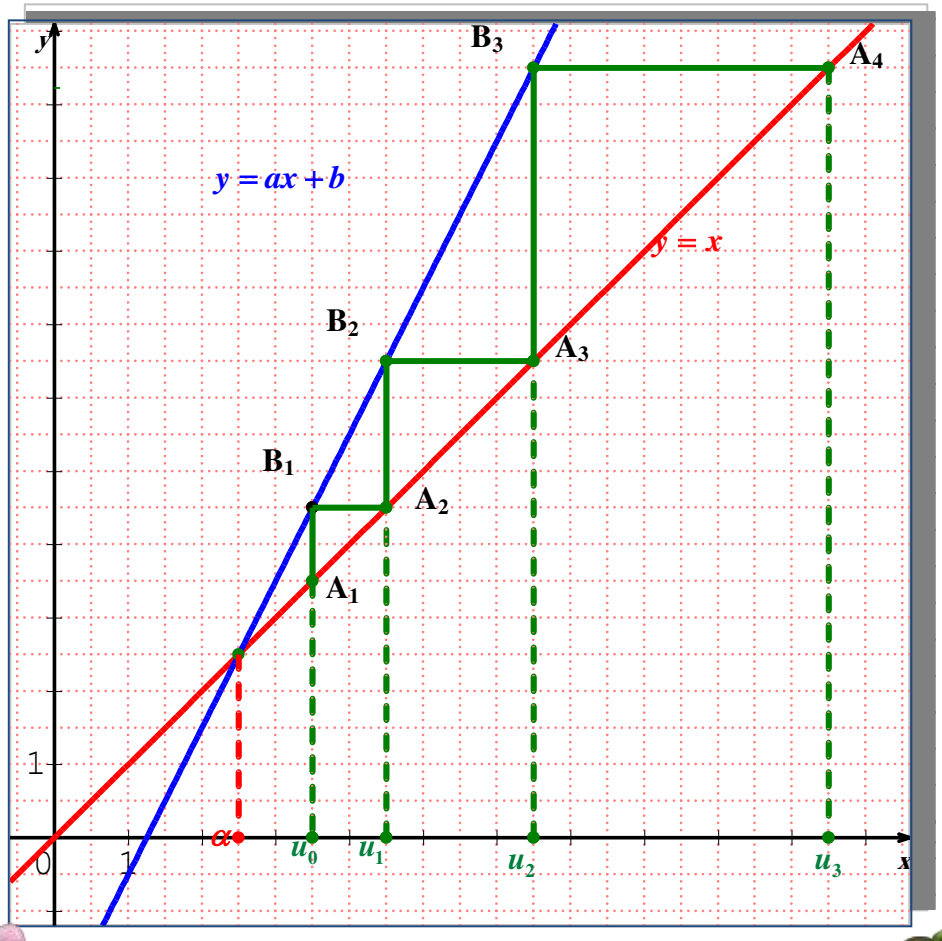
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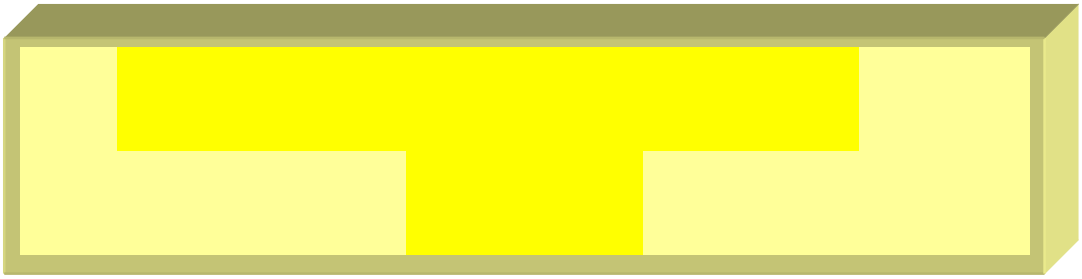
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01

(u_n) $u_0 = 4$ $u_{n+1} = \sqrt{u_n + 20}$ n

1 $4 \le u_n < 5$ $n \ge 0$

2 (u_n)

3 (u_n)

02

(u_n) $u_0 = -1$ $2u_{n+1} = u_n + 3$ n

1 $u_n < 3$

2 (u_n)

3 (u_n) $\lim\limits_{x \to +\infty} u_n$

4 $u_n = 3 - 2^{-n+2}$ n

03

(u_n) $u_0 = 1$ $u_{n+1} = u_n + 2n + 3$ n

1 (u_n)

2 $u_n \ge n^2$ n (u_n)

3 u_n n

04

(u_n) $u_0 = \frac{4}{3}$ $u_{n+1} = \frac{(n+1)}{(n+3)} u_n$ n $\in$

1 u_1 u_2 u_3 $u_n = \frac{8}{(n+2)(n+3)}$ n $\in$

1 b a $u_n = \frac{a}{n+2} + \frac{b}{n+3}$

2 $S_n = u_0 + u_1 + ... + u_n$ n $\lim\limits_{x \to +\infty} S_n$

05

(u_n) $u_1 = 1$ $2u_{n+1} = (u_n^2 - 2u_n + 4)$ *

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(u_n) u_3 u_2 1

2 (u_n) $u_{n+1}=\frac{1}{2}(u_n-1)^2+\frac{3}{2}$ 2

(u_n) 3

06

r u_0 (u_n) I

$u_1+u_2+u_3=24$ $u_1^2+u_2^2+u_3^2=210$

u_0 r u_2 1

n $S_n=u_0+u_1+.....+u_n$ n u_n 2

$v_n=e^{-3n+14}$ (v_n) II

(v_n) 1

$\lim\limits_{x\to+\infty}P_n$ $\lim\limits_{x\to+\infty}S_n$ $P_n=v_0.v_1.....v_n$ $S_n=v_0+v_1+...+v_n$ 2

07

4 $u_0=5$ u_n

n $S_n=u_0+u_1+....+u_n$ n u_n 1

2020 2

08

$u_n=\frac{1}{v_n-1}$ $v_{n+1}=\frac{5v_n-1}{v_n+3}$ $n\in$ $v_0=2$ v_n

u_2 u_1 u_0 v_2 v_1

u_n

n v_n n u_n

$T_n=v_0.u_0+v_1.u_1+...+v_n.u_n$ $S_n=u_0+u_1+...+u_n$ n

09

c b a

c b a 1

$a^2+b^2+c^2=(a+b+c)(a-b+c)$

3276 78 2

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10

x y z

lnx lny lnz 1

$\ln x \times \ln y \times \ln z = -105 \quad \ln(x \times y \times z) = 21$ 2

11

1995

z y x

y x z z y x

1995 x+y+z

12

n $u_0 = 3$ (u_n)

a $u_{n+1} = \frac{(2a+1)}{3}u_n - \frac{(2a-4)}{3}$

(u_n) a 1

(u_n) a $a \neq \frac{5}{2}$ 2

n n u_n

(u_n) a 3

50 u_{50}

$u_n = 3^n + 2$ n $a = 4$ 4

$$u_0 + u_1 + ... + u_n = \frac{1}{2}\left(3^{n+1} + 4n + 3\right)$$

13

$u_5 + u_3 = 20 \quad u_1 = 1$ * (u_n)

q 1

$T_n = \frac{1}{u_1} + \frac{1}{u_2} + ... + \frac{1}{u_n} \quad S'_n = u^2{}_1 + u^2{}_2 + ... + u^2{}_n \quad S_n = u_1 + u_2 + ... + u_n$ 2

$P_n = u_1 \times u_2 \times ... \times u_{n+1}$ * n 3

$\lim_{x \to +\infty} P_n$ n P_n $P_n = \left[u_1 \times q^{\frac{n}{2}}\right]^{n+1}$

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14

$\ln u_3 + 2\ln\sqrt{u_6} = 11$ $\ln u_3 - \ln u_2 = 1$ (u_n)

(u_n) u_0 q 1

(u_n) n u_n 2

n $S_n = u_1 + u_2 + \ldots + u_n$ 3

$v_n = 3\ln u_{n+1} - \ln u_n$ (v_n) 4

(v_n)

n $S_n = v_0 + v_1 + v_2 + \ldots + v_{n-1}$

15

c b a 1

a b c 216

a^2 b^2 c^2 133

u_0 12

( ) v_n u_n (v_n) (u_n) 2

$u_{n\ 1}$ $\frac{2}{3}u_n$ 1

(v_n)

