Олимпиада ЮМШ 2020-21 года

Код участника: 1677

Лист подготовки устного ответа

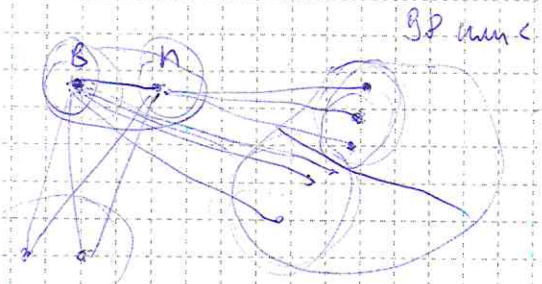
Лист № 1

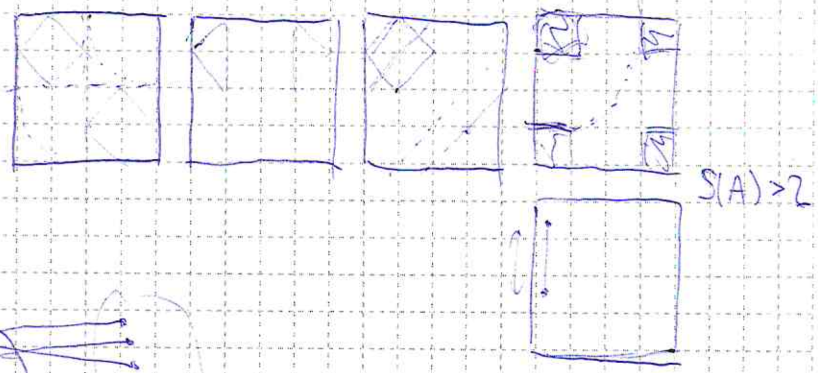
Фиксация санитарных выходов:

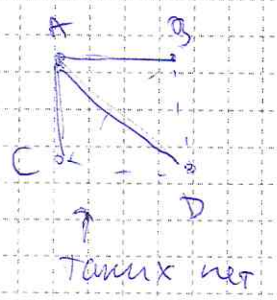
1 выход:		возвращение:	
2 выход:		возвращение:	
3 выход:		возвращение:	
4 выход:		возвращение:	
5 выход:		возвращение:	

