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-8. -	

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-5. -	

-7 -	

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6.

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8.

9.

10.

1.	C $\overline{C}$	12	4	4	4
2.		16	6	4	6
3.	C	12	4	4	4
4.		12	4	4	4
5.		12	4	4	4
7.		13	4	4	5
		4		2	2
		27			27
		108	**26**	**26**	**56**

1-2. ***C***

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-7. . -

-9.

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-13. .

.

I

1. $z_1 = (a_1, b_1) \quad z_2 = (a_2, b_2)$

2.
3.
4.
5.

6. $\boldsymbol{C} = \langle C; +, \bullet \rangle$.
7.
8. $z = a + ib$.

9.
10.

11.
12.
13.

14. $z_0 = x_0 + iy_0$ $\boldsymbol{C}$?
15.
?
16. n -

1.1. $z_1 = 2 + i2,\ z_2 = 2 - i2$

$$z_3 = z_1 + z_2,\ z_4 = z_1 \cdot z_3,\ z_5 = \frac{z_2}{z_4},\ z_6 = z_4 - z_5.$$

1.2. z

$z = 5;$ $z = -10;$ $z = 7i;$ $z = -3i;$

$z = 3 - i3;$ $z = -1 + \sqrt{3}i;$ $z = -\sqrt{3} - i;$ $z = \sin\alpha + i\cos\alpha,\ \alpha \in \boldsymbol{R}.$

1.3. $|z_1 - z_2|$ z_1 z_2

1.4.

$z \cdot \bar{z} = |z|^2$; $|z| = |\bar{z}|$; $Arg(z_1 \cdot z_2) = Arg\ z_1 + Arg\ z_2$; $|z^n| = |z|^n$, $n \in \boldsymbol{N}$;

1.5.

$|z + 2i| = 3$; $|z + 2i| < 3$; $|z + 2i| > 3$ $\arg(iz + 1) = \frac{\pi}{2}$.

1.6.

$z^2 + 49 = 0$; $z^2 + 4z + 5 = 0$; $z^3 - 27i = 0$.

1.7. $z_1 = 2i$, $z_2 = 1 - \sqrt{3}i$

$z_3 = z_1 - z_2$, $z_4 = z_2 \cdot z_3$, $z_5 = \frac{z_2}{z_4}$.

1.8 z

$z = -3 + i$; $z = \sqrt{3} - i$; $z = \sin\alpha - i\cos\alpha$, $\alpha \in \boldsymbol{R}$.

1.9 $z \in C$

– z; $z^2 = \bar{z}^2$; $Arg(z^2) = 2Argz$.

1.10.

$|z - i| = |2 - i|$; $|z - i| < |2 - i|$; $|z - i| > |2 - i|$.

1.11

$z^3 + 1 = 0$; $z^2 - 2z + 5 = 0$; $z^4 - 81i = 0$.

I

1.

2. ?

3. ( )?

4. -

$z = x + iy$

$M(\xi, \eta, \zeta)$

5.

$\boldsymbol{C}$?

6.

7.

8.
9.
10.
11.

2.1. z_0

$$M_0\left(\frac{1}{2\sqrt{2}}, \frac{1}{2\sqrt{2}}, \frac{1}{2}\right)$$

2.2. $y = x$

?

2.3. $$z_n = \frac{n - in + 2 + 3i}{n}$$

$a = 1 - i$.

2.4. $\lim\limits_{n\to\infty} z_n = 0$ $\lim\limits_{n\to\infty} |z_n| = 0$.

2.5. z_n

$$z_n = \frac{n^2 + i5}{1 + in^2}; \qquad z_n = \left(\frac{3 + 4i}{25}\right)^n.$$

2.6. G

$$z_n = i^n \frac{n+1}{n} \quad (n = 1, 2, 3, \ldots).$$

2.7.

$$\sum_{n=1}^{\infty} \frac{i^n}{i + n^2}; \qquad \sum_{n=1}^{\infty} \frac{(3i)^n}{n!}; \qquad \sum_{n=1}^{\infty} \frac{n+1}{(1+i)^n}.$$

2.8. z_0

$$M_0\left(0, -\frac{1}{2}, \frac{1}{2}\right)$$

2.9. $x^2 + y^2 = 1$

?

