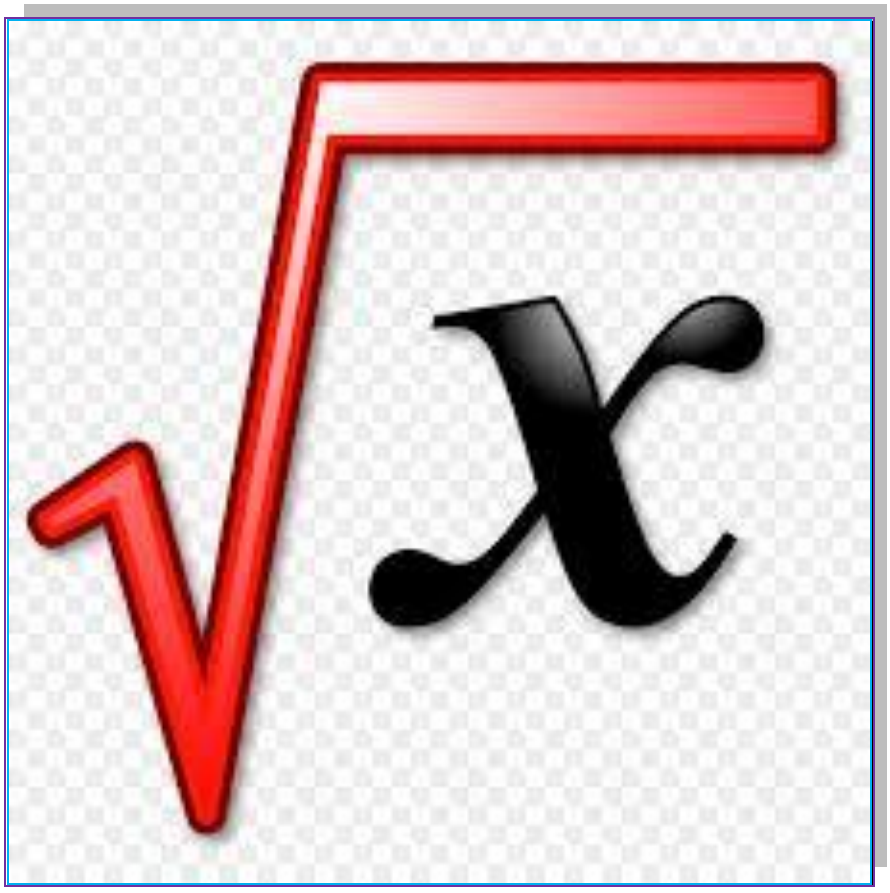
2020



BAC2020

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05

I $P(z)=z\left[z^2-9z+31\right]-39$ $P(z)$ z

1 $P(z)=(z-3)\left(z^2+az+b\right)$ z b a

2 $P(z)=0$

II M B A $(O;u,v)$

θ $m\neq b$ $m\neq a$ $m=3+2e^{i\theta}$ $b=\bar{a}$ $a=3-2i$

1 2 3 $\mathscr{E}$ M $|m-3|$

$-\frac{\pi}{2}$ A r M P p m

$\frac{\pi}{2}$ B r' M L $l=5+(m-1)i$

2 $MKLB$ $l+m=b+k$ K k

$n=2+m+(3-m)i$ $APNM$ N

3 $\mathscr{E}$ M $[PL]$ Ω

$\mathscr{E}$ Ω

4 NK

ΩNK

5 M N

04

U_1 U_2 U_1

U_2 1 1 0 1 1 1 1 2 0

1 0 1 1 2

U_2 U_1 **I**

1

A **B** **C**

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B A 2

U_1 3

U_3 U_2 U_1 II

X

X

04

13 5^n n **1**

13 $2020^{1441}+1442^{2021}-5$ **2**

13 $2020^{1441}-1442^{2021}+5n^2$ n **3**

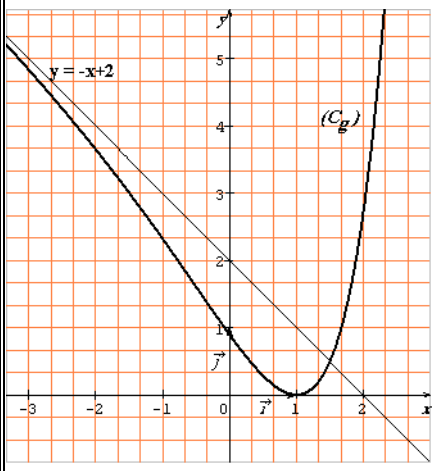
$8\times 2^{12n}+6\times 2019^{2020}+2020\equiv 2[13]$ n **3**

$2^{2019}\equiv 8[13]$ **4**

13 $A_n=1962^n+7n-22\times 2^{2019}$ n

13 A_{1962}

07



$g(x)=(2x-3)e^{x-1}-x+2$ g **I**

g (C_g)

g $g'(x)$ **1**

$g(x)$ **2**

$(2x-3)e^{x-1}\geq x-2$ x **3**

$f(x)=(2x-3)e^{x-1}$ f **II**

$(O;i;j)$ (C_f)

$\lim\limits_{x\to+\infty} f(x)$ $\lim\limits_{x\to-\infty} f(x)=0$ **1**

$f'(x)=(2x-1)e^{x-1}$ f **2**

f $f'(x)$ **3**

(C_f) **4**

(C_f) $-\frac{1}{2}$ A

1 (Δ) (C_f) **5**

(C_f) (Δ) (Δ) (C_f)

$f(x)-x=m$ m m **6**

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05

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

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

1 (v_n)

$4u_n = 5^n(4u_0 + 3) - 3$ * n

2 5^n 11

$5^4 \equiv 13[17]$ $13^2 \equiv -1[17]$ $5^{16} \equiv 1[17]$

$u_{2020} \equiv u_0[11]$ $u_{2020} \equiv 13u_0 + 9[17]$

3 $(x;y)$ $17x - 13y = 9$

$u_{2020} \equiv 0[17]$ $u_0 \equiv 15[17]$

u_0 u_{2020} 187

4 $u_0 = 253$ S_n $S_n = u_0 + u_1 + ... + u_n$

$\begin{cases} 16S_n \equiv 0[11] \\ n \equiv 2971[5] \end{cases}$ n $16S_n = 1015 \times 5^{n+1} - 12n - 1027$ n

04

(I (E) $z^2 - 2(1 + 2\cos\theta)z + 5 + 4\cos\theta = 0$ z θ

(II $(O;u;v)$ A B C D

$z_A = 1 + 2e^{i\frac{\pi}{2}}$ $z_B = 1 + 2e^{i\frac{\pi}{6}}$ $z_C = \overline{z_B}$ $z_D = \overline{z_A}$

1 z_A z_B

2 n $\arg\left[\frac{z_B - 1}{2}\right]^{n^2+n+4} = \pi k$ $k \in$

3 $\frac{z_D - z_B}{z_A - z_B}$

A B C D ABD

4 (Γ) M(z) $\bar{z}z_A = \bar{z} + k(z_B - 1)e^{-i\frac{5\pi}{6}}$ k -

04

$(O,i;j;k)$ $A(2;1;3)$ $B(3;2;5)$ $C(-1;7;6)$

1 AB AC

$AE = \alpha AB + \beta AC$ α β

A B C $E(0;4;4)$

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$\cos(BAC)$ $AB.AC$ **2**

$\frac{9\sqrt{3}}{2}ua$ ABC

(ABC) $D(-1;3;5)$ E **3**

$ABCD$

(AC) E $[AC]$ E' **4**

$x-2y-z+12=0$ (DEE')

07

$g(x)=x-\ln x$ $]0;+\infty[$ g **I**

$]0;+\infty[$ $g(x)$ **2** g **1**

$\begin{cases} f(x)=x+1+x\ln\left(\frac{x+1}{x}\right) \\ f(0)=1 \end{cases}$ $]-\infty;-1[\cup[0;+\infty[$ f **II**

