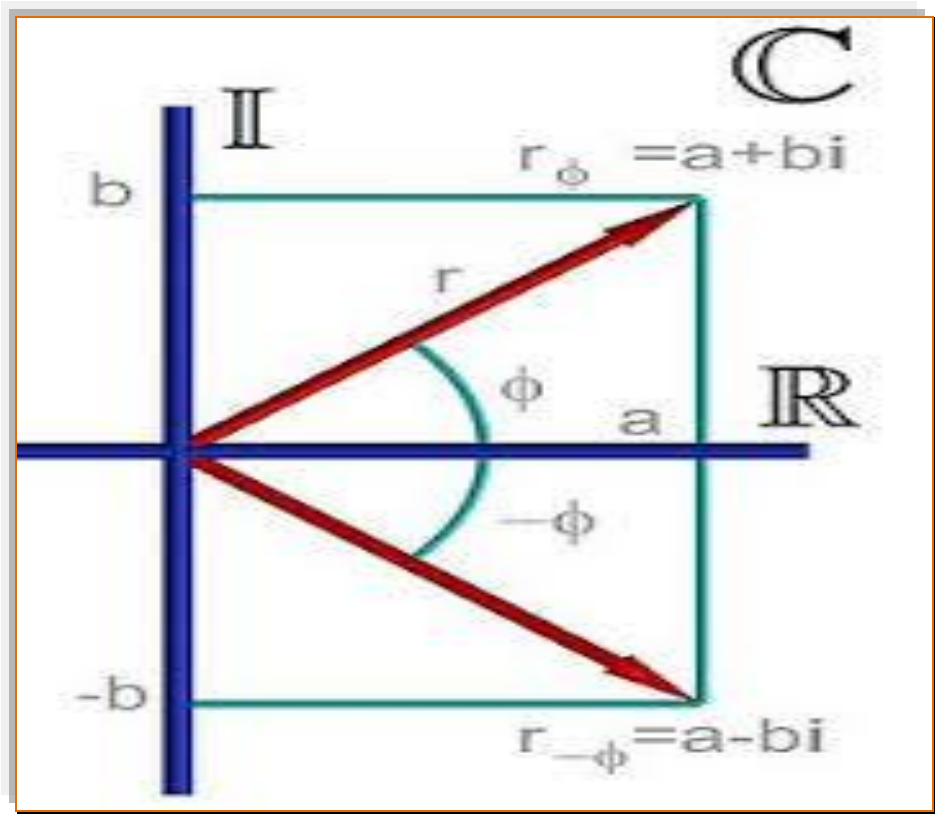
****



BAC2020

larbibelabidi @ gmail.com

العربي الجزائري Facebook

قلم الجزائر

WWW.DZPEN.COM

قلم الجزائر
WWW.DZPEN.COM



2 ، 1

BAC2020

قلم الجزائر
WWW.DZPEN.COM

1

01

$z' = -1 + 2i \quad z = 3 + i\sqrt{3}$

$z_3 = \frac{z}{z'} \quad z_2 = z'^3 \quad z_1 = z \times z' \quad z_0 = z^2$

$K = -\sqrt{3}z^2 + iz^3$ z^3 z^2 $z = \frac{1}{2} - \frac{\sqrt{3}}{2}i$ z

$b = \sqrt{2-\sqrt{3}} + i\sqrt{2+\sqrt{3}} \qquad a = \sqrt{6}+\sqrt{2} + i\,(\sqrt{6}-\sqrt{2}\,)$

b^4 a^3 b^2 a^2

02

$z_6 = \frac{z^2 + iz - 1}{-z + 2i} \quad z_5 = \frac{1-z}{1+iz} \quad z_4 = (z-i)(z+i) \quad z_3 = i(1+z) \quad z_2 = 2z - 2i \quad z_1 = 2 + iz$

$z_2 = \frac{-i + \sqrt{3}}{-2i} \quad z_1 = (\sqrt{3} - i)(-2i)$

$\overline{\left(z_2^{1441}\right)}$ $\overline{\left(z_1^{2020}\right)}$ $\overline{\left(\frac{z_2}{z_1}\right)}$ $\overline{z_2 \times z_1}$ $\overline{z_1 + z_2}$ $\overline{z_2}$ $\overline{z_1}$

03

$z_3 = \sqrt{3} + i \quad z_2 = -z_1 \quad z_1 = \overline{z_0} \quad z_0 = 1 + i$ -1

$\left(\frac{-4}{z_3}\right)^{19}$ $(z_0)^{44}$ $\frac{(z_1)^5}{(z_0)^4}$ -2

04

$|z|^2 + i(z + \bar{z}) - 4 + 2i = 0$ 4 $z.\bar{z} - \bar{z} + z - 5 - 2i = 0$ 3 $\bar{z} + 1 + i = i\bar{z} + 3$ 2 $2iz - 3i + (1-i)z = 0$ 1

$$\begin{cases} iz - (-1+i)z' = -4 - 3i \\ (1+i)z + 2i\,z' = 13 + 9i \end{cases}$$

z

$z^2 - 8\sqrt{3}z + 64 = 0$ 5 $2z^2 - 6z + 5 = 0$ 4 $z^2 = -\sin^2(\theta)$ 3 $z^2 + 3 = 0$ 2 $z^2 + 1 = 0$ 1

$z^2 = 5 - 12i$ 8 $z^2 - 2(1+\sqrt{2})z + 2(2+\sqrt{2}) = 0$ 7 $z^3 - 2z^2 + 4z = 0$ 7 $z^2 - 2(\sin\theta)z + 1 = 0$ 6

05

M C,B,A (O,u,v)

$z=x+iy$ $z_C=-5i$ $z_B=-1+4i$ $z_A=1-2i$

1 ABDC $AB=CD$ D

2 ABC H

3 $\{(A,-2),(B,1),(C,2)\}$ G

4 $\|-2MA+MB+2MC\|=4$ M(z) (Γ)

5 $3\|2MA-MB-2MC\|=\|MA+MB+MC\|$ M(z) (Δ)

6 $\|2MA-MB-2MC\|=\sqrt{3}\|MA+MB-2MC\|$ M(z) (Γ')

7 $-2\|MA\|^2+\|MB\|^2+2\|MC\|^2=48$ M(z) (E)

-8 * λ $-2MA+MB+2MC=\lambda u$ M(z) (Δ')

-9 . G H D C B A

(E) (Δ') (Δ) (Γ') (Γ)

06

$z_4=\dfrac{1+i}{i+\sqrt{3}}$ $z_3=-2i$ $z_2=-\sqrt{2}+i\sqrt{2}$ $z_1=-\sqrt{5}-i\sqrt{15}$ $z_0=2+2i\sqrt{3}$

$z_3=-\dfrac{i}{2}e^{-i2019\pi}$ $z_2=2\sqrt{3}e^{-i\frac{\pi}{6}}$ $z_1=\sqrt{5}e^{i\frac{3\pi}{2}}$ $z_0=-6e^{i\frac{3\pi}{4}}$

$z_2=3\sqrt{2}(\cos\dfrac{\pi}{6}-i\sin\dfrac{\pi}{6})$ $z_1=(-\sqrt{2}+1)e^{-i\frac{1441\pi}{4}}$ $z_0=(-\sqrt{3}+i)e^{i\frac{\pi}{6}}$

07

$z_B=4-i$ $z_A=2i$ B A I

M(z)

$k\in$ + $z=2i+ke^{i\frac{\pi}{3}}$ 5 $\theta\in$ $z=2i+2e^{i\theta}$ 4 $\arg(z-2i)\equiv\dfrac{\pi}{2}[2\pi]$ 3 $|z-2i|=|z-4+i|$ 2 $|z-2i|=4$ 1

z M II

$|z-i|=|z-2+4i|$(4 $|\bar{z}-2i|=4$ (3 $|(1+i)z-i|=|2+4i|$ (2 $|z-1+3i|=1$(1

WWW.DZPEN.COM

08

$L(z)=\dfrac{z-2i}{z-1}$ L M(z) B(1) A(2i)

$L(1+i)$ $L(-i)$ 1

$L(z)=1+i$ y x $z=x+iy$ 2

$$L(z)=\frac{(x^2+y^2-x-2y)}{(x-1)^2+y^2}+i\frac{(-2x-y+2)}{(x-1)^2+y^2}$$ L(z)

$|L(z)|=1$ L(z) L(z) M(z)

09

α z

$z=\alpha\sqrt{3}\pm\alpha i$ 5 $z=\alpha\pm\alpha\sqrt{3}i$ 4 $z=\alpha\pm\alpha i$ 3 $z=\alpha i$ 2 $z=\alpha$ 1

10

$L=\dfrac{z_1+z_2}{z_1-z_2}$ $K=\dfrac{z_1+z_2}{1+z_1.z_2}$ $|z_1|=|z_2|=1$ z_2 z_1

