

Complex Numbers: math practice, Grade 11 – download the PDF

21 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

1 Square roots of negatives



Write each number in the form bi (simplify the radical when possible).

a. $\sqrt{-36}$

b. $\sqrt{-50}$

c. $-\sqrt{-81}$

d. $\sqrt{-12}$

2 Powers of i



Simplify. (a) i^{15} (b) i^{22} (c) i^{40} (d) i^{101}

3 Add and subtract



Compute and write the answer in the form $a + bi$.

a. $(5 + 2i) + (3 - 7i)$

b. $(4 - i) - (9 + 3i)$

c. $(-2 + 6i) - (-2 - i)$

4 Multiply and distribute



Compute. (a) $3i(4 - 5i)$ (b) $(1 + 3i)(2 - i)$

5 Conjugates



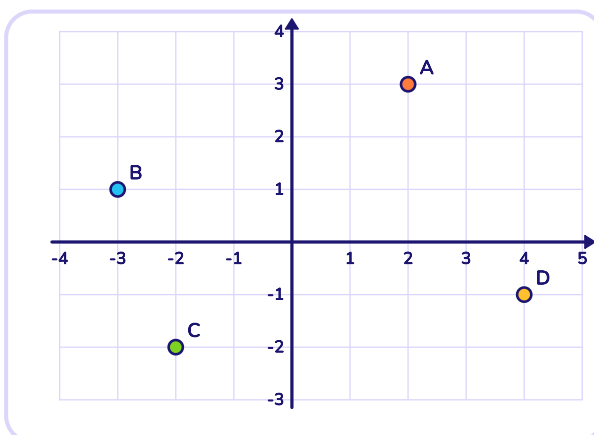
Write the conjugate of each number, then compute the product of $7 - 3i$ with its conjugate.

(a) $7 - 3i$ (b) $-4i$ (c) 9

6 Reading the complex plane



The figure shows four points in the complex plane. Write the complex number represented by each point, and give its real part and imaginary part.



7 Absolute values



Find the absolute value of each number. (a) $3 + 4i$ (b) $5 - 12i$ (c) $-8i$ (d) $-6 + 8i$

8 Matching parts



Find the real numbers x and y such that $(x + 2) + (3y - 1)i = 7 + 5i$.

9 Products and squares



Compute. (a) $(3 - 2i)(4 + 5i)$ (b) $(1 + i)^2$ (c) $(2 - 3i)^2$

10 Dividing complex numbers



Write each quotient in the form $a + bi$. (a) $\frac{8 + i}{2 - i}$ (b) $\frac{6}{1 + i}$

11 Pure imaginary solutions



Solve each equation over the complex numbers. (a) $x^2 + 49 = 0$ (b) $x^2 + 20 = 0$ (c) $2x^2 + 18 = 0$

12 Quadratic formula



Solve $x^2 - 6x + 13 = 0$ with the quadratic formula.

13 Circuit impedance



In an alternating-current circuit, engineers describe opposition to current with complex numbers called impedances (in ohms). Two components wired in series have impedances $Z_1 = 3 + 4i$ and $Z_2 = 2 - i$. In series the impedances add.

- Find the total impedance $Z_1 + Z_2$.
- The size of the impedance is its absolute value. Find it, rounded to the nearest hundredth.

14 True or false?



Decide whether each statement is true or false, and justify.

- $\sqrt{-4} \cdot \sqrt{-9} = \sqrt{36} = 6$.
- For $z = 2 + 3i$ and $w = 1 - 4i$, $\overline{z + w} = \overline{z} + \overline{w}$.

15 Distance in the plane



A treasure map uses the complex plane with one unit equal to one yard. The start is at $2 + i$ and the chest is at $-1 + 5i$. How many yards apart are they?

16 Complex roots with coefficients



Solve $x^2 + 4x + 9 = 0$ and check your answer with the sum and the product of the roots.

17 Build the equation



Find a quadratic equation with real coefficients whose solutions are $2 + 3i$ and $2 - 3i$.

18 Higher powers



Compute. (a) $(2 + i)^3$ (b) $(1 - i)^4$

19 A square root of a complex number



Show that $2 + 3i$ is a square root of $-5 + 12i$, then name the other square root.

20 Reciprocal with the conjugate



Let $z = 8 - 15i$.

- Compute $z \cdot \bar{z}$ and deduce $|z|$.
- Use part (a) to write $\frac{1}{z}$ in the form $a + bi$.

21 Quarter turns



A drone at the point $z = 4 + i$ of the complex plane is rotated a quarter turn counterclockwise about the origin by multiplying by i . Find its position after one, two, three, and four such moves.



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