$(O;i;j)$ (C_f)

$\lim\limits_{x\xrightarrow{<}-1} f(x)$ 1

$t=\frac{1}{x}$ $\lim\limits_{x\to-\infty} f(x)$ $\lim\limits_{x\to+\infty} f(x)$ $\lim\limits_{x\to+\infty} x\ln\left(\frac{x+1}{x}\right)=1$

0 f

$f'(x)=g\left(\frac{x}{x+1}\right)$ $]-\infty;-1[\cup]0;+\infty[$ x 2

f

$-2,32<\alpha<-2,30$ α $f(x)=0$ 3

$\lim\limits_{|x|\to+\infty}[f(x)-x]$ 4

$h(x)=x-1+x\ln\left(\frac{x+1}{x}\right)$ $]-\infty;-1[\cup]0;+\infty[$ h 5

$h(x)$ h

$y=x+2$ (Δ) (C_f) $h(x)$

(C_f) (Δ) 6

$1+\frac{1}{x}+\ln\left(\frac{x+1}{x}\right)=|m|$ m 7

(C_k) $\begin{cases} k(x)=x+1+x\ln\left(\frac{|x|+1}{|x|}\right);x\neq 0 \\ f(0)=1 \end{cases}$ k **III**

(C_f) (C_k) (C_k) $A(0;2)$

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04

672 756 **1**

y x $672x+756y=-840$ 1 **2**

E $8x+9y=-10$ 1

E ^{2} E

(P_2) (P_1) $(O;i;j;k)$ **3**

$3x-y+5z=0$ $x+2y-z=-2$

(P_2) (P_1)

(P_2) (P_1) (Δ)

E (Δ)

(Δ)

04

. $\frac{2}{3}$

$\frac{4}{5}$

. $\frac{1}{2}$

n $\mathbf{A_n}$ **n**

. $\overline{\mathbf{A}}_\mathbf{n}$ $\mathbf{q_n}$ $\mathbf{A_n}$ $\mathbf{p_n}$ **n** $\overline{\mathbf{A}}_\mathbf{n}$

$\mathbf{q_2}$ $\mathbf{p_2}$ $\mathbf{q_1}$ $\mathbf{p_1}$ 1

$\mathbf{p_{n+1}=\frac{3}{10}p_n+\frac{1}{2}}$ **n** 2

$\mathbf{u_n=p_n-\frac{5}{7}}$ **n** $\mathbf{(u_n)}$ 3

$\mathbf{(u_n)}$

. $\mathbf{(p_n)}$ **n** $\mathbf{p_n}$ **n** $\mathbf{u_n}$

. $\mathbf{p_n \geq 0{,}7123}$ **n** 4

05

$P(z)=z^3-\sqrt{3}z^2+z+7\sqrt{3}$ $P(z)$ z **I**

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$P(z)=(z+\sqrt{3})(z^2-2\sqrt{3}z+7)$ z $P(-\sqrt{3})$ **1**

$P(z)=0$ **2**

D C B A (O,u,v) **II**

$d=b-i$ $c=-\sqrt{3}$ $b=\bar{a}$ $a=\sqrt{3}-2i$

D $|d|$ **1**

C A B D B

ABC

m $[CB]$ M **2**

$m=(2\alpha-1)\sqrt{3}+2\alpha i$ $[0;1]$ α

AB M N n

B A C M P $p=-\sqrt{3}+4\alpha i$

$n=-\frac{\sqrt{3}}{2}+\frac{9}{2}i$ m $\alpha=\frac{1}{4}$ **3**

m^{2019} m^k k

BNP $\frac{p-b}{n-b}$

$-\frac{\pi}{3}$ B P **4**

07

$g(x)=-1+xe^{1-x}$ g **I**

$g(x)$ **2** g **1**

(C_f) $f(x)=x-1+xe^{1-x}$ f ***II***

$\lim_{x\to+\infty} f(x)$ $\lim_{x\to-\infty} f(x)$ **1**

$+\infty$ (Δ) (C_f)

$f'(x)+g(x)=e^{1-x}$ x $f'(x)$ **2**

f $f'(x)$

(C_f)

$[0.3;0.4]$ α $f(x)=0$ **3**

1 (T) (C_f) **4**

$\lim_{x\to-\infty} f'(x)$ (T) (C_f)

(C_f) (T) (Δ) **5**

$x-1\le y\le f(x)$ $1\le x<\lambda$ $M(x;y)$ $A(\lambda)$ **6**

$\lim_{\lambda\to+\infty} A(\lambda)$ $A(\lambda)=2-(\lambda+1)e^{1-\lambda}$

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05

(O, u, v)

$B(-2+i)$ $A(1-i)$ $|z-1+i|=|z+2-i|$ $M(z)$

$[AB]$ $[AB]$ (AB)

$-\theta+\frac{5\pi}{6}$ $\theta+\frac{5\pi}{6}$ $\theta+\frac{\pi}{6}$ $\frac{-3+i\sqrt{3}}{\bar{z}}$ θ z

$(-1-i)^n$ n

$n=3$ $n=4k+3$ $n=4k$

$\omega(-1+3i)$ $|z+1-3i|=|z+\sqrt{3}-i|$ $M(z)$

$(x-1)^2+(y+3)^2=\sqrt{2}$ $z=z_\omega+2e^{\theta i}$ $x+y-3=0$

ABC C

$z_C=1+3i$ $z_C=1+4i$ $z_C=1+2i$

$(BA;BC)=-\frac{\pi}{2}$ $z_B=5+i$ $z_A=2-3i$

04

q v_1

q v_1 (v_n)

$2v_1^2=v_4-v_2$ q v_1 q v_1 I

$q=2$ $v_1=3$ II

1441 2020 n v_n 1

$P_n=\ln(S_n)$ $S_n=v_1^2+v_2^2+.....+v_n^2$ 2

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

$v_\alpha<v_\beta$ β α 3

2304

$$\begin{cases} v_\alpha \times v_\beta = 2304 \\ PGCD(\alpha;\beta)=2 \end{cases}$$ $(\alpha;\beta)$

6 (v_n)

04

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$C(1;2;0)$ $B(1;0;2)$ $A(1;1;1)$ $(O;i;j;k)$ 1

$x^2-2(x+y+z-yz)+3=0$ (Γ)

C B A

C B A (Δ)

(Δ) $D(-1;0;3)$ (P)

(Δ) D D'

(Δ) M $M'(x';y';z')$ (Γ) $M(x;y;z)$ 2

(Γ) M' $\begin{cases} x'=2-x \\ y'=2-z \\ z'=2-y \end{cases}$ M'

AM' AM (Γ) M

(Γ) (AM)

D' (P) (Γ)

07

$g(x)=\dfrac{x}{x+1}-\ln(x+1)$ $]-1;+\infty[$ g (I

g 1

. $]-1;+\infty[$ $g(x)$ 2

$x\in]-1;0[\ ]0;+\infty[$ $f(x)=\dfrac{\ln(x+1)}{x}$ $f(0)=1$ $]-1;+\infty[$ f (II

$(O;i;j)$ (C_f)

. 0 f 1

. $\lim\limits_{x\to+\infty} f(x)$ $\lim\limits_{x\xrightarrow{>}-1} f(x)$ 2

0 f $]-1;+\infty[$ f

$f'(0)=-\dfrac{1}{2}$ (C_f) (T)

$h(x)=f(x)+\dfrac{1}{2}x-1$ $]-1;+\infty[$ h 3

$k(x)=x^2(f'(x)+\dfrac{1}{2})$ $k(x)$ $]-1;+\infty[$ $h'(x)$

. k $k'(x)=\dfrac{x^2(x+2)}{(x+1)^2}$ $]-1;+\infty[$ x

.(T) (C_f) $h(x)$ $h'(x)$

. (T) (C_f) 4

$f(x)=(\ln m)(x-2)$ $x>-1$ x m 5

. (E) m

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05

6 5 4 2 1 6 1

3

3 **B** **A"** 1

γ β α 2

γ β α

$\alpha\beta\gamma = 0[6]$

2021 20 $\overline{\alpha\beta\gamma}$

3 X 3

X

04

$P(z) = z^3 + (2-\sqrt{3})z^2 + (3-2\sqrt{3})z + 6$ z P(z) 1

$P(z) = (z+2)(z^2 + \alpha z + \beta)$ β α $P(-2)$

$P(z) = 0$

C B A $(O;u;v)$ 2

$z_C = -2$ $z_B = \overline{z_A}$ $z_A = 1 + i\sqrt{3}$

C B A z_C z_B z_A

(γ)