2.10. $$z_n = \frac{n^2 - 1 + (n^2 + 1)i}{n^2 + in - 1}$$

$a = 1 + i$.

2.11. z_n

$$z_n = \left(1 + \frac{i}{n}\right)^n; \qquad z_n = \arg\left(-1 + \frac{i^n}{n}\right).$$

2.12 G

$z_n = (-1)^n + \dfrac{i}{n} \quad (n = 1, 2, 3, \dots)$.

2.13

$\sum\limits_{n=1}^{\infty} \dfrac{\cos(in) + i\sin(in)}{n^2}$; $\sum\limits_{n=1}^{\infty} \dfrac{n!}{(in)^n}$; $\sum\limits_{n=1}^{\infty} \dfrac{(2i)^n}{n!}$.

I

1.

2. $w = f(z)$

3. $W = z^3$
$z = x + iy$
z.

4. $w = f(z)$ z_0 $\varepsilon - \delta$

5.

6. $w = f(z)$ z_0
$z = 0$

7.

3.1.

$w = \dfrac{\operatorname{Re} z^2}{z}$; $w = \dfrac{\operatorname{Re} z}{\operatorname{Im} z}$ $w = \dfrac{z + i}{z - i}$ $w = \overline{z^2} + |z^2|$.

3.2. $L = \{z : |z| = 1\}$ $w = \dfrac{1}{2}\left(z + \dfrac{1}{\bar{z}}\right)$.

3.3. w- $w = \dfrac{1}{z}$ z-

$x^2 + y^2 = 4$; $y = x$ $x = 1$ $(x-1)^2 + y^2 = 1$?

3.4. $T = \{z : |z| < 1\}$

$w = |z|$ $w = z - \bar{z}$?

3.5. $w = \dfrac{\operatorname{Re} z}{\operatorname{Im} z}$ $z_0 = 1 + i$.

3.6.

$\lim\limits_{z\to a} f(z)=b$; $\lim\limits_{z\to a} f(z)=\infty$; $\lim\limits_{z\to\infty} f(z)=b$;
$\lim\limits_{z\to+\infty} f(z)=b$; $\lim\limits_{z\to\infty} f(z)=\infty$; $\lim\limits_{z\to\infty} f(z)=0$.

3.7. $w=\dfrac{\operatorname{Re} z^2}{z}$ $z_0=0$

3.8. $f(z)=z^2+\bar{z}\cdot(z+1)$
C_z.

3.9.
$w=z^2-\dfrac{1}{z^2}$; $w=z^4+5$; $w=z^2+az+b$ (a b

3.10. $L=\{z:|z|=1\}$ $w=\dfrac{1}{2}\left(z+\dfrac{1}{z}\right)$.

3.11. w- $w=\dfrac{1}{z}$ z-

$x^2+y^2=1$; $y=-x$ $y=1$ $(x+1)^2+y^2=1$?

3.12. $T=\{z:|z|<1\}$

$w=|z-1|$ $w=\dfrac{1}{2}|z-\bar{z}|$?

3.13.
$w=\dfrac{\bar{z}}{z}$; $w=\dfrac{|z+i|^2}{z+i}$; $w=i\arg(z-1)$.

3.14. $w=\dfrac{(z-1)\cdot\operatorname{Im}(z-1)}{|z-1|}$ $z_0=1$

3.15. $f(z)=\bar{z}^2+5i$
C_z.

-

I

1. $w=f(z)$ z_0

2.
3.

$z_0=x_0+iy_0$

4.

5.

6. $f(z)=z^2+(z-1)\cdot\bar{z}$ -

4.1. $w=f(z)$ z_0,

$(z)=z^3-3z^2+1,\ z_0=1-i;$ $f(z)=\dfrac{z+i}{z-i},\ z_0=-i.$

4.2.

