

КОМПЛЕКСНЫЕ ЧИСЛА

ПРАКТИЧЕСКАЯ РАБОТА

СПЕЦИАЛЬНОСТЬ: 38.02.03

Практическая работа «Комплексные числа»

Задание 1. Найти сумму, разность, произведение и частное двух комплексных чисел в алгебраической форме.

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|---------------------|-----------------|----------------------|-----------------|
| 1. $z_1 = 2 + 3i,$ | $z_2 = 1 + i.$ | 19. $z_1 = 5 + 4i,$ | $z_2 = -5 + i.$ |
| 2. $z_1 = 3 + 4i,$ | $z_2 = 1 - i.$ | 20. $z_1 = 3 + 7i,$ | $z_2 = -5 - i.$ |
| 3. $z_1 = 1 - 2i,$ | $z_2 = -1 + i.$ | 21. $z_1 = 2 - 4i,$ | $z_2 = 6 + i.$ |
| 4. $z_1 = 2 + 5i,$ | $z_2 = -1 - i.$ | 22. $z_1 = 3 + 5i,$ | $z_2 = 6 - i.$ |
| 5. $z_1 = 3 - 8i,$ | $z_2 = 2 + i.$ | 23. $z_1 = 6 + 5i,$ | $z_2 = -6 + i.$ |
| 6. $z_1 = 3 - 7i,$ | $z_2 = 2 - i.$ | 24. $z_1 = 7 + 2i,$ | $z_2 = -6 - i.$ |
| 7. $z_1 = 2 + 6i,$ | $z_2 = -2 + i.$ | 25. $z_1 = 8 + 3i,$ | $z_2 = 7 + i.$ |
| 8. $z_1 = 4 + 2i,$ | $z_2 = -2 - i.$ | 26. $z_1 = 9 - 2i,$ | $z_2 = 7 - i.$ |
| 9. $z_1 = 5 + 3i,$ | $z_2 = 3 + i.$ | 27. $z_1 = 5 + 6i,$ | $z_2 = -7 + i.$ |
| 10. $z_1 = 6 - 2i,$ | $z_2 = 3 - i.$ | 28. $z_1 = -3 + 2i,$ | $z_2 = -7 - i.$ |
| 11. $z_1 = 7 + 9i,$ | $z_2 = -3 + i.$ | 29. $z_1 = 6 + 2i,$ | $z_2 = 8 + i.$ |
| 12. $z_1 = 3 - 7i,$ | $z_2 = -3 - i.$ | 30. $z_1 = -6 + 7i,$ | $z_2 = 8 - i.$ |
| 13. $z_1 = 4 + 3i,$ | $z_2 = 4 + i.$ | 31. $z_1 = -2 + 5i,$ | $z_2 = -8 - i.$ |
| 14. $z_1 = 8 + 3i,$ | $z_2 = 4 - i.$ | 32. $z_1 = 8 + 3i,$ | $z_2 = 9 + i.$ |
| 15. $z_1 = 8 - 2i,$ | $z_2 = -4 + i.$ | 33. $z_1 = -7 - 2i,$ | $z_2 = 9 - i.$ |
| 16. $z_1 = 9 + 2i,$ | $z_2 = -4 - i.$ | 34. $z_1 = 5 + 8i,$ | $z_2 = -9 + i.$ |
| 17. $z_1 = 7 + 3i,$ | $z_2 = 5 + i.$ | 35. $z_1 = -2 + 4i,$ | $z_2 = -9 - i.$ |
| 18. $z_1 = 6 - 4i,$ | $z_2 = 5 - i.$ | 36. $z_1 = -5 - 4i,$ | $z_2 = 10 + i.$ |

Задание 2. Представить комплексное число в тригонометрической и показательной формах.

1	$z = 2 + 2i$	2	$z = 2 - 2i$
3	$z = -2 + 2i$	4	$z = -2 - 2i$
5	$z = 2 + 2\sqrt{3}i$	6	$z = 2 - 2\sqrt{3}i$
7	$z = -2 + 2\sqrt{3}i$	8	$z = -2 - 2\sqrt{3}i$
9	$z = 2\sqrt{3} + 2i$	10	$z = 2\sqrt{3} - 2i$
11	$z = -2\sqrt{3} + 2i$	12	$z = -2\sqrt{3} - 2i$
13	$z = 3 + 3i$	14	$z = 3 - 3i$
15	$z = -3 + 3i$	16	$z = -3 - 3i$
17	$z = 3 + \sqrt{3}i$	18	$z = 3 - \sqrt{3}i$
19	$z = -3 + \sqrt{3}i$	20	$z = -3 - \sqrt{3}i$
21	$z = \sqrt{3} + 3i$	22	$z = \sqrt{3} - 3i$
23	$z = -\sqrt{3} + 3i$	24	$z = -\sqrt{3} - 3i$
25	$z = 1 + i$	26	$z = 1 - i$
27	$z = -1 + i$	28	$z = -1 - i$
29	$z = 1 + \sqrt{3}i$	30	$z = 1 - \sqrt{3}i$
31	$z = -1 + \sqrt{3}i$	32	$z = -1 - \sqrt{3}i$
33	$z = \sqrt{3} + i$	34	$z = \sqrt{3} - i$
35	$z = -\sqrt{3} + i$	36	$z = -\sqrt{3} - i$

Задание 3. Решить уравнения на множестве комплексных чисел.

