

Binomial and Multinomial Theorems

Printable teaching and practice sheet

Module 1 | Student Book pages 4-9 | Suggested time: 50 minutes | 20 marks



Name: _____ Class: _____ Date: _____

Learning goals

- Explain and apply binomial coefficient with valid conditions and clear reasoning.
- Explain and apply general binomial term with valid conditions and clear reasoning.
- Explain and apply multinomial coefficient with valid conditions and clear reasoning.

Quick reference

Binomial coefficient	The number $C(n,r)$ counts selections and gives the coefficient pattern in a binomial expansion.
General binomial term	A term in $(a+b)^n$ has the form $C(n,r)a^{(n-r)}b^r$.
Multinomial coefficient	For powers p,q,r with $p+q+r=n$, the coefficient is $n!/(p!q!r!)$.

Worked example

Find the coefficient of x^3 in $(x + 4)^4$. Worked solution: The selected term is $C(4,3) \cdot x^3 \cdot 4^1$; therefore the coefficient is $C(4,3) \cdot 4^1 = 16$.

Graduated practice

Answer without viewing the key. Show complete working for short-response questions.

1. Find the coefficient of x^3 in $(x + 4)^4$. [1 marks]

- | | |
|--------|-------|
| A) 256 | B) 20 |
| C) 16 | D) 12 |

2. Find the coefficient of x^2 in $(x + 4)^5$. [1 marks]

- | | |
|--------|--------|
| A) 640 | B) 160 |
| C) 644 | D) 636 |

3. Find the coefficient of x^1 in $(x + 2)^6$. [1 marks]

- | | |
|--------|--------|
| A) 12 | B) 194 |
| C) 192 | D) 190 |

4. Find the coefficient of x^3 in $(x + 2)^5$. [1 marks]

- | | |
|-------|-------|
| A) 40 | B) 80 |
| C) 42 | D) 38 |

5. Find the coefficient of x^1 in $(x + 2)^8$. [1 marks]

- | | |
|---------|---------|
| A) 16 | B) 1026 |
| C) 1024 | D) 1022 |

6. Find the coefficient of x^1 in $(x + 3)^8$. [1 marks]

- | | |
|----------|----------|
| A) 17496 | B) 24 |
| C) 17499 | D) 17493 |

7. True or false: The number $C(n,r)$ counts selections and gives the coefficient pattern in a binomial expansion. [1 marks]

☐ True ☐ False

8. True or false: Both exponents in a selected term are equal to r . [1 marks]

☐ True ☐ False

9. Find the coefficient of x^3 in $(x + 2)^7$. Show a complete method. [3 marks]

10. Find the coefficient of x^3 in $(x + 4)^6$. Show a complete method. [3 marks]

11. Find the coefficient of x^3 in $(x + 5)^4$. Show a complete method. [3 marks]

12. Find the coefficient of x^2 in $(x + 5)^5$. Show a complete method. [3 marks]

Challenge and review

1. Write a general rule for the coefficient of x^k in $(x+a)^n$ and define every symbol.
2. Create your own sum-of-coefficients problem and solve it in two ways.
3. Error analysis: a student wrote $C(7,2)=7^2$. Explain the error and give the correct value.

Follow-up plan

Below 14/20: revisit the general term and binomial coefficient, then retry Questions 1-4 and 9. At 14 or above: continue to the online module challenge.