

Real and Complex Numbers: Working with i

Grade 11 – Algebra 2 math · Worksheet · Standards: N-RN.A.1, N-RN.A.2, N-CN.A.1, N-CN.A.2

Name: _____ Date: _____ Class: _____

These problems build fluency with the real and complex number systems, from sorting numbers into sets to computing with the imaginary unit. They follow Common Core standards N-RN.A.1, N-RN.A.2, N-CN.A.1, and N-CN.A.2.

Problems move from naming parts of a complex number to multiplying binomials, powers of i , and circuit and rotation contexts. Show each step and rewrite roots of negative numbers with i first.

Standards: N-RN.A.1, N-RN.A.2, N-CN.A.1, N-CN.A.2 · **Level:** Grade 11 Algebra 2

Problem 1 Sorting numbers into sets (easy)

Classify each number as natural, integer, rational, irrational, or non-real. List every set that applies.

- a. 0.375
- b. $\sqrt{45}$
- c. $-\sqrt{64}$
- d. $\frac{5}{9}$
- e. $\sqrt{-25}$

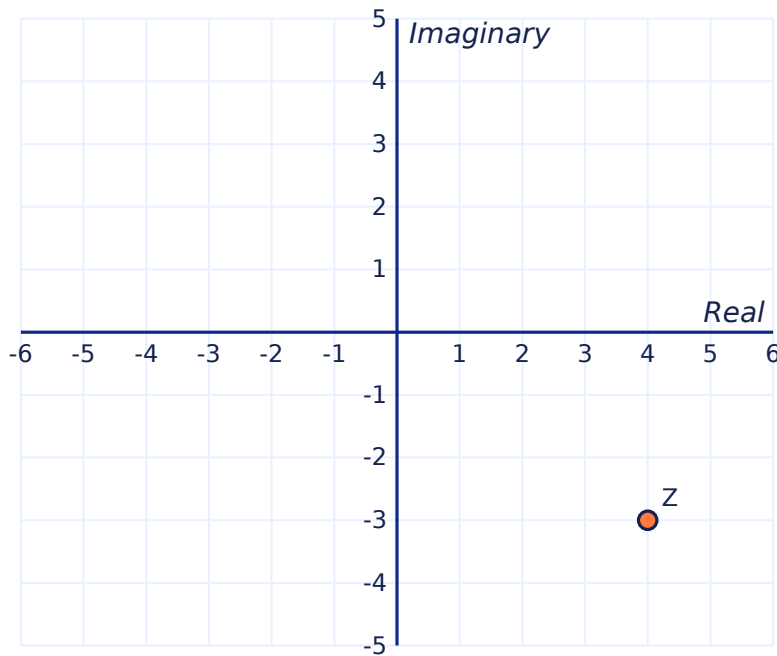
Problem 2 Simplifying negative roots (easy)

Write each as a multiple of i in simplest form.

- a. $\sqrt{-81}$
- b. $\sqrt{-44}$
- c. $-\sqrt{-72}$

Problem 3 Reading a point on the complex plane (easy)

The figure shows point Z . Write Z in the form $a + bi$, name its real and imaginary parts, and give the conjugate $a - bi$.



Point Z on the complex plane.

Problem 4 Adding and subtracting (easy)

Perform each operation.

- a. $(6 + 2i) + (-9 + 7i)$
- b. $(4 - 11i) - (-5 - 6i)$

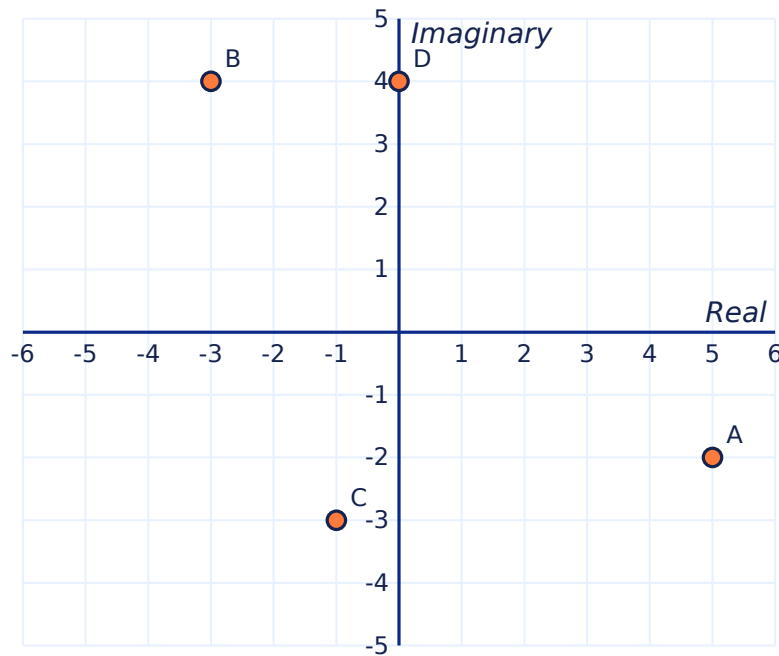
Problem 5 Identifying parts (easy)

State the real part and the imaginary part of each number.

- a. $9 - 4i$
- b. $-7i$
- c. 12
- d. $\frac{1}{2} + \frac{3}{4}i$

Problem 6 Plotting and naming points (medium)

Write the complex number for each labeled point in the figure.



Four points on the complex plane.

Problem 7 Multiplying binomials (medium)

Multiply and write the product as $a + bi$: $(5 + 3i)(4 - 6i)$.

Problem 8 Products with conjugates (medium)

Multiply.