L K 2 $\overline{L}$ $\overline{K}$ 1

11

$z_4=-3$ $z_3=3-4i$ $z_1=5+12i$ $z_0=2i$ 1

$z^4=-2-2i\sqrt{3}$ ، $z^3=8i$ ، $z^2=1+i\sqrt{3}$ z 2

12

$p(z)=z^4-2\sqrt{3}z^3+8z^2-8\sqrt{3}z+16$ 1

$\overline{p(z)}=p(\overline{z})$ z

p(z) $p(\sqrt{3}+i)$ $p(-2i)=0$

(O,u,v) 2

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

A B C D

A B C D

O B E 3

$$\frac{z_A-z_C}{z_E-z_C}=e^{-i\frac{\pi}{3}}$$

2020 قسم الجزائر
WWW.DZPEN.COM

13

$z = -\sqrt{3} + i$ 1

$z.z' = 6\left[\cos\frac{19\pi}{12} + i\sin\frac{19\pi}{12}\right]$ z' 2

z'

$\sin\frac{19\pi}{12}$ $\cos\frac{19\pi}{12}$ z'

14

$\bar{z} + \sqrt{z.\bar{z}} = 6 + 2i$ z 1

$\frac{8}{3} + 2i$ $-\frac{8}{3} + 2i$ $\frac{8}{3} - 2i$

$\overline{(z+i)}(z+i) = \overline{(z-1)}(z-1)$ $M(z)$ 2

y=x y=-x y=x-1

15

$\mathrm{Im}(z)$ z -1

$-i$ i -2

θ $\sin\left(\frac{\pi}{2} - \theta\right) + i\cos\left(\frac{\pi}{2} - \theta\right)$ -3

$\frac{\pi}{2}$ $\frac{1-i}{1+i}$ -4

BC $|z-i|$ z $-i$ i C B A -5

$i^n = (-1)^n$ n -6

z $|1+iz| = |1-iz|$ z -7

16

$z_3 = \frac{z_1}{z_2}$ $z_2 = \sqrt{3} + i$ $z_1 = 1 + i$

z_3 -1

z_3 z_2 z_1 -2

$\tan\frac{\pi}{12}$ $\sin\frac{\pi}{12} = \frac{-1+\sqrt{3}}{2\sqrt{2}}$ $\cos\frac{\pi}{12} = \frac{1+\sqrt{3}}{2\sqrt{2}}$ -3

WWW.DZPEN.COM

17

z M $L=\dfrac{z-2}{z+i}$ i z

L 4 L 3 L 2 $|L|=1$ 1

18

$z'=\dfrac{z-1}{1-\overline{z}}$ z' M' z M

$|z'|=1$ 1 z -1

M' $\dfrac{z'-1}{z-1}$ -2

19

$D(\dfrac{1}{z})$ $C(1+z^2)$ B(1) A(z²) M(z) (O,u,v)

D A M z M -1

C B M z M -2

20

(E) $z^3+2(i-1)z^2+(9-4i)z+18i=0$

z_0 (E) -1

ABC z_2 z_1 z_0 C B A -2

21

$z_2=\dfrac{5+11i\sqrt{3}}{7-4i\sqrt{3}}$ $z_1=\dfrac{1+i\sqrt{3}}{1-i}$ 1

$z_1^{\,n}$ n 2

$z_1^{\,n}$ n 3

22

$4e^{-\frac{\pi}{4}i}$ $(\sqrt{2}-i\sqrt{2})^2$ 2 $2e^{\frac{5\pi}{6}i}$ $-\sqrt{3}+i$ 1

$4z=-\sqrt{2}+\sqrt{6}+i\sqrt{2}-\sqrt{6}$ $(\sqrt{2}-i\sqrt{2})z+\sqrt{3}-i=0$ 3

M(z) B(−2) A(4i) (0;u;v) 4

(AB) $|z-4i|=|z+2|$ M

WWW.DZPEN.COM

23

$P(z)=|z|^2+4iz-5-4i$ $(O;u;v)$

$P(z)$ $P(z)$ $M(z)$ 1

$Im(z_1)$ 0 z_2 z_1 $P(z)=1$ z 2

O A C z_2 z_1 B A 3

ABC C

24

$Im(z_1)$ 0 $z_1\in$ z_3 z_2 z_1 $(z-2)(z^2-2\sqrt{2}z+4)=0$ 1

$\sin\frac{3\pi}{8}$ $\cos\frac{3\pi}{8}$ z_2+z_1 z_3 2

C B A $(O;u;v)$ 3

$z_C=-\sqrt{2}(1-i)$ $z_B=-\sqrt{2}(1+i)$ $z_A=\sqrt{6}-\sqrt{2}$

z_A z_B

A C

ABC

WWW.DZPEN.COM

2

25

T $T: M(z) \to M'(z')$ T

$z' = 2ize^{i\frac{\pi}{2}}$ $z' = (1+i)z - 3i$ 4 $z' = iz + 1 + i$ 3 $z' = -2z + 3 - 3i$ 2 $z' = z + i$ 1

26

S S

$z' = \sqrt{2}(1-i)z$ 4 $(z'+2) = (1-i)(z+2)$ 3 $(z'+i) = \sqrt{3}i(z+i)$ 2 $(z'-i) = 2(z-i)$ 1

27

T

2 $\omega(1-i)$ H 2 $v\begin{pmatrix}1\\2\end{pmatrix}$ T 1

$\frac{\pi}{6}$ 2 $\omega(2i)$ S 4 $\frac{\pi}{3}$ $\omega(i)$ R 3

28

$\frac{\pi}{2}$ A(i) r 2 A(i) h

roh = hor r h

29

(O;u;v)

$B(-2+4i)$ $A(1-2i)$ O h 1

O $C(1-i)$ B(1) $A(1-2i)$ r 2

D(5;2) C(2;−1) B(1;4) A(1;2) S_1 3

C(3) $B(1-i)$ A(1) S_2 4

B(−3;3) A(2;1) $\frac{3\pi}{4}$ $\sqrt{2}$ S_3 5

30

$M(x;y) \to M'(x';y') : \begin{cases} x' = -2y - 3 \\ y' = 2x + 1 \end{cases}$ f

B'(−1;−1) B f A(i) A' 1

f $z' = 2iz - 3 + i$ f 2

$x^2 + y^2 - 2x + 2y - 2 = 0$ M(x;y) Γ 4

f Γ Γ Γ

WWW.DZPEN.COM

WWW.DZPEN.COM

1

1 2012 31

$(z \neq 2-3i)$ $z = \dfrac{3i(z+2i)}{z-2+3i}$ z 1

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

$z_B = 1-i\sqrt{5}$ $z_A = 1+i\sqrt{5}$ z_B z_A

O B A

$z' = \dfrac{3i(z+2i)}{z-2+3i}$ z' M' $z \neq 2-3i$ z M 3

$[CD]$ (Δ) $z_E = 3i$ $z_D = 2-3i$ $z_C = -2i$ E D C

DM CM OM'

(γ) M' (Δ) M

(γ) E

2 2011 32

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

$z_C = 4i$ $z_B = 3+2i$ $z_A = 3-2i$

C B A 1

OABC

OABC Ω

$\|MO+MA+MB+MC\| = 12$ M (E) 2

$z^2-6z+13=0$ z 3

z_1 z_0

z M

$|z-z_0| = |z-z_1|$ M

1 2009 33

$(O;u;v)$

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

z_2 z_1 z_2 z_1 2

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

ABC BC AC AB $z_C=\frac{1}{2}(5+i\sqrt{3})$

$$Z=\frac{z_C-z_B}{z_A-z_B}$$

Z^{3K} Z^6 Z^3

2 2009 34

$p(z)=(z-1-i)(z^2-2z+4)$ P(z)

$P(z)=0$ 1

z_2 z_1 $z_2=1-\sqrt{3}i$ $z_1=1+i$ 2

$\frac{z_1}{z_2}$

$\sin\frac{7\pi}{12}$ $\cos\frac{7\pi}{12}$

$\left(\frac{z_1}{z_2}\right)^{456}$ 3

1 2008 35

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

$\left(\frac{z_1}{z_2}\right)^{2008}$ $Im(z_1)$ 0 z_2 z_1

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

$$Z=\frac{z_2+1-i}{z_1+1-i}$$

Z z_2 z_1 $-1+i$

$e^{i(\theta_1+\theta_2)}=e^{i\theta_1}\times e^{i\theta_2}$ $e^{i\theta}=\cos\theta+i\sin\theta$

$\frac{e^{i\theta_1}}{e^{i\theta_2}}=e^{i(\theta_1-\theta_2)}$ $e^{-i\theta}=\frac{1}{e^{i\theta}}$

ABC Z (

2020 الجزائر
WWW.DZPEN.COM

1 2013 36

$2z^2+6z+17=0$ 1

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

$z_C=-\frac{3}{2}-\frac{5}{2}i \quad z_B=-\frac{3}{2}+\frac{5}{2}i \quad z_A=-4$

ABC $\frac{z_B-z_A}{z_C-z_A}$

A BCDE E D $z_E \quad z_D$ 3

$\|MD+ME+MB+MC\|=10\sqrt{2}$ M (Γ_1)

