Arithmatic Seqeuqnce

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Let

$$a_n = a_1 + (n-1)d.$$

So the sequence is,

$$a_1, a_1 + d, a_1 + 2d, ..., a_1 + (n-2)d, a_1 + (n-1)d.$$

The summed value of the sequence is,

$$S_n = a_1 + (a_1 + d) + (a_1 + 2d) + ... + [a_1 + (n-2)d] + [a_1 + (n-1)d].$$

Rewrite S_n in an reverse order,

$$S_n = [a_1 + (n-1)d] + [a_1 + (n-2)d] + ... + (a_1 + 2d) + (a_1 + d) + a_1.$$

Taking the sum of the S_n in original order and in reverse order gives,

$$2S_n = [2a_1+(n-1)d]+[2a_1+(n-1)d]+[2a_1+(n-1)d]+...+[2a_1+(n-1)d]+[2a_1+(n-1)d].$$

$$\Leftrightarrow 2S_n = n[2a_1 + (n-1)d].$$

$$\Leftrightarrow S_n = \frac{n[2a_1 + (n-1)d]}{2}.$$

$$\Leftrightarrow S_n = \frac{n}{2}[2a_1 + (n-1)d].$$

$$\Leftrightarrow S_n = \frac{n}{2}[a_1 + a_1 + (n-1)d].$$

$$\Leftrightarrow S_n = \frac{n}{2}[a_1 + a_n].$$

Additional correction – a Polynomial function is:

$$f(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \cdots + a_2x^2 + a_1x^1 + a_0.$$