13. Three digit no. divisible by 7,

105, 112, 119 . . . . , 994

$a = 105$

$d = 112 - 105$

$= 7$

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

$\Rightarrow 994 = 105 + (n-1)7$

$\Rightarrow 994 = 105 + 7n - 7$

$\Rightarrow 994 = 98 + 7n$

$\Rightarrow 994 - 98 = 7n$

$\Rightarrow 896 = 7n$

$\Rightarrow \frac{896}{7} = n \quad \Rightarrow 128 = n$

$\therefore$ 128 three digit no. are divisible by 7

142
7 | 999
-7
29
-28
19
-14
5

999
-5
994

18
994 | 14
-98
896

896
-98
994

14. Multiple of 4 from 10 to 250,

12, 16, 20, 24 ..... , 248

$a = 12$

$d = a_2 - a_1 = 16 - 12 = 4$

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

$\Rightarrow 248 = 12 + (n-1)4$

$\Rightarrow 248 = 12 + 4n - 4$

$\Rightarrow 248 = 8 + 4n$

$\Rightarrow 240 = 4n$

$\Rightarrow 60 = n$

$\therefore$ 60 multiples of 4 lie between 10 and 250.

15. AP_1 : 63, 65, 67 ....

AP_2 : 3, 10, 17 ....

d of $AP_1 = 65 - 63 = 2$

d of $AP_2 = 10 - 3 = 7$

~~a of AP~~

as per question,

a_n of AP_1 = a_n of AP_2

a_n of AP_1

$\Rightarrow a_n = a + (n-1)d$

$\Rightarrow a_n = 63 + (n-1)2$

$\Rightarrow a_n = 63 + 2n - 2$

$\Rightarrow a_n = 61 + 2n$ ——— (I)

a_n of AP_2

$\Rightarrow a_n = a + (n-1)d$

$\Rightarrow a_n = 3 + (n-1)7$

$\Rightarrow a_n = 3 + 7n - 7$

$\Rightarrow a_n = 7n - 4$ ——— (II)

from (I) and (II), we get

$61 + 2n = 7n - 4$

$\Rightarrow 61 + 4 = 7n - 2n$

$\Rightarrow 65 = 5n$

$\Rightarrow 13 = n$

$\therefore$ 13^{th} term of both the APs will be equal

16. Given

$a_3 = 16$

$a_7 - a_5 = 12$

~~$a_3 = a + (n-1)d$~~

$a_3 = a + (3-1)d$

$\Rightarrow a_3 = a + 2d$ ——— (1)

$a_7 - a_5 = 12$

$\Rightarrow [a + (7-1)d] - [a + (5-1)d] = 12$

$\Rightarrow [a + 6d] - [a + 4d] = 12$

$\Rightarrow a + 6d - a - 4d = 12$

$\Rightarrow 2d = 12$

$\Rightarrow d = 6$

Replacing d in eqn (1), we get

$a_3 = a + 2 \times 6$

$\Rightarrow 16 = a + 12$

$\Rightarrow 4 = a$

$a_1 = 4$

$a_2 = a_1 + d = 4 + 6 = 10$

$a_3 = a + 2d = 4 + 2 \times 6 = 4 + 12 = 16$

$a_4 = a + 3d = 4 + 3 \times 6 = 4 + 18 = 22$

$a_5 = a + 4d = 4 + 4 \times 6 = 4 + 24 = 28$

$a_6 = a + 5d = 4 + 5 \times 6 = 4 + 30 = 34$

∴ AP: 4, 10, 16, 22, 28, 34, 40 ...

17. AP: 3, 8, 13 253

$a = 3$

$d = a_2 - a_1 = 8 - 3 = 5$

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

$\Rightarrow 253 = 3 + (n-1)5$

$\Rightarrow 253 = 3 + 5n - 5$

$\Rightarrow 253 = 5n - 2$

$\Rightarrow 255 = 5n$

$\Rightarrow 51 = n$

$a_{51} = 253$

Reversing AP: 253, 248 ... 13, 8, 3

$d = 248 - 253$

$= -5$

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

$\Rightarrow a_{20} = 253 + (20-1)\cdot -5$

$\Rightarrow a_{20} = 253 + (19) -5$

$\Rightarrow a_{20} = 253 - 95$

$\Rightarrow a_{20} = 158$

$\therefore$ 20^{th} term from last term $= 158$

18. Given

$a_4 + a_8 = 24$

$a_6 + a_{10} = 44$

$a_4 + a_8 = 24$

$\Rightarrow [a + (4-1)d] + [a + (8-1)d] = 24$

$\Rightarrow a + 3d + a + 7d = 24$

$\Rightarrow 2a + 10d = 24$

$\Rightarrow a + 5d = 12$

$\Rightarrow a = 12 - 5d$ ——— (1)

$a_6 + a_{10} = 44$

$\Rightarrow [a + (6-1)d] + [a + (10-1)d] = 44$

$\Rightarrow a + 5d + a + 9d = 44$

$\Rightarrow 2a + 14d = 44$

$\Rightarrow a + 7d = 22$

$\Rightarrow a = 22 - 7d$ ——— (2)

(1) = (2)

$\Rightarrow 12 - 5d = 22 - 7d$

$\Rightarrow 2d = 10$

$\Rightarrow d = \frac{10}{2}$

$\Rightarrow d = 5$

Substituting $d = 5$, in eq^n (1), we get,

$a = 12 - 5d$

$= 12 - 5 \times 5$

$= 12 - 25$

$a = -13$

$\therefore a_1 = a = -13$

$a_2 = a + d = -13 + 5 = -8$

$a_3 = a + 2d = -13 + 2(5) = -13 + 10 = -3$

AP: $-13, -8, -3 \ldots$

19. annual salary, $a_1 = ₹5000$

increment of each year, $d = ₹200$

$a_n = ₹7000$

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

$\Rightarrow 7000 = 5000 + (n-1)200$

$\Rightarrow 7000 - 5000 = (n-1)200$

$\Rightarrow 2000 = (n-1)200$

$\Rightarrow \frac{2000}{200} = (n-1)$

$\Rightarrow 10 = (n-1)$

$\Rightarrow 11 = n$

$a_{11} = ₹7000$

$\therefore$ 11^{th} year $= ₹7000$

20. Saved in first week, $a_1 = ₹5$

increased weekly saving, $d = ₹1.75$

$a_n = ₹20.75$

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

$\Rightarrow 20.75 = 5 + (n-1)1.75$

$\Rightarrow 20.75 - 5 = (n-1)1.75$

$\Rightarrow 15.75 = (n-1)1.75$

$\Rightarrow \frac{15.75}{1.75} = (n-1)$

$\Rightarrow 9 = (n-1)$

$\Rightarrow 10 = n$

$\therefore$ $a_{10} = 20.75$, 10^{th} week $= ₹20.75$