

Year 12 Pure Exam Questions – Binomial Expansion (Answers)

Q1.

Question Number	Scheme		Marks
(a)	$(2 - 3x)^6 = 64 + \dots$	64 seen as the only constant term in their expansion.	B1
	$\{(2 - 3x)^6\} = (2)^6 + {}^6C_1(2)^5(-3x) + {}^6C_2(2)^4(-3x)^2 + \dots$		M1
	M1: $({}^6C_1 \times \dots \times x)$ or $({}^6C_2 \times \dots \times x^2)$. For <u>either</u> the x term <u>or</u> the x^2 term. Requires <u>correct</u> binomial coefficient in any form <u>with the correct power of x</u> , but the other part of the coefficient (perhaps including powers of 2 and/or -3) may be wrong or missing. The terms can be "listed" rather than added. Ignore any extra terms.		
	${}^6C_1 2^5 - 3x + {}^6C_2 2^4 - 3x^2 + \dots$ Scores M0 unless later work implies a correct method		
	$= 64 - 576x + 2160x^2 + \dots$	A1: Either $-576x$ or $2160x^2$ (Allow $+$ $-576x$ here)	A1A1
		A1: Both $-576x$ and $2160x^2$ (Do not allow $+$ $-576x$ here)	
		[4]	
(a) Way 2	$(2 - 3x)^6 = 64 + \dots$	64 seen as the only constant term in their expansion.	B1
	$\left(1 - \frac{3}{2}x\right)^6 = 1 + {}^6C_1\left(\frac{-3}{2}x\right) + {}^6C_2\left(\frac{-3}{2}x\right)^2 + \dots$	M1: $({}^6C_1 \times \dots \times x)$ or $({}^6C_2 \times \dots \times x^2)$. For <u>either</u> the x term <u>or</u> the x^2 term. Requires <u>correct</u> binomial coefficient in any form <u>with the correct power of x</u> , but the other part of the coefficient (perhaps including powers of 2 and/or -3) may be wrong or missing. The terms can be "listed" rather than added. Ignore any extra terms.	M1
	$= 64 - 576x + 2160x^2 + \dots$	A1: Either $-576x$ or $2160x^2$ (Allow $+$ $-576x$ here)	A1A1
A1: Both $-576x$ and $2160x^2$ (Do not allow $+$ $-576x$ here)			
(b)	Candidate writes down $\left(1 + \frac{x}{2}\right) \times$ (their part (a) answer, at least up to the term in x). (Condone missing brackets)		
	$\left(1 + \frac{x}{2}\right)(64 - 576x + \dots)$ or $\left(1 + \frac{x}{2}\right)(64 - 576x + 2160x^2 + \dots)$ or $\left(1 + \frac{x}{2}\right)64 - \left(1 + \frac{x}{2}\right)576x$ or $\left(1 + \frac{x}{2}\right)64 - \left(1 + \frac{x}{2}\right)576x + \left(1 + \frac{x}{2}\right)2160x^2$ or $64 + 32x, -576x - 288x^2, 2160x^2 + 1080x^3$ are fine.		M1
	$= 64 - 544x + 1872x^2 + \dots$	A1: At least 2 terms correct as shown. (Allow $+$ $-544x$ here)	A1A1
		A1: $64 - 544x + 1872x^2$ The terms can be "listed" rather than added. Ignore any extra terms.	
		[3]	
		Total 7	
SC: If a candidate expands in descending powers of x , only the M marks are available			
	e.g. $\{(2 - 3x)^6\} = (-3x)^6 + {}^6C_1(2)^5(-3x)^5 + {}^6C_2(2)^4(-3x)^4 + \dots$		

Q2.

Question	Scheme	Marks	AOs
(a)	$\left(2 - \frac{x}{16}\right)^9 = 2^9 + \binom{9}{1} 2^8 \left(-\frac{x}{16}\right) + \binom{9}{2} 2^7 \left(-\frac{x}{16}\right)^2 + \dots$	M1	1.1b
	$\left(2 - \frac{x}{16}\right)^9 = 512 + \dots$	B1	1.1b
	$\left(2 - \frac{x}{16}\right)^9 = \dots - 144x + \dots$	A1	1.1b
	$\left(2 - \frac{x}{16}\right)^9 = \dots + \dots + 18x^2 (+ \dots)$	A1	1.1b
		(4)	
(b)	Sets '512' $a = 128 \Rightarrow a = \dots$	M1	1.1b
	$(a =) \frac{1}{4}$ oe	A1 ft	1.1b
		(2)	
(c)	Sets '512' $b + '-144' a = 36 \Rightarrow b = \dots$	M1	2.2a
	$(b =) \frac{9}{64}$ oe	A1	1.1b
		(2)	
(8 marks)			

Q3.

Question	Scheme	Marks	AOs
(a)	3^8 or 6561 as the constant term	B1	1.1b
	$\left(3 - \frac{2x}{9}\right)^8 = \dots + {}^8C_1(3)^7\left(-\frac{2x}{9}\right) + {}^8C_2(3)^6\left(-\frac{2x}{9}\right)^2 + {}^8C_3(3)^5\left(-\frac{2x}{9}\right)^3 + \dots$ $= \dots + 8 \times (3)^7\left(-\frac{2x}{9}\right) + 28 \times (3)^6\left(-\frac{2x}{9}\right)^2 + 56(3)^5\left(-\frac{2x}{9}\right)^3$	M1 A1	1.1b 1.1b
	$= 6561 - 3888x + 1008x^2 - \frac{448}{3}x^3 + \dots$	A1	1.1b
		(4)	
(b)	Coefficient of x^2 is $\frac{1}{2} \times "1008" - \frac{1}{2} \times "-\frac{448}{3}"$	M1	3.1a
	$= \frac{1736}{3}$ (or $578\frac{2}{3}$)	A1	1.1b
		(2)	
(6 marks)			

Q4.

Question	Scheme	Marks	AOs
(a)	$(2+ax)^8$ Attempts the term in $x^5 = {}^8C_5 2^3 (ax)^5 = 448a^5 x^5$	M1 A1	1.1a 1.1b
	Sets $448a^5 = 3402 \Rightarrow a^5 = \frac{243}{32}$	M1	1.1b
	$\Rightarrow a = \frac{3}{2}$	A1	1.1b
		(4)	
(b)	Attempts either term. So allow for 2^8 or ${}^8C_4 2^4 a^4$	M1	1.1b
	Attempts the sum of both terms $2^8 + {}^8C_4 2^4 a^4$	dM1	2.1
	$= 256 + 5670 = 5926$	A1	1.1b
		(3)	
(7 marks)			
Notes			
(a)			
M1: An attempt at selecting the correct term of the binomial expansion. If all terms are given then the correct term must be used. Allow with a missing bracket ${}^8C_5 2^3 ax^5$ and left without the binomial coefficient expanded			
A1: $448a^5 x^5$ Allow unsimplified but 8C_5 must be "numerical"			
M1: Sets their $448a^5 = 3402$ and proceeds to $\Rightarrow a^k = \dots$ where $k \in \mathbb{N}$ $k \neq 1$			
A1: Correct work leading to $a = \frac{3}{2}$			
(b)			
M1: Finds either term required. So allow for 2^8 or ${}^8C_4 2^4 a^4$ (even allowing with a)			
dM1: Attempts the sum of both terms $2^8 + {}^8C_4 2^4 a^4$			
A1: cso 5926			