Number Systems and Counting

1. Natural Numbers = $N = \{1, 2, 3, ...\}$

2. Whole Numbers = $W = \{0, 1, 2, 3, ...\}$

3. Integers = $Z = \{..., -3, -2, -1, 0, 1, 2, 3, ...\}$

4. Rationals = $Q = \{\frac{p}{q} \mid p, q \in Z, q \neq 0\}$

5. Irrationals = $I = \{z \mid z \notin Q\}$

6. Reals = $R = Q \cup I$

Rules:

1. $ab = 0 \Leftrightarrow a = 0 \text{ or } b = 0$

2. $\frac{a}{b} = c \Leftrightarrow a = bc$

3. $1 + 2 + 3 + 4 + ... + n = \frac{n(n+1)}{2}$

4. Pascal's Triangle

5. Fibonacci:

$F_1 = 1, F_2 = 1, F_{n+1} = F_n + F_{n-1}$;

$\varphi_n = \frac{F_n}{F_{n-1}}; \varphi_n \to \varphi = \frac{1+\sqrt{5}}{2} \approx 1.618034; \varphi^2 = \varphi + 1$

$\frac{\varphi + 1}{\varphi} = \varphi$; $\frac{a+b}{a} = \frac{a}{b}$

6. Calculating square roots with the bisection method: $\frac{a+b}{2}$

7. Calculating square roots with the Babylonian method: $x = \frac{n+x}{x+1}$ ($x = \sqrt{n}$)