- | | |
|------------------------|-------------------------|
| 1. а) $x^2 + 1 = 0.$ | б) $x^2 + 3x + 4 = 0.$ |
| 2. а) $x^2 + 2 = 0.$ | б) $x^2 - 2x + 3 = 0.$ |
| 3. а) $x^2 + 3 = 0.$ | б) $x^2 - 5x + 7 = 0.$ |
| 4. а) $x^2 + 4 = 0.$ | б) $x^2 + x + 2 = 0.$ |
| 5. а) $x^2 + 5 = 0.$ | б) $x^2 + 3x + 3 = 0.$ |
| 6. а) $x^2 + 6 = 0.$ | б) $x^2 + x + 1 = 0.$ |
| 7. а) $x^2 + 7 = 0.$ | б) $x^2 + 4x + 5 = 0.$ |
| 8. а) $x^2 + 8 = 0.$ | б) $x^2 - 2x + 2 = 0.$ |
| 9. а) $x^2 + 9 = 0.$ | б) $3x^2 - x + 1 = 0.$ |
| 10. а) $2x^2 + 1 = 0.$ | б) $2x^2 + 2x + 1 = 0.$ |
| 11. а) $3x^2 + 1 = 0.$ | б) $x^2 + 2x + 9 = 0.$ |
| 12. а) $4x^2 + 1 = 0.$ | б) $x^2 - 3x + 5 = 0.$ |
| 13. а) $5x^2 + 1 = 0.$ | б) $x^2 + x + 6 = 0.$ |
| 14. а) $6x^2 + 1 = 0.$ | б) $3x^2 + x + 2 = 0.$ |
| 15. а) $7x^2 + 1 = 0.$ | б) $2x^2 - 5x + 4 = 0.$ |
| 16. а) $8x^2 + 1 = 0.$ | б) $x^2 + x + 3 = 0.$ |
| 17. а) $9x^2 + 1 = 0.$ | б) $5x^2 - x + 1 = 0.$ |
| 18. а) $2x^2 + 3 = 0.$ | б) $4x^2 + 2x + 1 = 0.$ |
| 19. а) $2x^2 + 5 = 0.$ | б) $x^2 + 2x + 5 = 0.$ |
| 20. а) $2x^2 + 7 = 0.$ | б) $x^2 - 3x + 6 = 0.$ |
| 21. а) $2x^2 + 9 = 0.$ | б) $7x^2 + x + 1 = 0.$ |
| 22. а) $3x^2 + 2 = 0.$ | б) $4x^2 - x + 1 = 0.$ |
| 23. а) $3x^2 + 4 = 0.$ | б) $3x^2 + x + 2 = 0.$ |
| 24. а) $3x^2 + 5 = 0.$ | б) $5x^2 + 2x + 1 = 0.$ |
| 25. а) $3x^2 + 7 = 0.$ | б) $2x^2 - 3x + 2 = 0.$ |
| 26. а) $3x^2 + 8 = 0.$ | б) $3x^2 + 2x + 1 = 0.$ |
| 27. а) $4x^2 + 1 = 0.$ | б) $4x^2 + 3x + 1 = 0.$ |
| 28. а) $4x^2 + 3 = 0.$ | б) $5x^2 - 2x + 1 = 0.$ |
| 29. а) $4x^2 + 5 = 0.$ | б) $6x^2 - 3x + 1 = 0.$ |
| 30. а) $4x^2 + 7 = 0.$ | б) $x^2 + 2x + 5 = 0.$ |
| 31. а) $4x^2 + 9 = 0.$ | б) $2x^2 - x + 1 = 0.$ |
| 32. а) $5x^2 + 1 = 0.$ | б) $3x^2 - x + 2 = 0.$ |
| 33. а) $5x^2 + 2 = 0.$ | б) $2x^2 + x + 2 = 0.$ |
| 34. а) $5x^2 + 3 = 0.$ | б) $4x^2 + x + 3 = 0.$ |
| 35. а) $5x^2 + 4 = 0.$ | б) $x^2 - x + 2 = 0.$ |
| 36. а) $5x^2 + 6 = 0.$ | б) $5x^2 + x + 2 = 0.$ |

Задание 4. Найти произведение и частное двух комплексных чисел в тригонометрической форме.

