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Types of Progressions.
- → Arithmetic Progression
- → Geometric Progression.
- → Harmonic Progression.

Fibonacci Numbers.

1
1, 1
1, 1, 2
1, 1, 2, 3
1, 1, 2, 3, 5
1, 1, 2, 3, 5, 8
1, 1, 2, 3, 5, 8, 13.

a_1 = first term.	$a_1 = 1^2 = 1$
a_2 = second term.	$a_2 = 2^2 = 4$
a_3 = third term.	$a_3 = 3^2 = 9.$
a_n = n^{th} term.	
$a_n = n^2$ than	Ap = 1, 4, 9, 16 . . .

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$S_n \rightarrow 1 + 2 + 3 + \dots + 19 + 20$

$= 21 \times 10 = 210.$

$S_n \rightarrow 1 + 2 + 3 \dots + 49 + 50$

$= 51 \times 25 = 1275.$

$S_n \rightarrow 1 + 2 + 3 \dots + 100$

$= 101 \times 50 = 5050$

Arithmetic Progression.

An arithemetic progression is a sequence of numbers such that the difference d between each consecutive term is a constant.

$a, a+d, a+2d, a+3d \dots$

The n^{th} term, $T_n = a + (n-1)d.$

Sum of first n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

$= \frac{n}{2}[a + l]$

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AP - $T_3 = 11$
$T_6 = 23$

find $T_9 = ?$
$T_1 = ?$
$T_{15} = ?$

12 12 12 12

3 _ _ 6 _ _ 9 - - 12 _ _ 15

$T_9 = 23 + 12$
$= 35$

$T_1 = 11 - 8$
$= 3$

$T_{15} = 35 + 24$
$= 59.$

DPP-1

Q.1) Write the first five terms of each of the sequences in Exercise whose n^{th} terms are:

$$a_n = \frac{n}{n+1}.$$

Ans $a_{(1)} = \frac{1}{1+1} = \frac{1}{2}.$

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$$a_2 = \frac{2}{2+1} = \frac{2}{3}$$

$$a_3 = \frac{3}{3+1} = \frac{3}{4}$$

$$a_4 = \frac{4}{4+1} = \frac{4}{5}$$

$$a_5 = \frac{5}{5+1} = \frac{5}{6}$$

Ap = $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6} \ldots$

Q2) Write the first five terms of each of the sequences in exercise whose n^{th} terms are :-
$a_n = 2^n$

Ans. $a_1 = 2^1 = 2$

$a_2 = 2^2 = 4$

$a_3 = 2^3 = 8$

$a_4 = 2^4 = 16$

$a_5 = 2^5 = 32$

Ap = 2, 4, 8, 16, 32 ...

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Q3) Write the first five terms of each of the sequences whose n^{th} terms are as following:-

$a_n = 2n^2 - n + 1.$

Ans. $A_1 = 2(1)^2 - (1) + 1$

$= 2$

$a_2 = 2(2)^2 - 2 + 1$
$= 7$

$a_3 = 2(3)^2 - 3 + 1$
$= 16$

$a_4 = 2(4)^2 - 4 + 1$
$= 29$

$a_5 = 2(5)^2 - 5 + 1$
$= 46$

Ap = 2, 7, 16, 29, 46 . . .

Q4) Write the first five terms of each of the sequences in exercise whose n^{th} term are:-
$a_n = n^{th}$ prime number.

Ans. Prime numbers = 2, 3, 5, 7, ~~12~~ 11, 13 . . . .

~~So~~, $a_n = n^{th}$ prime number.

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$a_1 =$ 1st Prime number
$= 2$

$a_2 =$ 2nd prime number
$= 3$

$a_3 =$ 3rd prime number.
$= 5$

$a_4 =$ 4th prime number.
$= 7$

$a_5 =$ 5th prime number.
$= 11$

Ap $= 1, 3, 5, 7, 11, \ldots$

Q-5) Write the first five terms of each of the sequences in exercise whose nth terms are as following :-
$a_n = 3n + 1$.

Ans. $a_1 = 3(1) + 1 = 4$
$a_2 = 3(2) + 1 = 7$
$a_3 = 3(3) + 1 = 10$
$a_4 = 3(4) + 1 = 13$
$a_5 = 3(5) + 1 = 16$.

