

Question		Answer	Marks	AO	Guidance	
7	(i)	$r = 0.98$	B1	3.3	Identify that r is 0.98	Allow any exact equiv, including $\frac{147}{150}$ or better
		$u_{12} = 150 \times 0.98^{11}$ or $u_{13} = 150 \times 0.98^{12}$	M1	3.4	Attempt u_{12} or u_{13} using ar^{n-1} with $a = 150$ and their r	Must attempt to evaluate at least one of the values Must be using correct formula Allow M1 even if subsequently incorrectly evaluated eg as $(ar)^{n-1}$
		$u_{12} = 120.1$ or $u_{13} = 117.7$	A1	1.1	Obtain one correct value	3sf or better
		$u_{12} > 120$ and $u_{13} < 120$, hence the thirteenth half marathon A.G.	A1	2.3	Conclude from both values with reference to half marathon number	Both values must be correct, and to a suitable degree of accuracy that allows comparison to 120 to be made Condone 'marathon' or 'run' instead of 'half marathon'
			[4]			OR B1 $r = 0.98$ or equiv M1 Equate ar^{n-1} with $a = 150$ and their r to 120 and attempt to find value for n (equation or inequality) A1 Obtain $n = 12.05$, or better Ignore inequality signs for this A1 A1 Conclusion with reference to half marathon number A0 if incorrect inequality signs
	(ii)	$\frac{150(1 - 0.98^n)}{1 - 0.98} = 2974$	M1*	3.1a	Equate S_N formula to 2974	Must be correct formula with $a = 150$ and their r Must be equated to 2974 Allow use of 2973.5 and/or 2974.5 as attempt to deal with 'nearest minute'

Question			Answer	Marks	AO	Guidance
			$0.98^n = 0.6035$	M1d*	1.1	Rearrange to useable form, and find value for n Must be using correct formula for S_n Must be using correct processes to solve equation BC so may be no evidence of log use
			$n = 25$ hence Chris has run 25 half marathons	A1	3.2a	Conclude with reference to number of half marathons run Must be put in context and not just $n = 25$ Condone 'marathons' or 'runs' instead of 'half marathons'
				[3]		
	(iii)		Does not take into account possible variations in conditions	E1	3.5b	Identify that times for individual half marathons may vary from the model Any sensible reason eg weather, terrain, injury etc
			Assumes that times will continue to improve	E1	3.5b	Identify that improvements may not continue Any sensible reason as to why the model has long-term limitations E0 for 'model will eventually predict 0 minutes'
				[2]		