Sums of Powers of the First n Integers

$$\sum_{k=1}^{n} k = 1 + 2 + 3 + \cdots + n = \frac{n(n+1)}{2}$$

$$\sum_{k=1}^{n} k^2 = 1^2 + 2^2 + 3^2 + \cdots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

$$\sum_{k=1}^{n} k^3 = 1^3 + 2^3 + 3^3 + \cdots + n^3 = \frac{n^2(n+1)^2}{4}$$

$$\sum_{k=1}^{n} k^4 = \frac{n}{30}(n+1)(2n+1)(3n^2+3n-1)$$

$$\sum_{k=1}^{n} k^5 = \frac{n^2}{12}(n+1)^2(2n^2+2n-1)$$

$$\sum_{k=1}^{n} k^6 = \frac{n}{42}(n+1)(2n+1)(3n^4+6n^3-3n+1)$$

$$\sum_{k=1}^{n} k^7 = \frac{n^2}{24}(n+1)^2(3n^4+6n^3-n^2-4n+2)$$

$$\sum_{k=1}^{n} k^8 = \frac{n}{90}(n+1)(2n+1)(5n^6+15n^5+5n^4-15n^3-n^2+9n-3)$$

$$\sum_{k=1}^{n} k^9 = \frac{n^2}{20}(n+1)^2(2n^6+6n^5+n^4-8n^3+n^2+6n-3)$$

$$\sum_{k=1}^{n} k^{10} = \frac{n}{66}(n+1)(2n+1)(3n^8+12n^7+8n^6-18n^5-10n^4+24n^3+2n^2-15n+5)$$