1	$z_1 = 2 + 2\sqrt{3}i$	$z_2 = -5\sqrt{3} - 5i$	2	$z_1 = 2 - 2\sqrt{3}i$	$z_2 = -5\sqrt{3} + 5i$
3	$z_1 = -2 + 2\sqrt{3}i$	$z_2 = 5\sqrt{3} - 5i$	4	$z_1 = -2 - 2\sqrt{3}i$	$z_2 = 5\sqrt{3} + 5i$
5	$z_1 = 2 + 2i$	$z_2 = -5 - 5\sqrt{3}i$	6	$z_1 = 2 - 2i$	$z_2 = -5 + 5\sqrt{3}i$

7	$z_1 = -2 + 2i$	$z_2 = 5 - 5\sqrt{3}i$	8	$z_1 = -2 - 2i$	$z_2 = 5 + 5\sqrt{3}i$
9	$z_1 = 3 + 3i$	$z_2 = -7\sqrt{3} - 7i$	10	$z_1 = 3 - 3i$	$z_2 = -7\sqrt{3} + 7i$
11	$z_1 = -3 + \sqrt{3}i$	$z_2 = 7\sqrt{3} - 7i$	12	$z_1 = -3 - \sqrt{3}i$	$z_2 = 7\sqrt{3} + 7i$
13	$z_1 = 2\sqrt{3} + 2i$	$z_2 = -6 - 6\sqrt{3}i$	14	$z_1 = 2\sqrt{3} - 2i$	$z_2 = -6 + 6\sqrt{3}i$
15	$z_1 = -2\sqrt{3} + 2i$	$z_2 = 6 - 6\sqrt{3}i$	16	$z_1 = -2\sqrt{3} - 2i$	$z_2 = 6 + 6\sqrt{3}i$
17	$z_1 = \sqrt{3} + 3i$	$z_2 = -7 - 7i$	18	$z_1 = \sqrt{3} - 3i$	$z_2 = -7 + 7i$
19	$z_1 = -\sqrt{3} + 3i$	$z_2 = 7 - 7i$	20	$z_1 = -\sqrt{3} - 3i$	$z_2 = 7 + 7i$
21	$z_1 = 1 + i$	$z_2 = -8 - 8\sqrt{3}i$	22	$z_1 = 1 - i$	$z_2 = -8 + 8\sqrt{3}i$
23	$z_1 = -1 + i$	$z_2 = 8 - 8\sqrt{3}i$	24	$z_1 = -1 - i$	$z_2 = 8 + 8\sqrt{3}i$
25	$z_1 = 1 + \sqrt{3}i$	$z_2 = -8\sqrt{3} - 8i$	26	$z_1 = 1 - \sqrt{3}i$	$z_2 = -8\sqrt{3} + 8i$
27	$z_1 = -1 + \sqrt{3}i$	$z_2 = 8\sqrt{3} - 8i$	28	$z_1 = -1 - \sqrt{3}i$	$z_2 = 8\sqrt{3} + 8i$
29	$z_1 = 3 + 3i$	$z_2 = -7 - 7\sqrt{3}i$	30	$z_1 = 3 - 3i$	$z_2 = -7 + 7\sqrt{3}i$
31	$z_1 = -3 + 3i$	$z_2 = 7 - 7\sqrt{3}i$	32	$z_1 = -3 - 3i$	$z_2 = 7 + 7\sqrt{3}i$
33	$z_1 = \sqrt{3} + i$	$z_2 = -8 - 8i$	34	$z_1 = \sqrt{3} - i$	$z_2 = -8 + 8i$
35	$z_1 = -\sqrt{3} + i$	$z_2 = 8 - 8i$	36	$z_1 = -\sqrt{3} - i$	$z_2 = 8 + 8i$

Задание 5. Выполнить возведение комплексного числа в степень по формуле Муавра.

1	$(6 - 6i)^3$	2	$(-6 + 6i)^3$	3	$(-6 - 6i)^3$
4	$(6 + 6i)^3$	5	$(-1 - \sqrt{3}i)^6$	6	$(1 + \sqrt{3}i)^6$
7	$(-1 + \sqrt{3}i)^6$	8	$(1 - \sqrt{3}i)^6$	9	$(5\sqrt{3} - 5i)^3$
10	$(5\sqrt{3} + 5i)^3$	11	$(-5\sqrt{3} + 5i)^3$	12	$(-5\sqrt{3} - 5i)^3$
13	$(-4 + 4i)^4$	14	$(-4 - 4i)^4$	15	$(4 + 4i)^4$
16	$(4 - 4i)^4$	17	$(-2 - 2i)^4$	18	$(2 - 2i)^4$
19	$(2 + 2i)^4$	20	$(-2 + 2i)^4$	21	$(-1 - i)^6$
22	$(1 - i)^6$	23	$(-1 + i)^6$	24	$(1 + i)^6$
25	$(7 - 7i)^3$	26	$(-7 + 7i)^3$	27	$(-7 - 7i)^3$
28	$(7 + 7i)^3$	29	$(3 + 3i)^4$	30	$(-3 + 3i)^4$
31	$(-3 - 3i)^4$	32	$(3 - 3i)^4$	33	$(\sqrt{3} + i)^6$
34	$(\sqrt{3} - i)^6$	35	$(-\sqrt{3} - i)^6$	36	$(-\sqrt{3} + i)^6$

Задание 8. Выполнить действия над комплексными числами в алгебраической форме.