(u_n) u_n 9 $(\frac{2}{3})^n$ 3 n

w_n $\ln(v_n)$ (w_n) 3

P_n $(u_0$ 3) $(u_1$ 3) .... $(u_n$ 3) P_n 4

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1 2019 16

(u_n) $u_0 = 13$ $u_{n+1} = \frac{1}{5}u_n + \frac{4}{5}$

1 $u_n > 1$ n

(u_n)

2 (v_n)

3 n v_n $u_n = 1 + \frac{12}{5^n}$ n $\lim\limits_{x \to +\infty} u_n$

4 $(u_0 - 1)(u_1 - 1) \times \ldots\ldots \times (u_n - 1) = \left(\frac{12}{5^{\frac{n}{2}}}\right)^{n+1}$ n

2 2019 17

f $f(x) = \sqrt{x+2} + 4$ $[4;7[$

1 f $[4;7[$

x $f(x) \in [4;7[$ $[4;7[$

2 x $f(x) = \frac{-x^2 + 9x - 14}{x - 4 + \sqrt{x+2}}$ $[4;7[$

x $f(x) - x > 0$ $[4;7[$

3 (u_n) $u_0 = 4$ $u_{n+1} = f(u_n)$

$4 \le u_n < 7$ n

(u_n)

4 $7 - u_{n+1} < \frac{1}{4}(7 - u_n)$ n

(u_n) $0 < 7 - u_n \le 3\left(\frac{1}{4}\right)^n$ n

1 2018 18

(u_n) $u_0 = 1$ $u_{n+1} = 1 - \frac{9}{u_n + 5}$:n

1 $u_n > -2$ n

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(u_n)

$v_n = \dfrac{1}{u_n + 2}$ n 2

$\dfrac{1}{3}$ (v_n)

$\lim\limits_{x \to +\infty} u_n$ u_n v_n n 3

$u_0.v_0 + u_1.v_1 + ... + u_n.v_n = \dfrac{1}{3}(1 - n^2)$ n 4

2 2018 19

$u_{n+1} = u_n + \ln\left(\dfrac{2n+3}{2n+1}\right)$ n $u_0 = 0$ (u_n)

u_3 u_2 u_1 1

(u_n) $\dfrac{2n+3}{2n+1} > 1$ n 2

$v_n = 2n + 1$ n (v_n) 3

$e^{u_n} = v_n$ n

$\lim\limits_{x \to +\infty} u_n$ n (u_n)

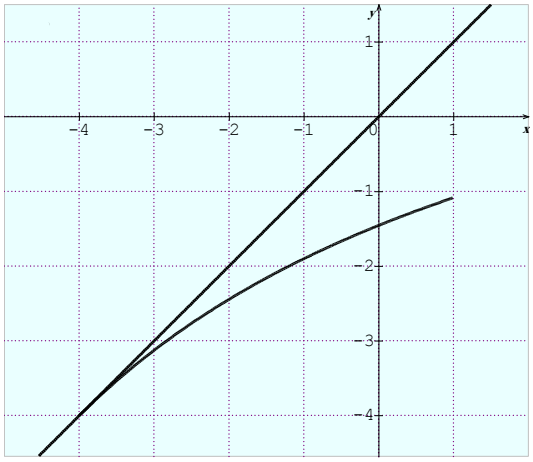
$T = e^{u_{1439}} + e^{u_{1440}} + ... + e^{u_{2018}}$ $S_n = \ln\left(\dfrac{v_1}{v_0}\right) + \ln\left(\dfrac{v_2}{v_1}\right) + ... + \ln\left(\dfrac{v_n}{v_{n-1}}\right)$ 4

1 2017 20

(v_n) (u_n)

$v_n = \dfrac{u_n + 2}{1 - u_n}$ $u_{n+1} = 3 - \dfrac{10}{u_n + 4}$ n $u_0 = \dfrac{1}{4}$

0 u_n 1 1



(u_n)

$\dfrac{5}{2}$ (v_n) 2

n v_n

n

$\lim\limits_{x \to +\infty} u_n$ $u_n = 1 - \dfrac{3}{v_n + 1}$

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2 2017 21

$f(x)=\dfrac{3x-16}{x+11}$ $[-4;1]$ $f\ (0,i,j)$

$y=x$ (Δ) (C_f)

$f(x)\in[-4;1]$ $x\in[-4;1]$ $[-4;1]$ f I

$u_{n+1}=f(u_n):n$ $u_0=0$ (u_n) II

u_3 u_2 u_1 u_0 1

(u_n)

(u_n) $-4<u_n\leq 0$ n 2

$v_n\times u_n=1-4v_n$: (v_n) 3

S $\dfrac{1}{7}$ (v_n)

$S=v_0\times u_0+v_1\times u_1+.....+v_{2016}\times u_{2016}$

1 2017 22

$\begin{cases} v_0=6 \\ v_{n+1}=\dfrac{3}{4}v_n+1 \end{cases}$ $\begin{cases} u_0=1 \\ u_{n+1}=\dfrac{3}{4}u_n+1 \end{cases}$ (v_n) (u_n)

v_1 u_1 1

$u_{n+1}-u_n$ $u_{n+2}-u_{n+1}$ 2

(v_n) (u_n)

$w_n=u_n-v_n$ (w_n) 3

n w_n w_0 q (w_n)

(v_n) (u_n) 4

2 2017 23



(C_f) $f(x)=\dfrac{3x+1}{x+3}$ $[0;+\infty[$ f

$y=x$ (Δ) (O,i,j)

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$u_0 = \alpha$ u_0 (u_n) α

$u_{n+1} = f(u_n)$: n

(u_n) α I

$\alpha = 5$ II

u_3 u_2 u_1 u_0 1

(u_n)

$v_n = \dfrac{u_n - 1}{u_n + 1}$ (v_n) 2

$\dfrac{1}{2}$ (v_n)

$\lim\limits_{x \to +\infty} u_n$ u_n v_n n

S_n' n $S_n = v_n + v_{n+1} + ...v_{n+2016}$ n 3

$$S_n' = \frac{1}{u_n + 1} + \frac{1}{u_{n+1} + 1} + ... + \frac{1}{u_{n+2016} + 1}$$

1 2016 24

$f(x) = \sqrt{2x + 8}$ $[0; +\infty[$ f I

(O, i, j) (C)

$\lim\limits_{x \to +\infty} f(x)$ 1

f

$y = x$ (Δ) (C) 2

(Δ) (C) 3

$u_{n+1} = f(u_n)$: n $u_0 = 0$ (u_n) II

u_2 u_1 u_0 1

(u_n) 2

$0 \le u_n$ 4 n 3

(u_n)

$4 - u_{n+1} \le \dfrac{1}{2}(4 - u_n)$ n

$\lim\limits_{x \to +\infty} u_n$ $4 - u_n \le \dfrac{1}{2^n}(4 - u_0)$ n

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2 2016 25

$f(x)=\dfrac{5x}{x+2}$ $[0;+\infty[$ f I

f $\lim\limits_{x\to+\infty} f(x)$ 1

$f(x)\geq 0$ $[0;+\infty[$ x 2

$u_{n+1}=\dfrac{5u_n}{u_n+2}$:n $u_0=1$ (u_n) II

$1\leq u_n\leq 3$ n 1

(u_n)

$v_n=1-\dfrac{3}{u}$: (v_n) 2

v_0 $\dfrac{2}{5}$ (v_n)

n u_n v_n n

(u_n)

$S_n=\dfrac{1}{u_0}+\dfrac{1}{u_1}+...+\dfrac{1}{u_n}$ S_n n 3

1 2016 26

$f(x)=\dfrac{13x}{9x+13}$ $I=[0;4]$ f

I f 1

I $f(x)$ I x

n $u_{n+1}=f(u_n)$ $u_0=4$ (u_n)2

$0\leq u_n\leq 4$ n

(u_n)

$u_n\neq 0$ n 3

$v_n=2+\dfrac{13}{u_n}$: (v_n) 4

v_0 (v_n)

n v_n

$\lim\limits_{x\to+\infty} u_n$ n $u_n=\dfrac{52}{36n+13}$

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2 2016 27

$u_{n+1}=\dfrac{2u_n+2}{u_n+3}$ n $u_0=0$ (u_n)

