① A: 1 Au moins 3 mentent
B: 2
C: 3 OK
D: 4 faux

② $N_2 + N_3 = 6$
$N_1 + N_3 = 5$ $\rightarrow N_2 = N_1 + 1$ $N_1 = 2$ ou 3, $N_2 = 2$ ou 4
~~$N_1 + N_2 = 11 - 2N_3$~~ $\rightarrow N_1 = 3$ et $N_2 = 4$ $(N_3 = 2) \rightarrow 7$

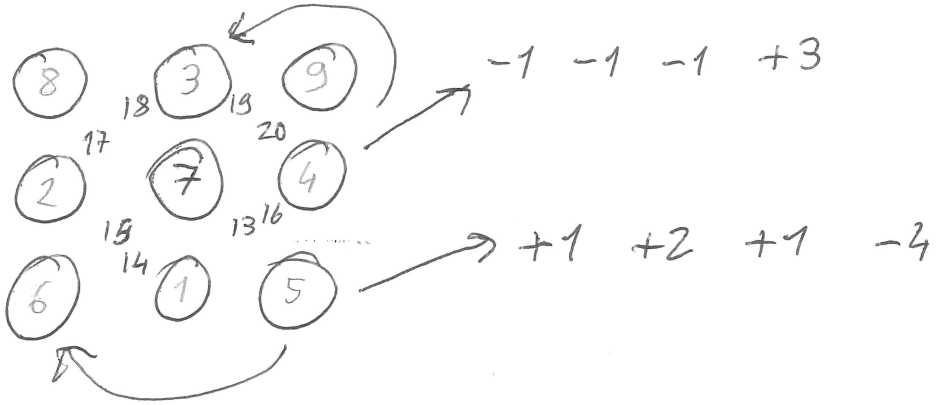
③ 1 carré : 2×2
Ombre : $\left(\frac{1}{2} + 1 + \frac{3}{2} + 2\right) \times 4$ ~~$= 200$~~ $+ \frac{3 \times 5}{2} \times 4 = 20 + 30 = 50$
Lum : $15 \times 4 - 50 = 60 - 50 = 10$

④ 7 ND + 5 MG + 1 = 13

⑤ $\equiv +111$ à droite $\rightarrow 6 + 3 = 9$

⑥ $4 \times 5 \times 3$
$2 \times 8 \times 6$ ($\rightarrow 96$)
$9 \times 7 \times 1 = 63$

⑦ C : centre, S : somme
$2S + 6C = 13 + 14 + \ldots + 20 = 33 \times 4 = 132$
$S = 1 + 2 + \ldots + 9 = 45$
$C = \frac{132 - 90}{6} = 7$



⑧ 2 — parmi 5 : $4 + 3 + 2 + 1 = 10$

45 min

(9) 600 kg

$\frac{41}{3} \times 6 = 82$ $\quad$ $\frac{17}{2} \times 6 = 51$

$3 \times 82 + 2 \times 51 = 246 + 102 = 348$

$600 - 348 = 252$

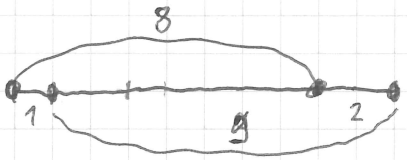
$3 \times 82 < 252 \rightarrow$ au -4 en plus

$5 \times 51 > 252 \rightarrow$ au $+4$ en plus) 9

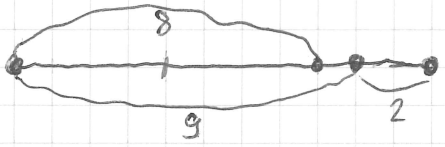
(10) 18 sommets dont 10 de degré impair.

$10 - 2 = 8 \rightarrow$ 8 en plus ? $\quad 33 + 8 = 41$

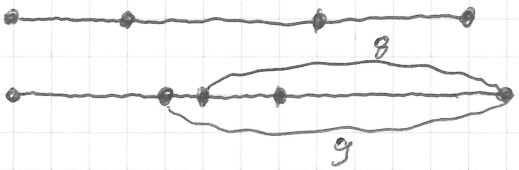
(11)



imp.



2+9 $\quad$ 3+8 $\quad$ 7 → imp.



3+9 $\quad$ 34589 imp.