Ap $= 4, 7, 10, 13, 16 \ldots$

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Q6) Find the Indicated terms in each of the sequences whose n^{th} terms ~~are~~ is given:-

$$a_n = (n-1)(n+2)(n-3), \ a_{10}$$

Ans $a_{10} = (10-1)(10+2)(10-3)$
$= (9)(12)(7)$
$= (108)(7)$
$= 756$

So, $a_{10} = 756$.

Q7) Find the Indicated terms in each of the sequences whose n^{th} term is given:-

$$a_n = \frac{n^2}{2^n}; \ a_7.$$

Ans. $a_7 = \frac{(7)^2}{2^7}$

$= \frac{49}{128}$

So, $a_7 = \frac{49}{128}$.

Q14) If 3rd and 10th terms of an A.P, be 9 and 21 Respectively then the sum of its first 12 terms is ____
(A) 180 (B) 360 (C) 150 (D) 210.

Ans. $a_3 = 9$ and $a_{10} = 21$

So, $a + 2d = 9$ —— ①
$a + 9d = 21$ —— ②
$-\quad -\quad -$

$-7d = -12$

$d = \frac{12}{7}$

Putting value of d in eq-① we get:-

$\therefore a + 2\left(\frac{12}{7}\right) = 9$

$\therefore a = 9 - \frac{24}{7}$

$\therefore a = \frac{63-24}{7} = \frac{39}{7}$

$S_{12} = \frac{12}{2}\left[2\left(\frac{39}{7}\right) + 11\left(\frac{12}{7}\right)\right]$

$= 6\left[\frac{78}{7} + \frac{132}{7}\right]$

$= 6 \times \frac{1}{7}(78 + 132)$

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$$= \frac{6}{7}(210)$$

$$= 180$$

So, S_{12} = (A) 180.

Q-16> If 9 times the 9^{th} term of an AP is equal to 13 times the 13^{th} term, then the 22nd term of the AP is.
(A) 0 (B) 22 (C) 198 (D) 220.

Ans. So, $9(a_9) = 13(a_{13})$

$\therefore 9(a+8d) = 13(a+12d)$

$\therefore 9a + 72d = 13a + 156d$

$\therefore 9a - 13a = 156d - 72d$

$\therefore -4a = 84d$

$\therefore a = -\frac{84}{4}d = -21d$

$a_{22} = a + (22-1)d = a + 21d$

$a_{22} = -21d + 21d = 0$

So, T_{22} = (A) 0.

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Q28) If the n^{th} term of an A.P. 9, 7, 5 ... is equal to the n^{th} term of an AP. 15, 12, 9 ... then find n.

Ans

First Ap	Second Ap
$Ap = 9, 7, 5 \ldots$	$Ap = 15, 12, 9 \ldots$
$a = 9$	$a = 15$
$d = -2$	$d = -3$
$\therefore a_n = 9 + (n-1)-2$	$\therefore A_n = 15 + (n-1)-3$
$= 9 + 2 - 2n$	$= 15 - 3n + 3$
$= 11 - 2n$ — ①	$= 18 - 3n$ — ②

So $A_n = a_n$ (By comparing eq-① and eq-②)

$\therefore 18 - 3n = 11 - 2n$

$\therefore -2n + 3n = 18 - 11$

$\therefore n = 7.$

Q.8) Write the first five terms of the sequences in obtain the corresponding series:-
$a_1 = 3, \quad a_n = 3a_{n-1}, \quad \forall \; n > 1.$

Ans.) $a_1 = 3$

$a_n = 3a_{n-1}$

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Sol. $a_1 = 3$

$a_2 = 3a_{n-1} = 3a_1 = 9$

$a_3 = 3a_2 = 3\times9 = 27$

$a_4 = 3a_3 = 3\times27 = 81$

$a_5 = 3a_4 = 3\times81 = 243.$

Q-10) The fibonacci sequence is defined by $1 = a_1 = a_2$ and $a_n = a_{n-1} + a_{n-2}$, $n > 2$ find $\frac{a_{n+1}}{a_n}$.