$w=(\bar{z}-z)^2;$ $w=\overline{z+\operatorname{Re} z};$ $w=(z+i)^3-2\bar{z};$

$w=|z-i|^2+(z-i)^2;$ $w=iz^2-3z;$ $w=\operatorname{Im} z+i\operatorname{Re} z.$

4.3. $w=\bar{z}$

4.4. a, b c
$w=ax+by+i(cx+y)$

4.5. -

$f(z)=z^3-z+1;$ $g(z)=z^2-\bar{z}$ $q(z)=\dfrac{5}{z^2-z}?$

4.6. $w=f(z)$ z_0,

$f(z)=z^2+2z,\ z_0=3+2i;$ $f(z)=\dfrac{z+1}{z-1},\ z_0=-1.$

4.7. $w=|z-a|^2$ a.

4.8.

$w=(\operatorname{Re} z+i\operatorname{Im}\bar{z})^2;$ $w=\operatorname{Im}(z+\operatorname{Re} z);$ $w=z^3-2|z-1|^2;$

$w=\overline{z-i}+(z-i)^2;$ $w=z^2+2iz;$ $w=\operatorname{Re}^2 z-i\operatorname{Im}^2 z.$

4.9. -

$f(z)=z^2+\bar{z}-z;$ $g(z)=z^{2015}-2015$ $q(z)=\dfrac{z}{z^2-4}?$

I

1. $f(z)$
z_0?
2. $f(z)$
z_0?
3. z_0
4. D
5.
6. $D=\{z \mid 0<\operatorname{Im} z<\pi\}$
$W=e^z$?
7. -
C?

5.1. $w=f(z)$
z_0
$(z)=z^3-3z^2+1,\ z_0=1-i;$ $f(z)=\dfrac{z+i}{z-i},\ z_0=-i.$

5.2. $\gamma_1:|z-1|=2$ $\gamma_2:|z+1|=2$
$w=iz^2+z-1.$

5.3.
$w=\dfrac{z+i}{z-i}$

5.4. $w=\dfrac{iz+1}{iz-1}$

5.5. $\operatorname{Re} z=a$ $\operatorname{Im} z=b$ $(a,b\in R$
$w=z^2.$

5.6.

5.7. $w=f(z)$
z_0
$f(z)=(z-3)^2,\ z_0=2+i;$ $f(z)=\dfrac{iz+1}{z-1},\ z_0=-1.$

5.8. $\gamma_1 : |z-1| = |z+1|$ $\gamma_2 : |z+i| = |z-i|$

$w = iz^{2022} + 2021z - 1.$

5.9. $w = \dfrac{z}{z-i}.$

5.10.

$w = 3z^2 - 6z + 11$ $\dfrac{\pi}{2}.$

5.11. $w = \dfrac{1}{z}$ $|z| = R,$

$\arg z = \alpha$ ($R > 0$, $0 \le \alpha < 2\pi$).

5.12.

Основные элементарные функции комплексного переменного и их свойства

I

1.

2.

3. $W = az + b, \quad a \neq 0,$

:

$t = |a|z$ ($z = 0$

$|a|$);

$\tau = e^{i \arg a} t$ ($t = 0$ $\arg a$);

$W = \tau + b$ (b $|b|$)?

4. -

5. -

6. -

$W = \dfrac{az+b}{cz+d}, \quad bc - ad \neq 0, c \neq 0,$

:

$t = \dfrac{c^2}{bc-ad} z + \dfrac{cd}{bc-ad}$ $\tau = \dfrac{1}{t}$ $W = \dfrac{a}{c} + \tau$?

7. -

8.

-

9.

10. $z = x + iy$
$\sin(5-3i)$ $\cos(2i)$.
11.
12. $|\sin z| > 100$ z_1
$|\sin z_1| > 100$.
13. $z = x + iy$
$\mathrm{Ln} z$?
14.

1.
$0, 1, -i$ $1-i$.

2. $T_2 = \{z : |z-i| \le 2\}$
$T_1 = \{W : |W| \le 1\}$.

3. $w = \dfrac{z+1}{z}$:
$|z| = 2$; $|z-1| = 1$; $\mathrm{Re}\, z = 0$; $\mathrm{Im}\, z = 1$.

4. $T_1 = \{z : |z-2i| \le 1\}$ $w = (1+i)z + 2$.

5. $\mathrm{Im}\, z > 0$ $T_2 = \{w : |w| < 2\}$.

6.
$e^{-1+i\frac{\pi}{2}}$ $\sin(1+i)$ $\cos(1-i)$.