$\left(\frac{z_A}{z_B}\right)^n$ n

k $\overline{z} = ke^{-\frac{2\pi}{3}i}$ M(z) (Δ)

$z_A = L(z_B) + (1-L)z_C$ L 3

ABC B A

ABCD D z_D

04

3^n n 1

$2019^{2020} - 1962 \times 1441^{1442}$ 2

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$33^{16n+2}-2\times109^{8n+1}-11\equiv0[10]$ n 3

$10<n\leq25$ $7\times3^{n+1}-1\equiv0[10]$ n 4

$\overline{y612}$ $\overline{xx0xx02}$ A 5

9 A y x

3^n 4 6

•

X 7

X

X

$V(X)$ $E(X)$

$P\left(e^{x^2-5x+4}\leq1\right)$

07

$g(x)=(x-1)e^x+(x+1)$ $[0;+\infty[$ g I

$[0;+\infty[$ g 1

$[0;+\infty[$ x $g(x)\geq0$ $g(0)$ 2

$f(x)=\dfrac{xe^x}{(e^x-1)^2}$ * f II

$(O;i;j)$ (C_f)

f 1

$\lim\limits_{x\xrightarrow{>}0} f(x)$ 2

$\lim\limits_{x\to+\infty} f(x)$ $f(x)=\dfrac{x}{e^x(e^{-x}-1)^2}$ * x 3

$f'(x)=\dfrac{-e^x g(x)}{(e^x-1)^3}$ $]0;+\infty[$ x 4

* $]0;+\infty[$ f

(C_f) 5

$\dfrac{1}{t(t-1)}=\dfrac{1}{t-1}-\dfrac{1}{t}$ $\int_2^3 \dfrac{1}{t(1-t)}dt=2\ln2-\ln3$ 6

$t=e^x$ $\int_{\ln2}^{\ln3} f(t)dx=\int_2^3 \dfrac{\ln t}{(t-1)^2}dt$

$y=0$ $x=\ln3$ $x=\ln2$ (C_f)

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05

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

1 $u_n < n + 3$ n

(u_n)

(u_n)

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

(v_n)

n u_n n v_n

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

3 (t_n) $t_n = \ln(v_n)$

n t_n (t_n)

n $S'_n = t_0 + t_1 + ... + t_n$

04

1 $5u + 4v = 12$ x y

$(u;v)$ $5u + 4v = 1$ (E)

(E) ×

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

(E) $(x;y)$ $PGCD(x, y) = 6$

3 $(O; i; j; k)$

$A(2;2;-1)$ $B(4;1;-2)$ $C(-2;1;3)$

(ABC) C B A

4 $(O; i; j)$ (ABC) $M(x;y;z)$ (Δ)

(Δ).

$OM_0 = 3$ (Δ) M_0

04

1 $z^2 + z + 1 = 0$ z

2 F D C B A (O;i, j)

$z_F = \overline{z_D}$ $z_D = -2 + 2\sqrt{3}i$ $z_C = -2$ $z_B = \overline{z_A}$ $z_A = -\frac{1}{2} + \frac{\sqrt{3}}{2}i$

z_F z_D z_C z_B z_A

F D C B A F A

ABC

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$(z_D)^n$ n 3

$z_E = -\frac{z_F}{2}$ E 4

(EF) (ED) $\frac{z_F - z_E}{z_D - z_E}$

+ r $\overline{z} + 2 = 2\sqrt{3}i + re^{-i\frac{\pi}{2}}$ z M (Δ) 5

(Δ) (Δ) F

07

$\begin{cases} f(x) = x(1+\ln^2 x); x \in]0;+\infty[\\ f(0) = 0 \end{cases}$ $[0;+\infty[$ f **I**

1cm (O;i;j) (C_f)

$\lim_{x\to+\infty} \frac{f(x)}{x}$ $\lim_{x\to+\infty} f(x)$ 1

f $\lim_{x \xrightarrow{>} 0} f(x) = 0$ 2

$\lim_{x \xrightarrow{>} 0} \frac{f(x)}{x}$

$f'(x) = (1+\ln x)^2$ $]0;+\infty[$ x

$[0;+\infty[$ f

e^{-1} I (C_f) 3

$y = x$ (Δ) (C_f)

$[0;e]$ (C_f) (Δ)

$\begin{cases} U_{n+1} = f(U_n) \\ U_0 = e^{-1} \end{cases}$ (U_n) **II**

$e^{-1} < U_n < 1$ n 1

$\lim_{x\to+\infty} U_n$ (U_n) 2

$F(x) = \int_1^x f(t)dt$ $[0;+\infty[$ F **III**

F 1

$]0;+\infty[$ x $x\ln x$ x $-\frac{1}{4}x^2 + \frac{1}{2}x^2\ln x$ 2

$\int_1^x t(\ln t)^2 dt = \frac{x^2}{2}(\ln x)^2 - \int_1^x t(\ln t)dt$ $]0;+\infty[$ x

$\int_0^1 f(x)dx$ F(x)

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04

(u_n) $u_0 = e$ n $u_{n+1} = \dfrac{eu_n + 1}{u_n + e}$

1 a b $u_{n+1} = a + \dfrac{b}{u_n + e}$

2 $u_n \leq e$ n 1

3 (u_n)

4 N (v_n) $v_n = \left(\dfrac{e-1}{e+1}\right)^{n+1}$

(v_n) (v_n)

n $T_n = v_n + v_{n+1} + \ldots\ldots + v_{n+2020}$

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

n S_n $S_n = \dfrac{1}{u_n + 1} + \dfrac{1}{u_{n+1} + 1} + \quad + \dfrac{1}{u_{n+2020} + 1}$ T_n

05

1 7^n n 10

$\left(7^{4k} + 7^{4k+1} + 7^{4k+2} + 7^{4k+3}\right)$ k 10

$\left(7^{2020} - 7^{1441} + 7^{2022} - 7^{1443} - 1441\right)$

2 (S_n) $S_n = 1 + 7 + 7^2 + \ldots + 7^n$ n

(S_n) S_2 S_1 S_0

(S_n)

$S_{n+4} \equiv S_n [10]$ n

S_n n 10

04

$P(z)$ z **I**

$P(z) = z^3 - 2(4+i)z^2 + 4(5+4i)z - 40i$

1 $P(z) = 0$

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$P(z)=(z-2i)(az^2+bz+c)$ z c b a **2**

$P(z)=0$ **3**

E D C B A (O,u,v) **II**

$e=2+2i\left(-1+\sqrt{3}\right)$ $d=\bar{a}$ $c=\bar{b}$ $b=4-2i$ $a=-2i$

$\left(\frac{d-e}{c-e}\right)^{2020}$ $\frac{d-e}{c-e}$ **1**

(DE,DC) CDE

$\frac{\pi}{3}$ A B E **2**

D E A

$ABCD$ $a+c=b+d$

$[CD]$ h $\frac{h-d}{e-d}$ **3**

$\sin\frac{\pi}{12}=\frac{\sqrt{2-\sqrt{3}}}{2}$ $\cos\frac{\pi}{12}=\frac{\sqrt{2+\sqrt{3}}}{2}$

07

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

g **1**

$g(x)$ $g(0)$ **2**

$f(x)=(x^2+1)e^x$ f **II**

$(O;i;j)$ (C_f)

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

f $f'(x)$ **2**

$f'(x)$

f

(C_f)