$\arg(z+4)=\frac{\pi}{4}$ M (Γ_2) 4

(Γ_2) (Γ_2) B

1 2010 37

$(z-3+2i)(z^2+6z+10)=0$ 1

I D C A $(O;u;v)$ 2

$z_I=1 \quad z_D=-3-i \quad z_C=-3+i \quad z_A=3-2i$

$\begin{cases}\arg(z-3+2i)=\arg(z-1)+\frac{\pi}{2}\\ |z-3+2i|=|z-1|\end{cases}$ z 3

z $\frac{z-3+2i}{z-1}=i$

ABCD $AB=DC$ $z_B=3$ B

$Z=\frac{z_A-z_I}{z_B-z_J}$ $z_J=1-2i$ z_J J

ABIJ $AB=JI$

قسم الجزائر
WWW.DZPEN.COM

1 2011 38

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

(E) (1

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

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

L

$z_A-z_B=L(z_C-z_B)$

S ABC

2 2010 39

$a=-2+2\sqrt{3}i$ 1

$z^2=-2+2\sqrt{3}i$

C B A (O;u;v) 2

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

$\frac{z_C-z_A}{z_B-z_A}$

ABC

$\arg(\bar{z}+2)=\frac{\pi}{3}$ M z (E) 3

(E) B

(E)

1 2009 40

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

$(\bar{z}+3)^2-2(\bar{z}+3)+2=0$

M B A (O;u;v) 2

z $(1+i)$ $(1-i)$

+ k $z=1-i+ke^{i\frac{5\pi}{4}}$ M (Γ)

$|z-1+i|=|z-1-i|$ M (Γ)

WWW.DZPEN.COM

2 2009 41

$z^2-6z+18=0$ 1

$z_1=3-3i$ 2

$z_1\times z_3=6(\cos\frac{\pi}{12}+i\sin\frac{\pi}{12})$ z_3

$\sin\frac{\pi}{12}$ $\cos\frac{\pi}{12}$

C B A $(O;u;v)$ 3

$\frac{\sqrt{2}}{2}+i\frac{\sqrt{6}}{2}$ $3-3i$ $3+3i$

G_α $\{(A,1);(B,-1);(C,\alpha)\}$ α

* α G_α

1 2008 42

$z^3+(2-4i)z^2-(6+9i)z+9(-1+i)=0$ (*)

(*) $z_0=3i$ 1

z_1 z_2 (*) 2

z_2 z_1 z_0 C B A 3

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

$AM^2+BM^2-CM^2=-13$ M (E) 4

(E) (E) A

2 2008 43

θ r

$z^2-2r\cos(\frac{\theta}{2})z+r^2=0$ 1

$(O;u;v)$ 2

OAB θ B A

WWW.DZPEN.COM

1 2009 44

$f(z)=\dfrac{z-i}{z-1}$ $f(z)$ 1 z

$(45+45i)f(z)=23+45i-2z$ 1

$(O;u;v)$ z M 2

$f(z)$ M

$\arg(f(z_0))=\dfrac{3\pi}{2}$ $|f(z_0)|=1$ z_0

z_0 i 1 C B A 3

ABC

ACBD (AB) C D

2 2008 45

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

$\dfrac{1}{\alpha}$ $P(z)$ α 1

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

$P(z)=0$ 3

D C B A $(O;u;v)$ 4

m $\dfrac{m}{2}-\dfrac{m}{2}i$ $-\dfrac{m}{2}-\dfrac{m}{2}i$ $-1+i$ $1+i$

ABCD m

WWW.DZPEN.COM

1 2019 46

$(z-i)(z^2-4z+5)=0$ z (I

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

$2+i$ $2-i$ i

ABC $\frac{z_C-z_A}{z_C-z_B}$ 1

$f(z)=\frac{iz-1-2i}{2z-4-2i}$ $2+i$ z 2

$|f(z)|=\frac{1}{2}$ z M (E)

$[f(i)]^{1440}$

$\frac{\pi}{2}$ C r 3

C A D r B D

A D

2 2019 47

$(O;u;v)$

z_C z_B z_A C B A

$z_C=-2z_A$ $z_B=\overline{z_A}$ $z_A=\sqrt{2}+i\sqrt{6}$

$\left(\frac{z_A}{2\sqrt{2}}\right)^{2019}+\left(\frac{z_B}{2\sqrt{2}}\right)^{2019}$ z_A 1

T B D z_D C A T 2

ABDC

z_C-z_A 3

$\left(\frac{-6\sqrt{2}}{z_C-z_A}\right)^n$ n 4

C A M 5

$\frac{z_A-z}{z_C-z}$ M (E)

WWW.DZPEN.COM

1 2018 48

$z^2-\sqrt{3}z+1=0$ z 1

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

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

$\left(\frac{z_A}{z_B}\right)^n=\frac{1+i\sqrt{3}}{2}$ n z_B z_A

OBC $\frac{z_B}{z_C}=e^{\frac{\pi}{3}i}$ 3

r C B

$|z|=\left|\overline{z}-\frac{\sqrt{3}+i}{2}\right|$ z M (γ) 4

r (γ)

2 2018 49

z $\overline{z}$ $(\overline{z}-4+i)(z^2-4z+5)=0$ I

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

$z_C=\overline{z_A}$ $z_B=4+i$ $z_A=2+i$

$\left(\frac{z_B-z_A}{z_C-z_A}\right)^n$ n $\frac{z_B-z_A}{z_C-z_A}=i$ 1

$\begin{cases}|z_D-z_A|=|z_B-z_A| \\ \text{Arg}\left(\frac{z_D-z_A}{z_B-z_A}\right)=\frac{\pi}{3}+2k\pi\end{cases}$ z_D D 2

z_D ABD

ABD G z_G 3

D G A

$\text{Arg}\left(\frac{z_G-z}{z_C-z}\right)=\pi+2k\pi;(k\in\ )$ z M (Γ) 4

1 2017 50

$(z+2)(z^2-4z+8)=0$ I

$(O;u;v)$ II

WWW.DZPEN.COM

$z_C = -2$ $z_B = \overline{z_A}$ $z_A = 2 - 2i$ C B A

z_B z_A 1

ACD B D z_D 2

$\arg\left(\frac{z_B - z}{z_A - z}\right) = \frac{\pi}{2}$ B A M z M (Γ) 3

(Γ) (Γ) O

h (Γ) (Γ') 2 C h 4

(Γ')

2 2017 51

$(O; u; v)$

$S = \left\{-\frac{1}{2} + i\right\}$ $\left(\frac{z+1-i}{z-i}\right)^2 = 1$ 1

$(z+2)(\overline{z}+2) = |z+2|^2$ z 2

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

$\frac{\pi}{2}$ 3 1 Ω S 4

(C) S 3 ω(0;1) (C)

9 ω'(−2;−3)

$Z = (\sin\alpha + i\cos\alpha)(\cos\alpha - i\sin\alpha)$ α 5

k $\arg(Z) = \frac{\pi}{2} - 2\alpha + 2k\pi$

1 2017 52

$(z-2)(z^2 + 2z + 4) = 0$ z I

$\|u\| = 2cm$ $(O; u; v)$ II

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

z_C z_B 1

C B A ABC

$\frac{2\pi}{3}$ $\frac{1}{2}$ O S 2

WWW.DZPEN.COM

C' B' A' S

C' B' A' S C B A

A'B'C'

2 2017 53

$(O;u;v)$

$z_C = 4-3i \quad z_B = 1+i \quad z_A = -3-2i$ C B A

C B A S 1

ABC $\dfrac{z_A - z_B}{z_C - z_B}$ 2

$[AC]$ I ABC G 3

I G B I G z_I z_G

ABCD I B D 4

$\|MA + MC\| = 5\sqrt{2}$ M (Γ) 5

(Γ) (Γ) C

1 2016 54

M $(O;u;v)$

$z' = \dfrac{z-2}{z-1}$ z' M' $z \neq 1$ z

$z' = z$ z 1

$z_2 = \overline{z_1} \quad z_1 = 1-i$ z_2 z_1 B A 2

$\dfrac{z_2}{z_1}$

O R A B

2 1 D C $z' \neq z$ 3

(Γ) M' M (Γ)

2 O h 4

S

$S = hoR$

S (Γ) (Γ')

2 2016 55

$\left(z - \dfrac{\sqrt{3}}{2} - \dfrac{1}{2}i\right)(z^2 + \sqrt{3}z + 1) = 0$ 1

قسم الجزائر
WWW.DZPEN.COM

C B A (O;u;v) 2

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

z_C z_B z_A

A C B S

ABCD D 3

z $\bar{z}$ $|z - z_A| = |\bar{z} - z_B|$ z M (E)

