Def A sequence is an order list of numbers

$a_1, a_2, a_3, a_4, \ldots, a_n, \ldots$

where

a_1 : 1^{st} term

a_2 : 2^{nd} term

a_3 : 3^{rd} term

⋮

a_n : n^{th} term

Exp Write the first four terms of the sequence $a_n = \frac{(-1)^n}{2n}$, $n = 1, 2, \ldots$

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n^{th} term

1^{st} term is $a_1 = \frac{(-1)^1}{2(1)} = \frac{-1}{2}$

2^{nd} term is $a_2 = \frac{(-1)^2}{2(2)} = \frac{1}{4}$

3^{rd} term is $a_3 = \frac{(-1)^3}{2(3)} = \frac{-1}{6}$

4^{th} ... (4)

4th term is $a_{[4]} = \frac{(-1)^{[4]}}{2^{[4]}} = \frac{1}{8}$

Def A sequence is called arithmetic if the difference between any two successive terms is fixed $\underline{d}$

$$a_n - a_{n-1} = d$$ → common difference

for all $n = 2, 3, 4 \ldots$

Exp Which of the following sequences arithmetic?!

(1) 1, 3, 5, 7, ---

$3-1 = 2$
$5-3 = 2$
$7-5 = 2$
→ $d=2$

Yes its arithmetic with $d = 2$

(2) $10, 8, 4, 2, 1, \cdots$

$8 - 10 = -2$

$4 - 8 = -4$

no it is not arithmetic

(3) $\frac{1}{2}, \frac{5}{6}, \frac{7}{6}, \cdots$

$\frac{5}{6} - \frac{1 \times 3}{2 \times 3} = \frac{5}{6} - \frac{3}{6} = \frac{5-3}{6} = \frac{2}{6}$

$\frac{7}{6} - \frac{5}{6} = \frac{7-5}{6} = \frac{2}{6}$

Yes it is arithmetic with $d = \frac{2}{6} = \frac{1}{3}$

Def The n^{th} term of any arithmetic sequence is

$$a_n = a_1 + (n-1)\,d$$

a_1: 1st term

d: common difference

Exp Find the 11^{th} term in the following arithmetic sequences

① 1, 3, 5, 7, ...

a_1

1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, ...

1 2 3 4 5 6 7 8 9 10 11

a_1 n

Find 11^{th}

$d = 3 - 1 = 2$

$n = 11$

$a_1 = 1$

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

$a_{11} = a_1 + (11-1)d$

$= 1 + 10 \cdot 2$

$= 1 + 20$

$= 21$

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$a_{11} = 1 + 10 \cdot 2$

$= 11 \cdot 2$

$= 22$

② $\frac{1}{2}, \frac{5}{6}, \frac{7}{6}, \ldots$

a_1 , $d = \frac{7}{6} - \frac{5}{6} = \frac{2}{6} = \frac{1}{3}$, $n = 11$

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

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

$$a_{11} = a_1 + (11-1)d$$

$$= \frac{1}{2} + 10 \cdot \frac{1}{3}$$

$$= \frac{1}{2}\overset{\times 3}{} + \frac{10}{3}\overset{\times 2}{}$$

$$= \frac{3}{6} + \frac{20}{6}$$

$$= \frac{23}{6}$$

Exp IF the first term of an arithmetic sequence is 4 and the 9^{th} term is 20.

Find the 75^{th} term.

$a_1 = 4$, $a_9 = 20$, Find a_{75}

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

$a_9 = a_1 + (9-1)d$

$20 = 4 + 8d$

$-4 \quad -4$

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

$a_{75} = a_1 + (75-1)d$

$= 4 + 74d$??

$= 4 + 74.2$

$20 - 4 = 16$, $-4 - 4 = -8$

$\frac{16}{8} = \frac{8d}{8}$

$2 = d$

$= 4 + 74.2$

$= 4 + 148$

$= 152$

Def The **Sum of the first n** terms of an arithmetic sequence is

$$S_n = \frac{n}{2}\left[a_1 + a_n\right]$$

a_1: 1st term

a_n: n^{th} term $\Rightarrow$ $a_n = a_1 + (n-1)d$

Exp Find the **sum of the first 10** terms of the arithmetic sequence whose first term is 2 and it's common difference 4

Find S_{10}

$$S_n = \frac{n}{2}\left[a_1 + a_n\right]$$

$n = 10$

$a_1 = 2$

$d = 4$

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

S_n ... $2L$ ... $)$

$$S_{10} = \frac{10}{2}\left[a_1 + a_{10}\right]$$

$$= 5\left[2 + 38\right]$$

$$= 5 \cdot 40$$

$$= 200$$

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

$$a_{10} = 2 + (10-1)4$$

$$= 2 + 9 \cdot 4$$

$$= 2 + 36$$

$$= 38$$

$a_1 = 2$, $d = 4$

$18 - 14 = 4$ $\quad$ $30 - 26 = 4$

2, 6, 10, 14, 18, 22, 26, 30, 34, 38, ...

1 2 3 4 5 6 7 8 9 10

$2 + 6 + 10 + 14 + 18 + 22 + 26 + 30 + 34 + 38 = 200$

Exp Find the sum of the first 51 terms for the arithmetic sequence:

$-10, -6, -2, \cdots$

Find S_{51}

$$S_n = \frac{n}{2}\left[a_1 + a_n\right]$$

$a_1 = -10$

$d = -2 - -6$

Find S_{51}

$n = 51$

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

$S_{51} = \frac{51}{2}[-10 + a_{51}]$

$= \frac{51}{2}[-10 + 190]$

$= \frac{51}{2}[180]^{90}$

$= 4590$

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

$a_{51} = a_1 + (51-1)d$

$= -10 + 50 \cdot 4$

$= -10 + 200$

$a_{51} = 190$

$d = -2 - -6$

$= -2 + 6$

$= 4$

$d = -6 - -10$

$= -6 + 10$

$= 4$