1 (Δ) (C_f)

(C_f) (Δ) **3**

f F $f(x)=2f'(x)-f''(x)+2e^x$ x **4**

$[-1;1]$ f

(C_h) $h(x)=\frac{x^2+1}{e^x}$ h **III**

$h(x)=f(-x)$ x **1**

(C_h) **2**

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05

0 **−1** **8**

2 **1** **1**

1

A

C **B**

X

X

$\mathbf{E(X^2)}$ $\mathbf{X^2}$

$\mathbf{1 \le n \le 9}$ **n** 2

" " $\mathbf{P(D)}$

n $\mathbf{P(D)}$

$\mathbf{P(D)=\frac{7}{15}}$ **n**

04

$(O;u;v)$ 1

$z_B = 2+\sqrt{3}+i$ $z_A = 1-i$ B A

. z_B $z_B = z_A\left(1+\sqrt{3}\right)e^{i\frac{\pi}{3}}$ z_A

$-\frac{\pi}{6}$ O r B D 2

$[BD]$ (γ)

$\arg\left[(z-z_B)^2\right] = \arg(z_B) - \arg(z_D)$ $M(z)$

. $z_C = 1+i$ C 3

$ACBD$ ABC

-2 O h $S = r$ h S 4

S

$H_n = S$ S ... S H_n $n \ge 2$ $n \in$

n مرة

H_n n

04

$3u_{n+2} = 5u_{n+1} - 2u_n$ $u_1 = 1$ $u_0 = 0$ (u_n)

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

(v_n) (u_n)

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$\frac{2}{3}$ (v_n)

(u_n) n v_n

(u_n) $0 \le u_n \le 3$ n **2**

$S_n = v_0 + v_1 + v_2 + ... + v_{n-1}$ S_n n **3**

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

(u_n)

07

$g(x) = -x^2 + 2 - \ln x$ $]0;+\infty[$ g **I**

$\lim_{x \to +\infty} g(x)$ $\lim_{x \xrightarrow{>} 0} g(x)$ **1**

$g'(x) < 0$ $x > 0$

g

$[1.3;1.4]$ α $g(x) = 0$ **2**

$g(x)$ x

$f(x) = x - 1 + \frac{1}{x}(1 - \ln x)$ $]0;+\infty[$ f **II**

(O, i, j) (C_f)

(C_f) $\lim_{x \to +\infty} \left(f(x) - (x-1)\right)$ $\lim_{x \xrightarrow{>} 0} f(x)$ $\lim_{x \to +\infty} f(x)$ **1**

f $f'(x)$ $f'(x) = -\frac{g(x)}{x^2}$ $x > 0$ **2**

$y = x - 1$ (Δ) (C_f) **3**

$y = \left(1 - \frac{1}{e}\right)\left[\left(1 + \frac{1}{e}\right)x - 1\right]$ e (C_f) (T)

$f(\alpha)$ $]0;+\infty[$ x $x + 1 - \frac{2}{x}$ **4**

(C_f) (T) (Δ) $f(\alpha) = \alpha + 1 - \frac{2}{\alpha}$

$A(\lambda) = \int_{\lambda}^{e} \frac{1}{x}(1 - \ln x)dx$ $A(\lambda)$ $0 < \lambda < 1$ λ **5**

$A(\lambda) = 1$ λ $A(\lambda) = \frac{1}{2}\left((\ln \lambda)^2 - 2\ln \lambda + 1\right)$ $A(\lambda)$

(C_h) $h(x) = f(e^x)$ h **III**

$\lim_{x \to +\infty} h(x)$ $\lim_{x \to -\infty} h(x)$ **1**

h **2**

0 (C_h) **3**

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05

$P(z)=z^3+z^2-4z+6$ z $P(z)$

$\overline{P(z)}=P(\overline{z})$ z 1

$P(z)$ $1+i$ 2

$P(z)=0$ 3

C B A (O,u,v)

$z_C=\overline{z_B}$ $z_B=1+i$ $z_A=-1$

$z'=(1+i)z+i$ $M'(z')$ $M(z)$ S 1

S

AMM′ A M

z_n A M_n n 2

$M_{n+1}=S(M_n)$ n $M_0=O$

$z_n=(1+i)^n-1$ n

M_n A O n

04

C(2;−1;2) B(−2;−3;4) A(2;1;0) (0,i;j;k)

$y+z-1=0$ (ABC) n **1**

$[AB]$ (P) **2**

$(2MI.AB=0)$ $(M\in(P))$ $[AB]$ I M

(P) I

$[BC]$ E (P) $E(-2;3;4)$

(ABC) E $H(-2;0;1)$ **3**

$x^2+y^2+z^2+4x-6y-8z-7=0$ $M(x;y;z)$ (S) **4**

(S)

ABC $(\mathscr{C})$ (ABC) (S)

03

$8x-5y=3$ (E) $(x;y)$ 1

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$(p;q)$ m

$m=5q+4$ $m=8p+1$

$m\equiv 9[40]$ (E) $(p;q)$

$m\equiv 9[40]$ 2020 m

n 2

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

7 $2020^{1441}+1441^{2020}$

$a\neq 0$ 9 b a 3

$N=\overline{a00b}$ 10 N

$10^3\equiv -1[7]$

7 N

08

$h(x)=x(1-2\ln x)+2(x-\sqrt{e})$ $]0;+\infty[$ h **I**

h **1**

$]0;+\infty[$ $h(x)$ **2**

$f(x)=2x(1-2\ln x)$ $x>0$ $f(0)=0$ $[0;+\infty[$ f **II**

$(O;i;j)$ (C_f)

$\lim_{x\to+\infty} f(x)$ (C_f) $\lim_{x\xrightarrow{>}0}\frac{f(x)}{x}$ **1**

$f'(x)=-2(1+2\ln x)$ $]0;+\infty[$ f **2**

f $f'(x)$ $]0;+\infty[$

O 0 (C_f) (Δ) **3**

(Δ) (C_f)

(C_f) (Δ) **4**

$]0;+\infty[$ f x $x^2(1-\ln x)$ **5**

$\lim_{\lambda\to 0}\mu_\lambda$ $[\lambda;\sqrt{e}]$ f μ_λ $0<\lambda<\sqrt{e}$ λ

(C_g) $g(x)=f(e^{-x})$ g **6**

$g(x)$

$\lim_{x\to+\infty} g(x)$ $\lim_{x\to-\infty} g(x)$

(C_g)

(C_g)

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05

3 4 **1**

3

$\frac{4}{63}$ $\frac{5}{84}$ $\frac{2}{7}$ $\frac{11}{81}$ 3

$\frac{79}{84}$ $\frac{1}{21}$ $\frac{1}{7}$ $\frac{2}{7}$ 3

X

$\frac{55}{84}$ $-\frac{16}{21}$ $\frac{2}{3}$ 0 $E(X)$

M_2 M_1 **2**

60% M_1 70%

M_2 20%

M_2 M_1

$\frac{6}{25}$ $\frac{3}{50}$ $\frac{4}{5}$ $\frac{3}{5}$ M_2

$\frac{12}{25}$ $\frac{3}{5}$ $\frac{33}{50}$ $\frac{21}{50}$

$\frac{33}{50}$ $\frac{7}{11}$ $\frac{6}{25}$ $\frac{4}{11}$ M_2

04

$u_{n+1}=10u_n+27$ n $u_0=7$ (u_n)

$u_n=10^{n+1}-3$ n **1**

$u_n+2=9\left[1+10+10^2+...+10^n\right]$ n

u_n n

u_3 **2**

5 3 2 u_n

7 3^n n **3**

7 $17\times9^{3n+1}-6\times3^{2n+2}-2019^{1440}$

7 u_n n

11 u_n n 4

04

$u_{n+1}=\frac{3}{4}u_n+\frac{1}{6}$ n $u_0=\frac{1}{12}$ (u_n) 1

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(u_n) (u_n) $u_n = -\frac{7}{12}\left(\frac{3}{4}\right)^n + \frac{2}{3}$