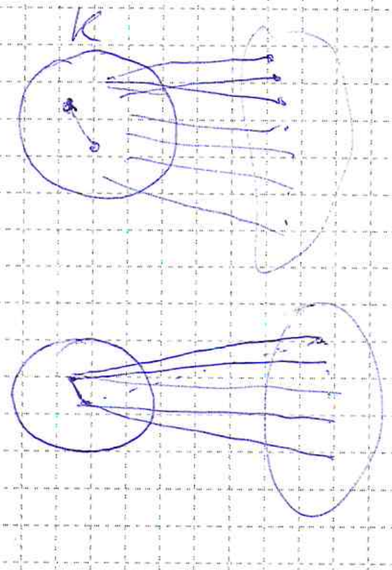
Время окончания: 15^{30}

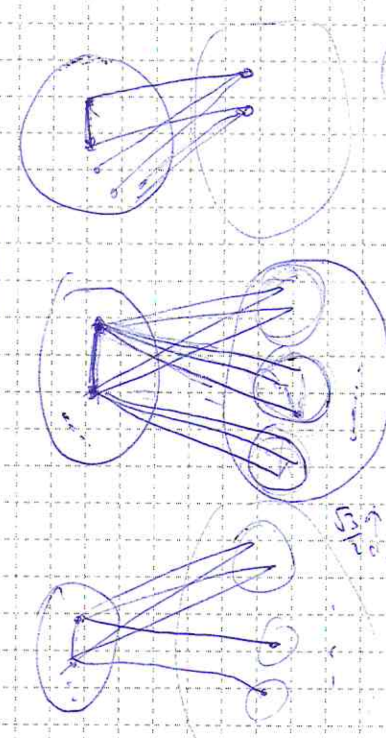
Всего листов: 2





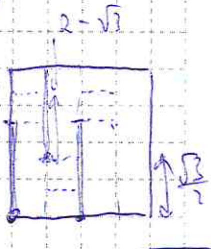






$\frac{\sqrt{3}}{2} - 2 + \sqrt{3} = \frac{3\sqrt{3}}{2}$

$2-\sqrt{3}$



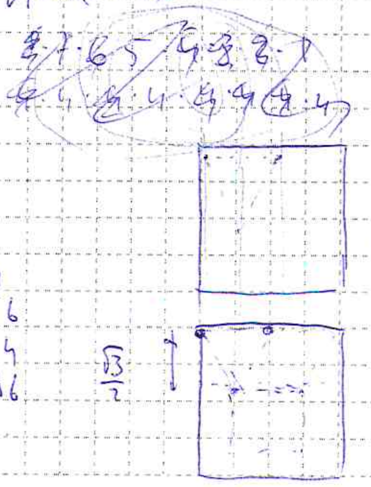
$n \le n! - 4^n \le 4n$

$n + 4^n \le n! \qquad 1 + \frac{4^n}{n} \le (n-1)!$

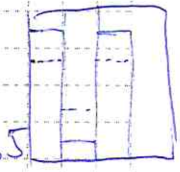
$n! \le 4n + 4^n$

$(n-1)! \le 4 + \frac{4^n}{n}$

$1! = 1$	$4^1 = 4$
$2! = 2$	$4^2 = 16$
$3! = 6$	$4^3 = 64$
$4! = 24$	$4^4 = 256$
$5! = 120$	$4^5 = 1024$
$6! = 720$	$4^6 = 4096$
$7! =$	$4^7 = 16$



400 | 165
330 | 2,5
700

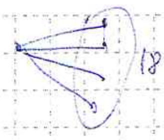


0,35

$\frac{\sqrt{3}}{2}$

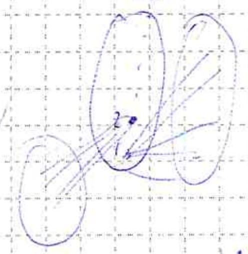
$\sqrt{3} + \frac{\sqrt{3}}{2} = \frac{3\sqrt{3}}{2}$

$\frac{\sqrt{3}}{2} + \left(2 - \frac{3\sqrt{3}}{2}\right) = 4 - \frac{\sqrt{3}}{2}$