4+9 = 13

4 impossible

(12) $M \cdot N \quad M \times N = 60 \quad X = M + N + 1$

$M' \times N' = 90 \quad X = M' + N' + 1$

$60 =$	1×60	$u(61-u) = 90$	non
$=$	2×30	$u(32-u) = 90$	non
$=$	3×20	$u(23-u) = 90$	5×18 OK
$=$	4×15	$u(19-u) = 90$	9×10 OK

2 sol° : 20 et 24

(14) N maisons. $25 \mid N-1$

$N = 26 \rightarrow$ moyenne $\simeq 13$ + entier $\rightarrow 20,16$

$N = 51 \rightarrow$ moyenne $\geq 25 \rightarrow N = 26$

Moyenne min = 13

" max = $\frac{2+26}{2} = 14$) $\rightarrow 13,16 \rightarrow$ âge = 7

(15)

5	6	7	8	9
4		14		10
3		21		11
2		28		12
1		35		13

5	6	7	8	9
4				11
3				13
2				15
1				17

5	6	7	8	9
4		10		12
3		13		15
2		16		18
1		19		21

9	10
6	
5	
3	
1	

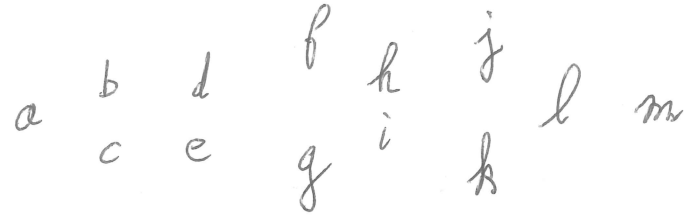
1	2	3	4	5
4				

13	14	15	16	17
10		12		18
7		9		19
4		6		20
1		3		21

10	7	4
		8
		12
		16
		20

4	8	12	16	20
7				
10				

(16)



$35 + l = 1+2+\dots+13 = 91$

$S \geq 1+2+3+4+5+6 = 21$

$S \leq \frac{13+12+11+10+9+8}{2}$ $m = \frac{63}{2} \rightarrow S \leq 31$

$m = h+i+l$

$a = d+e$

(17)

$\binom{N+1-3}{3}$

$\binom{7+1-3}{3} = \binom{5}{3} = \frac{5\times4\times3}{6} = 10$ OK

$\frac{(N-2)(N-3)(N-4)}{6}$

$2016/16 = 126 = 2\times3^2\times7$

$6\times2016 \mid (N-2)(N-3)(N-4)$

$2^6\times3^3\times7 \mid (N-2)(N-3)(N-4)$

~~$497 = 7\times71$~~ $497 = 7\times71$

$64 \mid N-3$ ou $32 \mid N-2$ ou $32 \mid N-4$

(63×64) 27 divise l'un des 3

32 64×63 96 128 160

81 108 135 162

192 224 256 288 320 352

189 216 243 270 297 324 351

384 416 448 480 512

378 405 432 459 486

$N-4$ $N-2$

$160\times161\times162$

$7 \mid 161$ $N = 164$

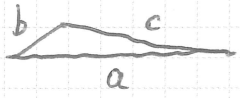
$N-2$

$350\times351\times352$

$7 \mid 350$ $N = 354$

2 sol°

(17) (18)



$2016 = 2^5 \times 3^2 \times 7$

$a = b + c - 2$ $\qquad P = 2b + 2c - 2$

$a+b+c \mid 2^6 \times 3^2 \times 7$

$b + c - 1 \mid 2^5 \times 3^2 \times 7$

$(2b+2c-2)(4)(2b-2)(2c-2) = 16 S^2$

$(b+c-1)(b-1)(c-1) = S^2/2$

$= 2^9 \times 3^4 \times 7^2$

avec $b+c-1 \mid 2^5 \times 3^2 \times 7$

$u = b - 1 \qquad v = c - 1 \qquad b + c - 1 = u + v + 1$

$u v (u+v+1) = 2^9 \times 3^4 \times 7^2 = K$

$u v^2 + u(u+1) v - K = 0$

$\Delta = u^2 (u+1)^2 + 4Ku = u[u(u+1)^2 + 4K]$

$7 \mid u$

$u = 7$: $2^4 \times 3^2 \mid v \qquad 144 \mid v$ $\qquad 81$

$v(v+8) = 2^9 \times 3^4 \times 7$

$= 8 \times 64 \times 81 \times 7$ non

$u = 14$: $v(v+15) = 2^8 \times 3^4 \times 7$

$= 256 \times 7 \times 3 \times 27$

$256 \times 64 = 192 \qquad 7 \times 27 = 189$ non

$u = 21$: $v(v+22) = 2^9 \times 3^{43} \times 7$

$= 2 \times 256 \times 27 \times 7$ non

$u = 28$: $v(v+29) = 2^7 \times 3^4 \times 7$

$= 128 \times 81 \times 7$ non

$u = 42$: $v(v+43) = 2^8 \times 3^3 \times 7$

$= 256 \times 27 \times 7$ non

$u = 49$: $v(v+50) = 2^9 \times 3^4$

$= 2 \times 256 \times 81$ non

(18) suite

$u = 56$: $v(v+57) = 2^6 \times 3^4 \times 7$

$= 64 \times 3 \times 27 \times 7$ non

$u = 63$: $v(v+64) = 2^9 \times 3^2 \times 7$

$= 2^9 \times 9 \times 7$

~~126~~

$u = 63$

$b = 64$