7. $\sin^2 z + \cos^2 z = 1$ $z \in \boldsymbol{C}$.

8. $\sin z = 2$; $\cos z = 1$; $e^z = i$.

1. $2-i$ i
-1.
2. $|z+1-i| \le 4$

$\dfrac{\pi}{2}$.
3. - , $-i$, $1-i$
i, ∞, 1.

4. $w = \dfrac{z-i}{z+i}$:

$|z| = 1$; $|z+1| = 1$; $\operatorname{Re} z = 1$.

5. - $|z| < 1$

$\operatorname{Re} W > 0$.

6.

e^{1+i} $\sin i$ $\cos(2-3i)$.

7. $\sin 2z = 2\sin z \cos z$ $z \in \boldsymbol{C}$.

8. $\operatorname{Ln}(-i)$.

Понятие интеграла от функции комплексного переменного

I

1.

2. $f(z)$ L?

3. $f(z)$

L

4. $\int\limits_L f(z)dz$

$\operatorname{Re} f(z) = u(x,y)$ $\operatorname{Im} f(z) = v(x,y)$?

5.

6.

7. $\oint\limits_L z^n dz$, $L = \{z : |z| = \rho\}$, $\rho > 0$ n -

1. $f(t)$

t,

$f(t) = (t+i)^3$; $f(t) = \dfrac{t+i}{t-i}$; $f(t) = e^{it}$.

2.

$\int\limits_{-1}^{1} (t+i)^2 dt$; $\int\limits_0^1 \dfrac{dt}{t+i}$; $\int\limits_0^{2\pi} e^{it} dt$.

3. $f(z) = z^2$ $[-4; 4i]$,

4. $f(z)$ L

$f(z) = \operatorname{Re} z$, $L = [-1-i;\ 1+i]$; $f(z) = \bar{z}$, $L = [1; i]$;

$f(z)=(z+i)^2,\ L=\left\{z \,\middle|\, z=e^{it},\ 0\le t\le \pi\right\};$ $f(z)=|z|,\ L\colon |z|=1;$

$f(z)=z+(z+1)\bar{z},\ L$ $1,\ 1+i,\ i.$

1. $f(t)$

$t,$

$f(t)=t^2+t+i(t^2-1);$ $f(t)=\dfrac{t^2+1}{t^2+i};$ $f(t)=\cos t+i\sin t.$

2.

$\int\limits_{-\pi}^{\pi}\sin(t+i)dt;$ $\int\limits_{0}^{1}\dfrac{dt}{t^2+i};$ $\int\limits_{0}^{\pi}e^{-2it}dt.$

3. $f(z)=z+2i$ $[2i;\ 2],$

4. $f(z)$ L

$f(z)=\operatorname{Im} z,\ L=[-i;1+i];$

$f(z)=\bar{z}^2,\ L=[1+i;0];$

$f(z)=z\cdot\bar{z}-1,\ L=\left\{z \,\middle|\, z=e^{it},0\le t\le 2\pi\right\};$

$f(z)=\operatorname{Im}^2 z-i\operatorname{Re}^2 z,\ L\colon |z|=1;$

$f(z)=\dfrac{z+\bar{z}}{2},\ L$ $1,\ i,\ -1,\ -i.$

Теорема Коши. Интегральная формула Коши

I

1.
2. $f(z)$ D
3. -

$f(z).$
4. $f(z)$?
5.

1. $f(z)$ L

$f(z)=(iz+1)^2,\ L=[-1+i;2i];$

$f(z)=e^{iz},\ L=[0;\pi];$

$f(z)=z\cdot\cos z,\ L=\{z: z=t+it^2, 0\le t\le 1\};$

$f(z)=z^2\cdot e^{-iz},\ L=\{z:\ |z|=2\};$

$f(z)=\dfrac{z^3}{z-2},\ L=\{z:|z|=1\};$

$f(z)=\dfrac{e^z}{z(z+2)},\ L=\{z: z=e^{it}, 0\le t\le 2\pi\};$

$f(z)=\dfrac{z}{z^2-4z+3},\ L=\{z:\ |z-1|=1\};$

$f(z)=\dfrac{1}{z(z^2+1)},\ L=\{z:\ |\mathrm{Re}\, z|+|\mathrm{Im}\, z|=2\}.$

2. a ($a>0$ $\int_L \dfrac{dz}{z^2+9}$,

$L=\{z:\ |z-i|=a\}.$

3. z_1 z_2 –

$\int_L \dfrac{dz}{(z-z_1)(z-z_2)}$ L

z_k, $k=1,2$?