$(O;u,v)$ 2

O $-\frac{\pi}{4}$ $z' = -\frac{\sqrt{2}}{2}(1-i)z$ T

$y = -x+1$ (Δ) $\arg(z-i) = -\frac{\pi}{4}$ M(z)

$(O;i;j;k)$ 3

A 2;1; 1 (d) $x+y-z+1=0$ (P)

u 1; 1;1

$x-y+z=0$ (P) O (Q)

$a = n\left(n^2+5\right)$ n 4

6 3 2

07

$g(x) = 1+xe^x$ g I

$\lim_{x\to+\infty} g(x)$ $\lim_{x\to-\infty} g(x)$ **1**

g **2**

$g(x)$

$f(x) = e^{2x}+(x+1)e^x+x$ f **II**

$2cm$ $(O;i,j)$ (C_f)

$\lim_{x\to-\infty}\left(f(x)-x\right)$ $\lim_{x\to+\infty} f(x)$ $\lim_{x\to-\infty} f(x)$ **1**

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

f $f'(x)$

$e^{\alpha} = -\alpha$ $-0.6 \le \alpha \le -0.5$ α $f(x)=0$ **3**

0 (C_f) (Δ) **4**

$-1.3 \le \beta \le -1.0$ β $e^x+x+1=0$ **5**

$y=x$ (D) (C_f)

(C_f) (Δ) (D) **6**

$f(x) = (e^x+x)(e^x+1)$ x **7**

$x=0$ $x=\alpha$ (C_f) $\mathscr{A}$

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05

(O,i,j,k)

$(x+2y-z+2)^2+(3x+y+2z-1)^2=0$ $M(x,y,z)$ 1

(D)

$(x+2y-z+2)^2-(3x+y+2z-1)^2=0$ $M(x,y,z)$ 2

(Q) (P)

$(P)\cap(Q)=(D)$

(P_m) m 3

$(1+3m)x+(2+m)y+(2m-1)z+2-m=0$

(D) (P_m)

(P_m) (D)

06

$(z+\sqrt{3}-3i)(z^2-6z+12)=0$ 1

C B A $(O;u,v)$ 2

$z_C=-\sqrt{3}+3i \quad z_B=3-i\sqrt{3} \quad z_A=3+i\sqrt{3}$

OAC $\frac{z_C}{z_A}$ z_C z_A

$\left(\frac{z_A}{2\sqrt{3}}\right)^{1441}-i\left(\frac{z_B}{2\sqrt{3}}\right)^{2020}$

(BC) (AD) C D 3

C A $E(3-\sqrt{3},0)$ S 4

C O E A 5

04

$L_n=9C_{n+1}^2+27C_{n+1}^3+81C_{n+1}^4+.....+3^{n+1}C_{n+1}^{n+1}$ n

$L_n=4^{n+1}-3n-4$ 1

$S_n=L_1+L_2+.....+L_n$ 2

n S_n S_3 S_2 S_1

7 4^n

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$L_n \equiv 0[7]$ n

7 4^n A 3

A 3

1441 2020 A 4

07

$g(x)=1-(x+2)\ln(x+2)$ $]-2;+\infty[$ g **I**

$\lim_{x\to+\infty} g(x)$ $\lim_{x\xrightarrow{>}-2} g(x)$ 1

g

$-0.24<\alpha<-0.23$ $]-2;+\infty[$ α $g(x)=0$ 2

$]-2;+\infty[$ $g(x)$

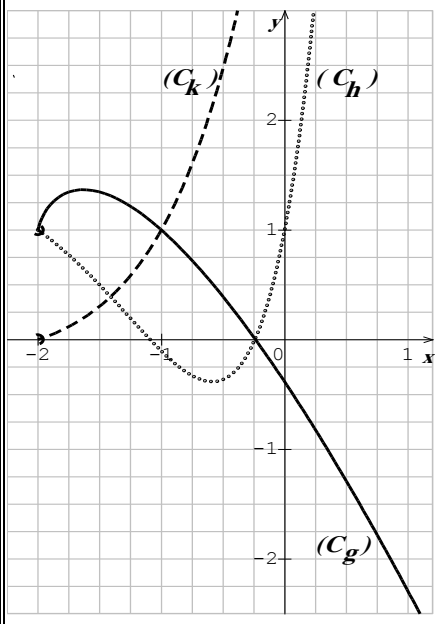
(C_f) $f(x)=\dfrac{\ln(x+2)}{e^x}$ $]-2;+\infty[$ f **II**

$(O;i;j)$

$]-2;+\infty[$ f f' $f'(x)=\dfrac{g(x)}{(x+2)e^x}$ 1

$\lim_{x\to+\infty} f(x)$ $\lim_{x\xrightarrow{>}-2} f(x)$ 2

f



k h g (C_k) (C_h) (C_g) 3

$]-2;+\infty[$

$k(x)=(x+2)e^{x+1}$ $h(x)=3(x^2+2x)e^x+1$

1 $\begin{cases} g(x)=0 \\ h(x)=0 \end{cases}$

$h(x)=0$

$]-0.24;-0.23[$

$h(\beta)=0$ β $h(-0.25)$

β α

$g(x)=k(x)$

e (Δ) (C_f) 4

$f(\alpha)$ -3α 5

(C_f) Δ 6

m $y=m(x+1)$ (Δ_m) 7

A (Δ_m)

(Δ_m) (C_f) m

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04

9^n 2^n n 1

2

$$16^{2002}+15^{2002}+2002$$

$$2^{6n+3}+2007^{6n+3}+41^{6n+3}+1 \qquad n$$

$$4\times12^{2n}+22^{3n+1} \qquad n$$

$$2011^{3n-1}+142^{6n-2}+9 \qquad n$$

$$\begin{cases} U_n=56\times9^n+13\times2^n \\ S_n=u_0+u_1+\quad+u_n \end{cases} \qquad n$$

$S_n\equiv-38[91]$ n S_n n

05

z M T_m m

$z'=(m+i)z+m-1-i$ z' M'

T_m m

T_m m

$m=1$

T_1 A

$\dfrac{z'-1}{z-1}$ $\dfrac{z'-1}{z-1}$ $z\in\ -\{1\}$

T_1

$z'-z=i(z-1)$ z

M AMM' A M

n T_1

$T_1\ T_1\ ....\ T_1=T^{(n)}\quad n\geq1$ $T_1\ T_1=T^{(1)}$

$T^{(n)}$

$T^{(n)}$ n

$T^{(1962)}$ $T^{(1440)}$ $T^{(2020)}$

04

$(o;i;j;k)$

S(−1;1;2) C(0;−3;−2) B(2;0;1) A(2;−1;2) $x-3y+z-3=0$ (P)

(P) B 1

(AC) (P) (AC) −2

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ABC $AB.BC$

(AC) B (Q)

(Q) S (d) 3

(Q) S B

$SABC$

$2x+3y+3z-7=0$ (SAB) 4

SAB (SAB) C

07

(C_f) $f(x)=\dfrac{1}{x(1-\ln x)}$ x f

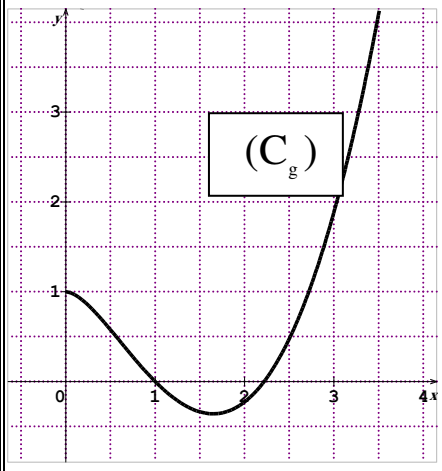
2cm $(O;i;j)$ f

$D_f=]0;e[\cup]e;+\infty[$ f 1 I

$\lim\limits_{x\xrightarrow{>}e} f(x)$ $\lim\limits_{x\xrightarrow{<}e} f(x)$ 2

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

$x(1-\ln x)=x-x\ln x$ $\lim\limits_{x\xrightarrow{>}0} f(x)$



$f'(x)=\dfrac{\ln x}{x^2(1-\ln x)^2}$ D_f x 3

D_f f D_f $f'(x)$

$]0;+\infty[$ g II

(C_g) $g(x)=1-x^2(1-\ln x)$

$g(x)=0$ 1

$2,2<\alpha<2,3$ α $g(x)=0$

$f(x)-x=\dfrac{g(x)}{x(1-\ln x)}$ D_f x 2

α 1 (C_f) $y=x$ (Δ)

