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STEM SMART Single Maths 27 - Binomial Expansion - Natural n

Binomial Expansion - Natural n

A-level Maths Topic Summaries - Series

Subject & topics: Maths | Algebra | Series **Stage & difficulty:** A Level P1

Fill in the blanks below to complete the notes on binomial expansion for integer powers of n.

The binomial theorem is used to expand brackets of the form $(a+b)^n$. For integer powers of n,

$$(a+b)^n = \binom{n}{0}\square + \binom{n}{1}\square\, b + \binom{n}{2} a^{n-2}\square + \ldots + \binom{n}{n-1} a\square + \binom{n}{n} b^n$$

The $\binom{n}{r}$ brackets are the numbers in $\square$ triangle. It is useful to know that

- $\binom{n}{0} = \binom{n}{n} = \square$
- $\binom{n}{1} = \binom{n}{n-1} = \square$

Items:

1 a a^{n-1} a^n b^2 b^{n-1} n **Pascal's**

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Expand and Simplify Binomials

Pre-Uni Maths for Sciences C1.1

Subject & topics: Maths | Algebra | Series **Stage & difficulty:** A Level P1

Part A

$(x+1)^4$

Expand and simplify $(x+1)^4$.

The following symbols may be useful: x

Part B

$(z+2a)^3$

Expand and simplify $(z+2a)^3$.

The following symbols may be useful: a, z

Part C

$(a-b)^5$

Expand and simplify $(a-b)^5$.

The following symbols may be useful: a, b

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Binomial Expansion 3

Pre-Uni Maths for Sciences C1.7

Subject & topics: Maths | Algebra | Series **Stage & difficulty:** A Level C1

Expand $(3-a)^4$ in ascending powers of a up to and including the term in a^3. Hence, without using a calculator, evaluate $(2.9)^4$ correct to 2 decimal places

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Binomial Expansion 7

Subject & topics: Maths | Algebra | Series **Stage & difficulty:** A Level P2

Use binomial expansion to expand and simplify the expression $\left(ax^2 + \frac{2}{x}\right)^5$.

The following symbols may be useful: x

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Find Coefficients 1

Pre-Uni Maths for Sciences C1.2

Subject & topics: Maths | Algebra | Series **Stage & difficulty:** A Level P1

Find the coefficient of x^3 in the expansion of:

Part A

$(x-10)^5$

$(x-10)^5$

Part B

$(2x-\frac{1}{2})^6$

$\left(2x-\frac{1}{2}\right)^6$

Part C

$(x-y)^{10}$

$(x-y)^{10}$

The following symbols may be useful: `x, y`

Part D

$(x - \frac{1}{x})^7$

$$\left(x - \frac{1}{x}\right)^7$$

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Find Coefficients 2

Pre-Uni Maths for Sciences C1.3

Subject & topics: Maths | Algebra | Series **Stage & difficulty:** A Level P1

Without expanding the binomials, find:

Part A

Coefficient of x^4y^6

The coefficient of x^4y^6 in the expansion of$(x^2+3y^2)^5$.

Part B

Coefficient of x^{20}

The coefficient of x^{20} in the expansion of $(x^2+3x)^{12}$.

Part C

The coefficient of ab^7

The coefficient of ab^7 in the expansion of $(a+\frac{1}{4}b)^8$.

Part D

Constant term

The constant term in the expansion of $\left(\frac{x^2}{2} - \frac{8}{x}\right)^9$.

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Group and Expand

Pre-Uni Maths for Sciences C1.5

Subject & topics: Maths | Algebra | Series **Stage & difficulty:** A Level P1

Expand $(1-2x+3x^2)^7$ in ascending powers of x as far as x^3.

The following symbols may be useful: x

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Binomial Theorem Applied to Variable Acceleration

Subject & topics: Maths | Algebra | Series **Stage & difficulty:** A Level P2

The force $F(t)\,\mathrm{N}$ on a particle of mass $4\,\mathrm{kg}$ at time $t\,\mathrm{s}$ is given by

$$F(t) = (\sqrt{t} + 2)^5 - (\sqrt{t} - 2)^5$$

for $t \geq 0$.

At $t = 0$ the particle is at rest at the origin. Find an expression for its displacement from the origin, $x\,\mathrm{m}$, in terms of t.

The following symbols may be useful: `t, x`

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