θ $z = z_B + \sqrt{3}e^{\theta i}$ z M (Γ)

(Γ) A

1 2016 56

$P(z) = z^3 - 24\sqrt{3}$ z 1

b a $P(2\sqrt{3}) = 0$

$P(z) = (z - 2\sqrt{3})(z^2 + az + b)$ z

$P(z) = 0$

C B A (O;u;v) 2

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

$\frac{z_C - z_A}{z_B \quad z_A}$

C B A r

ABC

AB C D z_D

ABCD

k ∈ $\arg\left(\frac{z}{=}{z}\right) = 2k\pi$ z M (Γ) 3

2 2016 57

$2\bar{z}^3 + 3\bar{z}^2 - 3\bar{z} + 5 = 0$ z

$(2\bar{z} + 5)(\bar{z}^2 - \bar{z} + 1) = 0$ (E) 1

(E)

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

WWW.DZPEN.COM

$z_D = -\frac{5}{2}$ $z_C = -1$ $z_B = \overline{z_A}$ $z_A = \frac{1}{2} - \frac{\sqrt{3}}{2}i$

D C B A z_B z_A

$z_B - z_C = z_B(z_A - z_C)$

ABC

S A F 2 $\frac{\pi}{3}$ C S 3

AFC F

+ K $z+1 = kz_B$ z M (Γ) 4

1 2015 58

β $\bar{\beta}$ α $\bar{\alpha}$ $\begin{cases} 2\alpha - \beta = -3 \\ 2\bar{\alpha} + \bar{\beta} = -3 - 2i\sqrt{3} \end{cases}$ β α I

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

$z_A = z_C.e^{i\frac{\pi}{3}}$ $z_B = \overline{z_A}$ $z_A = -\frac{3}{2} + i\frac{\sqrt{3}}{2}$

$\left(\frac{z_A}{z_C}\right)^n$ n z_C z_A 1

$2\left(\frac{z_A}{\sqrt{3}}\right)^{2015} + \left(\frac{z_B}{\sqrt{3}}\right)^{1962} - \left(\frac{z_C}{\sqrt{3}}\right)^{1435}$

$z_D = 1+i$ D 2

A D O S

$\sin\frac{7\pi}{12}$ $\cos\frac{7\pi}{12}$ $\frac{z_A}{z_D}$

+ k $z = k(1+i)e^{i\left(\frac{7\pi}{12}\right)}$ M(z) 3

2 2015 59

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

$(z_A$ $\overline{z_A})$ $z_C = -(z_A + z_B)$ $z_B = -\overline{z_A}$ $z_A = 2e^{i\frac{\pi}{6}}$ z_C z_B z_A

z_C z_B 1

(γ) C B A

C B A (γ)

WWW.DZPEN.COM

$\frac{z_B - z_C}{z_B - z_A} = e^{-i\frac{\pi}{3}}$ 2

O ABC

$|z| = |z - \sqrt{3} - i|$ z M (E)

A C O r 3

[OB] r (E)

1 2014 60

$z^2 - 6\sqrt{2}z + 36 = 0$ 1

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

$z_D = \frac{z_C}{2}$ $z_C = 6\sqrt{2}$ $z_B = \overline{z_A}$ $z_A = 3\sqrt{2}(1+i)$

$\left(\frac{(1+i)z_A}{6\sqrt{2}}\right)^{2014}$ $(1+i)z_A$ z_B z_A

D C B A O

OACB (CA;CB) $\frac{z_B - z_C}{z_A - z_C}$

$\frac{\pi}{2}$ O R 3

R

C' A C R C C'

R OACB R A A'

2 2014 61

$(z-i)(z^2 - 2z + 5) = 0$ z 1

1cm (O;u;v) 2

$z_C = 1 - 2i$ $z_B = 1 + 2i$ $z_A = i$ C B A

C B A

BC A H z_H

ABC

$\frac{\pi}{2}$ $\frac{1}{2}$ A S 3

S

$\frac{1}{2}cm^2$ S ABC

WWW.DZPEN.COM

$|z| = |iz+1+2i|$ M z M 4

1 2013 62

α $z^2-(4\cos\alpha)z+4=0...(I)$ z I 1

$\left(\frac{z_1}{z_2}\right)^{2013}=1$ z_2 z_1 I $\alpha=\frac{\pi}{3}$ 2

(O;u;v) 3

$z_C=4+i\sqrt{3}$ $z_B=1-i\sqrt{3}$ $z_A=1+i\sqrt{3}$ C B A

$\frac{z_C-z_A}{z_B \quad z_A}$ C B A

A S B

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

ABDG D z_D

2 2013 63

$z^2+4z+13=0.....(E)$ z (E)

(E) $-2-3i$ 1

$z_B=i$ $z_A=-2-3i$ B A 2

M(z) $\frac{\pi}{2}$ $\frac{1}{2}$ A S

M'(z')

$z'=\frac{1}{2}iz-\frac{7}{2}-2i$

S B C C z_C

$2AD+AB=0$ D 3

B A D

D z_D

ACD $\frac{z_D-z_A}{z_C-z_A}=i$

2 2012 64

$P(z)=z^3-12z^2+48z-72$ 1

p(z) 6

WWW.DZPEN.COM

$p(z)=(z-6)(z^2+\alpha z+\beta)$ z β α

$p(z)=0$

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

$z_C=3-i\sqrt{3}$ $z_B=3+i\sqrt{3}$ $z_A=6$

z_C z_B z_A

$\frac{z_A-z_B}{z_A-z_C}$

ABC

S $\frac{\pi}{2}$ $\sqrt{3}$ C S 3

S A A' $z_{A'}$

A' B A

2 2011 65

$(O;u;v)$

$z_C=-4+i$ $z_B=2+3i$ $z_A=-i$ C B A

$\frac{z_C-z_A}{z_B-z_A}$ 1

ABC $\frac{z_C-z_A}{z_B-z_A}$

M'(z') M(z) T 2

$z'=iz-1-i$

T B T

D C A $z_D=-6+2i$ D 3

D C A h

D B A S

1 2010 66

B A $(O;u;v)$

$z_B=3i$ $z_A=1+i$

z_B z_A 1

$z'=2iz+6+3i$ M'(z') M(z) S 2

S

WWW.DZPEN.COM

S A C z_C

ABC

$\{(A,2);(B,-2);(C,2)\}$ D 3

D z_D

ABCD

M (Δ) z D B M 4

$\frac{z_B - z}{z_D - z}$ z

(Δ) $z_E = 6+3i$ E

(Δ) $\frac{z_B - z}{z_D - z}$

2 2010 67

$z^2 - 6z + 18 = 0$ 1

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

$z_D = -z_B$ $z_C = -z_A$ $z_B = \overline{z_A}$ $z_A = 3+3i$

O D C B A

B A O R

ABCD D O B C O A

2 2008 68

$z^2 + iz - 2 - 6i = \left(z + \frac{i}{2}\right)^2 - \frac{7+24i}{4}$ $7+24i$ 1

$z^2 + iz - 2 - 6i = 0$ z_2 z_1 (

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

$[AB]$ (Γ) ω z_ω $z_B = -2-2i$ $z_A = 2+i$

$z_C = \frac{4-i}{1+i}$ z_C C (3

(Γ) C z_C

θ (k 0) k $M_0(z_0)$ S (4

$z' - z_0 = ke^{i\theta}(z - z_0)$ $M'(z')$ $M(z)$

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

WWW.DZPEN.COM

1 2019 69

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

1 A (Γ) $z_C=\frac{3}{2}+i\left(1+\frac{\sqrt{3}}{2}\right)$ $z_B=2+i$ $z_A=1+i$

(Γ) C 1

A r B C $(AB;AC)$

z' M' z M S 2

$$z'=(1+i\sqrt{3})z+\sqrt{3}-i\sqrt{3}$$

S

S B D z_D

D C A $S=hor$ A 3

$k\in{}^{*}_{+}$ $z=z_A+ke^{i\frac{\pi}{3}}$ z M (E) 4

(E) (E) C

2 2019 70

$(2-2\sqrt{3})^2=16-8\sqrt{3}$ I

$Z=-16\sqrt{3}-16i$ Z L_2 L_1

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

$z_C=-\frac{1}{4}z_A$ $z_B=\frac{1}{2}iz_A$ $z_A=4e^{i\frac{\pi}{4}}+4e^{i\frac{5\pi}{6}}$

$z_A=4\sqrt{2}e^{i\frac{7\pi}{12}}$ z_A 1

$\sin\frac{7\pi}{12}$ $\cos\frac{7\pi}{12}$ 2

C B B A S 3

S z M z' M'

S $z'=\frac{1}{2}iz$

$\{(A;2),(B;-2),(C;4)\}$ z_G G 4

WWW.DZPEN.COM

$z_G = 2e^{i\frac{\pi}{3}}$

$\left\|MA - MB + 2MC\right\| = 2\sqrt{2}$ z M (E)