$v_n=\dfrac{u_n-1}{u_n+2}$ n (v_n)

v_0 q (v_n) 1

v_n n 2

n u_n

$\lim\limits_{x\to+\infty} u_n$

$S_n=v_0+v_1+\ldots+v_n$ n 3

n $\dfrac{1}{u_n+2}=\dfrac{1}{3}(1-v_n)$

$S'_n=\dfrac{1}{u_0+2}+\dfrac{1}{u_1+2}+\ldots+\dfrac{1}{u_n+2}$ n

1 2015 28

$u_{n+1}=(1+u_n)e^{-2}-1: n$ $u_0=e^2-1$ (u_n)

u_3 u_2 u_1 (1

$(1+u_n)$ 0 n 2

(u_n) 3

$v_n=3(1+u_n)$ n 4

(v_n)

$\lim\limits_{x\to+\infty} u_n$ n u_n v_n

$\ln v_0+\ln v_1+\ldots..+\ln v_n=(n+1)(-n+2+\ln 3)$ n

2 2015 29

$(O;i;j)$

(C_f) $f(x)=\dfrac{4x+1}{x+1}$ $[0;+\infty[$ f I

$[0;+\infty[$ f 1

y=x (D) (C_f) 2

$[0;6]$ (D) (C_f) 3

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$\begin{cases} v_0 = 5 \\ v_{n+1} = f(v_n) \end{cases}$ $\begin{cases} u_0 = 2 \\ u_{n+1} = f(u_n) \end{cases}$ (v_n) (u_n) II

v_3 v_2 v_1 v_0 u_3 u_2 u_1 u_0 1

(v_n) (u_n)

$\alpha = \dfrac{3+\sqrt{13}}{2}$ α $v_n \le 5$ $2 \le u_n$ α n 2

(v_n) (u_n)

$v_{n+1} - u_{n+1} \le \dfrac{1}{3}(v_n - u_n)$ n 3

$0 \quad (v_n - u_n) \le \left(\dfrac{1}{3}\right)^{n-1}$ n

(v_n) (u_n) $\lim\limits_{x \to +\infty} (v_n - u_n)$

1 2014 30

$u_{n+1} = \dfrac{2}{3}u_n - \dfrac{4}{3}: n$ $u_0 = 1$ (u_n)

$v_n = u_n + 4: n$ (v_n)

(v_n) 1

n u_n v_n 2

(u_n) 3

$S_n = u_0 + u_1 + u_2 + \ldots + u_n$ S_n (4

$w_n = 5\left(\dfrac{1}{v_n + 5} - 1\right)$ (w_n) (5

(w_n)

$\lim\limits_{x \to +\infty} (u_n - w_n)$

2 2014 31

e $u_n = e^{\frac{1}{2}-n}$ (u_n) I

(u_n) 1

$\lim\limits_{x \to +\infty} u_n$ 2

$S_n = u_0 + u_1 + u_2 + \ldots + u_n$ S_n n 3

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ln $v_n = \ln(u_n)$ n II

(v_n) n v_n 1

$P_n = \ln(u_0 \times u_1 \times u_2 \times ..... \times u_n)$ P_n n 2

$P_n + 4n$ 0 n

1 2013 32

$v_n = \dfrac{5^{n+1}}{6^n}$ (v_n) I

$\lim\limits_{x \to +\infty} v_n$ 2 (v_n) 1

$u_{n+1} = \sqrt{5u_n + 6}$: n $u_0 = 1$ (u_n) II

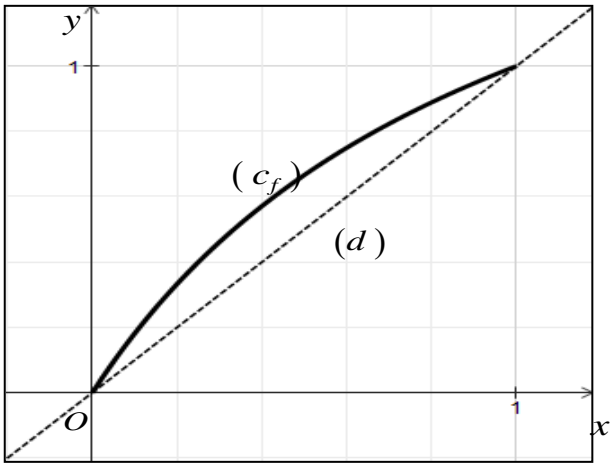
$1 \le u_n \le 6$: n 1

(u_n) 2

$6 - u_{n+1} \le \dfrac{5}{6}(6 - u_n)$ n 3

$\lim\limits_{x \to +\infty} u_n$ $0 \le (6 - u_n) \le v_n$ n

2 2013 33



f (C_f)

$f(x) = \dfrac{2x}{x+1}$ $[0;1]$

$y = x$ (d)

$u_0 = \dfrac{1}{2}$ (u_n) 1

$u_{n+1} = f(u_n)$

u_3 u_2 u_1 u_0

(u_n)

$[0;1]$ f 2

$0 \le u_n \le 1$: n

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(u_n)

$v_n = \dfrac{u_n - 1}{u_n}$ (u_n) 3

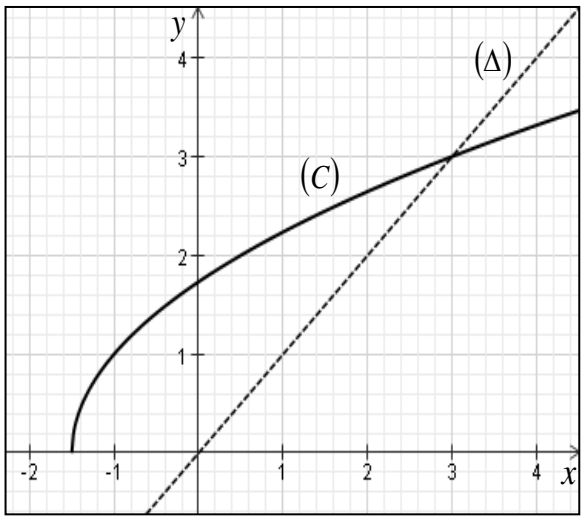
v_0 $\dfrac{1}{2}$ (v_n)

(u_n)

1 2012 34

$u_{n+1} = \sqrt{2u_n + 3}$ n $u_0 = 1$ (u_n)

C $h(x) = \sqrt{2x+3}$ $\left[-\dfrac{3}{2} + \infty\right[$ h 1



$y = x$ (Δ)

u_3 u_2 u_1 u_0

(u_n)

0 u_n 3: n ∈ 2

(u_n) 3

$\lim\limits_{n\to+\infty} u_n$ (u_n)

2 2012 35

$u_{n+1} = 3 + \sqrt{u_n - 3}$: n $u_0 = \dfrac{13}{4}$ (u_n)

3 u_n 4: n 1

(u_n) $u_{n+1} - u_n = \dfrac{-u_n^2 + 7u_n - 12}{\sqrt{u_n - 3} + u_n - 3}$ n ∈ 2

(u_n) 3

$v_n = \ln(u_n - 3)$ (v_n) 4

$\dfrac{1}{2}$ (v_n)

$\lim\limits_{x\to+\infty} u_n$ n u_n v_n

$P_n = (u_0 - 3)(u_1 - 3)(u_2 - 3) \times ..... \times (u_n - 3)$ n

$\lim\limits_{x\to+\infty} P_n = \dfrac{1}{16}$ n P_n

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1 2011 36

(u_n) $u_0=-1$ $u_{n+1}=3u_n+1$ n

v_n $v_n=u_n+\frac{1}{2}$ $n\in$

v_n 1

u_n $+\infty$ $-\frac{1}{2}$ $-\infty$ 2

$S_n=-\frac{1}{2}\left[1+e^{\ln 3}+e^{2\ln 3}+e^{3\ln 3}+....+e^{n\ln 3}\right]$ n 3