1	$\frac{5-8i}{(1+9i)(5+7i)} - \frac{8-4i}{1-5i}$	2	$\frac{(-2+8i)(3+8i)}{-5-i} + \frac{-2+9i}{1-3i}$
3	$\frac{-4-3i}{(1-8i)(5+7i)} - \frac{4-4i}{-1-8i}$	4	$\frac{(1-7i)(4+9i)}{2-i} + \frac{3-3i}{-4+6i}$
5	$\frac{(4+9i)(-1-7i)}{6-5i} + \frac{-2-5i}{-2-3i}$	6	$\frac{-2+8i}{(1-3i)(-7-7i)} - \frac{1-4i}{-3-9i}$
7	$\frac{(-6+3i)(-8-4i)}{1-i} + \frac{-4-6i}{3+2i}$	8	$\frac{(1-3i)(2-2i)}{5-3i} + \frac{3-7i}{8-2i}$
9	$\frac{-9-5i}{(1-4i)(1-7i)} - \frac{2-3i}{-5-6i}$	10	$\frac{-2+3i}{(2-5i)(-3+5i)} - \frac{2+i}{3-6i}$
11	$\frac{(1-8i)(4+9i)}{-3-i} + \frac{8+7i}{1+5i}$	12	$\frac{(-7+6i)(-1-7i)}{-4-5i} + \frac{1-2i}{1-8i}$
13	$\frac{9+7i}{(1-4i)(9-7i)} - \frac{2-5i}{9-8i}$	14	$\frac{(7-2i)(4-4i)}{-6-i} + \frac{9-2i}{-1+2i}$
15	$\frac{(1+4i)(7-5i)}{3-8i} + \frac{-2-7i}{3-2i}$	16	$\frac{-6+7i}{(2+5i)(-6-8i)} + \frac{1+5i}{1-6i}$
17	$-\frac{-4-3i}{(9+5i)(-2-8i)} + \frac{-2+5i}{3-5i}$	18	$\frac{-2+5i}{(1-5i)(2-7i)} - \frac{1-3i}{-6-4i}$
19	$\frac{(-3-5i)(2+9i)}{5-i} + \frac{7-2i}{-3+5i}$	20	$\frac{-2-7i}{(-5+4i)(6-2i)} + \frac{8-i}{3-8i}$
21	$-\frac{5-9i}{(1-4i)(-6-7i)} + \frac{6-9i}{4-5i}$	22	$\frac{1-9i}{(-2-6i)(8+3i)} - \frac{-7+i}{6-9i}$
23	$\frac{(2-3i)(-6+5i)}{1-i} + \frac{8-7i}{6-8i}$	24	$\frac{1-8i}{(6+5i)(-1+7i)} + \frac{7-i}{4+3i}$
25	$-\frac{(-8+4i)(-1-7i)}{6+2i} + \frac{3+7i}{-8-5i}$	26	$\frac{-1+7i}{(2-4i)(-3-8i)} - \frac{2-3i}{9+4i}$
27	$\frac{(1-4i)(3+8i)}{6-i} + \frac{8+3i}{7+5i}$	28	$\frac{(-5+4i)(6-2i)}{5+3i} + \frac{-5-i}{4+5i}$
29	$-\frac{-8+3i}{(1-i)(-3-4i)} - \frac{1+6i}{2+8i}$	30	$\frac{-8+5i}{(-2-6i)(8-3i)} - \frac{-7-i}{1-4i}$
31	$\frac{(2-4i)(-3+5i)}{-9+7i} + \frac{8-6i}{6-i}$	32	$\frac{-3+8i}{(-6+4i)(1-3i)} + \frac{2-i}{4-7i}$
33	$-\frac{5+9i}{(5-3i)(-4-3i)} - \frac{8-6i}{-6-5i}$	34	$\frac{2-6i}{(-3-6i)(4+3i)} - \frac{9+i}{6+5i}$
35	$\frac{(-6-5i)(1+7i)}{-8+7i} + \frac{-2+5i}{-1-5i}$	36	$\frac{-5+3i}{(-7+3i)(-4-8i)} + \frac{5-i}{-6-7i}$