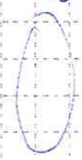


18 100 1 2 3

10

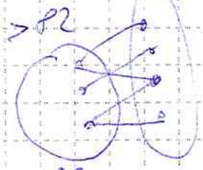


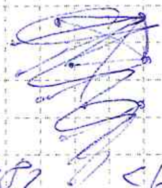
10



<18

>82



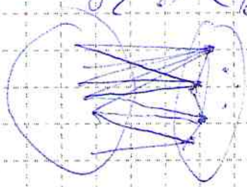


11 $\frac{89}{11}=8$

9 $\frac{91}{9}=10$

$88 : 12 = 7$

>82 <18

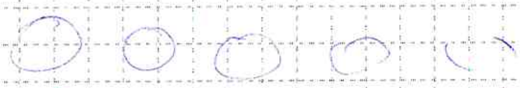


1 9

12

$\begin{array}{r|l} 82 & 17 \\ -68 & 4 \\ \hline 14 & \end{array}$

8 92

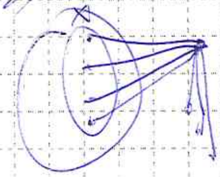


a $100-a$

10 10 10 10 14

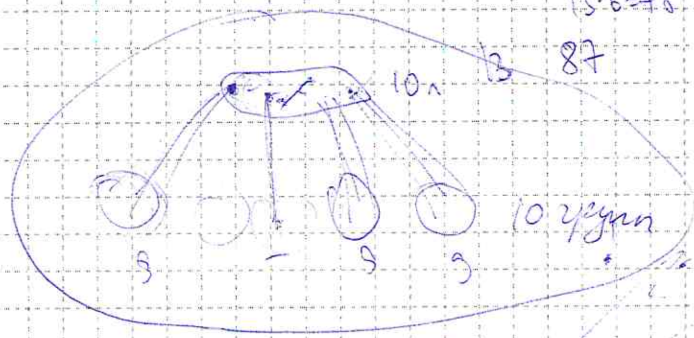
$\frac{100-a}{a} \geq 80$

$13 \cdot 6 = 78$



13 87

7 93



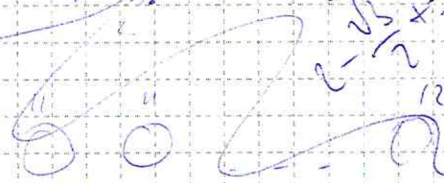
10 n

9 9 9

10 групп

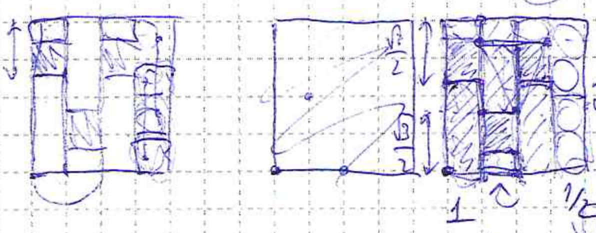
~~13 2 94~~

$\frac{\sqrt{3}}{2}$



12

$n \leq n! - 4^n \leq 4n$



$2-\sqrt{3}$

$2-\sqrt{3}$

$2-\sqrt{3}$

$\frac{\sqrt{3}}{2}$

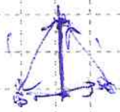
$\frac{\sqrt{3}}{2}$

$\left(2-\frac{\sqrt{3}}{2}\right)\cdot\frac{1}{2}\frac{\sqrt{3}}{2} - (2-\sqrt{3}) =$

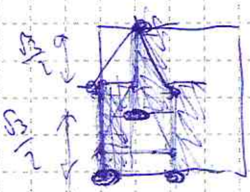
$= \frac{\sqrt{3}}{2} - 1$

1

$\sqrt{3}\cdot\frac{1}{2} + (2-\sqrt{3})\frac{1}{2} + (2-\sqrt{3})\frac{1}{8} + \frac{1}{2} =$



$\frac{1}{2}$

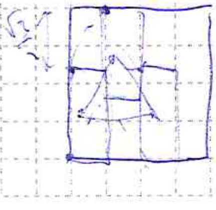


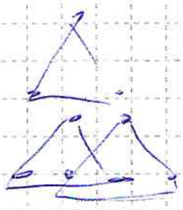
$= 2,5 - \sqrt{3}/2$

$2,5 - \frac{\sqrt{3}}{2} < 1,65$

$2,5 - 1,65 < \frac{\sqrt{3}}{2}$

$5 - 3,3 < \sqrt{3}$





$\frac{1}{2}(2-\sqrt{3})$

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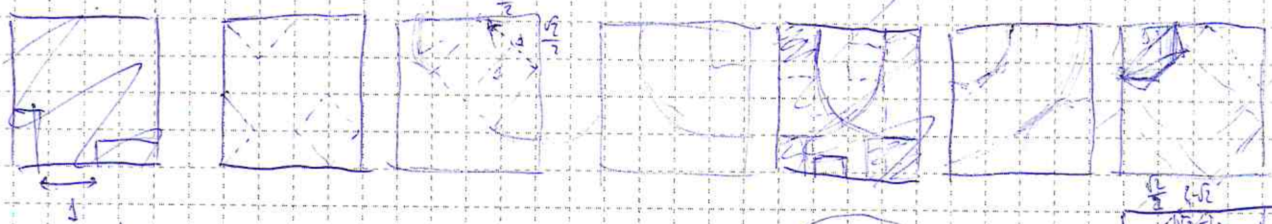
Лист подготовки ответа

Лист № 2



$n \le n! - 4^n \le 4n$

$10! = 720 \cdot 7 \cdot 8 \cdot 9 \cdot 10 = 720 \cdot 720 \cdot 7$

$4^{10} = 1024 \cdot 1024$

$n! \le 4n + 4^n$

$(n+1)n! \ge (4n + 4^n) \cdot 4$

$16n \overset{?}{>} 4(n+1)$

$4n > n+1 ?$

$3n > 1 ?$

$\left(2 - \frac{\sqrt{2}}{2}\right) \cdot \frac{2}{\sqrt{2}} = \frac{4}{\sqrt{2}} - 1$