S (E) (E') (E)

1 2018 71

$z^2 - 2\sqrt{2}z + 4 = 0$ z I

(O;u;v) II

$z_B = \overline{z_A}$ $z_A = \sqrt{2} + i\sqrt{2}$ B A

$\left(\frac{2}{z_B}\right)^{2018}$ $\frac{1}{z_B}$ z_A 1

(–3) $z_\omega = \frac{\sqrt{2}}{2}$ ω h B C 2

$z_C = -\sqrt{2} + i3\sqrt{2}$ C

$.(-\frac{\pi}{2})$ O r B D z_D 3

ACD $\frac{z_C - z_A}{z_D - z_A} = -i$ 4

ACED E

2 2018 72

(E).....$4z^2 - 2z + 1 = 0$ z I

(E) z_2 z_1 $\frac{1}{z_2}$ $\frac{1}{z_1}$

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

. $z_C = 1 - i\sqrt{3}$ $z_B = 1 + i\sqrt{3}$ $z_A = 4$

ABC $\frac{z_B - z_A}{z_C \quad z_A}$ 1

A C B

CB A D 2

ACBD

$\left|iz + \sqrt{3} - i\right| = \left|z - 1 + i\sqrt{3}\right|$ M (z) (γ) 3

(γ) ABC G 4

WWW.DZPEN.COM

1 2017 73

$(O;u;v)$

$z_C=-i \quad z_B=2+i \quad z_A=-1$ C B A

ABC $\dfrac{z_A-z_C}{z_B-z_C}$ 1

A B C S 2

S D E C B D 3

E z_E $z_E=1-2i$ D z_D

ADEB

B A M z M (Γ) 4

$k\in \quad \arg(z-z_A)-\arg(z-z_B)=\dfrac{\pi}{2}+2k\pi$

(Γ) (Γ) C

2 2017 74

$(O;u;v)$

$z_D=\overline{z_C} \quad z_C=\dfrac{1}{2}(1-i) \quad z_B=\overline{z_A} \quad z_A=1+i$ D C B A

z_D z_B z_C z_A 1

$(z_A)^n=(z_B)^n$ n

B C A D h 2

ADCB $\dfrac{z_C-z_B}{z_D-z_A}$

$\{(A;2),(B;2),(C;-1);(D;-1)\}$ G z_G 3

$\|2MA+2MB-MC-MD\|=\sqrt{5}$ M (Γ) 4

(Γ) (Γ) A

1م 2017 75

$(z-4)(z^2-2z+4)=0$ z I

$(O;u;v)$ II

$z_C=1-i\sqrt{3} \quad z_B=1+i\sqrt{3} \quad z_A=4$ C B A

WWW.DZPEN.COM

ABC $\dfrac{z_C - z_A}{z_B \quad z_A}$ 1

$\dfrac{2\pi}{3}$ O r B D 2

ABDC

$z_n = (z_C)^n + (z_B)^n$ n 3

$z_n = 2^{n+1} \times \cos\left(\dfrac{n\pi}{3}\right)$ n

$t_n = z_{6n}$ n

$P_n = t_0 \times t_1 \times t_2 \times ..... \times t_n.$ n P_n n t_n

2م 2017 76

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

(O;u;v) II

$z_C = \overline{z_B}$ $z_B = -1-i\sqrt{3}$ $z_A = -1+\sqrt{3}$ C B A

ABC $z_B - z_A = i(z_C - z_A)$ 1

$L = \dfrac{z_C - z_A}{z_C}$ L 2

$\tan\dfrac{\pi}{12}$ $L = \dfrac{\sqrt{6}}{2}(\cos\dfrac{\pi}{12} + i\sin\dfrac{\pi}{12})$

M' z M S 3

$z' = (z - z_B)L + z_B$ z'

S

SoS C B A C' B' A' 4

A'B'C'

1 2016 77

$9z^2 - 6\sqrt{3}z + 4 = 0$: 1

B A (O;u;v) 2

$z_B = \overline{z_A}$ $z_A = \dfrac{\sqrt{3}}{3} + \dfrac{1}{3}i$

$\left(\dfrac{z_A}{z_B}\right)^{2016} + \left(\dfrac{z_A}{z_B}\right)^{1437} = 0$ z_B z_A

WWW.DZPEN.COM

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

$z' = \left(\frac{z_A}{z_B}\right) z$ z' M' z M f 3

f

f A C z_C

ABCD O D z_D

2 2016 78

z 1 I

$(z^2 - 2\sqrt{2}z + 4)(2z - \sqrt{2}) = 0$

2

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

$c = \sqrt{2} - i\sqrt{2}$ $b = \sqrt{2} + i\sqrt{2}$ $a = \frac{\sqrt{2}}{2}$

C B A 1

3 π A S C D 2

$-\frac{\pi}{2}$ O R C E

E D e d

z 1 $z = \frac{d-b}{e-b}$ III

I B F $[DE]$ I 2

BDFE

1 2015 79

B A $(O; u; v)$

$z_B = 3 + 3i$ $z_A = 1 - i$ z_B z_A

z_B z_A 1

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

$\frac{z}{z_A}$ z $\frac{z}{z_A} = 4e^{i\frac{\pi}{12}}$ z

WWW.DZPEN.COM

$\sin\frac{\pi}{12}$ $\cos\frac{\pi}{12}$ (

$\frac{\pi}{2}$ A B C z_C 2

ABC

ABDC $\{(A,-1);(B,1);(C,1)\}$ D z_D

2 2015 80

z 1

θ $z^2-4(\sin\theta)z+4=0...(I)$

z_2 z_1 z_2 z_1 (I) $\theta=\frac{\pi}{3}$ 2

C B A $(O;u;v)$ 3

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

ABC $\frac{z_C-z_A}{z_B \quad z_A}$

A S B C

ABDC AC t B D

$z\neq z_B$ $\frac{z-z_C}{z \quad z_B}$ z M (Γ_1) 4

$z\neq z_B$ $\frac{z-z_C}{z \quad z_B}$ z M (Γ_2)

1 2014 81

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

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

$z_3=i$ $z_2=\sqrt{3}-i$ $z_1=\sqrt{3}+i$

$\frac{z_1}{z_2}$

$\left(\frac{z_1}{z_2}\right)^n$ n

C B A S 3

ABC

WWW.DZPEN.COM

$|z-z_1|^2+|z-z_3|^2=5$ M(z E 4

$|z-z_1|=|z-z_3|$ M(z E'

2 2014 82

$z_0=1+i$ A $(O;u;v)$

θ $z=z_0+2e^{i\theta}$ M(z) (γ) 1

+ k $z=z_0+ke^{i\left(\frac{3\pi}{4}\right)}$ M(z) (γ')

(γ') (γ)

$z_1=z_0+2e^{i\left(\frac{3\pi}{4}\right)}$ z_1 B 2

OAB $\frac{z_1-z_0}{z_0}$

$-\frac{\pi}{2}$ A B C z_2

$\alpha+\beta=\sqrt{2}$ $\{(A,\alpha);(C,\beta)\}$ O β α

$((1+\sqrt{2})MA-MC).(MA-MC)=0$ M (E)

1 2013 83

$(z+5-i\sqrt{3})(z^2+2z+4)=0$ z 1

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

$z_C=-5+i\sqrt{3}$ $z_B=-1+i\sqrt{3}$ $z_A=-1-i\sqrt{3}$

B O C A S

S

$\{(A,2);(B,-1);(C,1)\}$ D z_D 3

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

$\|2MA-MB+MC\|=\|MA-MB\|$ M (Γ)

WWW.DZPEN.COM

1 2012 84

$\begin{cases} 2z_1 + 3z_2 = 9 - 2i \\ 3z_1 - z_2 = 8 + 8i \end{cases}$ z_2 z_1 1

Ω B A $(O;u;v)$ 2

$z_\Omega = 1 - 2i$ $z_B = -3$ $z_A = 3 + 2i$ z_Ω z_B z_A

ΩAB $z_B - z_\Omega = i(z_A - z_\Omega)$

2 A h 3

h Ω C z_C h

$\{(A,1);(B,-1);(C,1)\}$ D z_D

ABCD

$\|MA - MB + MC\| = 4\sqrt{5}$ M (E) 4

(E) (E) B

2 2011 85

(E)

$L = \dfrac{-4\sqrt{2} + i\sqrt{2}}{5 + 3i}$ L $(O;u;v)$

L 1

$(-4\sqrt{2} + i\sqrt{2})^{12} + (5 + 3i)^{12}$ $L^{12} + 1 = 0$

$L^{4n} + L^{4p} = 0$ p n

$z_B = 5 - 3i$ $z_A = 5 + 3i$ B A (2

$\dfrac{3\pi}{4}$ $\sqrt{2}$ B A A' $z_{A'}$

ABA' G z_G (

WWW.DZPEN.COM

1 2019 86

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

$z_E=1 \quad z_D=\overline{z_B} \quad z_C=\overline{z_A} \quad z_B=i \quad z_A=1+i\sqrt{2}$