$S_n=\frac{3^{n+1}-1}{2}$ $S_n=\frac{1-3^n}{4}$ $S_n=\frac{1-3^{n+1}}{4}$

2 2011 37

α 1

u_n $u_0=6$ $u_{n+1}=\alpha u_n+1$ n

v_n $v_n=u_n+\frac{1}{\alpha-1}$ $n\in$

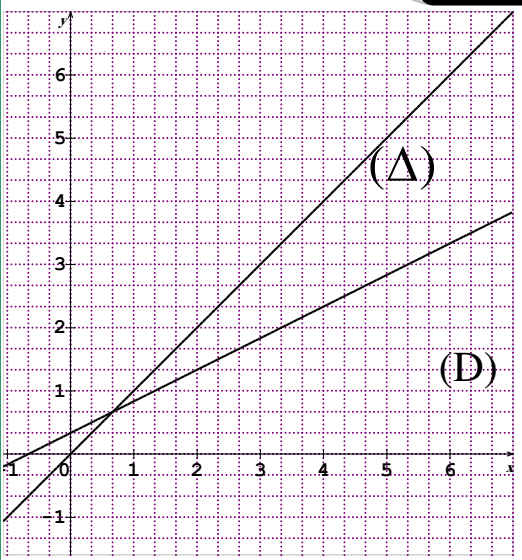
(v_n) α 1

u_n α n v_n α n

(u_n) α

$T_n=u_0+u_1+...+u_n$ $S_n=v_0+v_1+...+v_n$ n $\alpha=\frac{3}{2}$ 2

2 2010 38



$(D):y=\frac{1}{2}x+\frac{1}{3}$ $(\Delta):y=x$

(u_n) 1

$u_0=6$ $u_{n+1}=\frac{1}{2}u_n+\frac{1}{3}$ n

u_4 u_3 u_2 u_1 u_0

(D) (Δ)

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(u_n)

u_n $\frac{2}{3}$ n 2

(u_n)

$v_n = u_n - \frac{2}{3}$ (v_n) 3

(v_n)

n u_n v_n n

$S_n = v_0 + v_1 + v_2 + ... + v_n$ S_n

$S'_n = u_0 + u_1 + u_2 + ... + u_n$ S'_n

1 2009 39

$u_0 = 1 \quad u_1 = 2 \quad u_{n+2} = \frac{4}{3}u_{n+1} - \frac{1}{3}u_n$ (u_n)

$v_n = u_{n+1} - u_n$ (v_n)

(v_n) 2 v_1 v_0 1

$S_n = v_0 + v_1 + ... + v_{n-1}$ S_n n 3

$u_n = \frac{3}{2}\left(1 - \left(\frac{1}{3}\right)^n\right) + 1$ n

2 2009 40

(u_n)

$\begin{cases} u_1 + 2u_2 + u_3 = 32 \\ u_1.u_2.u_3 = 216 \end{cases}$ q u_1 (u_n)

q u_2 1

n u_n

n $S_n = u_1 + u_2 + ... + u_n$

$S_n = 728$ n

$v_{n+1} = \frac{3}{2}v_n + u_n \quad v_1 = 2$ * (v_n) 2

v_3 v_2

$\frac{1}{2}$ (w_n) $w_n = \frac{v_n}{u_n} - \frac{2}{3}$ $n \in$ *

n v_n n w_n

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1 2008 41

$f(x)=\dfrac{x+2}{-x+4}$ $I=[1,2]$ f 1

I f

I f(x) I x

$u_{n+1}=f(u_n)$ $u_0=\dfrac{3}{2}$ (u_n) 2

I u_n n

(u_n)

$u_n=1+\dfrac{1}{\left(\frac{3}{2}\right)^n+1}$ $n\in N$ 3

$\lim\limits_{x\to+\infty} u_n$

2 2008 42

$u_0=\dfrac{5}{2}$ $u_{n+1}=\dfrac{2}{3}u_n+2$ $(u_n)_{n\in N}$

(d) $y=x$ (Δ) $(O;i;j)$ 1

$f(x)=\dfrac{2}{3}x+2$ f

u_4 u_3 u_2 u_1 u_0

(u_n)

$u_n\le 6$ $n\in N$ 2

(u_n) (u_n)

$v_n=u_n-6$ n 3

(v_n)

$\lim\limits_{n\to+\infty} u_n$ n u_n

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1 2019 43

$v_n = u_n - 3n + 1$ $\begin{cases} u_0 = 0 \\ u_{n+1} = 7u_n - 18n + 9 \end{cases}$ (v_n) (u_n)

(v_n) 1

n u_n n v_n 2

$S_n = u_0 + u_1 + ... + u_n$ n S_n 3

9 7^n n 4

$1440^{2019} + 1962^{1954} + 1954^{1962}$ 9

$6S_n - 7u_n \equiv 0[9]$ n

1 2018 44

(e) $f(x) = \dfrac{2x}{ex+1}$ $[0;+\infty[$ f

$u_{n+1} = f(u_n)$: n $u_0 = \dfrac{5}{4e}$ (u_n)

$u_n > \dfrac{1}{e}$ n 1

$u_{n+1} - u_n = \dfrac{e.u_n(\frac{1}{e} - u_n)}{e.u_n + 1}$ n

(u_n)

$v_n = \dfrac{e.u_n}{e.u_n - 1}$ n (v_n) 2

n v_n v_0 2 (v_n)

$\lim\limits_{x \to +\infty} u_n$ u_n $v_n = 1 + \dfrac{1}{e.u_n - 1}$ n 3

$S_n = v_0 + v_1 + ... + v_n$ S_n n

7 2^n n 4

7 S_n n

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2 2018 45

(v_n) $u_n = 2(3)^n$ (u_n)

$v_{n+1} = 5v_n + u_n$ n $v_0 = 4$

$w_n = \frac{v_n}{u_n} + \frac{1}{2}$ n 1

$\frac{5}{3}$ (w_n)

$v_n = 5^{n+1} - 3^n$ n n w_n 2

8 5^n 3^n n 3

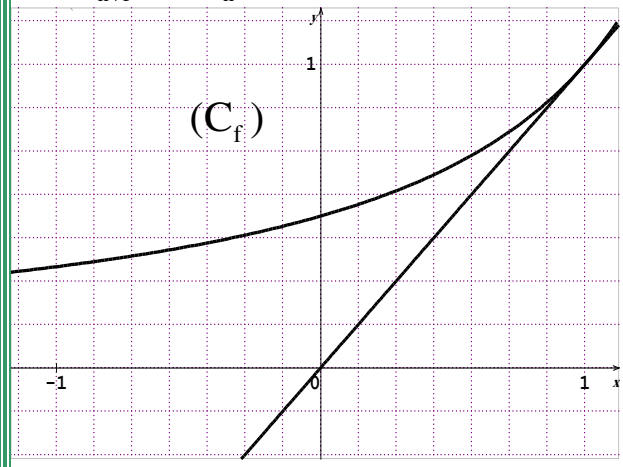
8 v_n n 4

1 2017 46

(C) $f(x) = \frac{1}{2-x}$ $]-\infty;1]$ f

$y = x$ (Δ) (O, i, j)

$u_{n+1} = f(u_n)$: n $u_0 = -1$ (u_n)



1

u_3 u_2 u_1 u_0

(u_n)

u_n 1 من n 2

(u_n) 3

$v_n = \frac{2}{1-u_n}$ n (v_n) 4

n v_n 2 (v_n)

$\lim_{n\to+\infty} u_n$ u_n

2 2017 47

$u_{n+1} = \frac{n+1}{\alpha n} u_n$ n $u_1 = \frac{1}{\alpha}$ (u_n)

2 α

u_n 0 n 1

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(u_n)

$v_n = \frac{1}{\alpha n} u_n$ n (v_n) 2

α v_1 $\frac{1}{\alpha}$ (v_n)

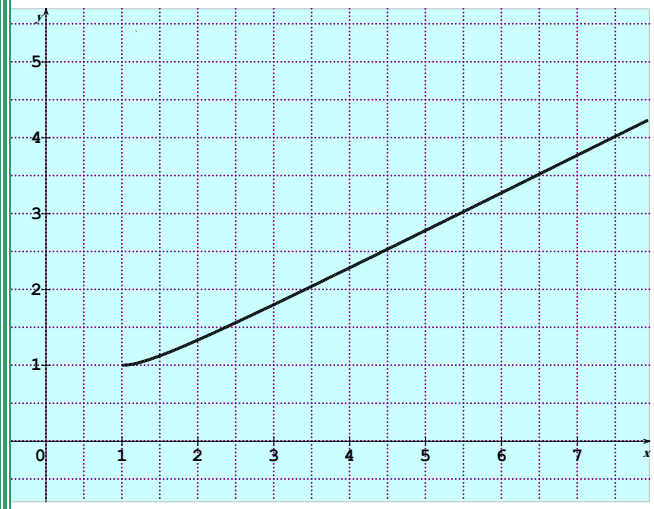
$\lim\limits_{n\to+\infty} u_n$ u_n v_n α n

