
LATEX TEMPLATE FOR GITHUB

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ABSTRACT. Your abstract here.

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11 1. INTRODUCTION

12 Include some references [1, 2, 3]. Lorem Ipsum is simply dummy text of the printing and
13 typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since
14 the 1500s, when an unknown printer took a galley of type and scrambled it to make a type
15 specimen book. It has survived not only five centuries, but also the leap into electronic

Date: February 5, 2026.

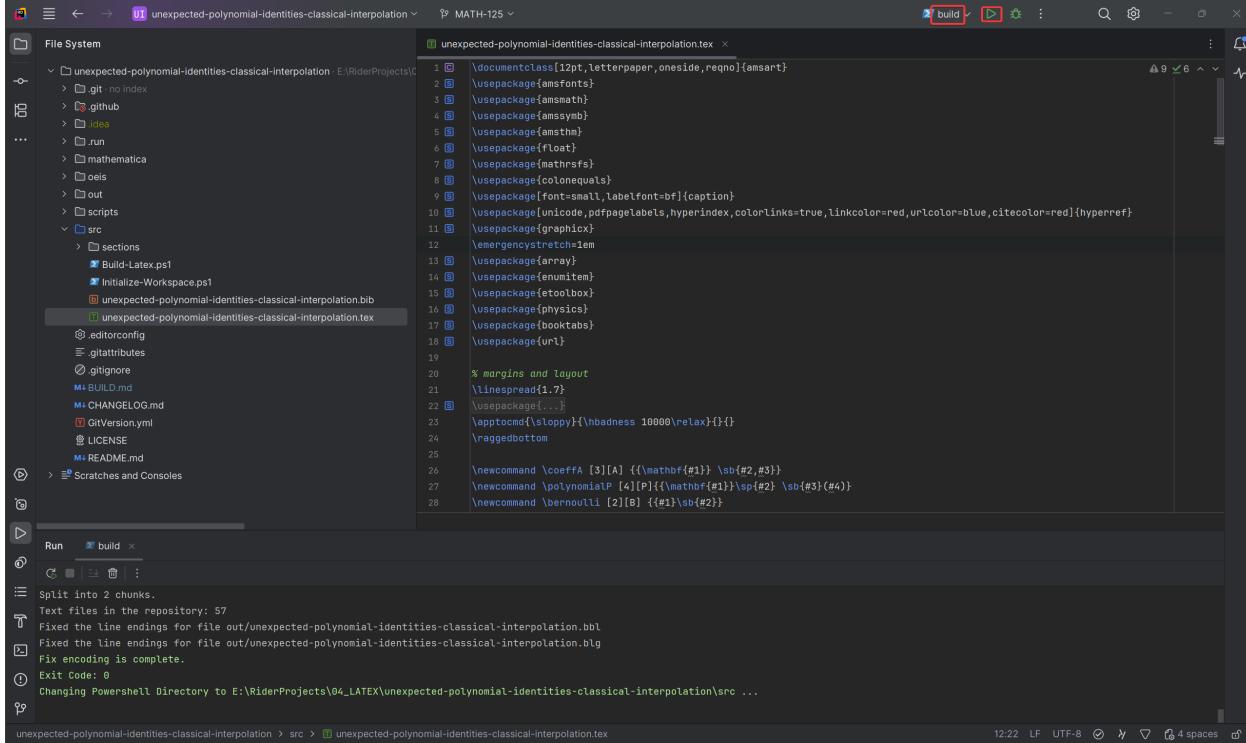
2010 *Mathematics Subject Classification.* 05A19, 05A10, 41A15, 11B68, 11B73, 11B83.

Key words and phrases. Sums of powers, Newton's interpolation formula, Finite differences, Binomial coefficients, Faulhaber's formula, Bernoulli numbers, Bernoulli polynomials Interpolation, Approximation, Discrete convolution, Combinatorics, Polynomial identities, Central factorial numbers, Stirling numbers, Eulerian numbers, Worpitzky identity, Pascal's triangle, OEIS.

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16 typesetting, remaining essentially unchanged. It was popularised in the 1960s with the
 17 release of Letraset sheets containing Lorem Ipsum passages, and more recently with desktop
 18 publishing software like Aldus PageMaker including versions of Lorem Ipsum.

19 Image example



The screenshot shows a LaTeX editor interface with the following details:

- File System:** Shows the project structure with files like `Build-Latex.ps1`, `Initialize-Workspace.ps1`, and `unexpected-polynomial-identities-classical-interpolation.bib`.
- Editor View:** Displays the LaTeX code for `unexpected-polynomial-identities-classical-interpolation.tex`. The code includes document class definitions, package imports (amsfonts, amsmath, amssymb, amsthm, float, mathrsfs, colonequals, hyperref, graphicx, array, enumitem, toolbox, physics, booktabs, url), and various commands for margins, layout, and new commands for coefficients and polynomials.
- Build Log:** Shows the build process with messages like "Text files in the repository: 57", "Fixed the line endings for file out/unexpected-polynomial-identities-classical-interpolation.bbl", "Fixed the line endings for file out/unexpected-polynomial-identities-classical-interpolation.blg", "Fix encoding is complete.", "Exit Code: 0", and "Changing PowerShell Directory to E:\RiderProjects\04_LATEX\unexpected-polynomial-identities-classical-interpolation\src ...".
- Bottom Status Bar:** Shows the current time (12:22), file type (LF), encoding (UTF-8), and other status indicators.

