



Education, Sabaragamuwa Province/

Provincial Education Department Sabaragamuwa

Weekly School Department of Education, Sabaragamuwa

Weekly School Department of Education, Sabaragamuwa Province/

Subject: Mathematics

Week- 34

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Grade: 10

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## 24. Arithmetic Progressions

An arithmetic progression is a sequence of numbers such that a constant value is obtained when any term (other than the first term) is subtracted from the term right after that term.

Example: 9, 11, 13, 15,...

$$11 - 9 = 2$$

This constant value '2' is called the common difference.

$$13 - 11 = 2$$

Since there is a common difference, this sequence of numbers are called the arithmetic progression

$$15 - 13 = 2$$

The  $n^{\text{th}}$  term  $T_n$  of the arithmetic progression with first term  $a$  and common difference  $d$  is given by

$$T_n = a + (n - 1) d$$

The sum  $S_n$  of the first  $n$  terms of an arithmetic progression with first term  $a$  and common difference  $d$  is given by

$$S_n = \frac{n}{2} \{2a + (n - 1)d\}$$

Example:

Find the 11<sup>th</sup> term of the arithmetic progression 10, 15, 20, 25,...

$$a = 10, d = 5, n = 11,$$

$$T_n = a + (n-1)d$$

$$T_{11} = 10 + (11 - 1)5$$

$$= 10 + 10 \times 5$$

$$= 10 + 50$$

$$= 60$$

(1) Find the indicated term of each of the following arithmetic progressions.

(i) 5, 10, 15, 20, ... (12<sup>th</sup> term)

(ii) 10, 13, 16, 19, ... (21<sup>th</sup> term)

(iii) 14, 18, 22, 26, ... (11<sup>th</sup> term)

(iv) 70, 65, 60, 55, ... (15<sup>th</sup> term)

(v) 100, 97, 94, 91, ... (10<sup>th</sup> term)

(vi)  $\frac{1}{2}$ , 1,  $1\frac{1}{2}$ , 2, ... (16<sup>th</sup> term)

Example:

Find the sum of the first 10 terms of the arithmetic progression 5, 10, 15, 20,...

$$a = 5, d = 5, n = 10 \quad s_n = ?$$

$$S_n = \frac{n}{2} \{ 2a + (n-1)d \}$$

$$S_{10} = \frac{10}{2} \{ 2 \times 5 + (10-1)5 \}$$

$$S_{10} = 5 \{ 10 + 9 \times 5 \}$$

$$S_{10} = 5 \{ 10 + 45 \}$$

$$S_{10} = 5 \times 55$$

$$S_{10} = 275$$

(3) Find the sum of the indicated number of terms in each of the following progressions

(i) 10, 20, 30, 40, ... first 20 terms

(ii) 9, 11, 13, 15, ... first 10 terms

(iii) 10, 13, 16, 19, ... first 15 terms

(iv) 16, 20, 24, 28, ... first 12 terms

(v) 50, 45, 40, 35, ... first 10 terms

(vi) 12, 8, 4, 0, ... first 12 terms

(vii) -2, -4, -6, -8, ... first 13 terms

(viii)  $\frac{1}{3}$ ,  $\frac{2}{3}$ , 1,  $1\frac{1}{3}$ , ... first 10 terms

Example:

Find which term is 27 in the arithmetic progression 1, 3, 5, 7, ...

$$a = 1, d = 2, T_n = 27 \quad n = ?$$

$$T_n = a + (n-1)d$$

$$27 = 1 + (n-1)2$$

$$27 = 1 + 2n - 2$$

$$27 = 2n - 1$$

$$27 + 1 = 2n$$

$$28 = 2n$$

$$14 = n$$

27 is the 14<sup>th</sup> term

(2) For each of the following situations, find the number of terms (n) of the relevant arithmetic progression.

(i) 5, 10, 15, 20, ...  $T_n = 50$

(ii) 13, 15, 17, 19, ...  $T_n = 41$

(iii) 10, 20, 30, 40, ...  $T_n = 510$

(iv) 18, 20, 22, 24, ...  $T_n = 60$

(v) 30, 28, 26, 24, ...  $T_n = 0$

(vi) 30, 25, 20, 15, ...  $T_n = -15$

(vii) 0.3, 0.6, 0.9, 1.2, ...  $T_n = 3$

(viii) -3, -6, -9, -12, ...  $T_n = -45$