$[1;\alpha]$ x $f(x)-x\le 0$ $[1;\alpha]$ (C_g) $g(x)$

(C_f) (Δ) $(O;i;j)$ 3

(C_f) A cm^2 $\int_1^{\sqrt{e}}\dfrac{1}{x(1-\ln x)}dx=\ln 2$ (4

$x=\sqrt{e}$ $x=1$ (Δ)

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

$1\le u_n\le\alpha$ n

(u_n)

(u_n)

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04.5

$2020x-1441y=13 \ldots(E)$ (x,y) (E) 2

1441 2020 1

E 2

n n 2 E

n E (x,y)

$PGCD(x,y)$ n $PGCD(x,y)$

5 2^n n

$2^y+x\equiv 0[5]$ E (x,y)

$v_n=1441n+7$ $u_n=2020n-6$ (v_n) (u_n) n 4

(v_n) (u_n)

05

$(z-1+\sqrt{3})(z^2-2z+4)=0\ldots(E)$ z 1

z_2 $\mathrm{Im}(z_2)$ 0 $z_1\in$ (E) z_3 z_2 z_1 2

$z_2^{2020}+z_3^{2020}$ z_3 z_2

$\arg(z_2^n+z_3^n)\equiv\pi[2\pi]$ n

C B A (O;u;v) 3

$z_C=1-\sqrt{3}i$ $z_B=1+\sqrt{3}i$ $z_A=1-\sqrt{3}$

ABC $\frac{z_A \quad z_C}{A \quad B}$

$\{(A,2);(B,1);(C,-1)\}$ G

$2MA^2+MB^2-MC^2=-3$ M

04

$f(x)=\frac{x^3+2}{x^2+1}$ $[2;+\ [$ f I

$[2;+\ [$ f $f'(x)$

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

$2<u_n<3$ $n\in$ 1

$u_n^2<\frac{9}{10}(u_n^2+1)$ $n\in$ $u_n^2-\frac{9}{10}(u_n^2+1)$ 2

(u_n) (u_n) 3

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

$\lim\limits_{x\to+\infty} u_n$ $0<(u_n-2)<\left(\frac{9}{10}\right)^n$ $n\in$ 5

07

$g(x)=\ln(e^{2x}-e^x+\frac{1}{2})-2x$ g I

$g(x)=\ln(1-e^{-x}+\frac{1}{2}e^{-2x})$ x 1

g 2

$g(x)$ x $g(-\ln 2)$ 3

$f(x)=\ln\left(2e^{2x}-2e^x+1\right)-\ln 2$ f II

$(O;i;j)$ f (C_f)

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

$f(x)-2x=g(x)$ x

(D) (C_f) $+\infty$ (D) (C_f)

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

f $f'(x)$

0 (C_f) (Δ)

(C_f) α 3

(C_f) (Δ) (D)

(C_h) $h(x)=\ln(\frac{1}{2}e^{2x}-e^x+1)$ h 4

$h(x)=f(x-\ln 2)+\beta$ β

(C_f) (C_h)

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05

$C(1;0;1)$ $B(1;1;0)$ $A(2;1;1)$ $(O;i;j;k)$

C B A $\cos A$ $AB.AC$

ABC

(ABC) $n(1;\alpha;\alpha)$ α

(P_m) m

$(m+2)x+my+(2m+1)z+m+1=0$

(P_m)

(P_m) (ABC)

V $ABCD$ $D(2;0;0)$

D $E(\frac{3}{2};\frac{1}{2};\frac{1}{2})$ (S)

B A (S)

ABC (C) (S) (ABC)

(ABC) E (Δ)

ABC I

V $ABCF$ I D F

04

2 n 2 1 1 1

$n>1$

1

2

X 3

X X

$E(X)=\frac{1347}{337}$ n $E(X)=\frac{4n^2+22n+30}{(n+3)(n+4)}$

04

b a $\begin{cases}a+b=2\\ab=4\end{cases}$ b a **1**

$(O;u;v)$ **2**

$z_D=-2$ $z_C=z_A^2$ $z_B=\overline{z}_A$ $z_A=1+i\sqrt{3}$ D C B A

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$$2\left(\frac{z_A}{2}\right)^{2019} = z_D$$

ACD $\dfrac{z_C - z_D}{z_A - z_D}$

C A O S **3**

$[AD]$ I $S(I) = D$

$ACDB$ $z_C + z_B$

θ $2z = z_A + 2e^{i\theta}$ z M $(\mathscr{C})$ **4**

$(\mathscr{C})$

S $(\mathscr{C})$ $(\mathscr{C})$

07

$g(x) = x^2 + 2\ln x$ $]0;+\infty[$ g (I

g

x $g(x)$ $0.75 < \beta < 0.76$ β $g(x) = 0$

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

$(O;i,j)$ f (C_f)

$\lim\limits_{x\to+\infty} f(x)$ $\lim\limits_{\substack{>\\ x\to 0}} f(x)$

(Δ) (C_f) $+\infty$ (C_f) $y = -x + 1$ (Δ)

$x^2 f'(x) + g(x) = 0$ $]0;+\infty[$ x

f

(Δ) (T) (C_f)

(C_f) (T) (Δ)

$-mx + 2 + 2\ln x = 0$ (E) m m

$f_\alpha(x) = 1 - x + \dfrac{\alpha}{x}(1 + \ln x)$ $]0;+\infty[$ f_α α (III

$(O;i,j)$ (C_α)

(C_α)

$\{(A;1),(B;2),(C;-1)\}$ G_α $C(-2\alpha;2\alpha-2)$ $B\left(1;\dfrac{2\ln\alpha}{\alpha}\right)$ $A\left(-2;\dfrac{4}{\alpha}\right)$

G_α α

$^{*}_{+}$ α G_α

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05

I $(E)\quad z^3-(4-3i)z^2+(5-12i)z+15i=0$

1 (E) $(-3i)$

2 $b\quad a\qquad (z+3i)\left(z^2+az+b\right)=0$ (E)

(E)

II $(O;u,v)$

$d=-3i\quad b=\overline{a}\quad a=2-i$ $D\quad B\quad A$

1 $\frac{\pi}{2}$ O r B C c $D\quad B\quad A$

$\arg(Z)\quad |Z|$ $Z=\dfrac{2c-1-i}{2a-1-i}$

2 $\{(B;6),(C;5),(D;3)\}$ G g

$\|6MB+5MC+3MD\|=21\sqrt{2}$ $M(z)$ $\mathscr{C}$

$\mathscr{C}$

3 $\arg(z+3i)=\dfrac{\pi}{4}(\pi)$ $M(z)$ $\mathscr{F}$

$\mathscr{F}$ $\mathscr{F}$ A

$\mathscr{F}$ G

04

1 $11x-6y=726$ 1 1

PPCM $x_0\ y_0\ =924$ PGCD $x_0\ y_0\ =3$ 1 $x_0\ y_0$

1

2 (v_β) $u_0=12$ 13 (u_α)

$v_0=3$ 13

$\beta\quad\alpha$ $(v_\beta)\quad(u_\alpha)$

$11x-6y=9552$ 2 $u_\alpha\ v_\beta$ $\beta\quad\alpha$

$\beta-\alpha=4$ 2 $u_\alpha\ v_\beta$

04

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4 6

3

X **1**

X X

2

A_2 A_1 A_0

4 **3**

B_2 B_1 B_0

B_2 B_1 B_0

$P(B_0)$ $P_{A_2}(B_0)$ $P_{A_1}(B_0)$ $P_{A_0}(B_0)$

07

2cm $(O;i,j)$

(C_f) $f(x)=\begin{cases} e^{2x}+x+1; x\le 0 \\ x[\ln x-1]+2; x>0 \end{cases}$ f **I**

