Question Number	Scheme	Marks
8(a)	$X = S_1 + S_2 + S_3$	
	$[X \sim]\text{N}(54, 0.0027)$ or e.g. $[\text{E}(X) =]54$, $[\text{Var}(X) =]0.0027$	M1 A1
	$\left[\text{P}\left(X > 54.1\right) =\right]\text{P}\left(Z > \pm\dfrac{54.1-'54'}{\sqrt{'0.0027'}}\right)\left[= \text{P}\left(Z > 1.924...\right)\right]$	M1
	$[=1-0.9726] = 0.0274$ (Calc 0.02714…) awrt 0.027	A1
		(4)
(b)	$Y = C_1 - C_2$	
	$[Y \sim]\text{N}(0, 0.0018)$ or e.g. $[\text{E}(Y) =]0$, $[\text{Var}(X) =]0.0018$	M1
	$\left[\text{P}\left(Y > 0.02\right) =\right]\text{P}\left(Z > \pm\dfrac{0.02-'0'}{\sqrt{'0.0018'}}\right)\left[= \text{P}\left(Z > 0.4714...\right)\right]$	M1
	$[=1-0.6808] = 0.3192$ (Calc 0.31867…) awrt 0.319	A1
	$2\times\text{P}\left(Y > 0.02\right) = 2\times'0.3192' = 0.6384$ (Calc 0.63735…) awrt 0.637 - awrt 0.638	M1 A1
		(5)
(c)	$T = P_1 + C_1 + ... + C_5 + S_1 + ... + S_{28}$	
	Let $R = T - 30P_1 = C_1 + ... + C_5 + S_1 + ... + S_{28} - 29P_1$ (or e.g. $Q = T - 30P_1 - 190$)	M1 A1
	$[R \sim]\text{N}\left(194, 33.6697\right)$ or e.g. $[\text{E}(R) =]194$, $[\text{Var}(R) =]33.6697$ (or $\text{N}\left(4, 33.6697\right)$)	M1 A1
	$\left[\text{P}\left(R < 190\right) =\right]\text{P}\left(Z < \pm\dfrac{190-'194'}{\sqrt{'33.6697'}}\right)\left[= \text{P}\left(Z < -0.68935...\right)\right]$ (or e.g. $\text{P}\left(Q < 0\right)$)	M1
	$[=1-0.7549] = 0.2451$ (Calc 0.2453…) awrt 0.245	A1
		(6)

	Notes		Total 15
(a)	**M1**	For N(54, …) oe seen or used. May see e.g. $[\text{E}(X) =]\ 3\times18$. Implied by awrt 0.027	
	A1	For N(54, 0.0027) oe seen or used (Standard deviation (0.05196…) May be seen in their standardisation. The unevaluated expressions for μ and σ^2 can score	
	M1	For standardising with 54.1, their mean $\neq 18$ or 6 and their standard deviation $\neq 0.03$ or 0.0027 (if their mean/or their sd/var are incorrect then working must be shown. Allow $\pm$ stand	
	A1	awrt 0.027 **provided standardisation seen**	
(b)	**M1**	For N(0, 0.0018) oe seen or used e.g. seen in their standardisation. The unevaluated expressions for μ and σ^2 can score. Implied by awrt 0.319 or awrt 0.637– awrt 0.638	
	M1	For standardising with 0.02, their mean and their standard deviation $\neq 0.0018$. Allow $\pm$ stand	
	A1	awrt 0.319 **provided standardisation seen.** May be implied by their final answer	
	M1	For 2 × their 0.319 provided their probability of "0.319" is < 0.5 Imp by correct prob statement	
	A1	**Dep on all previous method marks scored and standardisation seen** awrt 0.637– awrt 0.638	
(c)	**M1**	For sight or use of $T - 30P_1$ may be implied by sight of 194 oe or awrt 33.7 oe. May attempt $T - 30P_1 - 190$ May be implied by sight of 4.	
	A1	for $C_1 + ... + C_5 + S_1 + ... + S_{28} - 29P_1$ oe May be implied by sight of awrt 33.7.	
	M1	For N(194, …) oe seen or used. May be unsimplified. (or N(4, …))	
	A1	For N(194, 33.6697) oe seen or used. The expressions for μ and σ^2 can score. (or N(4,33.6697))	
	M1	For standardising with 190, their mean and their standard deviation $\neq 33.6697$. Allow $\pm$ stand	
	A1	**Dependent on all previous marks scored** for awrt 0.245 **provided standardisation seen**	

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