Figure 1. Image example (from caption).

m/r	0	1	2	3	4	5	6	7
0	1							
1	1	6						
2	1	0	30					
3	1	-14	0	140				
4	1	-120	0	0	630			
5	1	-1386	660	0	0	2772		
6	1	-21840	18018	0	0	0	12012	
7	1	-450054	491400	-60060	0	0	0	51480

Table 1. Coefficients $\mathbf{A}_{m,r}$. See OEIS sequences [4, 5].

$$\begin{array}{c} \left[\begin{array}{c} a \\ b \end{array} \right]_m \\ \left[\begin{array}{c} a \\ b \end{array} \right]_m \end{array}$$

21 And for any natural m we have polynomial identity

$$x^m = \sum_{k=1}^m T(m, k) x^{[k]} \quad (1)$$

22 where $x^{[k]}$ denotes central factorial defined by

$$x^{[n]} = x \left(x + \frac{n}{2} - 1 \right)_{n-1}$$

23 where $(n)_k = n(n-1)(n-2) \cdots (n-k+1)$ denotes falling factorial in Knuth's notation. In
24 particular,

$$x^{[n]} = x \left(x + \frac{n}{2} - 1 \right) \left(x + \frac{n}{2} - 1 \right) \cdots \left(x + \frac{n}{2} - n - 1 \right) = x \prod_{k=1}^{n-1} \left(x + \frac{n}{2} - k \right) \quad (2)$$

25 This is an equation reference (1).

26 Continuing similarly, we are able to derive the formula for multifold sums of powers, which
27 is

28 **Theorem 1.1** (Multifold sums of powers via Newton's series). *For non-negative integers*
29 r, n, m *and an arbitrary integer t*

$$\Sigma^r n^m = \sum_{j=0}^m \Delta^j t^m \left[\left(\sum_{s=1}^r (-1)^{j+s-1} \binom{j+t-1}{j+s} \Sigma^{r-s} n^0 \right) + \binom{n-t+r}{j+r} \right]$$

30 *Proof.* By Newton's series for power and repeated applications of the segmented hockey stick
31 identity. \square

Proposition 1.2 (Falling factorial).

$$(x)_n = x(x-1)(x-2)(x-3) \cdots (x-n+1) = \prod_{k=0}^{n-1} (x-k)$$

Proposition 1.3.

$$\frac{(x)_n}{n!} = \binom{x}{n}$$

32 1.1. Rising factorials.

Proposition 1.4 (Rising factorial).

$$x^{(n)} = x(x+1)(x+2)(x+3)\cdots(x+n-1) = \prod_{k=0}^{n-1}(x+k)$$

Proposition 1.5.

$$\frac{x^{(n)}}{n!} = \binom{x+n-1}{n}$$

33 1.2. Central factorials.

Lemma 1.6 (Central factorial).

$$n^{[k]} = n \left(n + \frac{k}{2} - 1 \right) \left(n + \frac{k}{2} - 2 \right) \cdots \left(n - \frac{k}{2} + 1 \right) = n \prod_{j=1}^{k-1} \left(n + \frac{k}{2} - j \right)$$

Proposition 1.7.

$$n^{[k]} = n \left(n + \frac{k}{2} - 1 \right)_{k-1}$$

1.3. Derivatives.

$$\frac{dx}{dy} = \frac{f(x+h) - f(x)}{h}$$

$$\frac{d^3x}{dy^3} = \frac{f(x+h) - f(x)}{h}$$

34 CONCLUSIONS

35 Conclusions of your manuscript.

36 Here is an itemize list with adjusted margins

37 • Conclusion 1

38 • Conclusion 2

39 • Conclusion 3

40

ACKNOWLEDGEMENTS

41 The author is grateful to [Full Name] for his valuable contribution [contribution] about
42 the fact that [interesting claim].

43

REFERENCES

- 44 [1] Petro Kolosov. Finding the derivative of polynomials via double limit. *GitHub*, 2024.
- 45 [2] Alekseyev, Max. MathOverflow answer 297916/113033. <https://mathoverflow.net/a/297916/113033>,
46 2018.
- 47 [3] Petro Kolosov. The coefficients $U(m, l, k)$, $m = 3$ defined by the polynomial identity. <https://oeis.org/A316387>, 2018.
- 48 [4] Petro Kolosov. Entry A302971 in The On-Line Encyclopedia of Integer Sequences. <https://oeis.org/A302971>, 2018.
- 49 [5] Petro Kolosov. Entry A304042 in The On-Line Encyclopedia of Integer Sequences. <https://oeis.org/A304042>, 2018.

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- 66 • **Sources:** github.com/kolosovpetro/NewtonsFormulaAndSumsOfPowers
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