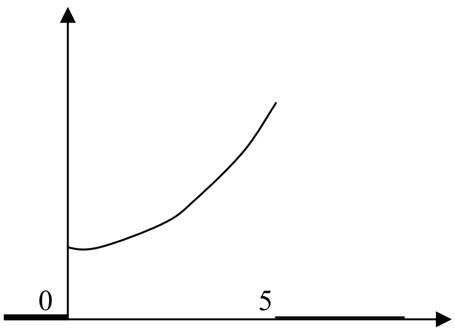
1 **(i)** 1/12	B1 [1]	Accept 0.0833
(ii) trains arrive every 12 minutes	B1 [1]	must have 'every 12 minutes'
2 **(i)** 0.145 $= 87 / n$ $n = 600$	B1 M1 A1 [3]	correct mid-point equating their mid-point with $87 / n$ correct answer
(ii) $0.0321 = z \times \sqrt{\frac{0.145(1-0.145)}{600}}$ $z = 2.233 \quad \Phi(z) = 0.9872$ 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]	±1.645 seen one correct unsimplified equation of correct form second unsimplified equation of correct form (or clear use of 1-tail test and ±1.282 used) correct answer

4	(i)	Mr – 5Mrs $\sim N(512 - 5\times89,\ 62^2 + 25\times7.4^2)$ $\sim N(67, 5213)$	B1 B1	Correct unsimplified mean Correct unsimplified variance
		P(Mr > 5 Mrs) = P(Mr – 5 Mrs > 0) $= P\left(z > \frac{0-67}{\sqrt{5213}}\right)$ $= P(z > -0.9280)$ = 0.823	M1 M1 A1 [5]	Using distribution Mr – 5 Mrs Standardising and using tables Correct answer
	(ii)	Mr + Mrs $\sim N(601,\ 62^2 + 7.4^2)$	B1	Correct mean and variance
		E[5/8(Mr + Mrs)] = 376 miles Var[5/8(Mr + Mrs)] = $\frac{25}{64}\times3898.76$ = 1520 sd = 39.0 miles	B1 B1 [3]	Correct answer SR Two separate answers 320 and 55.6 B1 Correct answer
5	(i)	$\int_0^5 ke^{0.2t}\,dt = 1$	M1	Equating to 1 and attempting to integrate
		$\left[\frac{k}{0.2}e^{1.0}\right] - \left[\frac{k}{0.2}e^{0}\right] = 1$ $\frac{k}{0.2}(e-1) = 1$	A1	Correct integrand and limits
		$k = \frac{1}{5(e-1)}$ AG	A1 [3]	Correct answer legitimately obtained
	(ii)		B1 B1 [2]	Correct curve shape Correct horizontal lines (need to see a 5)
	(iii)	$\int_0^T ke^{0.2t}\,dt = 0.2$	M1	Equation relating T and 0.2 or 0.8
		$\left[5ke^{0.2T}\right] - [5k] = 0.2$ $e^{0.2T} = \frac{0.2}{5k} + 1 = 1.344$	A1	Correct equation (can be in 'k')
		T = 1.48 (seconds)	A1 [3]	Correct answer

6 **(i)** $\lambda_A = np = 0.022 \times 55 = 1.21$ $\lambda_B = 0.058 \times 55 = 3.19$ total $\lambda = 4.4$ P(more than 2) = 1 – P(0, 1, 2) $= 1 - e^{-4.4}\left(1 + 4.4 + \frac{4.4^2}{2!}\right)$ = 1 – 0.185 = 0.815	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(≤2)) Correct answer
(ii) $\lambda = 0.08n$ P(at least 1 stained tablecloth) = 1 – P(0) $1 - e^{-0.08n} > 0.99$ $0.01 > e^{-0.08n}$ $n > 57.6$ least value of $n = 58$	B1 M1 M1 A1 [4]	Correct λ Equation of correct form relating their λ 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 $n = 57$)
7 **(i)** Type I error is made when we say the number of white blood cells has decreased when it hasn't. $P(0) = e^{-5.2} = 0.005516$ $P(1) = e^{-5.2}(5.2) = 0.02868$ $\Sigma < 0.10$ $P(2) = e^{-5.2}(5.2^2/2) = 0.07458$ $\Sigma > 0.10$ P(Type I error) = 0.0342	B1 M1 M1* A1dep [4]	Correct and relating to question Evaluating at least 2 of P(X = 0, 1, 2) Comparing their Σ 3 probs with 10% (must be Σ probs) Correct answer, dep on previous M
(ii) H_0: $\lambda = 5.2$ H_1: $\lambda < 5.2$ P(0+1+2) = 0.1087 > 10% 2 not in C Region. Accept H_0. Not enough evidence to say the number of blood cells has decreased.	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
(iii) P(Type II error) = 1 – P(0, 1) $= 1 - e^{-4.1}(1 + 4.1)$ = 0.915	B1 M1 A1 [3]	Identifying correct area (indep) Some form of (Poisson) expression with mean 4.1 Correct answer