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$a_1, a_2, a_3 \dots$

$$S = \frac{a_1}{1-q}$$

a_1

$a_1 + a_2$

$\boxed{a_1 + a_2 + a_3 + \dots}$

$S_1 = a_1$

$S_2 = a_1 + a_2$

$S_3 = \dots$

$\vdots$

$S =$

$\boxed{|q| < 1}$

$S \in \mathbb{R}$

$1 + 2 + 4 + 8 \dots = \infty$

$1 - 2 + 4 - 8 + 16 \dots$ $+\infty$ $-\infty$

cg rb.

$\Uparrow$

$|q| < 1$

$$S = \frac{a_1}{1-q} = S \Leftarrow |q| < 1$$

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$$a_1 = \frac{x}{x-1} \qquad a_2 = \frac{x}{(x-1)^2} \qquad a_3 = \frac{x}{(x-1)^3} \quad \dots$$

$$a_1 + a_2 + a_3 + \dots$$

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$$a_1 \xrightarrow{\cdot q} a_2 \xrightarrow{\cdot q} a_3 \xrightarrow{\cdot q} a_4$$

$$a_1 + a_2 + a_3 + a_4 + \ldots = S = 7$$

$$q^2$$

$$\frac{a_1}{1-q} \qquad |q| < 1$$

$$(1-q) > 0$$

$$|q| < 1 \Rightarrow 1 - q > 0$$

$1 -$ ujemna > 0

2.227

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$b_n > 0 \ \forall_{n \in N_+}$ $b_{k-1} - 9b_{k+1} = 0 \ \forall_{k \in N_+, \ k \geq 2}$

$T_a: \ \underline{|q| < 1}$

$a_{n+1} = a_n \cdot q$ $b_{k+1} = \underline{b_k} \cdot q$

$b_k = b_{k-1} \cdot q$

$b_5 = b_4 q$

$\underline{b_7 = b_5 \cdot q^2}$ $b_{k+1} = b_{k-1} \cdot$

$$\boxed{b_n = b_k \cdot q^{n-k}}$$

$\dfrac{a_1(1-q^3)}{1-q} = 26 \cdot$

$S = \dfrac{a_1}{1-q}$

$\underbrace{a_4 + a_5 + a_6 + \dots}_{S}$

q

$\underbrace{\underbrace{(a_1 + \dots + a_n)}_{S_n} + \dots}_{S}$

2.210

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$$\underline{st\, L = 1}$$

$$st\, M = 1$$

$$\frac{n^{1}}{\sqrt{a^2n^2+n+4} - n}$$

$\uparrow$ st 1 $\qquad$ $\uparrow$ st 1

$$a_1 + a_2 + a_3 + \dots = \begin{cases} S = \frac{a_1}{1-q} \\ |q| < 1 \end{cases}$$

$$\lim_{n\to\infty} \frac{n}{\sqrt{\quad} -}$$

$$\lim_{n\to+\infty} a_n = \pm\infty \Rightarrow a_n \text{ jest rozb. do } \infty$$

$\boxed{1}$, $\boxed{-1}$ $\qquad$ $\pm\infty$

$$\frac{1}{\sqrt{a}-\sqrt{b}} = \frac{\sqrt{a}+\sqrt{b}}{a-b}$$

WIECH $|a| = 1 \Rightarrow \underline{a^2 = 1}$

$$n\left(\sqrt{n^2\left(1+\frac{1}{n}+\frac{1}{n^2}\right)}+n\right) = \frac{\cancel{n}\left(\sqrt{1+\frac{1}{n}+\frac{1}{n^2}}+1\right)}{\cancel{n}\left(1+\frac{1}{n}\right)} = \infty$$

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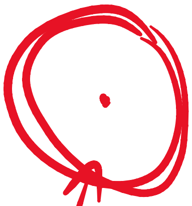
$r_1 = r$ $\quad r_2 = \frac{3}{4} r_1 = \frac{3}{4} r$ $\quad \boxed{r_n = \frac{3}{4} r_{n-1}}$ $n > 1$