1. $f(z)$ L

$f(z)=(2iz-1)^3,\ L=[i;1+2i];$

$f(z)=e^{-2iz},\ L=\left[-\dfrac{\pi}{2};\dfrac{\pi}{2}\right];$

$f(z)=z\cdot\sin z,\ L=\{z: z=t+\pi i\sin t, 0\le t\le\pi\};$

$f(z)=z\cdot e^z,\ L=\{z:|z|=1\};$

$f(z)=\dfrac{z^2+i}{z+2i},\ L=\{z:|z|=1\};$

$f(z)=\dfrac{e^z}{(z-2i)(z+2)},\ L=\{z:\ z=e^{it}, 0\le t\le 2\pi\};$

5 ( ) = ——————, $L=\{z:|z-2i|=2\};$

$f(z)=\dfrac{z^2-iz}{z(z^2-1)},\ L$ $2,\ -2+2i,\ -2-2i.$

2. a ($a>0$ $\int_L \dfrac{dz}{z^2+a^2}$,

$L=\{z:\ |z|=a+1\}.$

Степенные ряды в комплексной области

I

1.
2.
3.
4.
5.

1.

$$\sum_{n=0}^{\infty}\left(\frac{z-1+i}{3+4i}\right)^n; \qquad \sum_{n=0}^{\infty}\frac{z^n}{n!} \qquad \sum_{n=0}^{\infty}\frac{(2iz-3)^n}{(1+i)^n}.$$

2. $$\frac{z}{z^2+4}=\sum_{n=0}^{\infty}c_n(z+1-i)^n$$

c_0 c_1.

3. $T_2=\{z:|z-i|<2\}$ $z=1$ $z=-3-i$?

4. $\sum_{n=0}^{\infty}c_n(z+i)^n$ $z_1=1-2i$ $z_2=-3-5i$ $z_3=0,\ z_4=-1,$ $z_5=-2+i,\ z_6=-4+6i$?

5. $f(z)$ L

$f(z)=\frac{z+2i}{(z^2+1)(z+1)^2},\ L=\{z:\ |z-1|=1\}$ $f(z)=\frac{e^z}{(z-i)^3},\ L=\{z:\ |z-2|=10\}.$

1.

$$\sum_{n=0}^{\infty}\left(\frac{z+i}{1+i}\right)^n; \qquad \sum_{n=0}^{\infty}\frac{(-1)^n z^n}{n} \qquad \sum_{n=0}^{\infty}\frac{(iz-5)^n}{(3+4i)^n}.$$

2. $$\frac{1}{z^2+1}=\sum_{n=0}^{\infty}c_n(z+2+i)^n$$

c_0 c_1.

3. $|z+i|<5$ $z=1$ $z=-3+10i$?

4. $\sum_{n=0}^{\infty}c_n(z-i)^n$ $z_1=2+i$ $z_2=-3-i$ $z_3=0,\ z_4=3i,$ $z_5=-2+i,\ z_6=-1+6i$?

5. $f(z)$ L

$f(z)=\dfrac{z+i}{z^2+4},\ L:|z-i|=2;$ $f(z)=\dfrac{z^4+4z+1}{(z-i)^{2012}},\ L:|z-i|=1.$

6. $a\in C$ $\displaystyle\int_L \frac{z^2+1}{(z-a)^2}dz$

$L=\{z:\ |z|=1\}.$

Разложение аналитических функций в ряд Тейлора. Нули аналитической функции. Теорема единственности. Аналитическое продолжение

I

1. $f(z)$ a.
2.
3. $f(z)$
4. $f(z)$?
5.
6.
7.
8. D $f(z)$
9. $F(z)$ $f(z)$
10.

1. $f(z)$ $z-a$

$f(z)=e^{iz},\ a=-1;$ $f(z)=\sin^2 z,\ a=0;$ $f(z)=\dfrac{z}{z^2-4},\ a=2i.$

2.

