(12)

10, 11, 12, 13, 14, 15, 16, 17, 18, 19, ← 2 numbers

20, 21, 22, 23, 24, 25, 26, 27, 28, 29, ← 2 numbers...

30, 31, 32, 33, 34, 35, 36, 37, 38, 39,   numbers   rows

... ... ... 100 ⟹ 2 × 9 = 18 between

10 and 100

101 to 999 has 2 × 10 × 9 numbers = 180 ← odd

numbers in each row ↓    rows ↓    hundreds ↓

= 198 total

$$\boxed{198}$$

(13)

$\dfrac{a}{b} \searrow \dfrac{3}{4}$   [$4a = 3b$] ×2

$8a = 6b$

$6b = 5c$   then

$\dfrac{b}{c} \searrow \dfrac{5}{6}$

$8a = 5c$   by transitivity

$\dfrac{8a}{c} = \dfrac{5c}{c}$

$\left(\dfrac{1}{8}\right)\dfrac{8a}{c} = 5\left(\dfrac{1}{8}\right)$

$\dfrac{a}{c} = \dfrac{5}{8}$

(14)

2 min     3½ min

12:00 pm   flashes every 2 min    flashes every 3½ min

:02          :035

:04          :07

:06    flashe    :105      → so   12:14

:08    together  :14             12:28

:10    every                     12:42

:12    14 min                    12:56

:14                            $\boxed{1:10 \text{ pm}}$

$\boxed{:14}$   flash together every 14 min

(15)  5293 × 5293 × ... × 5293 (6x)

= ending 9

④

$=10$                                            $=10$

$N = 1 \cdot ②\cdot 3 \cdot 4 \cdot ⑤\cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot \underset{\sim}{10} \cdot 11 \cdot ⑫\cdot 13 \cdot 14 \cdot ⑮\cdot 16 \cdot$

$17 \cdot 18 \cdot 19 \cdot \underset{\sim}{20} = XXXX \ldots 0000$

4 zeros

^terminal

⑤     ② 3 4 ⑤ 6 7 ⑧ 9 10 ⑪ … put in column form

           1st      2nd      3rd      4th

| $\frac{N^{th}}{1st}$ | ② | 3 | 4 |
|------|---|---|---|
| 2nd | ⑤ | 6 | 7 |
| 3rd | ⑧ | 9 | 10 |
| 4th | ⑪ | 12 | 13 … |
| ⋮ | | | |

$\underset{=}{or}$

$3 \cdot (N-1) + 2 = 449$

$3 \cdot (N-1) = 447$

$N - 1 = 149$

$N = 150$

⑪ₜₕ

| M | T | W | R | F | S | Sn |
|---|---|---|---|---|---|----|

Jan   1   2   3   4   5   6   7

        |8| 9   10   11   12   13   14

        15   16   17   18   19   20   21

        22   23   24   25   26   27   28

        29   30   31   2/1   2/2   2/3   2/4

Feb   5   6   7   8   9   10   11   Feb

        12   13   14   15   16   17   18

        19   20   21   |22| ← Thur

Jan : ~~XXXX~~ = ~~XXXX~~

① 

| M | T | W | R | F | S | Sn |
|---|---|---|---|---|---|----|
| today | 1 | 2 | 3 | 4 | 5 | |
| 6 | [7] | 8 | 9 | 10 | 11 | 12 |
| 13 | [14] | 15 | 16 | 17 | 18 | 19 |
| 20 | [21] | . | . | . | . | . |

... [98] 99 100

note: Tuesdays after today are multiples of 7, so find the remainder of 100 divided by 7 (or $\frac{100}{7}$) which is R2. Two days after Tuesday is **Thurs.**

② Look at the following Patterns:

1st → ① 2 3 ④ 5 6 ⑦ 8 9 ⑩ 11 12 ⑬ 14 15 ⑯ 17 18 ⑲ 20 21 ㉒ 23 24 ㉕ 26 27 ㉘

29 30 ㉛ 32 33 ㉞ 35 36 ㊲ 38 39 ㊵ 41 42 ㊸ 44 45 ㊻ 47 48 ㊾ 50 51 ㊼ 53 54 ㊽ 56 57 ㊽

41st → 61 ← 21st          10th ↘          20th ↗

It's easy to make a mistake if you write it out to the 100th number (as I did). However, if you think of a math sentence for each number in the sequence, you might see a pattern to the numbers:

2nd number: $3 \times 1 + 1 = 4$
3rd : $3 \times 2 + 1 = 7$
4th : $3 \times 3 + 1 = 10$
5th : $3 \times 4 + 1 = 13$
6th : $3 \times 5 + 1 = 16$

21st : $3 \times 20 + 1 = 61$

100th : $3 \times 99 + 1 = 298$

③ This is similar to problem 1. Note that under column A, the successive numbers are obtained by the formula: $7 \times (N-1) + 1$ where N = nth number in the sequence. Example: 3rd number in column A is $7 \times (3-1) + 1 = 7 \times 2 + 1 = 15$

So $-[7 \times (142) + 1] + 5 = 995 + 5$
  (Remainder)        R
$= 1000$

Count 5 columns from A, which is **F**