$(z^2+1)(z^2-2z+3)=0$ 1

D C B A $|z_C-z_E| \quad |z_B-1| \quad |z_A-1|$ 2

A B $z_B-z_E=\frac{\sqrt{2}}{2}(1+i)(z_A-z_E)$

ABE

ABDE AE BD 3

z_2 z_1 w_2 w_1 4

$(z_1.\overline{z_2}+\overline{z_1}.z_2=0)$ (w_2 w_1)

$(z-z_A)(\overline{z}-z_D)+(z-z_B)(\overline{z}-z_C)$ z M

2 2019 87

$P(z)=z^4-6z^3+29z^2-24z+100$ z 1

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

$\overline{z}$ $P(z)=0$ z

$P(z)=0$

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

$z\neq 2i \quad z'=\frac{-iz+4+3i}{z-2i}$ z' $3-4i$ $2i$

$\{(A;-2),(B;1)\}$ J $\{(A;2),(B;1)\}$ I

j I z_J z_I

$|z'|=2$ M(z) (E)

(E) $(IM.JM=0)$ (E) M

k $\arg(z')=2k\pi$ M(z) (Γ)

(Γ) (Γ) $\frac{9}{2}-\frac{5}{2}i$ D

(Γ) (E) G 3

WWW.DZPEN.COM

1 2018 88

$]-\pi;\pi]$ θ $(O;u;v)$

z I

$$(z^2-2z+2)(z^2-2(\sin\theta)z+1)=0$$

D C B A II

z_C $\overline{z_C}$ $z_D=\overline{z_C}$ $z_C=\sin\theta+i\cos\theta$ $z_B=1-i$ $z_A=-\sqrt{2}e^{\frac{5\pi}{4}i}$

$z_D=\overline{z_C}$ z_C z_B z_A 1

$z_E=\frac{z_A}{z_B}$ z_E E 2

E D C

$(2\sqrt{2}-2)$ $\frac{\pi}{4}$ A S 3

S C B θ

$(z_D)^n$ n $\theta=\frac{-3\pi}{4}$ 4

2 2018 89

$(E).....4z^2-2z+1=0$ z I

(E) z_2 z_1 $\frac{1}{z_2}$ $\frac{1}{z_1}$

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

. $z_C=1-i\sqrt{3}$ $z_B=1+i\sqrt{3}$ $z_A=4$

ABC $\frac{z_B-z_A}{z_C}$ z_A 1

A C B

CB A D 2

ACBD

z M (γ) 3

$$|iz+\sqrt{3}-i|=|z-1+i\sqrt{3}|$$

(γ) ABC G 4

2020 قسم الجزائر
WWW.DZPEN.COM

1 2017 90

$(z-2+2i)(z^2-2\sqrt{2}z+8)=0$ z I

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

$z_C=2(1-i)$ $z_B=\overline{z_A}$ $z_A=\sqrt{2}+\sqrt{6}i$

C B A z_C z_B z_A 1

(Ω)

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

+ k $z=z_C-k\left(\frac{z_A}{z_B}\right)$ z M (Γ)

(Γ) (Γ) C

2 O h $\frac{2\pi}{3}$ O r 3

hor (Ω) hor

2 2017 91

$\frac{21}{4}+5i$ $\left(\frac{5}{2}+i\right)^2$ I

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

$z_I=i$ $z_C=-\overline{z_A}$ $z_B=-\frac{3}{2}i$ $z_A=\frac{3}{2}+\sqrt{2}e^{\frac{\pi}{4}i}$

z_C z_A 1

ABC $\frac{z_C-z_B}{z_A-z_B}$ 2

I A B S 3

S

$T_n=SoSo.....S$ T_n $n\geq 2$ n

n مرة

T_n n

1 2017 92

$2z^2-10z+\frac{29}{2}=0$ z I

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

WWW.DZPEN.COM

$z_D = i$ $z_C = -\overline{z_A}$ $z_B = \frac{3}{2}e^{-i\frac{\pi}{2}}$ $z_A = \frac{3}{2} + \sqrt{2}e^{\frac{\pi}{4}i}$

D C B A z_B z_A 1

ABC $\frac{z_A - z_B}{z_C - z_B}$

ABCE D B E 2

D A B S 3

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

$z_n - z_B = 5\left(\frac{\sqrt{2}}{2}\right)^{n+1} e^{i\frac{\pi}{4}(n+1)}$ n

(AB) A_n n

2 2017 93

$z^2 - 2(1-\sin\alpha)z + 2(1-\sin\alpha) = 0.....(E)$ I

(E) z_2 z_1 α

(E) z_2 z_1 1

$z_1^{2017} + z_2^{2017} = 1$ $\alpha = \frac{\pi}{6}$ 2

(O;u;v) II

$z_C = 2z_A$ $z_B = \overline{z_A}$ $z_A = \frac{1}{2} + \frac{\sqrt{3}}{2}i$ C B A

$\left(\frac{z_A}{z_B}\right)^n$ n 1

M' z M S 2

$z' = (1+z_A)z + 2z_B$ z'

S

k ∈ $\arg(\bar{z} - z_B) = -\frac{\pi}{3} + 2k\pi$ z M (Γ) 3

(Γ) (Γ) C

1 2016 94

$z^2 - 4z + 5 = 0$ 1

WWW.DZPEN.COM

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

θ 1 z_0 $0\le\theta\le\frac{\pi}{2}$ θ 2

$1+i\sqrt{3}$

z_0 $\overline{z_0}$ $\frac{z_0(1+i\sqrt{3})}{\overline{z_0}}=2e^{\frac{\pi}{2}i}$ θ

$\left[\frac{z_0(1+i\sqrt{3})}{2}\right]^n$ θ n

$\left[\frac{z_0(1+i\sqrt{3})}{2}\right]^n$

C B A $(O;u;v)$ 3

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

$\{(A;1),(B;-1),(C;1)\}$ D z_D

ABCD

$\begin{cases}\arg(z_E-z_A)-\arg(z_E-z_B)=\frac{\pi}{2}\\ \left|\frac{z_E-z_A}{z_E-z_B}\right|=2\end{cases}$ z_E E

$z_E=\frac{14}{5}+\frac{3}{5}i$

B A

$[AB]$ I z M 4

I z_I

$z-z_I=e^{i\alpha}$ M (Γ) α

(Γ) E

α (Γ)

WWW.DZPEN.COM

2 2016 95

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

$\begin{cases} 2z_1 - 3z_2 = 5i\sqrt{2} \\ z_1 + 3z_2 = -2i\sqrt{2} \end{cases}$ z_2 z_1 2

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

$z_H = \dfrac{z_C - z_B}{z_E - z_B}$ $z_D = 1 - i$ $z_C = 1 + i$ $z_B = -i\sqrt{2}$ $z_A = i\sqrt{2}$

$DE = 2DO$ E

BEC z_H 1

$z' = z_A.z + z_B$ z' M' z M S 2

S

CD C (γ)

S (γ) (γ')

z C B M M (δ) **3**

$\dfrac{z_B - z}{z_C \quad z}$

1 2015 96

I H C B A $(O;u;v)$

$z_I = -1 - i$ $z_H = -3 + 4i$ $z_C = -3$ $z_B = -2 + i$ $z_A = i$

$(O;u;v)$ I H C B A 1

C A B

ABC G z_G 2

$\dfrac{z_B - z_C}{z_H - z_A}$ 3

(BC) (AH)

WWW.DZPEN.COM

ABC H

I H G 4

$\theta \in$ $z+1+i=\sqrt{5}e^{i\theta}$ z M (Γ) 5

(Γ) A

(Γ)

(Γ)

(Γ) C B

2 2015 97

z 1

$(1+\sqrt{3})^2=4+2\sqrt{3}$ $z^2-2(1-\sqrt{3})z+8=0$

$(O;u;v)$

$z_B=\overline{z_A}$ $z_A=(1-\sqrt{3})+i(1+\sqrt{3})$ B A

z_A $\frac{z_B}{z_A}=e^{\frac{-7\pi}{6}i}$ 2

$\sin\frac{7\pi}{12}$ $\cos\frac{7\pi}{12}$

$7x-2y=1$ $(x;y)$ 3

$7x-24y=12$ $(x;y)$

12 x

$7x-24y=12$ $(x;y)$

$(z_A)^n$ n

1 2014 98

$(z-1-2i)(z^2-2(1+\sqrt{3})z+5+2\sqrt{3})=0$ 1

WWW.DZPEN.COM

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

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

ABCD $\frac{z_B+z_D}{2} \neq \frac{z_A+z_C}{2}$ (BC) (AD) AB = CD

B A D $\frac{z_D-z_B}{z_A-z_B} = \sqrt{3}e^{i\frac{\pi}{2}}$ 3

D C B A ADB

ABCD

2 2014 99

B A (O;u;v)

