correct mean and variance  Correct answer SR Two separate answers 320 and 55.6 B1  Correct answer</p>
<p>5 (i) <math>\int_0^5 ke^{0.2t} dt = 1</math></p> $\left[\frac{k}{0.2} e^{1.0}\right] - \left[\frac{k}{0.2} e^0\right] = 1$ $\frac{k}{0.2}(e - 1) = 1$ $k = \frac{1}{5(e - 1)} \text{ AG}$	<p>M1  A1   A1 [3]</p>	<p>Equating to 1 and attempting to integrate  Correct integrand and limits  Correct answer legitimately obtained</p>
<p>(ii)</p> 	<p>B1    B1 [2]</p>	<p>Correct curve shape    Correct horizontal lines (need to see a 5)</p>
<p>(iii) <math>\int_0^T ke^{0.2t} dt = 0.2</math></p> $\left[5ke^{0.2T}\right] - [5k] = 0.2$ $e^{0.2T} = \frac{0.2}{5k} + 1 = 1.344$ $T = 1.48 \text{ (seconds)}$	<p>M1  A1  A1 [3]</p>	<p>Equation relating <math>T</math> and 0.2 or 0.8  Correct equation (can be in 'k')  Correct answer</p>

Page 6	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE AS/A LEVEL – May/June 2010	9709	71

<p><b>6 (i)</b> <math>\lambda_A = np = 0.022 \times 55 = 1.21</math>  <math>\lambda_B = 0.058 \times 55 = 3.19</math>  total <math>\lambda = 4.4</math>  <math>P(\text{more than } 2) = 1 - P(0, 1, 2)</math>  <math>= 1 - e^{-4.4} \left( 1 + 4.4 + \frac{4.4^2}{2!} \right)</math>  <math>= 1 - 0.185</math>  <math>= 0.815</math></p>	M1 A1 M1 A1 [4]	Two different $np$ (can be implied) Correct total 4.4 (or alt method: 6 correct combinations 0,0 1,0 etc stated and used) Finding $1 - P(0, 1, 2)$ , Poisson, any mean, allow one end error. (Or combinations method – use at least 4 and find $1 - P(\leq 2)$ ) Correct answer
<p><b>(ii)</b> <math>\lambda = 0.08n</math>  <math>P(\text{at least 1 stained tablecloth}) = 1 - P(0)</math>  <math>1 - e^{-0.08n} &gt; 0.99</math>  <math>0.01 &gt; e^{-0.08n}</math>  <math>n &gt; 57.6</math>  least value of <math>n = 58</math></p>	B1 M1 M1 A1 [4]	Correct $\lambda$ Equation of correct form relating their $\lambda$ and 0.99 Valid attempt to solve equation of correct form by logs or trial and error Correct answer (SR Accept use of Binomial leading to $n = 57$ )
<p><b>7 (i)</b> Type I error is made when we say the number of white blood cells has decreased when it hasn't.  <math>P(0) = e^{-5.2} = 0.005516</math>  <math>P(1) = e^{-5.2}(5.2) = 0.02868 \Sigma &lt; 0.10</math>  <math>P(2) = e^{-5.2}(5.2^2/2) = 0.07458 \Sigma &gt; 0.10</math>  <math>P(\text{Type I error}) = 0.0342</math></p>	B1 M1 M1* A1dep [4]	Correct and relating to question Evaluating at least 2 of $P(X = 0, 1, 2)$ Comparing their $\Sigma$ 3 probs with 10% (must be $\Sigma$ probs) Correct answer, dep on previous M
<p><b>(ii)</b> <math>H_0: \lambda = 5.2</math>  <math>H_1: \lambda &lt; 5.2</math>  <math>P(0+1+2) = 0.1087 &gt; 10\%</math>  2 not in C Region.   Accept <math>H_0</math>. Not enough evidence to say the number of blood cells has decreased.</p>	B1 M1 A1 [3]	Both hypotheses correct Stating 2 is not in the critical region from above, or evaluating $P(0, 1, 2)$ and comparing with 10% again Correct conclusion no contradictions
<p><b>(iii)</b> <math>P(\text{Type II error}) = 1 - P(0, 1)</math>  <math>= 1 - e^{-4.1}(1 + 4.1)</math>   <math>= 0.915</math></p>	B1 M1 A1 [3]	Identifying correct area (indep) Some form of (Poisson) expression with mean 4.1 Correct answer