$n \le n! - k^n \le kn$

$n! \le k^n + kn$

$\left(\frac{2}{\sqrt{2}} - 1\right)^2 = 3 - \frac{4}{\sqrt{2}}$

$\sqrt{\frac{4}{\sqrt{2}} - 2}$

$\frac{\frac{4}{\sqrt{2}} - 2}{2} = \frac{2}{\sqrt{2}} - 1$

$n + k^n \le n!$

$n+1 \le (n+1)! - k^{n+1} \le k(n+1)$

$\left(\frac{2}{\sqrt{2}} - 1\right) \cdot \frac{1 + \left(1 - 2\left(1 - \sqrt{\frac{4}{\sqrt{2}} - 2}\right)\right)}{2} \ge 0{,}07$

$n! \ge k^n + kn$

$(n+1)n! > (k^n + kn)k > k^{n+1} + k(n+1)$

$n \le n! - k^n \le kn$

$k^2 n \overset{?}{>} kn + k$

$kn > n+1 ?$

$(k-1)n > 1$

$\left(\frac{2}{\sqrt{2}} - 1\right)\left(\sqrt{\frac{4}{\sqrt{2}} - 2}\right) \ge 0{,}07$

$\left(3 - \frac{4}{\sqrt{2}}\right)\left(\frac{4}{\sqrt{2}} - 2\right) \ge \frac{49}{10000}$

$-6 + 8 + \frac{12}{\sqrt{2}} + \frac{8}{\sqrt{2}} = \frac{20}{\sqrt{2}} - 14 \overset{?}{\ge} 0{,}0049$

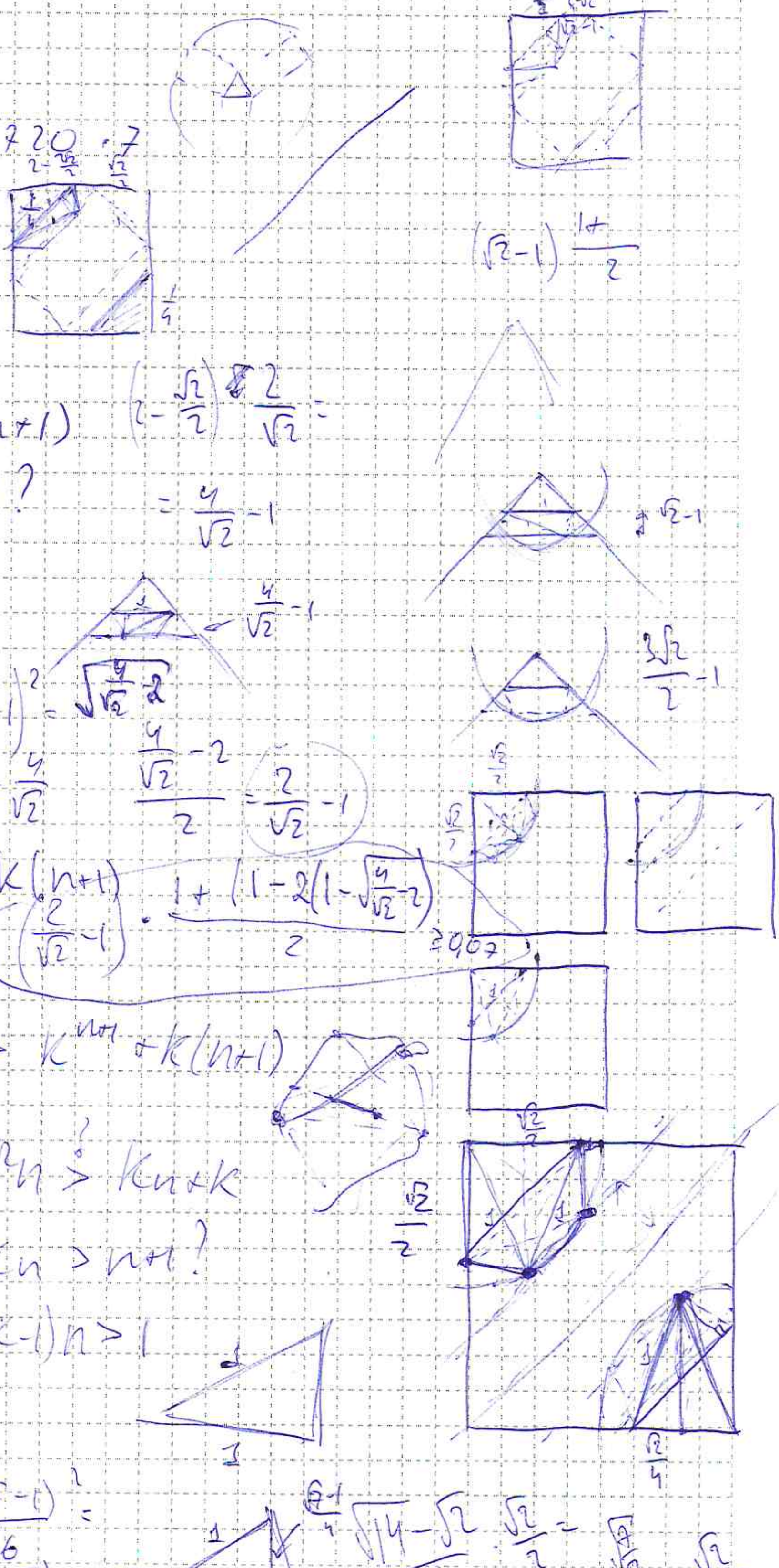
$1 - \frac{(\sqrt{7} - 1)^2}{16} = \frac{16 - 7 + 1 - 2\sqrt{7}}{16} = \frac{8 + 2\sqrt{7}}{16} =$