$\boxed{r_{n+1} = \frac{3}{4} r_n}$ $\quad n \in \mathbb{N}_+$

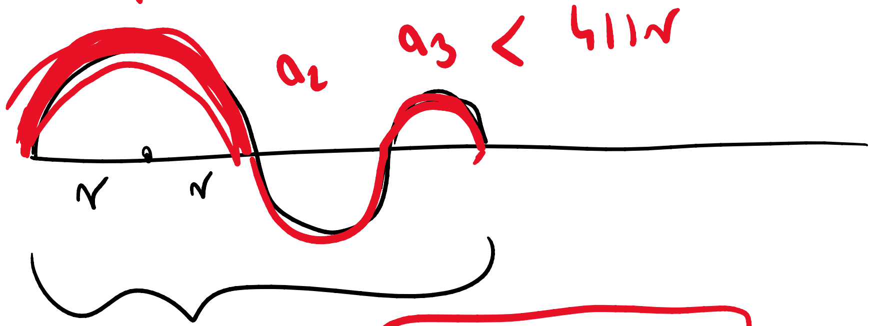
$\Updownarrow$

$\boxed{\text{cgant}}$

$S_n =$



$\boxed{2\pi r}$



$a_1 = \frac{2\pi r}{2} = \pi r$

$q = \frac{a_2}{a_1} = \frac{0{,}75\pi r}{\cancel{r\pi}} = 0{,}75$

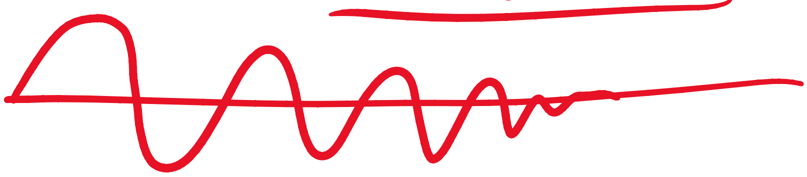
$\boxed{a_2 = 0{,}75 a_1}$

$S = \frac{\pi r}{1 - \frac{3}{4}} = 4\pi r$

$q = 0{,}75$

$S = 4\pi r$

$S_n < S$



r:

$a_1 + a_2$ $\quad a$ $\quad \pi r + \frac{3}{4}\pi r = \pi r\left(\frac{7}{4}\right)$

$$\frac{a_1 + a_2}{\underbrace{a_3 + a_4 + a_5 + \dots}} = \frac{9}{7}$$

$$L_T = \frac{\pi r + \frac{3}{4}\pi r}{\dfrac{\pi r\left(\frac{3}{4}\right)^2}{1 - \frac{3}{4}}} = \frac{\pi r\left(\frac{7}{4}\right)}{}$$