$x_0=0$ f 1

f $\lim\limits_{x \xrightarrow{>} 0} \dfrac{f(x)-2}{x}$ $\lim\limits_{x \xrightarrow{<} 0} \dfrac{f(x)-2}{x}$ 2

0 (C_f) (T)

f 3

(C_f) $-\dfrac{5}{4}<\alpha<-1$ α $f(x)=0$ 4

$\lim\limits_{x\to-\infty}[f(x)-x]$ 5

$f(5)$ 5 $]-\infty;5]$ (C_f) (T) 6

(C_f) $A(\alpha)$ 7

$A(\alpha)=(4-2\alpha)cm^2$ $x=0$ $x=\alpha$ $y=x+1$

$e^{f(x)}=m$ m 7

$z'=\dfrac{1}{2}(1-i)z+i$ $M'(z')$ $M(z)$ S **II**

S 1

(C_h) $h(x)=-x+\ln(-x)$ $]-\infty;0[$ h 2

f (C_f) S (C_h)

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05

1 193

206

2 (E) $4x-193y=78$ y x

$(a;b)$ $\begin{cases} PPCM(a;b)=618 \\ PGCD(a;b)=3 \end{cases}$ $4a-193b=78$

(E)

3 N M $\overline{\alpha 12\beta}$ $\overline{5\beta 1\alpha}$ $\mathrm{M}\equiv\mathrm{N}[193]$ 7

$44\alpha+48\beta\equiv 78[193]$

$11\alpha+12\beta=116$

β α N M

04

$(O;u,v)$

f M z M' z' $z'=z^2-4z$

1 B A $z_A=3+i$ $z_A=1-i$

z_A $\left(\frac{z_A}{\sqrt{2}}\right)^{2020}$

B' A' B A f $z_{B'}$ $z_{A'}$

f

2 I -3

$OMIM'$ $\left(z^2-3z+3=0\right)$

$z^2-3z+3=0$

3 $(z-2)$ $(z'+4)$ $|z-2|$ $|z'+4|$ $\arg(z-2)$ $\arg(z'+4)$

K J $z_K=-4$ $z_J=2$

M $\mathscr{C}$ J 2 M'

E $z_E=-4-3i$ (z_E+4) **3**

E f

04

$(\mathrm{U_n})$ $\mathrm{U_0}=2$ و $\mathrm{U_{n+1}}=\frac{(1+\alpha)\mathrm{U_n}-\alpha}{\mathrm{U_n}}$ $\alpha\in]0;1[$

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$U_n \geq 1$ n 1

(U_n) (U_n)

$V_n = \dfrac{U_n - 1}{U_n - \alpha}$ n 2

α (V_n)

α n U_n α n V_n

$\lim\limits_{n \to +\infty} U_n$ 1

$\alpha = \dfrac{1}{2}$ 3

$S_n = V_0 + V_1 + V_2 + \ldots + V_{n-1}$ n

$\dfrac{1}{2U_n - 1} = 1 - V_n$ n

$T_n = \dfrac{1}{4(U_0 - 1)^2} + \dfrac{1}{4(U_1 - 1)^2} + \ldots + \dfrac{1}{4(U_n - 1)^2}$ n

07

$g(x) = x^2 + 1 - 2\ln x$ $]0;+\infty[$ g ***I***

$\lim\limits_{x \xrightarrow{>} 0} g(x)$ $\lim\limits_{x \to +\infty} g(x)$ **1**

$0\ +\infty$ g x g **2**

$f(x) = x + \dfrac{1}{x}(1 + 2\ln x)$ $0\ +\infty$ f ***II***

$(O; i, j)$ f (C_f)

$\lim\limits_{x \to +\infty} f(x)$ $\lim\limits_{x \xrightarrow{>} 0} f(x)$ **1**

$f'(x) = \dfrac{g(x)}{x^2}$ $0\ +\infty$ f f'

f

$+\infty$ (C_f) $y = x$ (Δ) **2**

(Δ) (C_f)

$0.5 < \alpha < 0.6$ α $f(x) = 0$

$x \geq 1$ $A(x;2)$ (C_f) (T) **3**

(C_f) $B(e; e + \dfrac{3}{e})$ $x^2 g'(x) - 2xg(x) = 0$

(C_f) (T) (Δ)

$0\ +\infty$ f F x $(\ln x)^2$ **4**

$y = 0$ $x = 1$ $x = \alpha$ (C_f)

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05

$z^2-2z+4=0$ **1**

C B A $(O;u;v)$ **2**

$z_C=(1+\sqrt{3})+i(1-\sqrt{3})$ $z_B=1+i\sqrt{3}$ $z_A=1-i\sqrt{3}$

$\frac{z_A}{z_C}=\frac{1-i}{2}$ z_B z_A

S C A z_C

$M_{n+1}=S(M_n)$ z_n M_n n

OM_0M_1 $z_0=4$

(r_n) $r_n=|z_n|$ n

$r_n=M_{n-1}M_n$ n

(S_n) n (S_n) $S_n=M_0M_1+M_1M_2+...+M_{n-1}M_n$

04

(E) $3x-2y=1$ ^{2}

n

(E) $(14n+3;21n+4)$

$21n+4$ $14n+3$

$21n+4$ $2n+1$ d

$d=13$ $d=1$

$d=13$ $n\equiv 6[13]$

$A=21n^2-17n-4$ $B=28n^3-8n^2-17n-3$ $n\geq 2$ n

$(n-1)$ B A

B A n

04

$C(0;5;1)$ $B(3;5;4)$ $A(3;2;1)$ $(O;i;j;k)$

ABC $\cos BAC$ **1**

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(ABC) $n(1;1:-1)$ **2**

ABC G **3**

(ABC) G (Δ)

$E(4;6;0)$ EG n

V $EABC$

$\|3MG+ME\|=6\sqrt{3}$ M (S) **4**

(S) E **5**

(ABC) (S)

07

$g(x)=2\ln\left(\frac{x+1}{x}\right)-\frac{1}{x+1}$ $]0;+\infty[$ g **I**

$\lim\limits_{x\to+\infty} g(x)$ $\lim\limits_{x\xrightarrow{>}0} g(x)$

g g g' $g'(x)$

x $g(x)$

$f(x)=x^2\ln\left(\frac{x+1}{x}\right)$ $x>0$ $f(0)=0$ $]0;+\infty[$ f **II**

$2cm$ $(O;i,j)$ (C_f)

f

f

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

$f'(x)=xg(x)$ f f' $f'(x)$

f

(C_f) (C_f) $\lim\limits_{x\to+\infty}(f(x)-x)=-\frac{1}{2}$

$I(t)=\int_t^1 x^2\ln\left(\frac{x+1}{x}\right)dx$ $]0;1]$ t

$\lim\limits_{t\xrightarrow{>}0} I(t)$ $\frac{x^2}{x+1}=x-1+\frac{1}{x+1}$ $I(t)$

$f_n(x)=x^n\ln\left(\frac{x+1}{x}\right)$ $x>0$ $f_n(0)=0$ f_n n

f_n n

f_n n

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04

. $(O;u;v)$

$(2\bar{z}-1+9i)(z^2-8z+32)=0$ 1

$z_\Omega = i$ $z_C = \frac{1}{2}+\frac{9}{2}i$ $z_B = \bar{z}_A$ $z_A = 4+4i$ Ω C B A 2

$\arg(\bar{z}-4+4i)^2 = \frac{\pi}{2}+2\pi k \quad / \ k\in$ $M(z)$ (Γ)

