

# IB Math SL Complete Revision

## Session 1

Learn Tuition Centre

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## 1 Binomial Theorem

### 1.1 Things to Remember

- To find a given term of a binomial expansion, first write the general term, then pick out the  $x$  terms and equate the power of the  $x$  terms to the power of the required term.
- Do not expand binomial expressions for large powers of  $x$  (say beyond 6) in the exam unless specifically mentioned. Use a different method to solve.

### 1.2 Formula Booklet Reference

1. Binomial coefficient

$$\binom{n}{r} = \frac{n!}{r!(n-r)!}$$

2. Binomial theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \dots + \binom{n}{r}a^{n-r}b^r + \dots + b^n$$

### 1.3 Simplify Binomial Coefficients



Expand and simplify.

1.  $\binom{n}{2}$

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

2.  $\frac{(n+2)!}{n!}$

4.  $\frac{(2n-1)!}{(2n+1)!}$

5.  $\frac{(2n+2)!}{(2n)!}$

6.  $\frac{(p-2)!p!}{(p-1)!(p-4)!}$

7.  $\frac{10! 3!}{4! 6!}$

8.  $\frac{(4-2)!(9+1)!}{(9-2)!(4+1)!}$

9.  ${}^n C_4$

10.  ${}^{n+1} C_{n-1}$



11. Given that  $\binom{n}{2} = 15$  and  $n > 0$  find the value of  $n$ .

12. Given that  $n > 0$  and that  $\binom{2n}{2} = \binom{4}{2} + \binom{3n}{1}$  find the value of  $n$ .

#### 1.4 Expand and Simplify Binomial Expressions



Expand and simplify.

1.  $(2x - 1)^5$

2.  $\left(\frac{2}{x} - 2x\right)^3$

3.  $\left(x^2 - \frac{1}{x}\right)^4$

4.  $(p^2 + p + 1)^3$

5.  $\left(m^2n - \frac{m}{n}\right)^3$

6.  $(\sqrt{x} - 2\sqrt{2})^4$

### 1.5 Evaluate Binomial Expressions



Evaluate the following expressions using binomial expansion.

1.  $(2 + \sqrt{2})^4$

2.  $(2\sqrt{3} - 3\sqrt{2})^3$

3.  $(2.01)^4$

$$4. \frac{(10.1)^5}{100 + 2 + 0.01}$$

### 1.6 Find the General Term ( $(n + 1)^{th}$ term) of a Binomial Expansion



Write the general term of the following expansions.

1.  $(3p - 2q)^8$

2.  $\left(5x - \frac{x}{5}\right)^5$

2.  $(x^2 - x^3)^6$

2.  $\left(\frac{1}{2x} + 2x\right)^4$

### 1.7 Find the Given Term or Coefficient of a Term in a Binomial Expansion



1. Find the 6th term of the expansion  $(2x - 1)^{10}$ .

2. Find the 10th term of the expansion  $\left(\frac{x}{2} - \frac{2}{x}\right)^{20}$

3. Find the constant term of the expansion  $\left(x - \frac{2}{x}\right)^{12}$ .

4. Find the coefficient of the  $p^5$  term of the expansion  $\left(p + \frac{2}{p^3}\right)^{13}$ .

5. Find the coefficient of the  $x^{-3}$  term in the expansion  $(x - 1)^3 \left( \frac{1}{x} + x \right)^6$ .

6. Find the  $x^2$  term in the expansion  $\left( 2x - \frac{1}{x} \right)^6 \left( \frac{1}{2x} + x \right)^6$ .



7. Find the term independent of  $x$  in the expansion  $(x^2 + 1)\left(\frac{1}{x} + \frac{1}{x^2}\right)^3$

8. Find the constant term the expansion  $\left(e^x + \frac{1}{e^x}\right)^3 \left(e^x - \frac{1}{e^{2x}}\right)^3$ .

## 1.8 Find an Unknown Variable Given Partial Information About the Expansion



1. In the expansion  $(1 - kx)^n$  the second term is  $-12x$  and third term is  $60x^2$ . Find the values of  $k$  and  $n$ .

2. The first two terms of the binomial expansion is given below. Find the values of  $a$  and  $b$ .

$$(a - b)^5 = e^{5x} - 10e^{4x} + \dots$$

3. In the following expansion find the values of  $m$  and  $n$  given that  $m$  and  $n$  are positive integers.

$$(1 - mx)(2 - nx)^3 = 8 - 52x + 126x^2 - \dots$$

4. In the expansion of  $(x + a)^3(x - b)^6$  the coefficient of  $x^7$  is -9 and there is no  $x^8$  term. Find the possible values of  $a$  and  $b$ .

5. In the expansion  $\left(x + \frac{a}{x}\right)^3 \left(x - \frac{a}{x}\right)^3$  the coefficient of  $x^2$  term is -48. Given that  $a > 0$  find the value of  $a$ .

6. In the expansion of  $(2 - 3x)^n$  the coefficient of  $x^7$  is 314928. Find  $n$ .