1	**(i)**	9.3	B1 1	
	(ii)	27.9	B1 1	
	(iii)	E (S) = 17.4, E(T) = 19.4 E ($S - T$) = – 2.0, Var ($S - T$) = 37.2	M1 A1 B1ft 3	For subtracting their E[S] – E[T] can be non-numerical ft (i) & (ii) Adding (i) and (ii) ft non-negative answers only
			[Total: 5]	
2		Assume shots independent OR prob of scoring constant H_0: P(score) = 0.82 H_1: P(score) > 0.82 $20 \times 0.82^{19} \times 0.18 + 0.82^{20}$ = 0.102 (3 sf) No evidence that improved	B1 B1 M1 A1 B1f 5	In context Both. Allow 'p' For use of Bin(20,0.82)and either P(19) and/or P(20) attempted Valid comparison seen (with 0.05 if H_1 $p \neq 0.82$) and correct conclusion ft numerical errors in 0.102 only Normal approx'n: B1 B1 (μ= 16.4 acceptable here) if earned, then: CR = 1.222 (from $\frac{18.5 - 20 \times 0.82}{\sqrt{20 \times 0.82 \times (1 - 0.82)}}$, need cc) comp z = 1.282 No evidence that improved SC 1 Same scheme for proportions
			[Total: 5]	
3	**(i)**	$\bar{x}$ = 930/15 =(62) z = 1.751 '62' $\pm z \times \frac{12}{\sqrt{15}}$ = 56.6 to 67.4 (3 sf)	B1 B1 M1 A1 4	 Any z Must be an interval
	(ii)	92 % of such intervals will contain μ	B1 1	Accept P(This interval contains μ) = 0.92
	(iii)	Each possible sample of this size is equally likely	B1 1	Each member of pop equally likely to be chosen
			[Total: 6]	

4	**(i)**	$e^{-2} \times 2\ (\times)\ e^{-3} \times \frac{3^4}{4!}$	M1		Correct exp'n for P(1) with λ=2 OR P(4) with λ=3
		$e^{-5} \times \frac{5^4}{5!}$	B1		Correct exp'n
		÷	M1		dep M1B1
		$\frac{162}{625}$ or 0.259 (3 sf)	A1	4	
	(ii)	$(e^{-2} \times \frac{2^r}{r!} = \frac{2}{3}e^{-2} \Rightarrow)$			
		$3 \times 2^r = 2 \times r!$ OR $2^{r-1} = \frac{1}{3} \times r!$	B1		Legitimately shown
		$(\Rightarrow 3 \times 2^{r-1} = r!)$			
		$3 \times 2^3 = 24$ OR $3! = 24$ seen	B1	2	Legitimately shown on either equation
				[Total: 6]	
5	**(i)**	$\int_1^\infty \frac{k}{x^3} dx = 1$	M1		All correct, including limits and an attempt to integrate
		$\left[-\frac{k}{2x^2}\right]_1^\infty = 1$			
		$0 - (-\frac{k}{2}) = 1$	A1	2	or $0 + \frac{k}{2} = 1$ or $\frac{k}{2} = 1$ AG must be convincing
	(ii)	$\int_1^2 \frac{2}{x^3} dx$	M1		Attempt integ f(x); ignore limits
		$= \left[-\frac{1}{x^2}\right]_1^2$			
		$= \frac{3}{4}$	A1	2	
	(iii)	$\int_1^\infty \frac{2}{x^2} dx$	M1		Attempt integ $xf(x)$; ignore limits
		$= \left[-\frac{2}{x}\right]_1^\infty$	A1		Correct & correct limits
		$= 2$	A1	3	
				[Total: 7]	

6	**(i)**	λ (= 1.4 × 2.5) = 3.5 $1 - e^{-3.5}(1 + 3.5 + \frac{3.5^2}{2} + \frac{3.5^3}{3!})$ = 0.463 (3 sf)	B1 M1 A1 3	Any λ allow one end error
	(ii)	(λ = 672 × 1.4 = 940.8) N(940.8, 940.8) $\frac{999.5 - 940.8}{\sqrt{940.8}}$ (= 1.914) Φ('1.914') = 0.972 (3 sf)	B1 M1 M1 A1 4	Seen or implied Allow with wrong or no cc . no sd/var mixes
			[Total: 7]	
7	**(i)**	Assume sd unchanged or 4500 H_0: Pop mean = 34600 H_1: Pop mean > 34600 $\frac{35400 - 34600}{\frac{4500}{\sqrt{90}}}$ = 1.687/1.686 (1.69) cf 1.645 < 1.686 Evidence that mean wkly profit has increased	B1 B1 M1 A1 M1 A1 f 6	Both. Allow just μ, but not just "mean" Allow without √90 Valid comparison (or 0.0458/0.0459 <0.05 or 35380 < 35400 or 34600 < 34620) If H_1: ≠, and 1.96 used, max B1B0M1A1M1A1f No contradictions
	(ii)	Distr'n of X unknown. Yes	B1* B1* dep 2	Allow not Normal
	(iii)	0.05 or 5%	B1 1	
	(iv)	$\frac{a - 34600}{\frac{4500}{\sqrt{90}}}$ = 1.645 a = 35380 $\frac{35380 - 36500}{\frac{4500}{\sqrt{90}}}$ (= – 2.361) 1 – Φ('2.361') = 0.0091	M1 A1 M1 M1 A1 6	Attempt to find cv must see (+) 1.645 allow without √90. If found in (i) award when used Standardising with their " CV " must use √90 Correct tail
			[Total: 14]	