$\displaystyle\int_{|z+1|=2}\frac{e^{iz}}{(z+1)^2}dz;$ $\displaystyle\int_{|z|=1}\frac{\sin^2 z}{z}dz.$

3. $f(z)$

$f(z)=(z^2-9)(z^2+9);$ $f(z)=\dfrac{\sin^3 z}{z}.$

4. $a=0$ $f(z)$

$f(z)=z^2\sin z;$ $f(z)=z\left(e^{-z^2}-1\right).$

5. a m n
$f(z)$ $\varphi(z)$ a
$f(z)+\varphi(z);$ $f(z)\cdot\varphi(z);$ $f'(z)\cdot\varphi''(z).$

6. E
$E=[1-i;-1+i];$ $E=\left\{z: z=1+\frac{i}{n}, n\in N\right\}.$

7. $f(z)$
$f\left(\frac{1}{n}\right)=\frac{1}{n^2},\ n\in N;$ $f\left(\frac{1}{n}\right)=\frac{1}{n+\sin\frac{\pi n}{2}},\ n\in N.$

8. $\sin^2 z+\cos^2 z=1.$

9.
$\sin z=\cos z$ $z=\frac{\pi}{4}+2\pi m,\ n\in Z.$

10. $F(z)=\frac{1}{1-i}\sum_{n=0}^{\infty}\left(\frac{z-i}{1-i}\right)^n$
$f(z)=\sum_{n=0}^{\infty}z^n.$

1. $f(z)$ $z-a$
$f(z)=ze^{-z},\ a=-i;$ $f(z)=\frac{z+2}{z^2+4},\ a=2.$

2.
$\int_{|z+i|=2}\frac{ze^{-z}}{(z+1)^3}dz$ $\int_{|z-2|=1}\frac{z+2}{(z^2+4)(z-2)}dz.$

3. $a=0$ $f(z)$
$f(z)=z\sin z-z^2;$ ( ) (1) $^3.$

4. a m n
$f(z)$ $\varphi(z)$ a
$f(z)-\varphi(z);$ $f^2(z)\cdot\varphi^3(z);$ $c_1\cdot f(z)+c_2\cdot\varphi(z),\ c_1,c_2\in C.$

5. E
$E=\{z:|z|=1\};$ $E=\left\{z: z=\frac{1}{n}+2i, n\in N\right\}.$

6. $f(z)$
$f\left(\frac{1}{n}\right)=-f\left(-\frac{1}{n}\right),\ n\in N;$ $f\left(\frac{1}{n}\right)=\frac{1}{n^2+\cos^2\frac{\pi n}{2}},\ n\in N.$

7. $\sin 2z=2\sin z\cos z.$

8. $\cos z = \cos^2 z$

$z = 2\pi n,\ n \in Z$.

9. $$F(z) = \frac{1}{4}\sum_{n=0}^{\infty}(-1)^n \frac{z^n}{4^n}$$

$$f(z) = \frac{1}{3}\sum_{n=0}^{\infty}(-1)^n \frac{(z+1)^n}{3^n}.$$

Ряд Лорана. Изолированные особые точки аналитической функции

I

1.
2.
3.
4.
5. $f(z)$
6. $f(z)$ z_0
7. $f(z)$
8. $f(z)$?
9. $f(z)$
10. -

1.

$$\sum_{n=-\infty}^{\infty}\frac{3^n z^n}{n^2+1};\qquad \sum_{n=-\infty}^{\infty}\frac{(z+i)^n}{2^n};\qquad \sum_{n=0}^{\infty}\left(\frac{z^n}{n!}+\frac{n}{z^{n+1}}\right).$$

2. $f(z)$ $z - z_0$

$$f(z) = \frac{z}{(z+i)(z-3)},\ z_0 = 0;\qquad f(z) = z^2 \sin\frac{1}{z-1},\ z_0 = 1.$$

3. $f(z)$

$$f(z) = \frac{1}{\sin z};\qquad f(z) = z^3 e^{\frac{1}{z^2}};\qquad f(z) = \frac{1-\cos 2z}{z^2}.$$

4. $f(z)$ $\varphi(z)$ z_0 m n z_0

$$f(z)\cdot\varphi(z);\qquad \frac{f(z)}{\varphi(z)};\qquad f(z)+\varphi(z).$$

5. $f(z)$ Γ

$$f(z) = \frac{1}{z^3 - z^5},\ \Gamma = \left\{z:\ |z-1| = \frac{1}{2}\right\};\qquad f(z) = ze^{\frac{1}{z}},\ L = \{z:\ |z| = 1\}.$$

6. - $\sin\frac{1}{z}$.