a_3

$$\boxed{q \in (-1,1)} \Leftrightarrow |q| < 1$$

$q^n \to 0$

$n \to \infty$

$$\frac{2^n}{3^n} = \left(\frac{2}{3}\right)^n$$

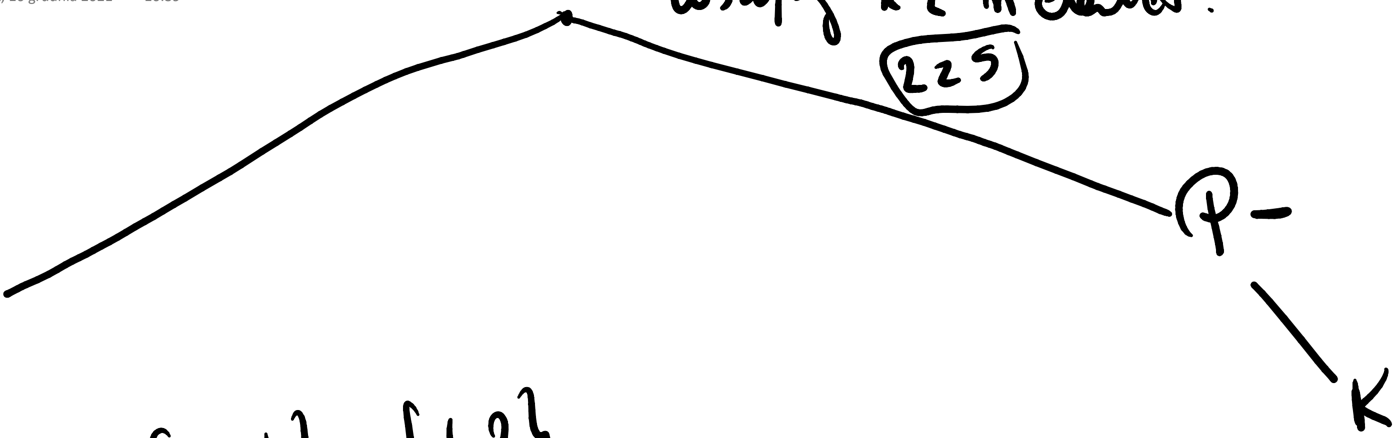
$$\frac{-5+(4n-5)}{2} \cdot (n+1)$$

$n=1$

$$-5 -1 +3 +7 + \dots + 4n-5$$

$$\frac{-1+4n-5}{2} \cdot n$$

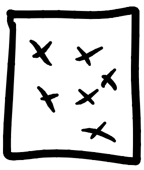
losuję k z n elementów.



K - $\{3,4\} = \{4,3\}$

KOMBINACJE

1, 2, 3, 4, 5 ~~3,3~~ $C_n^k = \binom{n}{k} = \frac{n!}{k!(n-k)!}$



$\binom{49}{6}$ $\boxed{nCr}$

$\binom{52}{14}$

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1,2,3,~~4,5~~

$\{1,2,3\}$

~~1 3 2~~

1,2,4

1,2,5

1,3,4

1,3,5

123	145
124	234
125	235
134	245
135	345

$$\binom{5}{3} = \binom{5}{2}$$

$$\boxed{\binom{n}{k} = \binom{n}{n-k}}$$

$\boxed{K-}$

liczymy ile. $10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 10!$

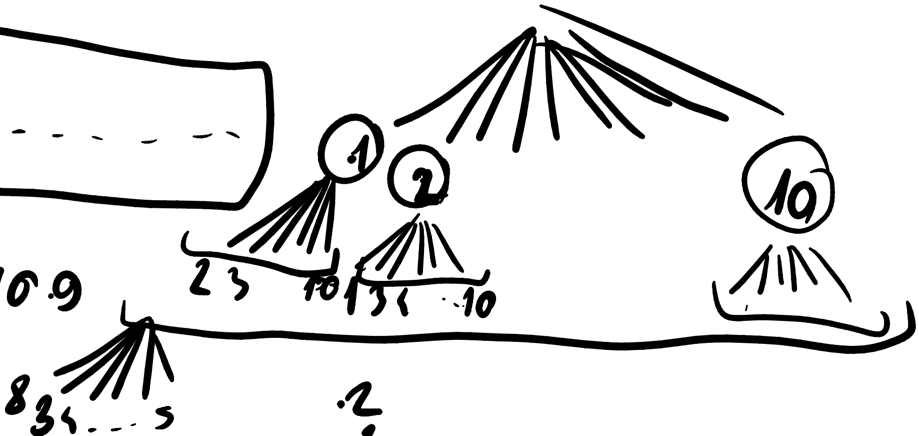
1,2,3,~~4~~,5,6,7

8,9,10

np 4 8

i

$10 \cdot 9 \cdot 8 \ldots$



$P_n = n!$

$90 = 10 \cdot 9$

$(1,2,3,4,5) \neq (2,1,3,4,5)$

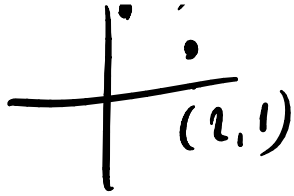
K+

~~(1,1)~~

K+

$(x,y) \neq (y,x)$

$\cancel{(1,1)}$



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$$\boxed{9} \cdot 8 \cdot 7 \cdot \boxed{\tfrac{1}{0}} + \frac{8}{7} \cdot 8 \cdot 7 \cdot \frac{4}{\cancel{8}}$$

0,

2, 4, 6, 8

I + II

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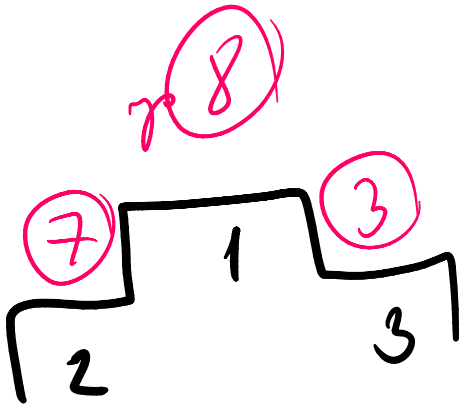
$$V_n^k = \frac{n!}{(n-k)!}$$