$S_n = u_1 + \frac{1}{2}u_2 + \frac{1}{3}u_3 + ... + \frac{1}{n}u_n$ S_n α n 3

$\lim\limits_{n\to+\infty} S_n = \frac{1}{2016}$ α

2 2016 48

C $f(x) = \frac{x^2}{2x-1}$ $[1;+\infty[$ f



$(O;i;j)$

$[1;+\infty[$ f 1

(u_n) 2

$u_{n+1} = f(u_n)$ n $u_0 = 6$

(u_n)

(u_n)

$1 \le u_n \le 6$ n

(u_n) (u_n)

$w_n = \ln(v_n)$ $v_n = \frac{u_n - 1}{u_n}$ (w_n) (v_n) 3

2 (w_n)

n v_n n w_n

$\lim\limits_{n\to+\infty} u_n$ $u_n = \frac{1}{1-\left(\frac{5}{6}\right)^{2^n}}$

$S_n = \frac{1}{w_0} + \frac{1}{w_1} + ... + \frac{1}{w_n}$ n 4

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2 2015 49

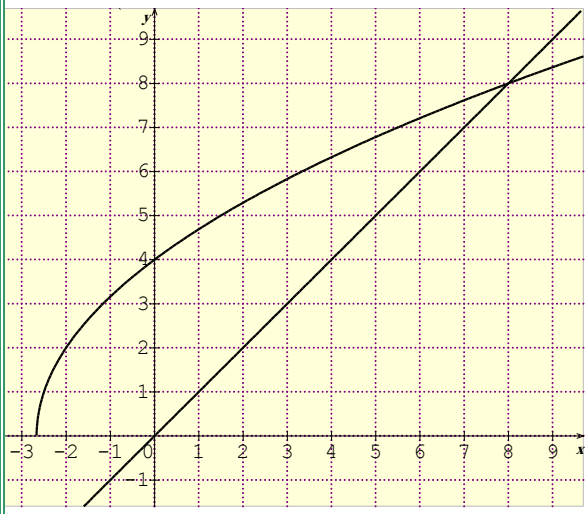
$u_{n+1}=\sqrt{6u_n+16}$ n $u_0=0$ (u_n)

C $h(x)=\sqrt{6x+16}$ $\left[-\frac{8}{3}+\infty\right[$ h 1

$y=x$ (Δ)

u_3 u_2 u_1 u_0

(u_n)



$0\le u_n$ 8: n $\in$ 2

$u_{n+1}-u_n=\frac{(8-u_n)(u_n+2)}{\sqrt{6u_n+16}+u_n}$ n $\in$

(u_n)

0 $8-u_{n+1}\le\frac{1}{2}(8-u_n)$: n $\in$ 3

$0\quad 8-u_n\le 8\left(\frac{1}{2}\right)^n$: n $\in$

1 2014 50

$\lim\limits_{n\to+\infty} u_n$

p n

5^n 16 n 1

$D_p=5^p$ $C_n=16n+9$ 2

$C_n=D_P$ n k $p=4k+2$

$p=6$ n

$f(x)=5^{(4x+2)}-9$ $[0;+\infty[$ f 3

f(x) f

$u_{n+1}=5^4(u_n+\frac{9}{16})-\frac{9}{16}$ n $u_0=1$ (u_n) 4

$u_n=\frac{5^{(4n+2)}-9}{16}$ n $\in$

(u_n) 5 u_n : n $\in$

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2 2014 51

$f(x)=x-\ln(x-1)$ $]1;+\infty[$ f I

$f(x)-x$ x 1

$f(x)\in[2:e+1]$ $x\in[2:e+1]$ f 2

$u_{n+1}=u_n-\ln(u_n-1)$ n $u_0=e+1$ (u_n) II

$u_n\in[2:e+1]$ n 1

(u_n) 2

(u_n) 3

1 2013 52

$u_n=\sqrt{\frac{u_{n-1}}{e}}$. n $u_0=e^2$ (u_n)

$v_n=\frac{1}{2}\ln u_n+\frac{1}{2}$ (v_n)

$\frac{1}{2}$ (v_n) 1

n u_n v_n 2

$\lim\limits_{x\to+\infty} S_n$ $S_n=v_0+v_1+...+v_n$ S_n n 3

$\lim\limits_{x\to+\infty} P_n$ $P_n=u_0\times u_1\times..\times u_n$ n 4

1 2011 53

$u_n=\frac{(n+1)^2}{n(n+2)}$ * (u_n)

u_n 1 $u_n=1+\frac{1}{n(n+2)}$ $n\in$ * 1

(u_n) 2

$P_n=\frac{2n+2}{n+2}$ $n\in$ * $P_n=u_1\times u_2\times u_3\times...\times u_n$ 3

$v_n=\ln(u_n)$ * v_n 4

$+\infty$ n S_n $S_n=v_1+v_2+v_3+...+v_n$ S_n P_n

1 2008 54

$f(x)=\frac{x^2+5}{x+2}$ 2 $+\infty$ f I

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2cm (O;i;j) f C_f

f

f

D C_f C_f y=x-2 D

$\left[1;\frac{5}{2}\right]$ $\left[1;\frac{5}{2}\right]$

n U_{n+1} $f(U_n)$ $U_0=1$ U_n II

U_2 U_1 U_0 y=x C_f

U_n

U_n $1 \le U_n \le \frac{5}{2}$ n

$\lim\limits_{n\to+\infty} U_n$ U_n

2 2008 55

(C_f) $f(x)=\frac{2x+3}{x+2}$ $[0;2]$ f

$[0;2]$ f 1

4cm (O;i;j) (C)

$f(x)\in[0;2]$ $x\in[0;2]$

$\begin{cases} u_0=0 \\ u_{n+1}=f(u_n) \end{cases}$ (u_n) 2

u_2 u_1 (u_n)

$y=x$ (D) (C) u_2 u_1 u_0

(u_n)

$0 \le u_n \le \sqrt{3}$ n 3

(u_n) u_{n+1} u_n n

$n\in$ * $(u_{n+1}-\sqrt{3}) \le \frac{2-\sqrt{3}}{u_n+2}(u_n-\sqrt{3})$

$n\in$ * $\left|(u_{n+1}-\sqrt{3})\right| \le k\left|(u_n-\sqrt{3})\right|$ $]0;1[$ k

$\lim\limits_{x\to+\infty} u_n$ $\left|(u_n-\sqrt{3})\right| \le k^n\left|(u_0-\sqrt{3})\right|$

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1 2019 56

y x $(x;y)$ $505x-673y=1.....(E)$ 1

$2020=4\times505$ $2019=3\times673$

y x (E) $(x;y)$ 2

$\begin{cases} v_0=4 \\ v_{n+1}=v_n+673 \end{cases}$ $\begin{cases} u_0=3 \\ u_{n+1}=u_n+505 \end{cases}$ (v_n) (u_n) 3

β α β v_β α u_α

(v_n) (u_n) 4

(w_n)

$X_n=\frac{1}{505}(w_n-2023)$ n

$p=X_1.X_2.X_3.....X_n$ n

2 2019 57

$u_1=0$ (u_n)

$u_{n+1}=u_n+2\sqrt{u_n}+1$ n

$\sqrt{u_{n+1}}-\sqrt{u_n}=1$ n 1

n u_n

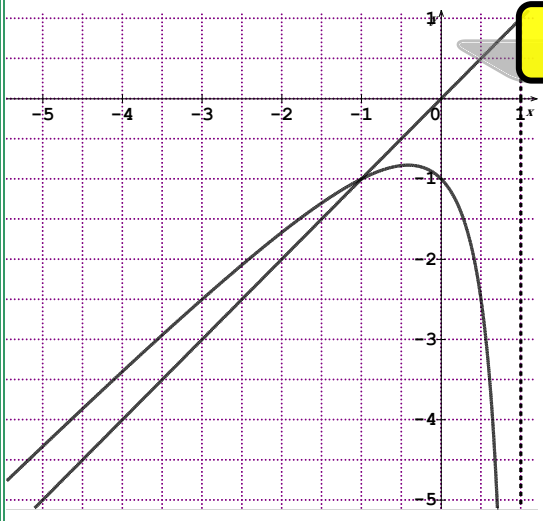
$u_n=n(n-2)+1$ n 2

$(n-5)$ $(n-2)$ n 3

$PGCD(n-2;u_n)=1$ $n\geq2$ n 4

$(n-5)u_n$ $(n-2)(n^2+1)$ n

2018 58



$f(x)=\frac{x^2+1}{x-1}$ $]-\infty;1[$ f

$u_0=-3$ (u_n)