$1 - \sqrt{\frac{4 + \sqrt{7}}{8}}$

$\frac{\sqrt{7} - 1}{4} \cdot \frac{\sqrt{14} - \sqrt{2}}{4} \cdot \frac{\sqrt{2}}{2} = \frac{2\sqrt{7} - 2}{8} = \frac{\sqrt{7} - 1}{4}$

$\frac{\frac{\sqrt{7}}{\sqrt{2}}}{2} - \frac{\sqrt{2}}{4} = \frac{\sqrt{14}}{4} - \frac{\sqrt{2}}{4}$

$2000 : 1{,}42 = 1408$



$n \le n! - k^n \le kn$

$10! = \cancel{...}\ 720\ 720 \cdot 7$

$6^{10} = \cancel{...}\ 1024 \cdot 3^{10}$

$n! \cancel{...} \le kn + k^n \qquad n > k \Rightarrow k < n+1$

$n \le n! - k^n$

$kn \le n!k - k^{n+1}$

$\frac{n!}{k} - k^{n-1} \le n$

$(n-1)! < \frac{n!}{k}$

$(n-1)! - k^{n-1} \le n$

$10! -$

$\frac{n!}{k} - k^{n-1} \le n \le \cancel{n! - k^n}$

$\cancel{\frac{(n+1)!}{k} - \frac{k^{n-1}}{n} \le 1}$

$1\ 2 \ldots (k-1)\ (k+1) \ldots n$

$k\ k\ \ k\ \ k\ \ k$

$\frac{n!}{k} \le k^{n-1} + n$

$\cancel{n + k^n \le n!}$

$n < k^2?$

$(k^2)! - k^{k^2}$ $\quad k(1+2+\ldots+k)$

$a = 1\ 2\ k \ldots k^2 \ldots$

хотел $\frac{a}{k} > k\ k\ k \ldots k\ k$
ли в
k раз больше

$k^{k^2} > \frac{k^{k^2}}{k}$

$x(k^2 - x + 1) \overset{?}{\ge} k^2$

$k^2(x-1) \overset{?}{\ge} k^2 - x$

$x(x-1)$

$ak - \frac{a}{k} \le k^2 \cdot n$

$a(k-1) \le k^2 n$

$a \le kn$

$a - \frac{a}{k} \le kn$

$a(k-1) \le k^2 n$

$a \le kn$?

$(k-4)(k+4) < k^2$

$1 \ldots k-1\ k+1 \ldots 2k-1$

$k = bc$

$\frac{k^2}{2}$ $\quad \frac{k^2+1}{2}$ $\quad \frac{k^2-1}{2}$ $\quad \frac{k^2}{4}$

$k^4 - 4 > 4k^2$

$(k^2)! > k^{k^2-1}$

$k^2 > 4$