Ans. $a_1 = a_2 = 1.$

and $a_n = a_{n-1} + a_{n-2}.$

$a_3 = a_{3-1} + a_{3-2}$

$= a_2 + a_1$

$= 1 + 1 = 2.$

$a_4 = a_{4-1} + a_{4-2}$

$= a_3 + a_2$

$= 2 + 1 = 3.$

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$a_5 = a_4 + a_3 = 3+2 = 5.$

To find. $\frac{a_{n+1}}{a_n}$

$\rightarrow \frac{a_{1+1}}{a_1} = \frac{a_2}{a_1} = \frac{1}{1}$

$\rightarrow \frac{a_{2+1}}{a_2} = \frac{a_3}{2} = \frac{2}{1}$

$\rightarrow \frac{a_{3+1}}{a_3} = \frac{a_4}{a_3} = \frac{3}{2}.$

$\rightarrow \frac{a_{4+1}}{a_4} = \frac{a_5}{a_4} = \frac{5}{3}.$

Q-9> Write the first five terms of the sequences in obtain the corresponding series :-

$a_1 = a_2 = 1, \quad a_n = a_{n-1} + a_{n-2}, \quad n > 2.$

Ans. $A_1 = A_2 = 1.$

$a_n = a_{n-1} + a_{n-2}$

$a_3 = a_{3-1} + a_{3-2} = a_2 + a_1 = 2.$

$a_4 = a_3 + a_2 = 2+1 = 3$

$a_5 = a_4 + a_3 = 3+2 = 5.$

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→ $T_5 = 10$
$T_{10} = 5$
find $T_{15} = ?$ and $T_1 = ?$

Ans
$$a + 4d = 10$$
$$a + 9d = 5$$
$$- \quad - \quad -$$
$$-5d = 5$$
$$\boxed{d = -1}$$

$$a + 4(-1) = 10$$
$$a = 14.$$

so, $T_1 = 14$
$T_{15} = a + 14d$
$= 14 + 14(-1)$
$= 0.$

Output

→ Ap = a, b, c, d, e. find $a - 4b + 6c - 4d + e$.

Let ap = 0, so, $a - 4(0) + 00 - 4(0) + 0 = 0.$

a) 2
~~b)~~ 0
c) 1
d) -1

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$\rightarrow$ $T_p = q$
$T_q = p$, find $T_r = ?$

a> $p+q+r$
b> $q+r-p$
c> $p+q-r$
d> $p-q-r$.

OR- Let p, q, r

$p = 1$
$q = 2$
$r = 3$.

$a + (p-1)d = q$ —— (1)
$a + (q-1)d = p$ —— (2)

$(p-q)d = q-p$

$\boxed{d = -1}$

$\therefore a + (p-1)(-1) = q$

$\therefore a - p + 1 = q$

$\therefore a = p + q - 1$

and $T_r = a + (r-1)d$.

$\therefore T_r = (p+q-1) + (r-1)(-1)$

$= p + q \cancel{-1} - r \cancel{+1}$

$T_r = p + q - r$.

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→ $T_{(p+q)} = 10$

$T_{(p-q)} = 4.$

find $T_p = ?$

a) 5
b) 6
c) 7
d) 8.

$T_{(p+q)} = a+(p+q-1)d = 10$
$T_{(p-q)} = a+(p-q-1)d = 4$

$2a+(2p-2)d = 10+4$

$2(a+(p-1)d) = 14$

$a+(p-1)d = 7.$

$\therefore T_p = 7.$

OR

$T_{2+1} = T_3 = 10$ So $T_p = T_2 = \frac{10+4}{2} = \frac{14}{2}$

$T_{2-1} = T_1 = 4.$

$T_2 = 7$
$\therefore T_p = 7$

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$T_m = 1/n$
$T_n = 1/m$

find $(a-d)$ and T_{mn}

Let $m = 1$ and $n = 2$

So, $T_1 = \frac{1}{2}$ and $T_2 = 1$

So, $d = \frac{1}{2}$ and $a = \frac{1}{2}$

$a - d = \frac{1}{2} - \frac{1}{2} \boxed{= 0.}$

$T_m = a + (m-1)d = 1/n$
$T_n = a + (n-1)d = 1/m$

$$(m-n)d = \frac{1}{n} - \frac{1}{m}$$

$$\therefore \cancel{(m-n)}d = \frac{\cancel{m-n}}{mn}$$

$$\therefore d = \frac{1}{mn}$$

$$\therefore a + (m-1)\frac{1}{mn} = \frac{1}{n}$$

$$\therefore a + \cancel{\frac{1}{n}} - \frac{1}{mn} = \cancel{\frac{1}{n}}$$

$$\therefore a = \frac{1}{mn}$$