$u_{n+1}=f(u_n)$ n

(C_f)

(Δ) (O,i,j)

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$y = x$

1

$u_3 \quad u_2 \quad u_1 \quad u_0$

(u_n)

$-3 \le u_n \le -1 \quad n$ **2**

$u_{n+1} + 1 \ge \frac{3}{4}(u_n + 1) \quad n$ **3**

$\lim_{x \to +\infty} u_n \quad u_n + 1 \ge -2\left(\frac{3}{4}\right)^n \quad n$

$S_n = u_0 + u_1 + u_2 + ... + u_n$ 4

$8\left[\left(\frac{3}{4}\right)^{n+1} - 1\right] \le (u_0 + 1) + (u_1 + 1) + ... + (u_n + 1) < 0 \quad n$

$\lim_{x \to +\infty} S_n$

2 2017 59

$u_0 = 1$ (u_n)

$u_{n+1} = 7u_n + 8 : n$

$3u_n = 7^{n+1} - 4 \quad n$ 1

$S_n' = u_0 + u_1 + ... + u_n \qquad S_n = 1 + 7 + 7^2 ..... + 7^n \quad n$ 2

$S'_n \quad S_n \qquad S_n \qquad n$

$18 \times S'_n = 7^{n+2} - 24n - 31 \quad n$

5 7^n n 3

5 S'_n n

2 2017 60

$u_{n+1} = 4u_n + 1$ $u_0 = 0$ u_0 (u_n)

$u_n = \frac{1}{3}(4^n - 1) \quad n$ 1

$u_{n+1} \quad u_n \qquad n$

$v_n = u_n + \frac{1}{3} \quad n$ (v_n) 2

v_0 (v_n)

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$S_n = v_0 + v_1 + v_2 ..... + v_{3n}$ S_n n

$4^{n+1} - 1$ $4^n - 1$ $n \in$ 3

7 4^n n 4

7 $A_n = 9S_n - 6n - 3^{6n+4}$ A_n n

1 2016 61

$\begin{cases} \ln(u_1) + \ln(u_2) = 11 \\ u_1 + u_2 = e^4(1+e^3) \end{cases}$ q u_0 (u_n)

q u_2 u_1 1

$q = e^3$ $u_1 = e^4$ 2

n u_n

n S_n $S_n = \ln(u_0) + \ln(u_1) + ... + \ln(u_n)$

$a_n = n + 3$ n 3

$PGCD(2S_n ; a_n) = PGCD(a_n ; 14)$ 3

$PGCD(2S_n ; a_n)$

$PGCD(2S_n ; a_n) = 7$

7 2^n 4

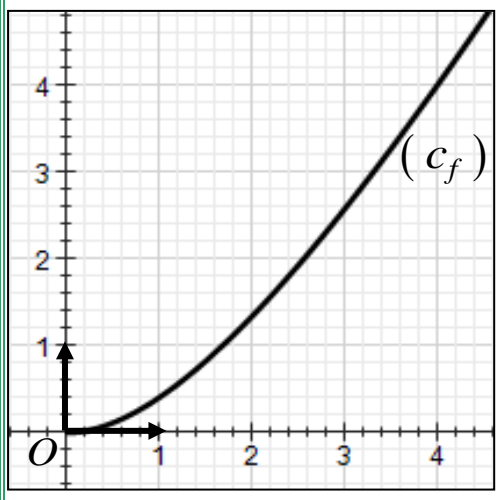
$b_n = 3n.a_n - 2S_n + 1437^{2016} + 1$ 5

$\begin{cases} b_n \equiv 0[7] \\ n \equiv 0[5] \end{cases}$ n

7 $1437^{9n+1} - 3 \times 4^{12n+1} + 52$ n 6

1 2014 62

(C_f) $f(x) = \dfrac{2x^2}{x+4}$ $[0; +\infty[$ f



f

f (1

$u_0 = 3$ (u_n) 2

$u_{n+1} = f(u_n)$ n

$y = x$ (Δ)

(Δ) (C_f)

u_4 u_3 u_2 u_1 u_0

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(u_n)

$0 \le u_n \le 3$ n 3

(u_n) (u_n)

$0 \le u_{n+1} \le \frac{6}{7}u_n$ n $7u_{n+1} - 6u_n$ 4

$0 \le u_n \le 3\left(\frac{6}{7}\right)^n$ n

$+\infty$ n (u_n)

2 2012 63

$u_{n+1} = 6u_n - 9$ n $u_0 = 16$ (u_n)

7 u_4 u_3 u_2 u_1 u_0 1

$u_{2k+1} \equiv b[7]$ $u_{2k} \equiv a[7]$ b a

$u_{n+2} \equiv u_n[7]$ n 2

$u_{2k+1} \equiv 3[7]$ $u_{2k} \equiv 2[7]$ k

$v_n = u_n - \frac{9}{5}$ n 3

(v_n)

$S_n = u_0 + u_1 + ... + u_n$ S_n u_n n

1 2011 64

$\begin{cases} m = PPCM(u_3;u_5) \\ d = PGCD(u_3;u_5) \end{cases}$ $\begin{cases} u_4 = 15 \\ m + d = 42 \end{cases}$ (u_n)

u_0 u_5 u_3 1

(u_n) 2010 n u_n 2

10080 (u_n) 5 3

n 4

$S = u_0 + u_1 + ... + u_{2n}$ S n

$S_2 = u_1 + u_3 + u_4 ... + u_{2n-1}$ $S_1 = u_0 + u_2 + u_4 ... + u_{2n}$ S_2 S_1 n

1 2009 65

3cm (C_f) $f(x) = \frac{1}{2}(x + \frac{5}{x})$ $[1,5]$ f 1

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f

$y = x$ (Δ) (C)

$u_0 = 5$ $u_{n+1} = \frac{1}{2}(u_n + \frac{5}{u_n})$ (u_n) 2

u_2 u_1

u_2 u_1 u_0 (Δ) (C)

$u_n \geq \sqrt{5}$ n 3

(u_n)

$\lim_{n\to+\infty} u_n$ $(u_n - \sqrt{5}) \leq \left(\frac{1}{2}\right)^n (u_0 - \sqrt{5})$ $(u_{n+1} - \sqrt{5}) \leq \frac{1}{2}(u_n - \sqrt{5})$ $n \in$ 4

2 2009 66

$u_{n+1} = 3u_n + 2n + 1$ n $u_0 = 0$ (u_n)

β α $v_n = u_n + \alpha n + \beta$ n v_n

v_n β α 1

n u_n v_n 2

$S' = u_0 + u_1 + u_2 + ... + u_n$ $S = v_0 + v_1 + v_2 + ... + v_n$ 3

5 3^n n 4

5 u_n n

1 2008 67

(C_f) $f(x) = 3 + \sqrt{x-1}$ $[1; +\infty[$ f

$\lim_{x\longrightarrow 1} \frac{f(x) - f(1)}{x - 1}$ 1

f

(C_f)

$y = x$ (D)

$u_{n+1} = f(u_n)$ $u_0 = 2$ (u_n) 2

u_2 u_1 u_0 (C_f) (D)

(u_n)

u_{n+1} u_n $2 \leq u_n \leq 5$ $n \in$ * 3

$\lim_{n\to+\infty} u_n$ (u_n)

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$u_0 = 2 \quad u_{n+1} = \frac{2}{3}u_n + 1$ (u_n)

$u_3 \quad u_2 \quad u_1$ 1

$v_n = u_n + \left(\frac{2}{3}\right)^n \quad n \in \quad :$ (v_n) 2

$n \qquad u_n \qquad (v_n)$

$\lim_{n \to +\infty} u_n$

$S = w_0 + w_1 + w_2 + ... + w_n \qquad w_n = \frac{2}{3}n - \left(\frac{2}{3}\right)^n : n \in$ (w_n) 3

