Question Number	Scheme	Marks
1. (a)	$\left(1-\frac{1}{6}x\right)^9 = 1+9\left(-\frac{1}{6}x\right)^1+\frac{9\times8}{2}\left(-\frac{1}{6}x\right)^2+\frac{9\times8\times7}{3!}\left(-\frac{1}{6}x\right)^3+\ldots$	M1
	$=1-\frac{3}{2}x+x^2-\frac{7}{18}x^3$	A1, A1 **(3)**
(b)	$(10x+3)\left(1-\frac{3}{2}x+x^2-\frac{7}{18}x^3\right)$	
	Coefficient of $x^3 = 10\times1+3\times-\frac{7}{18}=\frac{53}{6}$	M1 A1 **(2)** **(5 marks)**

(a)

M1: For an attempt at the binomial expansion. Score for a correct attempt at any of term 2, 3 or 4.

Accept sight of ${}^9C_1\left(\pm\frac{1}{6}x\right)^1$ or ${}^9C_2\left(\pm\frac{1}{6}x\right)^2$ or ${}^9C_3\left(\pm\frac{1}{6}x\right)^3$ condoning the omission of brackets.

Coefficients may appear from Pascal's triangle but should be correct for the term.

A1: For any two simplified terms of $-\frac{3}{2}x+x^2-\frac{7}{18}x^3$

A1: For $1-\frac{3}{2}x+x^2-\frac{7}{18}x^3$ ignoring terms with greater powers. Allow as a list, allow $+-\frac{3}{2}x$ etc but the fractions must be simplified. Accept $1x^2$. ISW following a correct expression (e.g. if multiply through by 2). If given as decimals they must be exact (recurring if appropriate).

(b)

M1: For attempting to find $10b\pm3c$ combined to a single term for their $(10x+3)\left(1+ax+bx^2+cx^3+\right)$

A1: cao for $\frac{53}{6}$ but condone $\frac{53}{6}x^3$ and isw. Accept embedded in an expansion with other terms as long as simplified to correct single x^3 term. If given as a decimal must be exact recurring.

Question Number	Scheme	Marks
2.(a)	$a+5d=2$ and $\frac{10}{2}\{2a+9d\}=-80$	B1 B1
	Solves simultaneously $\Rightarrow d=20, a=-98$	M1 A1 **(4)**
(b)	Attempts $\frac{n}{2}\{2\times-98+(n-1)\times 20\}...8000$	M1
	$5n^2-54n-4000...0 \Rightarrow n=(34.2)$	dM1
	$n=35$	A1 **(3)** **(7 marks)**

(a)

B1: One of $a+5d=2$ or $\frac{10}{2}\{2a+9d\}=-80$

B1: Both equations correct. May be un-simplified (isw after correct equations seen).

M1: Solves their two equations in a and d (one of which must be correct) and finds at least a or d. There may be slips, but score for any attempt that reaches a value provided at least one equation was correct and both attempted. Implied by correct answers following correct equations stated.

A1: For $d=20, a=-98$

Alt

B1: Correct formula in d only using 6th and 10th term $\frac{10}{2}\left((2-5d)+(2+4d)\right)=-80$

B1: $d = 20$

M1: Attempts to find a using $a + 5d = 2$

A1: Correct a

(b)

Note: allow all marks in (b) with any equality or inequality used throughout.

M1: Attempts to use $\frac{n}{2}\{2\times-98+(n-1)\times 20\}...8000$ with their a and d. Accept if set equal to 8001. NB If 800 or 80000 is used, allow the M (misread).

dM1: Sets up and **solves** a 3 term quadratic equation in n. Accept if just the positive root is given, but at least one positive root must be obtained.
Allow use of calculator /formulae (may need to check values if no method shown).
May be implied by a rounded or truncated positive integer value following a suitable equation having been set up.

FYI the correct equation is $5n^2-54n-4000...0$

A1: $(n=)35$ stated following a correct equation formed (allowing for incorrect inequality).

Alt by trial and improvement

M1: Attempts to use $\frac{n}{2}\{2\times-98+(n-1)\times 20\}$ with their a and d and integer values of n either side of the sum being 8000

dM1: Two consecutive values for n giving results either side of 8000 attempted.

A1: $n=35$ stated following correct working with both n=34 and n= 35 having been seen.