Question	Answer	Marks	Guidance
1(i)	9.6, 12.4	**B1 B1**	
		2	
1(ii)	6.6, 49.6	**B1 B1**	
		2	

Question	Answer	Marks	Guidance
2(i)	$\left(\lambda\left(=2\times2.4\right)=4.8\right)$ $e^{-4.8}\left(1+4+\frac{4.8^2}{2}+\frac{4.8^3}{3!}\right)$	**M1**	Any λ
	0.294 (3 sf)	**A1**	
		2	
2(ii)	$\left(\lambda\left(=60\times2.4\right)=144\right)$ N('144', '144')	**M1**	N and $\sigma^2=\mu$ SOI
	$\frac{139.5-'144'}{\sqrt{'144'}}\left(=-0.375\right)$	**M1**	Allow with no continuity correction
	ϕ('0.375')	**M1**	Correct area consistent with their working
	0.646 (3 sf)	**A1**	
		4	

Question	Answer	Marks	Guidance
3(i)	Assume population is normally distributed	**B1**	
	$\bar{x} = 25.9$	**B1**	Allow $\frac{259}{10}$
	$z = 2.17$	**B1**	
	$'25.9' \pm z \times \frac{3}{\sqrt{10}}$	**M1**	Must have correct form and z.
	23.8 to 28.0 (3 sf)	**A1**	CWO
		5	
3(ii)	0.03^2 (=0.0009)	**B1**	
		1	

Question	Answer	Marks	Guidance
4	Assume trains are independent OR probability of being on time is constant	**B1**	Must be in context
	H_0: P(on time)=0.92 H_1: P(on time)<0.92	**B1**	Both. Allow 'p' or π
	$1 - \left({}^{20}C_{17} \times 0.92^{17} \times 0.08^3 + {}^{20}C_{18} \times 0.92^{18} \times 0.08^2 + 20 \times 0.92^{19} \times 0.08 + 0.92^{20} \right)$	**M1**	Allow one end error Must have 1 – …
	=0.0706 (3 sf)	**A1**	
	Compare with 0.05	**M1**	Valid comparison needed
	No evidence that percentage less than 92%	**A1FT**	OE No contradictions. Method using normal approximation: If the first B1B1 is earned then: $\text{CV} - 1.566 \left(\text{from} \dfrac{16.5 - 20 \times 0.92}{\sqrt{20 \times 0.92 \times 0.08}}, \text{with continuity correction} \right)$ **or** CV=1.978 (without continuity correction) comp z=1.645 No evidence that % decreased (1.566) or evidence that % decreased (1.978) is awarded **SC2** after B marks
		6	

Question	Answer	Marks	Guidance
5(i)	Po(3)	**B1**	SOI
	$e^{-3}\left(\frac{3^3}{3!}+\frac{3^4}{4!}+\frac{3^5}{5!}\right)$	**M1**	Allow one or two extra terms (2 or 6 or both)
	0.493 (3 sf)	**A1**	
		3	
5(ii)	A correct equation from $P(0)=P(2)$ $\left(\text{leading to } 1=\frac{\lambda^2}{2}\right)$	**M1**	
	$\lambda=\sqrt{2}$ or 1.41 (3 sf)	**A1**	CWO
		2	

Question	Answer	Marks	Guidance
5(iii)(a)	Correct inequality $\left(\text{leading to } \frac{5.2^n}{n!} < \frac{5.2^{n+1}}{(n+1)!}\right)$	**B1**	
		1	
5(iii)(b)	$n+1 < 5.2$ or $1 < \frac{5.2}{n+1}$	**M1**	Simplify to a stage without exponentials, powers or factorials.
	Largest n is 4	**A1**	
		2	

Question	Answer	Marks	Guidance
6(i)	$k\int_0^3 \left(3x - x^2\right) \mathrm{d}x = 1$	**M1**	Attempt to integrate f(x) and = 1
	$k\left[\frac{3}{2}x^2 - \frac{x^3}{3}\right]_0^3$ $k\left(\frac{27}{2} - \frac{27}{3}\right) = 1$	**A1**	Correct integral and limits
	$k = \frac{2}{9}$	**A1**	AG No errors seen
		3	

Question	Answer	Marks	Guidance
6(ii)	$\frac{2}{9}\int_1^2 \left(3x - x^2\right)\mathrm{d}x = \frac{2}{9}\left[\frac{3}{2}x^2 - \frac{x^3}{3}\right]_1^2 = \frac{2}{9}\times\left(6 - \frac{8}{3} - \frac{3}{2} + \frac{1}{3}\right)$	**M1**	Attempt to integrate f(x) dx with limits 1 and 2 OE
	$\frac{13}{27}$ or 0.481 (3 sf)	**A1**	
		2	
6(iii)	$y = 3x - x^2$ symmetrical about $x = \frac{3}{2}$	**M1**	Attempt $\frac{2}{9}\int_0^3 (3x^2 - x^3)\,\mathrm{d}x$
	E(X)= $\frac{3}{2}$	**A1**	
	$\frac{2}{9}\int_0^3 (3x^3 - x^4)\,\mathrm{d}x$	**M1**	Attempt to integrate x^2f(x)
	$= \frac{2}{9}\left[\frac{3x^4}{4} - \frac{x^5}{5}\right]_0^3 \left(= \frac{2}{9}\times\frac{243}{20} = \frac{27}{10}\right)$ $\frac{'27'}{10} - \left(\frac{'3'}{2}\right)^2$	**M1**	Subtract their (E(X))^2 from their integral x^2f(x) with correct limits substituted
	$\frac{9}{20}$ or 0.45	**A1**	
		5	

Question	Answer	Marks	Guidance
7(i)	H_0: Pop mean=546 H_1: Pop mean>546	**B1**	Both. Allow just μ, but not just 'mean'
	$\frac{581-546}{\frac{120}{\sqrt{40}}}$	**M1**	Standardising. Need $\frac{120}{\sqrt{40}}$
	=1.845 allow 1.844	**A1**	Allow 1.84 or 1.85 AWRT
	1.845<1.96	**M1**	OE. Or area comparison 0.0325>0.025 or large probabilities
	No evidence that mean weekly income has increased	**A1FT**	No contradictions. If H_1: ≠, and 2.241 used, max B0M1A1M1A0
		5	
7(ii)	$\frac{a-546}{\frac{120}{\sqrt{40}}}=1.96$	**M1**	Standardise to find a. Need $\frac{120}{\sqrt{40}}$ **and** 546 **and** a value of z
	a = 583.19	**A1**	Allow 583 to 3sf
	$\frac{'583.19'-595}{\frac{120}{\sqrt{40}}}(=-0.622)$	**M1**	Standardise. Need $\frac{120}{\sqrt{40}}$ and 595
	ϕ('–0.622')=1 – ϕ('0.622')	**M1**	Consistent area
	0.267	**A1**	
		5	