1997 69

$\ln u_2 - \ln u_4 = 4$ $\ln u_1 + \ln u_5 = -12$ (U_n 1

n u_n u_0

$+\infty$ n S_n n S_n $u_0+u_1+.....+u_n$ S_n

$V_n = \ln u_n + \ln u_{n+1}$ n (V_n 2

(V_n

$S_n'^2$ 2^{30} n $v_0 + v_1 + ...+ v_n$ S'_n

2004 70

$U_n - 2U_{n+1} = 2n+3$ $n \in$ $U_0 = 2$ (U_n)

$U_n = 2^{-n} - 2n + 1$ $n \in$ 1

(V_n) m 2

$V_n = U_n + mn - 1$

$S_n = V_0 + V_1 + ... + V_n$ n

$\lambda \in$ $2KA + 3KB + \lambda KC = 0$ K C B A 3

$\{(A;S_0),(B;S_1),(C;S_2)\}$ K λ

2007 71

$4U_{n+2} = 7U_{n+1} - 3U_n$ $n \in$ $U_1 = \frac{1}{2}$ $U_0 = \frac{1}{4}$ (U_n)

$V_n = U_{n+1} - U_n$ $n \in$: (V_n)

$\frac{3}{4}$ (V_n) 2 V_0 U_2 1

$S_n = V_0 + V_1 + ... + V_n$ S_n 3

n U_n $V_n = U_{n+1} - U_n$ S_n U_n 4

$+\infty$ n U_n

2006 72

$n \in$ $u_{n+1} = \frac{7u_n + 2}{u_n + 8}$ u_0 (u_n)

(u_n) u_0 1

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u_2 u_1 $u_0 = 0$ 2

(u_n) $0 \le u_n \le 1$ $n \in$

$v_n = \dfrac{u_n + 2}{u_n - 1}$ $n \in$ (v_n) 3

(V_n)

$+\infty$ n (u_n) n u_n

$\pi_n = v_0 \times v_1 \times v_2 \times \ldots \times v_n$ $S = v_0 + v_1 + v_2 + \ldots + v_n$ π_n S_n

2004 — 73

7 4^n 3^n n 1

7 $\left(2 \times 2006^{3n+2} + 1424^{6n+1}\right)$ $n \in$ 2

$u_n = 2 \times 3^n + 3 \times 4^n$ $n \in$ 3

$s_n = u_0 + u_1 + \ldots + u_n$ s_n n

7 s_n n

1998 — 74

q u_0

q u_0 (u_n)

$3u_0^2 = u_3 - u_1$ u_0 q u_0 q 1

$P_n = v_0 \times v_1 \times v_2 \times \ldots \times v_n$ $S_n = v_0 + v_1 + v_2 + \ldots + v_n$ $q = 3$ $u_0 = 8$ 2

n P_n S_n

13 3^n n 3

13 S_n n

2005 — 75

β α 1

α β $\alpha(\alpha^2 - 19) = 35\beta$ β α

q u_0 (u_n) 2

q u_0 q u_0

$35u_0^2 + 19u_1 - u_3 = 0$ q u_0

S_n n $S_n = u_0 + u_1 + \ldots + u_n$

10 S_n n

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2016 76

(u_n) $u_0=2$ $u_{n+1}=\frac{1}{16}u_n+\frac{15}{16}$ n

1 $u_n>1$ n

n $u_{n+1}-u_n=-\frac{15}{16}(u_n-1)$

(u_n)

(u_n)

2 (v_n) $v_n=u_n-1$

(v_n) $\frac{1}{16}$ v_n n

(u_n) n $u_n=1+\left(\frac{1}{16}\right)^n$

2016 77

(شعبة العلوم التقنيّة /الدورة الرّئيسيّة- ترجمة الأستاذ:م.جبالى)



(Γ)

$f(x)=-x+\ln(1+x^2)$ $[0;+\infty[$ f (O,i,j)

O (Γ)

1 $\ln(1+x^2)\leq x$ $[0;+\infty[$ x

2 (u_n)

$$\begin{cases} u_0=\frac{3}{2} \\ u_{n+1}=\frac{1}{2}\ln(1+u_n^2) \ ; \ n\in \end{cases}$$

u_n 0 n

$u_{n+1}\leq\frac{1}{2}u_n$ n

$u_n\leq\frac{3}{2}\left(\frac{1}{2}\right)^n$ n

(u_n)

3 (S_n) $S_n=u_0+u_1+\quad+u_n$

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(S_n)

$$S_n \le 3-\frac{3}{2}\left(\frac{1}{2}\right)^n \quad n$$

(S_n)

C te d'Ivoire 2016 78

$h(x)=2x-x^2$ $[0;1]$ h 1

$[0;1]$ h

$[0;1]$ $h(x)$ $[0;1]$ x

$u_{n+1}=h(u_n)$ n $u_0=\frac{3}{7}$ u 2

0 u_n 1 n

u u

$v_n=\ln(1-u_n)$ n v 3

2 v

u v n v_n

2016 79

n $u_{n+1}=\frac{3+u_n}{5-u_n}$ $u_0=2$ (u_n)

n $u_{n+1}-3=\frac{4(u_n-3)}{2+(3-u_n)}$ 1

u_n 3 n

n $v_n=\frac{u_n-1}{3-u_n}$ (v_n) 2

$\frac{1}{2}$ (v_n)

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n $v_n=\left(\frac{1}{2}\right)^n$

n u_n n $u_n=\frac{1+3v_n}{1+v_n}$

(u_n)

2015 80

$q=\frac{1}{3}$ $u_0=\frac{1}{3}$ (u_n) 1

$\lim_{n\to+\infty}u_n$ u_1

$S_n=\frac{1}{2}\left(1-\frac{1}{3^{n+1}}\right)$ $S_n=u_0+u_1+\quad+u_n$ n

$1+x\le e^x$ $x\in$ $h(x)=e^x-1-x$ h 2

$v_n=(1+u_0)(1+u_1)\times\ldots\times(1+u_n)$ n (v_n) 3

v_1 v_0

(v_n)

$v_n\le e^{\frac{1}{2}\left(1-\frac{1}{3^{n+1}}\right)}$ n

(v_n)

1 $l\le\sqrt{e}$ (v_n) l

2015 81

n $u_0=a$ (u_n)

a $u_{n+1}=e^{2u_n}-e^{u_n}$

$g(x)=e^{2x}-e^x-x$ x g 1

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$g'(x)=(e^x-1)(2e^x+1)$ x $g'(x)$

g

(u_n) $u_{n+1}-u_n=g(u_n)$

$a\le 0$ 2

$u_n\le 0$ n

(u_n)

$a=0$ (u_n)

a 0 3

$u_{n+1}-u_n\ge g(a)$ n

$u_n\ge a+n.g(a)$ n

(u_n)

2014 82

$u_{n+1}=\dfrac{u_n-1}{u_n+3}$ n $u_0=0$ (u_n)

$u_n>-1$ n 1

(u_n)

(u_n)

$v_n=\dfrac{1}{u_n+1}$ (v_n) 2

(v_n)

(u_n) n u_n v_n

2014 83

$u_{n+1}=\dfrac{1}{2}u_n+7$ $n\in$ $u_0=13$ (u_n)

$u_n<14$ n 1

$v_n=u_n-14$ n (v_n) 2

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n v_n $\frac{1}{2}$ (v_n)

$u_n = 14 - \left(\frac{1}{2}\right)^n$ n

$u_n > 13.99$ n

Polynésie 2014 84

$u_{n+1} = u_n + 2n + 2$ $n \in$ $u_0 = 0$ (u_n)

u_2 u_1 1

(v_n) n v_n $v_n = u_{n+1} - u_n$ (v_n) 2

$S_n = (n+1)(n+2)$ n $S_n = v_0 + v_1 + \cdots + v_n$

n u_n $S_n = u_{n+1} - u_0$ n

2009 85

$3U_{n+1} = U_n + 6$ $n \in$ $U_0 = 6$ $(U_n$

U_n 3 $n \in$ 1

$(U_n$ $(U_n$

$V_n = \ln(U_n - 3)$ (V_n) 2

$r = -\ln 3$ (V_n)

$(U_n$ n U_n V_n

2004 86

$u_{n+1} = \frac{1}{2 - u_n}$ n $u_0 = 0$ (u_n) 1

u_3 u_2 u_1

(w_n) (u_n)

