Here's the explanation of the formulas in English:

1. Chudnovsky Formula:
The Chudnovsky formula is a rapidly converging series used for precise calculations of pi:

1/pi = 12 Sumk=0∞ [(-1)^k (6k)! (545140134k + 13591409)] / [(3k)! (k!)^3 (640320)^(3k + 3/2)]

Key Components:
- (6k)!: The factorial of a large value, which grows extremely fast and is combined with other factors here.
- 545140134k + 13591409: A linear expression that scales with each step.
- (3k)! and (k!)^3: Additional factors in the denominator that slow growth.
- (640320)^(3k + 3/2): A power term that accelerates the convergence of the series.

Properties:
- Very fast convergence: Each additional term increases accuracy by approximately 14 decimal places.
- Often used in world record attempts for pi calculations.

2. BBP Formula (Bailey-Borwein-Plouffe)
The BBP formula allows direct computation of pi at specific positions (e.g., hexadecimal digits) without calculating pri

pi = Sumk=0∞ [1/16^k * (4/(8k+1) - 2/(8k+4) - 1/(8k+5) - 1/(8k+6))]

Key Components:
- 16^k: A scaling factor that makes each iteration exponentially smaller.
- [4/(8k+1), 2/(8k+4), 1/(8k+5), 1/(8k+6)]: Terms defining the digits of pi.

Properties:
- Enables computation of pi directly at specific positions.
- Perfect for validation since it operates independently of the Chudnovsky method.

3. Riemann-Zeta Function
The Riemann-Zeta function is defined as:

zeta(s) = Sumn=1∞ [1/n^s], for s > 1.

Special Values:
- zeta(2): The series for s=2 gives pi^2/6.
- zeta(4): The series for s=4 gives pi^4/90.

Properties:
- Can validate pi^2 or pi^4 computations.
- An independent mathematical approach to verifying results.

4. Karatsuba Multiplication
Karatsuba multiplication is an efficient method for multiplying large numbers. Instead of the classical method (O(n^2))

Formula for two numbers a and b:
a * b = z2 * 10^(2m) + (z1 - z2 - z0) * 10^m + z0,

where:
- z0 = low_a * low_b,
- z1 = (low_a + high_a)(low_b + high_b),
- z2 = high_a * high_b.

Properties:
- Efficient for large numbers.
- Especially useful in the Chudnovsky formula, where terms grow rapidly.

Relationship Between the Formulas:
1. Chudnovsky provides the primary computation of pi.
2. BBP serves as a validation method for specific sections.
3. Riemann-Zeta independently checks pi^2 or pi^4.
4. Karatsuba is used to efficiently multiply large terms in Chudnovsky and BBP calculations.