TT

EXPAND $(a+b)^n$

Binomial coefficient from formula or calc or Pascals Δ

Start $(a)^n$ and decrease powers.

Start $(b)^0$ and increase powers

BINOMIAL COEFFICIENTS

$1, n, \frac{1}{2}n(n-1), \frac{1}{3!}n(n-1)(n-2), \ldots$

$\ldots \frac{1}{6!}\underbrace{n(n-1)(n-2)\ldots(n-5)}_{6 \text{ terms}}$

VALIDITY

- $n \notin \mathbb{N}$ infinite
  expansion $\approx$ original
  true if $-1 < \frac{b}{a} < 1$
- $n \in \mathbb{N}$ finite
  expansion = original
  1st few terms $\approx$ original if $-1 < \frac{b}{a} < 1$

ALGEBRAIC TECHNIQUES

BINOMIAL EXPANSION

1	2	3	4	5

Expand $(3-\frac{1}{2}x)^{-2}$ in ascending powers of x up to the term in x^2

	1	-2	$\frac{1}{2!}(-2)(-3)$	$\frac{1}{3!}(-2)(-3)(-4)$
	$(3)^{-2}$	$(3)^{-3}$	$(-3)^{-4}$	$(3)^{-5}$
	$(-\frac{1}{2}x)^0$	$(-\frac{1}{2}x)^1$	$(-\frac{1}{2}x)^2$	$(-\frac{1}{2}x)^3$

$$(3-\tfrac{1}{2}x)^{-2} \approx (1)(3)^{-2}(-\tfrac{1}{2}x)^0 + (-2)(3)^{-3}(\tfrac{1}{2}x)^1 + \tfrac{1}{2!}(-2)(-3)(-3)^4(-\tfrac{1}{2}x)^2 + \ldots$$

$$= (1)(\tfrac{1}{9})(1) + (-2)(\tfrac{1}{27})(\tfrac{1}{2}x) + \tfrac{1}{2}(-2)(-3)(\tfrac{1}{81})(\tfrac{1}{4}x^2) + \ldots$$

$$= \frac{1}{9} + \frac{1}{27}x + \frac{1}{108}x^2 + \ldots$$

only true if $-1 < \frac{1}{6}x < 1$

$-6 < x < 6$

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