Question Number	Scheme	Marks
7. (a)	$a = 2\times180 - 330 = 30$	B1
	$b = 4.5^2 \times 2 + 6.7^2 = 85.39$	M1 A1
		(3)
(b)	$X = L - 1.8S$	
	$\mathrm{E}(X) = 330 - 1.8\times180 = 6$	M1
	$\mathrm{Var}(X) = 6.7^2 + 1.8^2 \times 4.5^2 = 110.5$	M1 A1
	$\mathrm{P}(X > 0) = \mathrm{P}\left(Z > \dfrac{0-6}{\sqrt{110.5}}\right)$	M1
	$\mathrm{P}(Z > -0.57) = 0.7157$	A1
		(5)
(c)	$T = S_1 - \dfrac{S_1+S_2+S_3}{3} = \dfrac{2S_1 - S_2 - S_3}{3}$	M1 A1
	$\mathrm{E}(T) = 0$	M1
	$\mathrm{Var}(T) = \dfrac{1}{9}\left(2^2\times4.5^2 + 4.5^2 + 4.5^2\right) = \dfrac{6}{9}\left(4.5^2\right) = 13.5$	M1
	$\mathrm{P}(T > 5) = \mathrm{P}\left(Z > \dfrac{5-0}{\sqrt{13.5}}\right)$	M1
	$\mathrm{P}(Z > 1.36) = 1 - 0.9131 = 0.0869$	A1
		(6)
		[14]

	Notes
(a)	B1 30 cao M1 $2\times\mathrm{Var}(S) + \mathrm{Var}(L)$ A1 85.39 (allow 85.4)
(b)	1st M1 Seeing or using E(X) = 6 or correct expression for mean 2nd M1 $\mathrm{Var}(L) + 1.8^2\,\mathrm{Var}(S)$ (condone mixing variances for M1) 1st A1 for 110.5 (allow $65.61 + 6.7^2$) 3rd M1 standardising with their mean and s.d. leading to a probability $p > 0.5$ 2nd A1 awrt 0.716 [calc: 0.7159262…]
(c)	1st M1 realising the need to write as a single distribution using $\bar{S} = \dfrac{S_1+S_2+S_3}{3}$ 1st A1 for $\dfrac{2S_1 - S_2 - S_3}{3}$ 2nd M1 Using mean = 0 3rd M1 using Var(aS) = a^2Var(S) 4th M1 standardising with their mean and sd 2nd A1 awrt 0.0868 to awrt 0.0869 [calc: 0.08678…] Note: Assuming S_1 and $\bar{S}$ are independent, leads to E(T) = 0, Var (T) = 27, P($T > 5$) = 0.167… scores M0A0M1M0M1A0

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