$w_n = \frac{n}{n+1}$

$w_n = u_n$ n

$v_n = \ln\left(\frac{n}{n+1}\right)$ (v_n) 2

$v_1 + v_2 + v_3 = -\ln 4$

∞ n S_n $S_n = v_0 + v_1 + \cdots + v_n$ n

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2010 87

$u_{n+1}=\frac{1}{3}u_n+n-2$ n $u_0=1$ (u_n)

u_3 u_2 u_1 1

$u_n \geq 0$ $n \geq 4$ 2

$u_n \geq n-3$ $n \geq 5$

(u_n)

$v_n=-2u_n+3n-\frac{21}{2}$ n v_n 3

v_n

$u_n=\frac{25}{4}\left(\frac{1}{3}\right)^n+\frac{3}{2}n-\frac{21}{4}$ n

n S_n $S_n=\sum_{k=0}^{n} u_k$ n S_n

Metropole2010 88

$u_{n+1}=\frac{4u_n-1}{u_n+2}$ n $u_0=5$ $\mathbb{N}$ (u_n)

(C) $y=x$ $(O;i;j)$ 1

$f(x)=\frac{4x-1}{x+2}$ $[-2;+\infty[$ f

u_3 u_2 u_1 u_0

(u_n)

u_n 1 $n \in$ 2

$v_n=\frac{1}{u_n-1}$ 3

n v_n (v_n)

$\lim\limits_{x\to+\infty} u_n$ n u_n

A-Guyane2012 89

$u_{n+1}=\left(\frac{n+1}{2n}\right)u_n$ $u_1=\frac{1}{2}$ (u_n)

u_4 u_3 u_2 1

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u_n n 2

l (u_n)

$v_n = \frac{u_n}{n}$ n 3

v_1 (v_n)

$u_n = \frac{n}{2^n}$ n n

$f(x) = \ln x - x \ln 2$ $[1;+\infty[$ f 4

(u_n) $+\infty$ f

Pondichéry 2010 90

$u_{n+1} = \frac{1}{2}u_n + n - 1$ n $\in$ $u_0 = 1$ (u_n)

(u_n) 1

$v_n = 4u_n - 8n + 24$ n $\in$ (v_n) 2

(v_n)

$u_n = 7\left(\frac{1}{2}\right)^n + 2n - 6$ n $\in$

$S_n = u_0 + u_1 + \cdots + u_n$ n

Polynésie 2010 91

$u_{n+1} = \frac{3u_n}{1+2u_n}$ n $\in$ $u_0 = \frac{1}{2}$ (u_n)

u_2 u_1 1

$0 < u_n < 1$ n 2

(u_n) (u_n)

$v_n = \frac{u_n}{1-u_n}$ n (v_n) 3

(v_n)

(u_n) $u_n = \frac{3^n}{3^n + 1}$ n

تونس2010 92

n $v_0 = 2$ $u_0 = 1$ (v_n) (u_n)

$\frac{1}{2} < \alpha < 1$ α $v_{n+1} = (1-\alpha)u_n + \alpha v_n$ $u_{n+1} = \alpha u_n + (1-\alpha)v_n$

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$w_n = v_n - u_n$ (w_n) 1

$w_n = (2\alpha - 1)^n$ n w_1 w_0

(w_n)

$u_n \leq v_n$ n 2

(v_n) (u_n)

l (v_n) (u_n)

l $u_n + v_n = 3$ n

N Calédonie2011 93

$f(x) = x - \ln(x^2 + 1)$ f

$f(x) = x$ 1

$f(x) \in [0;1]$ $x \in [0;1]$ $[0;1]$ f 2

$u_{n+1} = u_n - \ln(u_n^2 + 1)$ $n \in$ $u_0 = 1$ (u_n)

$0 \leq u_n \leq 1$ n 1

(u_n) 2

(u_n) 3

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94

u_0 1

(u_n)

$u_{n\ 1}$ u_n $2n$ 3

(u_n) u_n n^2 n 1

(u_n) 2

w_n $u_{n\ 1}$ u_n n 3

(w_n)

$S_{n\ 1}$ w_0 w_1 ... $w_{n\ 1}$

(u_n) n u_n

95

$u_{n\ 1}$ $e\sqrt{u_n}$ n u_0 e^3 (u_n)

u_n e^2 n 1

(u_n) 2

v_n $\ln(u_n)$ 2 n 3

(v_n)

(u_n) (v_n) n u_n n v_n

P_n u_0 u_1 .... u_n P_n n 4

u_1 $\frac{1}{2}$ u_0 1 (u_n)

$u_{n\ 1}^2$ $2u_{n\ 2}$ u_n n

v_n $\frac{u_{n\ 1}}{u_n}$ n 1

v_0 (v_n)

$u_{n\ 1}$ $(\frac{1}{2})^{n\ 1}$ u_n n 2

u_n $(\frac{1}{2})^{\frac{n(n\ 1)}{2}}$ n 3

(u_n) 4

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u_n $\frac{n^2}{2^n}$ (u_n) *

v_n $\frac{u_{n+1}}{u_n}$ n 1

v_n $\frac{1}{2}$ * n $\lim_n v_n$ $\frac{1}{2}$

v_n $\frac{3}{4}$ n p p

u_{n+1} $\frac{3}{4}u_n$ n p

S_n u_5 u_6 ..... u_n n 5 2

u_n $(\frac{3}{4})^{n-5}$ u_5 n $5\,n$ 5

S_n 1 $\frac{3}{4}$ $(\frac{3}{4})^2$ ..... $(\frac{3}{4})^{n-5}$ u_5 n 5

S_n $4u_5$ n 5

$(S_n)_{n-5}$ 3

97

(u_n)

u_{n+1} $7u_n$ $8u_{n+1}$ n 1 u_1 1 u_0 0

s_n u_{n+1} u_n (s_n) 1

(s_n)

n s_n

t_n v_{n+1} v_n (t_n) v_n $(-1)^n$ u_n 2

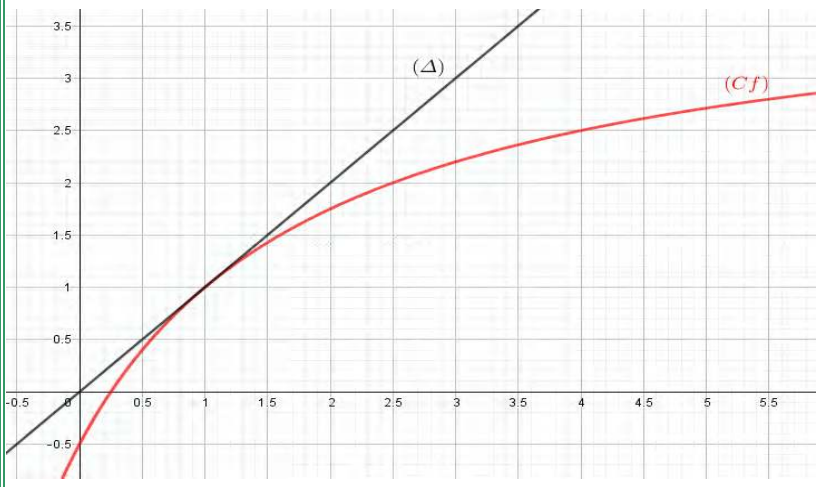
s_n t_n

t_0 ... t_{n-1} n u_n v_n 3

$\lim_n (\frac{u_n}{8^n})$

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98



$2;$ f

(C_f) $f(x)$ $\dfrac{4x \quad 1}{x \quad 2}$

( )

$(O;i;j)$

$u_0 \quad 5$

(u_n)

$u_{n \ 1} \quad f(u_n)$

$u_3 \quad u_2 \quad u_1 \quad u_0$ ( ) (C_f) 1

(u_n)

$u_n \quad 1 \quad 0 \quad n$ 2

1

$v_n \quad \dfrac{1}{u_n \quad 1} \quad n$ 3

$\dfrac{1}{3}$ (v_n)

(u_n) $v_n \quad u_n \quad n$

99

. $u_{n \ 1} \quad \dfrac{2}{1 \quad u_n} \quad n$ $u_0 \quad 3$ (u_n)

(u_n) 1

$x^2 \quad x \quad 2 \quad 0$ l (u_n) 2

$v_n \quad \dfrac{u_n \quad 1}{u_n \quad 2}$ (v_n) 3

(v_n)

(v_n)

(u_n) $n \quad u_n$ 4

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