$b = -1+2i \quad a = -2+6i$

$1+i$ 1

$z' = \sqrt{2}e^{i\frac{\pi}{4}}z+2$ z' M z M S 2

S D D' $d = 2i$ d D

S $z'-d = \sqrt{2}e^{i\frac{\pi}{4}}(z-d)$

$3x+5y = 11$ (Δ) 3

(Δ) (Δ) $M_0(-3;4)$

(BA) (BM_0') S M_0 M_0'

M(x;y) $[-5;5]$ y x 4

S M M' (BM') (BA)

1 2013 100

(O;u;v) b a I

$z_E = be^{\frac{3\pi}{2}i} \quad z_C = \overline{z_A} \quad z_B = -a\sqrt{2} \quad z_A = ae^{\frac{3\pi}{4}i}$ E C B A

WWW.DZPEN.COM

OAB $\frac{z_A - z_B}{z_A}$ 1

OABC

M'(z') M(z) $\frac{3\pi}{4}$ $\frac{b}{a}$ O S 2

S(A)=E S

S(C)=G S(B)=F b^2 OEFG

$|z_C|^2 + |z_E|^2 - 2|z_C \times z_E|\cos(\arg\frac{z_C}{z_E})$ b a 3

b a CE^2

2 2013 101

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

$(O; u; v)$ 2

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

z_A

$\arg(z - z_A)^2 = \arg(z_A) - \arg(z_B)$ M

$z' = z_A.z + z_B.\sqrt{3}$ M'(z') M(z) r 3

r

$z' = -2z + 3i$ M'(z') M(z) h

h

S S=hor

$z' = 2e^{\frac{\pi}{3}i}(z - i) + i$

2020 قسم الجزائر
WWW.DZPEN.COM

Ω(i) S(D)=E S(C)=D S(O)=C E Ω O 4

$\theta \in$ $z = 2e^{\theta i} + e^{\frac{\pi}{2}i}$ M(z) (Γ) 5

S (Γ) (Γ')

1 2012 102

$z^2 - \sqrt{2}z + 1 = 0$ 1

(O; u; v) 2

$z_C = z_A + z_B$ $z_B = \overline{z_A}$ $z_A = \frac{1+i}{\sqrt{2}}$ C B A

$\frac{z_A}{z_B}$ z_B z_A

O C B A C B A

$\frac{\pi}{4}$

OA'C'B'

$|z - z_A| = |z - z_B|$ z M Δ 3

Δ

$\left(\frac{z - z_A}{z - z_B}\right)^2 = i$

2 2012 103

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

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

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

(γ) D C B A

D C B A

O B E z_E 3

C R E A $\frac{z_A - z_C}{z_E - z_C} = e^{(-\frac{\pi}{3})i}$

2 O H AEC

RoH (γ) RoH

WWW.DZPEN.COM

1 2011 104

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

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

z_C z_B z_A 1

$\frac{z_B-z_A}{z_C-z_A}$ 2

ABC

ACBD D (3

z M' z M T 4

$z'=(-1+i)z+1-3i$

T

ToT

2 2011 105

$z^3-3z^2+3z-9=0...(E)$

c b a (E) 3 1

$z^3-3z^2+3z-9=(z-3)(az^2+bz+c)$ z

(E)

$(O;u;v)$ 2

$z_C=-\sqrt{3}i$ $z_B=\sqrt{3}i$ $z_A=3$ C B A

ABC

$z_D=2e^{i\frac{5\pi}{6}}$ D 3

$\frac{\pi}{3}$ O D E z_E

$z_F=1-\sqrt{3}i$ F 4

(OF) (OE) $\frac{z_F}{z_E}$

OEGF G z_G

WWW.DZPEN.COM

$(O;u;v)$

$z_I = 1-2i \quad z_B = -1-2i \quad z_A = 1-4i$ I B A 1

I B A

$$z = \frac{z_I - z_A}{z_I - z_B}$$

IAB

2 A I C

C z_C

D z_D $\{(A,1);(B,-1);(C,1)\}$ D

ABCD

$2\|MA - MB + MC\| = \|MA + MC\|$ M (Γ_1) 2

$\|MA - MB + MC\| = 1$ M (Γ_2) 3

WWW.DZPEN.COM

2001 107

$-6+i6\sqrt{3}$ 1

$\left(z+\frac{3\sqrt{3}+i}{4}\right)^2=\frac{-6+6\sqrt{3}i}{16}$ 2

z_2 z_1 $z_2=-\sqrt{3}-i$ $2z_1=-\sqrt{3}+i$ 3

$L=-2(\sin\theta+i\cos\theta)$ $(O;u;v)$ 4

L z_2 z_1 M B A θ

ABM $\theta=\frac{2\pi}{3}$ θ L

1995 108

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

z_0 $P(z)=0$ 1

$P(z)=(z-z_0)(z^2+az+b)$ b a

$P(z)=0$

$(O;u;v)$ 2

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

$(1-\sqrt{6})$ $(1+\sqrt{6})$ 3 C B A G

ABC G

2001 109

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

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

$z_2^{2010}+z_3^{2010}=2^{2011}$ z_3 z_2

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 $\frac{z_A-z_C}{z_A-z_B}$

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

WWW.DZPEN.COM

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

1998 110

$z^2-2(1+2i)z+9+20i=0...(1)$ 1

z_2 1 $z_1=3-2i$

ω $M_2(-1+6i)$ $M_1(3-2i)$ 2

R M_2 M_1 ω R

2005 111

z_3 z_2 z_1 $(z-1+i)(z^2-2z+5)=0...(1)$ 1

$C(1-i)$ $B(1+2i)$ $A(1)$ $(O;u;v)$ 2

C B A G

$MM'=MA+MB+MC$ M' M T 3

T $GM'=-2GM$

T

C' B' A' T C B A C' B' A' 4

2003 112

$f(z)=z^3-(2-3i)z^2-9z-18+27i$

$f(z)=0$ $\bar{z}$ $\overline{f(z)}$ 1

$2-3i$ $-3i$ $3i$ C B A 2

ABC A C B

2 2 1 C B A G

$MA^2+2MB^2-2MC^2=25$ M

2005 113

$f(z)=z^3-(1+4i)z^2-(5-3i)z+2+2i$ 1

$f(z)=0$

$f(z)=0$

$C(1;1)$ $B(0;2)$ $A(0;1)$ $(O;u;v)$ 2

C A B

$z'=(1+i)z+2$ $M'(z')$ $M(z)$ t

t

$OM=OM'$ M BMM'

WWW.DZPEN.COM

2002 114

$0\ 2\pi$ α $z=2\sin^2(\alpha)+i\sin(2\alpha)$

z α 1

z $\sin\alpha$ 2

z y x 3

α y x

2

α M z

2005 115

$$\alpha=\frac{\sqrt{3}-1}{2}-i\frac{\sqrt{3}+1}{2}$$

α α^2 α^2 1

$\cos(\frac{7\pi}{12})$ $\sin(\frac{7\pi}{12})$ 2

$\alpha^{12k}\in$ α^{1432} α^{2011} 3

$\left|\frac{z}{z-1}\right|=|\alpha|$ M z 4

1980 116

$\alpha=\sqrt{2-\sqrt{2}}-i\sqrt{2+\sqrt{2}}$ α

α α α^4 α^4 2 α^4 α^2 1

$|\alpha z|=8$ M(z) 3

1998 117

$z^2-2(1+\sqrt{3})z+5+2\sqrt{3}=0$ $z^2-2z+5=0$

D C B A $(0;u;v)$ 2

$1+\sqrt{3}-i$ $1+2i$ $1+\sqrt{3}+i$ $1-2i$:

ABC

ABC (γ)

(γ) D

D C B A (γ)

WWW.DZPEN.COM

2020 قلم الجزائر
WWW.DZPEN.COM

2019 N-Calédonie فرنسا/ 118

(O, u, v)

1 $z(z^2 - 8z + 32) = 0 \quad (E)$

☜ 16 (E)

2 $|iz| = |z - 3|$ z M (E)

☜ 3 O (E)