$\boxed{k+}$

C

$1, 2, 3 \ldots \ldots 10$

$$\underbrace{\underline{10}\cdot\underline{9}\cdot\underline{8}}$$



$$V_{10}^3 = \frac{10!}{7!} = \frac{10\cdot 9\cdot 8\cdot \cancel{7!}}{\cancel{7!}} = \underline{10\cdot 9\cdot 8}$$

$$V_n^k = \frac{n!}{(n-k)!}$$

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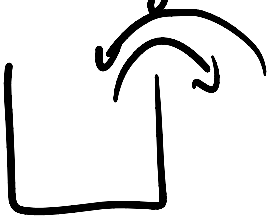
P+ (1,1)

K+ (1,2) ≠ (2,1)

$$\boxed{W_n^k = n^k}$$

kostki do gry

monety ..



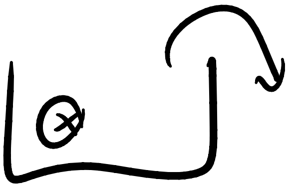
P-

K+

k ≤ n

$$V_n^k = \frac{n!}{(n-k)!}$$

zawody na podium.



n = n

$$P_n = n!$$

ludzie w kolejce

książki na półce

K-

k ≤ n

$$C_n^k = \binom{n}{k}$$

Lotto

karty

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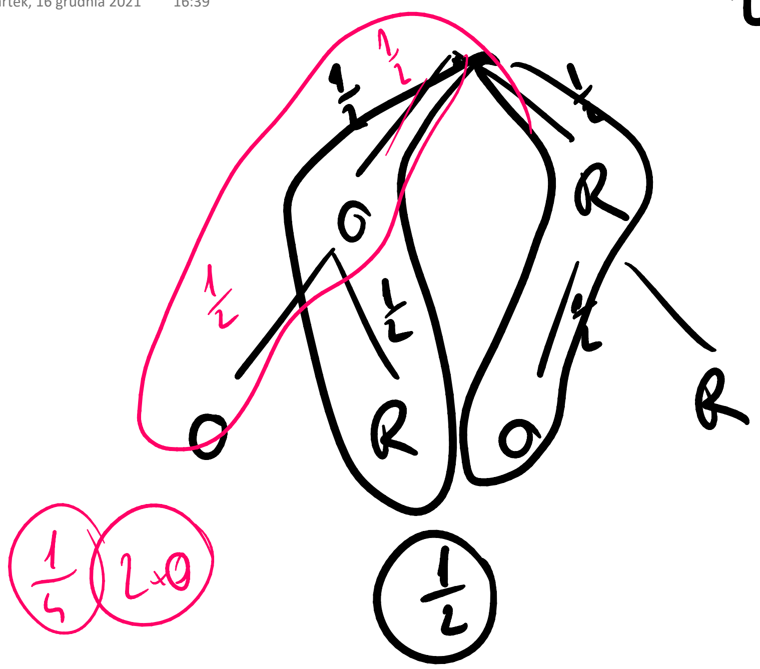
2×MONETA



2×O

1×O 1×R

2×R

100 ←

100 →

(O,O)
(O,R)
(R,O)
(R,R)

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2, ~~4~~, 6, ~~8~~, 10, ~~12~~, 14

4, ~~8~~, 12

$\boxed{8}$

8 $\mathbb{N}$

"2"

"4"

"8"

1. $\boxed{1 \times \text{"2"} \wedge 1 \times \text{"4"}}$

$\boxed{2 \times \text{"4"}}$

$\boxed{\text{"8"} \times 1 \cdot 1 \times 14}$

14 { na jeden sposób 8
na 14 sposobów inny liczby niż 8

1 2 3 4 5 6 7 9 10 11 12 13 14 15

$1 \cdot 14 + \binom{2}{2}$

"4" {4, 12}

4,

$\binom{n}{n-1} = \binom{n}{1} = n$

$\binom{n}{n} = 1$

$\binom{n}{0} = 1$

$\binom{n}{k} = \binom{n}{n-k}$

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2 2 2 7 0

7

— — — — —

7

7

4 opcji.