Year 11 Mathematics Extension 1

Topic: The Binomial Theorem (2 of 2)
Review Questions: Mixed one-off exam questions
Term 3, 2026

How to use this set

These are real past-paper questions on the binomial theorem that do not fit any one recurring pattern: genuine one-offs. They are here so you also meet the rarer, less predictable exam questions. Work through them once you are solid on the patterns in the main review docs. Every question you get wrong or struggle with goes in your **Mistakes Log**.

Mixed one-off exam questions

Q1 2022 Sydney Girls Trial Q10 · **1 mark**

Given that x and y are both prime numbers and integers larger than 1, how many terms of the binomial expansion $\left(\sqrt{x}+\sqrt[5]{y}\right)^{301}$ will be rational?

(A) 151

(B) 60

(C) 31

(D) 30

Q2 2020 Sydney Girls Prelim Q4(d) · **2 marks**

Suppose that x is a real number and that n is a positive integer. Show that

$$\cos^n 2x = \binom{n}{0}\cos^{2n} x - \binom{n}{1}\cos^{2n-2} x \sin^2 x + \binom{n}{2}\cos^{2n-4} x \sin^4 x - \cdots + (-1)^n \sin^{2n} x.$$

Q3 2020 HSC Q14(a) · **8 marks**

(i) Use the identity $(1+x)^{2n} = (1+x)^n(1+x)^n$ to show that

$$\binom{2n}{n} = \binom{n}{0}^2 + \binom{n}{1}^2 + \cdots + \binom{n}{n}^2,$$

where n is a positive integer. **(2 marks)**

(ii) A club has $2n$ members, with n women and n men. A group consisting of an even number $(0, 2, 4, \ldots, 2n)$ of members is chosen, with the number of men equal to the number of women. Show, giving reasons, that the number of ways to do this is $\binom{2n}{n}$. **(2 marks)**

(iii) From the group chosen in part (ii), one of the men and one of the women are selected as leaders. Show, giving reasons, that the number of ways to choose the even number of people and then the leaders is

$$1^2\binom{n}{1}^2 + 2^2\binom{n}{2}^2 + \cdots + n^2\binom{n}{n}^2.$$

(2 marks)

(iv) The process is now reversed so that the leaders, one man and one woman, are chosen first. The rest of the group is then selected, still made up of an equal number of women and men. By considering this reversed process and using part (ii), find a simple expression for the sum in part (iii). **(2 marks)**

Q4 2023 Normanhurst Boys Trial Q10 · **1 mark**

Consider the expansion of

$$\left(1 + x + x^2 + \cdots + x^n\right)\left(1 + 2x + 3x^2 + \cdots + (n+1)x^n\right).$$

What is the coefficient of x^n when $n = 50$?

(A) 1225

(B) 1300

(C) 1326

(D) 1431

Q5 2025 Sydney Boys Trial Q10 · **1 mark**

What is the coefficient of x^{293} in the expansion of $(x-1)(x^2-2)(x^3-3)\cdots(x^{24}-24)$?

(A) -7

(B) 13

(C) 20

(D) 28