1. $f(z)$ z_0

$f(z)=\dfrac{z^2+1}{z^2-5z+6},\ z_0=2;$ $f(z)=\left(z^2-1\right)\cdot e^{\frac{1}{z^2}},\ z_0=0.$

2. $f(z)$

$f(z)=\dfrac{z^2-1}{z^3-1};$ $f(z)=\dfrac{1-e^{z^2}}{z^4-z^2};$ $f(z)=\dfrac{e^{\frac{1}{z^2}}}{1-\cos^2 z}.$

3.

$z=0$

$z=i$ $\dfrac{c_{-3}}{(z-i)^3}$

4. $f(z)$ D

$\dfrac{f'(z)}{f(z)}$

$f(z)$ $f(z)=0.$

Вычет функции относительно изолированной особой точки

I

1. $f(z)$
2. $f(z)$
3. $f(z)$ z_0?
4.
5. $\operatorname{Re}s_{z_0} f(z)$ z_0 $f(z)$?
6.
7.

?

1. $f(z)$

$f(z)=\dfrac{z+2}{z^2-1};$ $f(z)=\dfrac{e^{iz}}{z^2(z-\pi)};$ $f(z)=\dfrac{\sin z}{z^4\cos z}.$

2.

$\int\limits_L \dfrac{z+1}{(z-1)(z+5)^2}dz,$ $L=\{z:|z|=3\};$

$\int\limits_L \dfrac{e^{iz}}{(z+1)(z+2)^2}$ $L=\{z:|\operatorname{Re} z|+|\operatorname{Im} z|=3\};$ $\int\limits_L \dfrac{dz}{\sin z}$ L

3 $z=\infty$

$f(z)=\dfrac{z^4+1}{z^6-1}$; $f(z)=\cos\dfrac{(z+2)\pi}{2z}$.

1. $f(z)$

$f(z)=\dfrac{z+1}{z^2+1}$; $f(z)=\dfrac{\sin\pi z+1}{z^2(z+1)}$; $f(z)=\dfrac{\cos\pi z}{(z-1)^2\sin\pi z}$.

2.

$\int\limits_L \dfrac{z+3}{(z+1)(z-5)^2}dz$ $L=\{z:|z+1|=1\}$;

$\int\limits_L \dfrac{\cos\pi z}{(z-1)(z-2)^2}$ $L=\{z:\mathrm{Re}^2 z+\mathrm{Im}^2 z=5\}$;

$\int\limits_L \dfrac{\cos 2z dz}{\sin z}$ L

3 $z=\infty$

) $f(z)=\dfrac{\sin\dfrac{1}{z}}{z-1}$; $f(z)=z\cos^2\dfrac{\pi}{z}$.

$\left(\dfrac{1}{2}-i\dfrac{\sqrt{3}}{2}\right)^{2021}$.

$g(z)=z^2-2\overline{z}+5i$ -

3 $\sum\limits_{n=0}^{\infty}\dfrac{(iz-3)^n}{(1-i)^n}$.

4. $\int\limits_L \dfrac{z+1}{(z-1)^2(z+10)}dz$ $L=\{z:|z|=2\}$.

5. $f(z)$

$f(z)=\dfrac{z+2}{z^2+4}$.

1		4,75-5
2		3,75-4,5
3		3-3,5
4		

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k

k

$$z^4 + i^k k = 0.$$

4. $$\oint_L \frac{e^z \cos kz}{z^2 + (k+1)z} dz \qquad L = \{z : |z| = 1\}.$$

5. $$\sum_{n=1}^{\infty} \left(k + (-1)^n\right)^n (z - ik)^n .$$

1.

1		

2.

1		4,75-5
2		3,75-4,5
3		3-3,5
4		

1. 7-
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