$z' = \frac{1}{2}(1+i)z+\frac{1}{2}+\frac{1}{2}i$ $M'(z')$ $M(z)$ S 3

$S(A)=C$ S

S (Γ) (Γ')

$A_{n+1}=S(A_n)$ $n\in$ $A=A_0$ A_n A_1 A_0 A_n z_n 4

$z_n - i = \left(\frac{\sqrt{2}}{2}\right)^n e^{i\frac{n\pi}{4}}(z_0-i)$ n

A_2 A_{n+1} $\Omega A_n A_{n+1}$

04

$C(1;0;1)$ $B(1;1;0)$ $A(2;1;1)$ $(O;i;j;k)$

C B A $\cos A$ $AB.AC$

$AB.AC$ ABC

(ABC) $n(1;-1;-1)$

(P_m) m

$(m+2)x+my+(2m+1)z+m+1=0$

(P_m)

(P_m) (ABC)

V $ABCD$ $D(2;0;0)$

D $E(\frac{3}{2};\frac{1}{2};\frac{1}{2})$ (S)

ABC (C) (S) (ABC) B A (S)

(ABC) E (Δ)

ABC I

V $ABCF$ I D F

05

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80%

60%

30%

1

2

07

$f(x)=4x(e^{-x}+\frac{1}{2}x-1)$ f I

1cm $(O;i;j)$ (C_f)

$\lim_{x\to+\infty} f(x)$ $\lim_{x\to-\infty} f(x)=-\infty$ 1

$f'(x)=4(1-e^{-x})(x-1)$ f 2

f

α $f(x)=0$

$e^{-\alpha}=1-\frac{\alpha}{2}$ $1,5<\alpha<2$

$y=2\alpha(\alpha-1)(x-\alpha)$ α (C_f) (T)

α 1,61 f(e) 4,5 f(−1) −5 $[-1;e]$ (C_f) (T) 3

$(-2x^2+4x+m)e^x=4x$ m

$f(x)\le 0$ $]-\infty;\alpha]$ x (C_f) 4

$\int_0^{\alpha} xe^{-x}dx$

(C_f) $A(\alpha)$

$A(\alpha)=\frac{2\alpha(3-\alpha^2)}{3}cm^2$ $x=\alpha$ $x=0$

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

$u_n<\alpha$ n 1

(u_n)

$f(x)+x\ge 0$ x 2

(u_n) $u_n\ge 0$ n

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04

$(z+1)^2+\left[2+i(\sqrt{5}+1)\right]^2=0$ **I**

C B A $(O;u;v)$ **II**

$z_A=-1+2i$ $z_B=i(2-\sqrt{3})$ $z_C=\overline{\sqrt{5}-2i}$

$|z_B-z_A|$ $|z_C|$ C B A **1**

$\frac{\pi}{3}$ $\frac{1+\sqrt{5}}{2}$ A S B C **2**

$z_{C'}$ C' C A **3**

$z_{B'}=-2+(2+\sqrt{3})i$ B' $BC'B'C$

$\frac{z_{B'}-z_C}{z_B-z_C}$

$\frac{AC}{AB}=\frac{CB'}{CB}=\frac{1+\sqrt{5}}{2}$ $(AB;AC)=(CB';CB)$

05

$u_{n+1}=10u_n+27$ n $u_0=7$ (u_n)

u_3 u_2 u_1 **1**

$u_n=10^{n+1}-3$ n **2**

$u_n+2=9\left[1+10+10^2+...+10^n\right]$ n

u_n n

5 3 2 u_n u_3 **3**

7 3^n n **4**

7 $17\times9^{3n+1}-6\times3^{2n+2}-2019^{1440}$

7 u_n n

11 u_n n **5**

04

$b=n^2+3n+2$ $a=2n+3$ b a n

b a b **1**

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42 13

y x $13x-42y=-31$ (E) **2**

$(59;19)$ (E)

$117\alpha+5\beta=2019$ (E) $(\alpha;\beta)$

9 2^n n **3**

9 $2018^{1954}+2019^{1962}$

$S_n=1+2+4+...+2^n$ n **4**

9 S_n n

07.5

$2cm$ $(O;i;j)$

(C_g) $g(x)=\dfrac{3e^x-1}{e^x+1}$ g **I**

g 1

$g(x)+g(-x)=2$ $x\in$ 2

$g(x)$ $g(-\ln 3)$ 3

(C_g) 4

(C_g) $y=x+\alpha$ α 5

(C_g) 6

$g(x)=a+\dfrac{be^{-x}}{e^{-x}+1}$ b a 7

$x=0$ $x=-3$ $y=0$ (C_g) 8

(C_f) $f(x)=-x+4\ln(e^x+1)$ f **II**

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

$\lim\limits_{x\to-\infty}\left(f(x)+x\right)=0$ $\lim\limits_{x\to+\infty}\left(f(x)-3x\right)=0$

(C_f) (C_f)

$f'(x)=g(x)$ x 2

f $f'(x)$

(C_f) 3

x m 4

$4\ln(e^x+1)=x+m$

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04

y x $2x-25y=5$ (E) **1**

$$\begin{cases} u_0 = 13 \\ u_{n+1} = 5u_n - 2 \end{cases} \quad (u_n) \qquad \textbf{2}$$

u_n u_4 u_3 u_2 u_1

$$u_{n+2} \equiv u_n [4] \quad n$$

$$u_{2k+1} \equiv 3[4] \quad u_{2k} \equiv 1[4] \quad k$$

$2u_n = 5^{n+2} + 1$ n **3**

$$2u_n \equiv 26[100] \quad n$$

u_n n **4**

$p\gcd(u_{n+1};u_n)$ **5**

04

0.1

0.8

0.6

p_n n G_n n

$p_1 = 0.1$ G_n

$p_2 = 0.62$ **1**

2

3

$$p_{n+1} = \frac{1}{5}p_n + \frac{3}{5} \quad n \qquad \textbf{4}$$

$$p_n = \frac{3}{4} - \frac{13}{4}\left(\frac{1}{5}\right)^n \quad n \qquad \textbf{5}$$

(p_n)

$$\frac{3}{4} - p_n < 10^{-7} \quad n \qquad \textbf{6}$$

05

(D_2) (D_1) $(O;i\ ;\mathrm{j};\mathrm{k})$

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$(D_2):\begin{cases} x=-t+1 \\ y=t \\ z=-2t+4 \end{cases}$ $;t\in$ $(D_1):\begin{cases} x=m \\ y=m-1 \\ z=1 \end{cases}$ $;m\in$

(D_2) (D_1) 1

(D_2) (D_1) $n(-1;1;1)$

$x-y+2z-3=0$ (D_2) (D_1) (P) 2

B (P) (D_2)

$A(1;0;1)$ (D_1) n B (D) 3

(D_2) M (P) (D_1) (Q) 4

(D_2) (Q)

$.(Q)$ M

07

$\lim\limits_{x\xrightarrow{>}0} x\ln x=0$ $\lim\limits_{x\to+\infty}\dfrac{\ln x}{x}=0$ I

$g(x)=2x-1-\ln x$ $]0,+\infty[$ g II

$\lim\limits_{x\to+\infty} g(x)$ $\lim\limits_{x\xrightarrow{>}0} g(x)$ 1

g 2

$]0,+\infty[$ $g(x)$ g 3

$]0.1;0.3[$ α $g(x)=1$ 4

$f(x)=x^2\left(1-\dfrac{\ln x}{x}\right)$ $]0,+\infty[$ f III

$(O;i;j)$ (C_f)

$\lim\limits_{x\to+\infty} f(x)$ $\lim\limits_{x\xrightarrow{>}0} f(x)$ 1

$f'(x)=g(x)$ $]0,+\infty[$ f 2

(C_f) $\dfrac{1}{2}$ f 3

(Δ) (C_f) 1 (C_f) (Δ) 4

0 x (OM) x (C_f) M 5

(C_f) (Δ) 6

$y=x-\alpha^2+\alpha$ α (C_f) 7

$x^2-x(1+\ln x)-m=0$ m

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