- a. $(7i)(-3i)$
- b. $(-2 + i)(-2 - i)$
- c. $(5 + 6i)(5 - 6i)$

Problem 9 Powers of an imaginary number (medium)

Simplify each power.

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

Problem 10 Product of negative roots (medium)

Find each product. Rewrite the roots with i before multiplying.

- a. $\sqrt{-9} \cdot \sqrt{-16}$

b. $\sqrt{-5} \cdot \sqrt{-20}$

Problem 11 Conjugate product (medium)

For each number, write its conjugate and find the product of the number and its conjugate.

a. $8 - 3i$

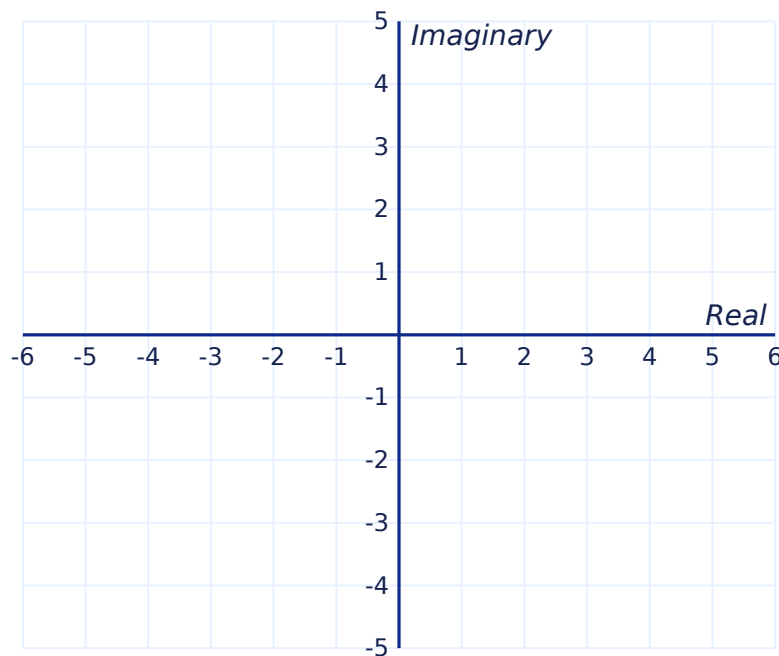
b. $5i$

Problem 12 Equal complex numbers (medium)

Find real numbers x and y so that $(x + 3) + (2y - 1)i = 9 + 7i$.

Problem 13 Adding on the complex plane (hard)

Let $u = 4 + i$ and $v = -2 + 3i$. Find $u + v$ and plot all three numbers on the grid.



Grid for plotting.

Problem 14 Squaring a binomial (hard)

Show that $(1 - i)^2 = -2i$, then use this result to evaluate $(1 - i)^6$.

Problem 15 Checking a solution (hard)

Decide whether $3 + 5i$ is a solution of $x^2 - 6x + 34 = 0$. Show the work.

Problem 16 Sum of four consecutive powers (hard)

Evaluate $i^{57} + i^{58} + i^{59} + i^{60}$.

Problem 17 Series impedance (hard)

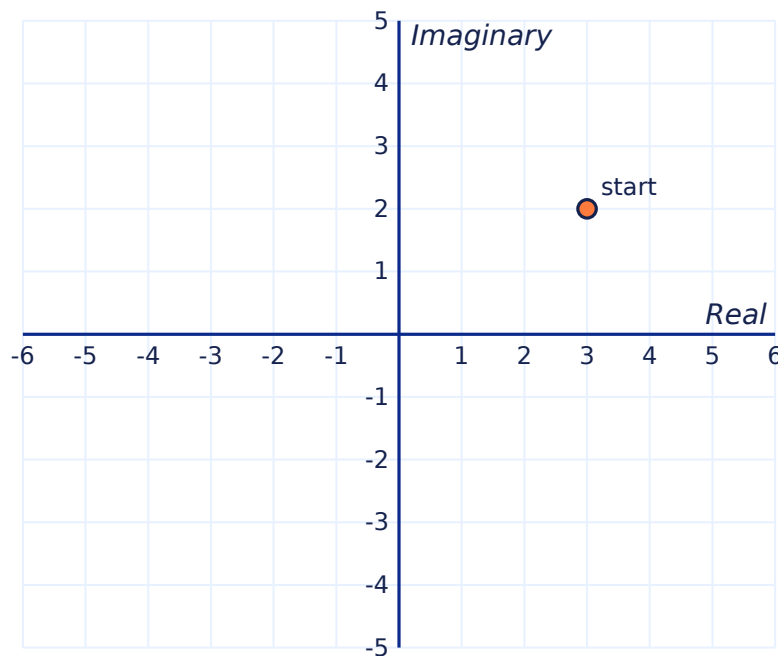
In a series circuit, a coil has impedance $12 + 5i$ ohms and a capacitor branch has $7 - 9i$ ohms. Find the total impedance.

Problem 18 Voltage in an AC circuit (hard)

A technician finds that the current in a circuit is $5 + 2i$ amps and the impedance is $3 - 6i$ ohms. Voltage equals current times impedance. Find the voltage in the form $a + bi$.

Problem 19 Quarter turns of a marker (hard)

A robotics club tracks a marker at the point $3 + 2i$ on a screen. Multiplying a number by i turns its point 90° counterclockwise about the origin. Find the marker position after one, two, and three such multiplications, and describe the pattern.



Starting position of the marker.

Problem 20 A real product (hard)

Find the value of k for which $(3 + ki)(2 - 5i)$ is a real number, and give that real product.