① $9+6+4=19$

② ~~273516~~ 2734516
→ 4 et 1

③ $1+2+\ldots+7=28$
$28-2\times 12=4$ au milieu

6 ↓ 2
1 4 7 → 2
5 3

④ ab : $ab=2(a+b)$
$=2a+2b$

$b=\dfrac{2a}{a-2}$ a minimal → $a=3$
→ 36

⑤ $6\times 2+4+4\times 5=36$

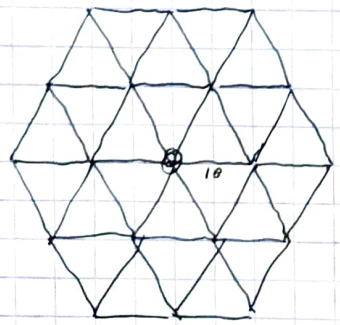
⑥ 22e étage : $2\times 22-1\ (=43)$ nb
PIP…P ⇒ 21 nb impairs

⑦ 12

⑧ → ×2

$22\times 3\times 2=132$

⑨



→ $5+2\times 4+2\times 3=19$

⑩ 1 P I P I P I P

1 → 4 ou 6

1 4 3 2 5 6 7 imp.
1 4 3 2 5 8 imp.

5 : 2 ou 6 ou 8
7 : 4 ou 6 → 476 ou 674

2 : 3 ou 5
8 : 3 ou 5 ⇒ 2 ou 8 à la fin → 7 positionné

1 . 7 . . 8 . 2

1 . 7 . . 2 . 8

1 4 7 6 5 2 3 8
1 4 7 6 5 8 3 2
1 6 7 4 3 2 5 8
1 6 7 4 3 8 5 2
4 sol°

⑪ $64^2=4096$

$1+2+3+\ldots+63=63\times 32=2016$
$\ldots+64=2080$ 18^2
$\ldots+65=2145$
$\ldots+66=2211$ 17^2
$\ldots+67=2278$
68?

(12)

0 9 a b c
1 8 d e f

$a = 2, 3$ ou ~~4~~

~~f = 4 ou 6~~

0 9 3 . 2
1 8 . 6 4 imp.

0 9 2 7 3
1 8 5 4 6 OK

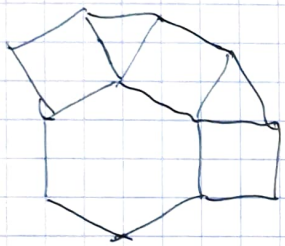
0 9 3 . 6
1 8 7 5 2 imp.

0 9 2 6 7
1 8 5 3 4 OK

0 9 3 2 7
1 8 6 5 4 OK

→ 3 sol° 18546 18534

(13)



→ période

→ 1/6

(14) $1001 \equiv 0\ [13]$ $1000 \equiv -1\ [7]$

$\Rightarrow 13 \mid E+O \Rightarrow E+O = 13$

. 4 9 . imp.

a 5 8 b $580 \equiv -1\ [7]$ $b-a-1 \equiv 0\ [7]$ $|b-a| \leq 4$ imp.

a 6 7 b $670 \equiv -2\ [7]$ $b-a-2 \equiv 0\ [7]$ → $b-a=2$

→ 2674 = LEON

a 7 6 b $760 \equiv -3\ [7]$ $b-a-3 \equiv 0\ [7]$ → $b-a-3=-7$

→ $a-b=4$ $a=8$ $b=4$

→ 8764 = LEON

a 8 5 b $850 \equiv -4\ [7]$ $b-a-4 \equiv 0\ [7]$ $b-a=4$

→ 2856 = LEON

a 9 4 b $940 \equiv -5\ [7]$ $b-a-5 \equiv 0\ [7]$ $b-a-5=-7$

→ $a-b=2$ $a=8$ $b=6$

→ 8946 = LEON

4 sol°

(15) $2022 = 2 \times 3 \times 337$

$2022 - 1011 - 674 - 6 + 2 + 3 + 337 - 1$

$= 1011 - 680 + 341 = 1012 - 340 = 672 \quad (= 336 \times 2 \times 1)$

672 : nb total de polygones.

$\rightarrow \underline{\underline{671}}$

(16) maximiser hauteur $\rightarrow$ pts sur sommets

(17) $n=3 \to 1/6$ 3 angles, somme $1/2$

$n=4 \to 1/4$ 4 angles, somme 1

5 angles, somme $3/2$

n angles, somme $\frac{n-2}{2} \to$ angles de $\frac{n-2}{2n}$ tour $= \frac{1}{2} - \frac{1}{n}$

$\frac{1}{6}$ $\frac{1}{4}$ $\frac{3}{10}$ $\frac{1}{3}$ $\frac{5}{14}$ $\frac{3}{8}$

~~9/24 8/24 6/24 4/24~~

$$\frac{p-2}{2p} + \frac{2p-2}{4p} = \frac{4p-6}{4p} \qquad \frac{6}{4p} = \frac{1}{2} - \frac{1}{n}$$

$$\frac{1}{n} = \frac{1}{2} - \frac{6}{4p} = \frac{2p-6}{4p}$$

$$n = \frac{4p}{2p-6} = \frac{2p}{p-3} = 2 + \frac{6}{p-3}$$

$p=4 \to n=8$ imp.

$p=5 \to n=5$ imp.

$p=6 \to n=4$ $(4,6,12)$

$p=9 \to n=3$ $(3,9,18)$

$$\frac{1}{4} + \frac{1}{3} + \frac{5}{12} = 1$$

$$\frac{1}{6} + \frac{7}{18} + \frac{8}{18} = 1$$

$\underline{\underline{22}}$ et $\underline{\underline{30}}$

$$\frac{p-2}{2p} + \frac{3p-2}{6p} = \frac{6p-8}{6p} \qquad \frac{4}{3p} = \frac{1}{2} - \frac{1}{n}$$

$$\frac{1}{n} = \frac{1}{2} - \frac{4}{3p} = \frac{3p-8}{6p} \qquad n = \frac{6p}{3p-8} = 2 + \frac{16}{3p-8}$$

$p=3 \to (3,9,18)$ $p=4 \to \ldots$

$p=8 \to n=3$ $(3,8,24)$ $\to \underline{\underline{35}}$

$$\frac{1}{6} + \frac{3}{8} + \frac{11}{24} = \frac{4+9+11}{24} = 1$$

17 suite

$$\frac{p-2}{2p} + \frac{4p-2}{8p} = \frac{8p-10}{8p} = \frac{4p-5}{4p}$$

$$\frac{1}{n} = \frac{1}{2} - \frac{5}{4p} = \frac{2p-5}{4p}$$

$$n = \frac{4p}{2p-5} = 2 + \frac{10}{4p-5}$$

(18)

$$\cancel{p^4 = 2p(2p-a)(2p-b)(2p-c)}$$

$$\cancel{p = 2(2p-a)(2p-b)(2p-c)}$$

p: ½ périm.

$$4p^2 = p(p-a)(p-b)(p-c)$$

$$4p = (p-a)(p-b)(p-c) \qquad a+b+c = 2p$$

$$= (p-a)(p-b)(a+b-p)$$

$a = \frac{p}{2}$ $\quad b = \frac{2p}{3}$ $\rightarrow$ $4p = \frac{p}{2} \times \frac{p}{3} \times \frac{7}{6}p$ $\qquad$ imp.

$p = 30?$ $\rightarrow$ $60?$