3 $z_n = \left(1 - i\sqrt{3}\right)^n$ n (z_n)

z_n M_n

☜ M_{n+3} O M_n n

4 $\left(e^{ix} - e^{-ix}\right)\left(e^{i(2x)} + e^{-i(2x)}\right) = 0$ x

☜ $\frac{3\pi}{4}$ $\frac{\pi}{4}$ 0 $-\frac{\pi}{4}$ $]-\pi, \pi[$

2018 Pondichéry فرنسا/ 119

1 $z^2 - i\sqrt{3}z - 1 = 0 ...(E)$

2 $P(z) = 3z^4 - 7i\sqrt{3}z^3 - 18z^2 + 7i\sqrt{3}z + 3$ z

$P(e^{i\frac{\pi}{3}}) = 0$ $P(i\sqrt{3}) = 0$

$$P(-\frac{1}{z}) = \frac{1}{z^4}.P(z)$$

$P(z) = 0$ $e^{i\frac{2\pi}{3}}$ $\frac{\sqrt{3}}{3}i$

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

$e^{i\frac{2\pi}{3}}$ $3e^{i\frac{\pi}{3}}$ $e^{i\frac{\pi}{3}}$

D $OD = OA + OC$ D

E (OD) (BD) A

E

WWW.DZPEN.COM

2018 120

$\|u\| = 1cm$ $(O;u;v)$

$z_C = 4$ $z_B = 2$ $z_A = -4$ C B A

$z_{C'} = j.z_C$ $z_{B'} = j.z_B$ $z_{A'} = j.z_A$ C' B' A'

$$j = -\frac{1}{2} + i\frac{\sqrt{3}}{2}$$ j

$z_{C'}$ $z_{B'}$ $z_{A'}$ 1

$z_{C'}$ $z_{B'}$ $z_{A'}$ j

C' B' A' 2

C' B' A'

C B A C' B' A' 3

$[C'A]$ $[C'C]$ $[A'C]$ P N M 4

MNP

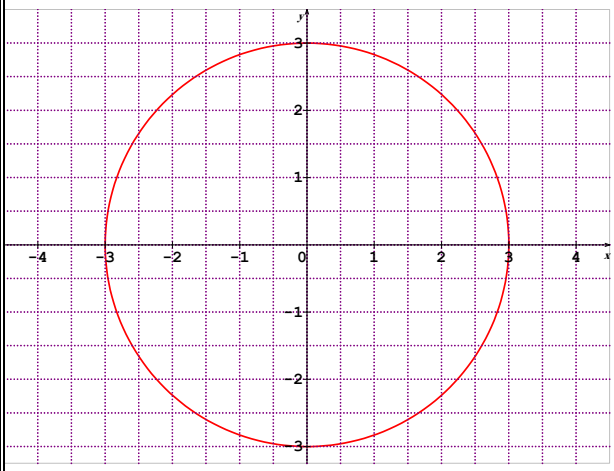
2017 121

$z^2 - (\sqrt{5} + 2i)z + 1 + 4i\sqrt{5} = 0...(E)$ 1

$\Delta = -3(\sqrt{5} + 2i)^2$ (E) $(\sqrt{5} + 2i)^2$

$b = (\sqrt{5} + 2i)(\frac{1 - i\sqrt{3}}{2})$ $a = (\sqrt{5} + 2i)(\frac{1 + i\sqrt{3}}{2})$ (E)

$(O;u;v)$ 1 2



3 O (C)

$\sqrt{5} + 2i$ Q

Q (C)

b a B A 3

(C) B A

$OA + OB = OQ$

OAQB

B A

2020 قسم الجزائر
WWW.DZPEN.COM

2017 122

$b=\sqrt{3}-1+(\sqrt{3}+1)i$ $a=\sqrt{3}+i$ b a

$\arg(b)=\frac{5\pi}{12}[2\pi]$ $|b|=2\sqrt{2}$ $b=(1+i)a$ 1

$$\cos\frac{5\pi}{12}=\frac{\sqrt{6}-\sqrt{2}}{4}$$

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

$c=-1+i\sqrt{3}$ c C b

$(OA;OC)\equiv\frac{\pi}{2}[2\pi]$ $OA=OC$ $c=ai$

OC A B

OABC

2016 123

z $z^3-13z^2-59z-87=0...(E)$ 1

(E) 3

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

M(z) $z_C=5+2i$ $z_B=5-2i$ $z_A=3$

B A M

ABC $\frac{z_A \quad z_B}{A \quad C}$

L * M L $\frac{z \quad 3}{z \quad 5 \quad 2i}$

(2 i) ABC (C) 2

$-\frac{\pi}{2}$ R

(C') R (C) (C')

2015 124

$a=2+\sqrt{2}+i\sqrt{2}$ a I

$2\sqrt{2+\sqrt{2}}$ a 1

قسم الجزائر
WWW.DZPEN.COM

$a = 2(1+\cos\frac{\pi}{4}) + 2i\sin\frac{\pi}{4}$ 2

$(\cos\theta+\sin\theta)^2$ $\sin 2\theta = 2\cos\theta.\sin\theta$ $1+\cos 2\theta = 2\cos^2\theta$ 3

$$a = 4\cos^2\frac{\pi}{8} + 4i\sin\frac{\pi}{8}.\cos\frac{\pi}{8}$$

$a^4 = 2\left(2\sqrt{2+\sqrt{2}}\right)^4.i$ a

$(O;e_1;e_2)$ II

R $z_A = 2+\sqrt{2}+i\sqrt{2}$ $z_\Omega = \sqrt{2}$ A Ω

$\frac{\pi}{2}$ Ω

2i R A B z_B 1

$|z-2i| = 2$ z M 2

2015 125

$u = \sqrt{2-\sqrt{2}} - i\sqrt{2+\sqrt{2}}$

u^4 u^2 1

u u^4 u^4 2

$\sin\frac{13\pi}{8}$ $\cos\frac{13\pi}{8}$ 3

$(O;u;v)$ 4

$|uz| = 8$ M(z)

a-guyane2014 126

2cm $(O;u;v)$

$f(z) = z^2+2z+9$ z f

f $-1+i\sqrt{3}$ 1

$f(z) = 5$ 2

A $f(z) = 5$ B A

z $f(z) = \lambda$ λ 3

$f(z) = \lambda$ λ

$|f(z)-8| = 3$ z (F) 4

WWW.DZPEN.COM

(F) $\sqrt{3}$ $\Omega(-1;0)$ (F)

y x $z = x + iy$ z 5

$x^2 - y^2 + 2x + 9 + i(2xy + 2y)$ $f(z)$

$f(z)$ z (E)

(D_2) (D_1) (E)

(D_2) (D_1)

(E) (F) 6

polynesie-2011S 127

$(O;u;v)$

OAB $B(7-3i)$ $A(2-5i)$ 1

$|z-i| = |z+2i|$ z M 2

$(3+i\sqrt{3})^{3n}$ n 3

$|z+i| = 1+|z|$ z $\frac{\pi}{2}$ 4

$z^2 + \frac{1}{z^2}$ $|z| = 1$ z 5

2011S 128

$z^2 - 18z + 82 = 0$ z 1

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

$z_C = 11-i$ $z_B = 9-i$ $z_A = 9+i$

B ABC $\frac{z_C - z_B}{z_A - z_B} = -i$

$4(1-i)$

$AC \times AB = 4\sqrt{2}$ $(z_C - z_A)(z_C - z_B) = 4(1-i)$

M M' z' M z 3

$\frac{3\pi}{2}$ B R

$z' = -iz + 10 + 8i$

$9-3i$ R C C'

WWW.DZPEN.COM

2006S 129

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

$z_D=-3-i \quad z_C=5i \quad z_B=1+i \quad z_A=4+i$

D C B A 1

$z'=(1+2i)z-2-4i \quad M'(z') \quad M(z)$ f 2

f B A

f E

$z'-z=-2i(2-i-z) \quad z$ 3

E M $(ME;MM')$ $\frac{MM'}{EM}$

EMM'

$z_G=-1-i\sqrt{3}$ G

f G G' z_G

2009 130

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

$c=(1-\sqrt{3})+(1+\sqrt{3})i \quad b=-\frac{\sqrt{3}}{2}+\frac{1}{2}i \quad a=2-2i$

b a 1

$\frac{5\pi}{6}$ O R 2

$z'=bz$ R M M' z' M z

R A C

c $\arg(c)=\arg(a)+\arg(b)+2k\pi$ 3

2005 131

$B \quad A \quad I \quad (o,u,v)$

$[AB]$ (γ) $z_B=-2-2i \quad z_A=1-2i \quad z_I=1$

$2cm$

(γ) -1

$z_D=\frac{3+9i}{4+2i}$ D -2

(γ) D z_D

2020 قسم الجزائر
WWW.DZPEN.COM

$\frac{\pi}{4}$ $\left(\Omega I, \Omega E\right)$ z_E (γ) E -3

$z_E = \frac{5\sqrt{2}-2}{4} + \frac{5\sqrt{2}}{4} i$ $z_E + \frac{1}{2}$

$z' + \frac{1}{2} = e^{i\frac{\pi}{4}}\left(z + \frac{1}{2}\right)$ M' M R -4

R

$z_K = 2$ K

R K

2004 132

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

z_1 z_2 z_1

$(z_1)^{2004}$ -2

$2cm$ $\left(o, u, v\right)$

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

O B A -1

B A

B B' $-\frac{\pi}{2}$ A R_1 O O' -2

$\frac{\pi}{2}$ A R_2

B' O'

$[OB]$ I -3

$AO'B'$ (AI)

$3\sqrt{3} - i$ $O'B'$ AI

3

WWW.DZPEN.COM