

Real and Complex Numbers: Working with i

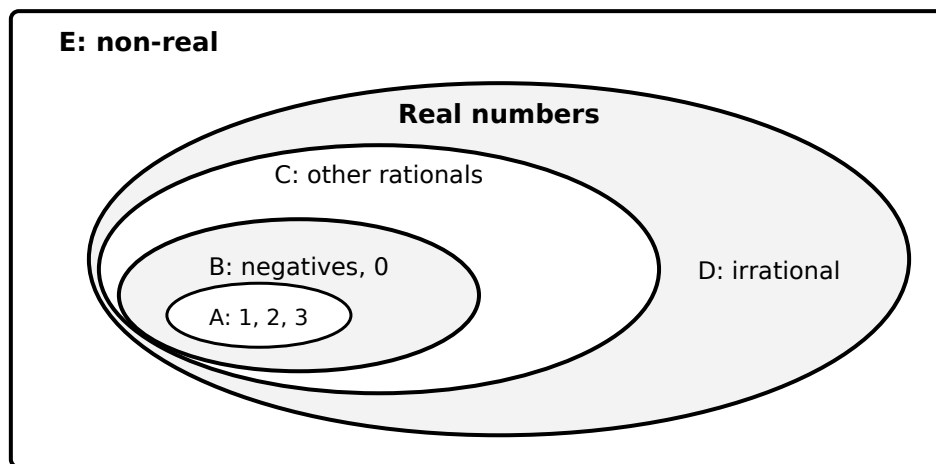
Grade 11 – Algebra 2 math · Test Answer Key · Standards: N-RN.A.1, N-RN.A.2, N-CN.A.1, N-CN.A.2

Each answer shows a full solution followed by the scoring guide. Award partial credit where indicated, and check that final answers are simplified: no i^2 remains and real and imaginary parts are combined.

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

Question 1 Place the numbers in the regions (2 points)

a) $36/4 = 9$: **A.** b) $-\sqrt{100} = -10$: **B.** c) $0.125 = 1/8$: **C.** d) $\sqrt{40} = 2\sqrt{10}$: **D.** e) $\sqrt{-16} = 4i$: **E.**



The regions used for the answers.

Scoring: 1 point for 3 or 4 correct placements, 2 points for all five.

Question 2 Simplify negative square roots (2 points)

a) $\sqrt{150} = 5\sqrt{6}$, so $\sqrt{-150} = 5i\sqrt{6}$.

b) $\sqrt{48} = 4\sqrt{3}$, so the sum is $-3 + 4i\sqrt{3}$.

Scoring: 1 point each; half credit for a correct radical with a missing i.

Question 3 Add and subtract (2 points)

a) $5 + 7i$.

b) $-6 + 9i - 4 + i = -10 + 10i$.

Scoring: 1 point each.

Question 4 Multiply complex numbers (3 points)

a) $20 + 8i - 15i - 6i^2 = 26 - 7i$.

b) $36 - 12i + i^2 = 35 - 12i$.

c) $49 - 4i^2 = 53$.

Scoring: 1 point each.

Question 5 Powers of i (2 points)

a) $47 = 4 \cdot 11 + 3$, so $i^{47} = -i$.

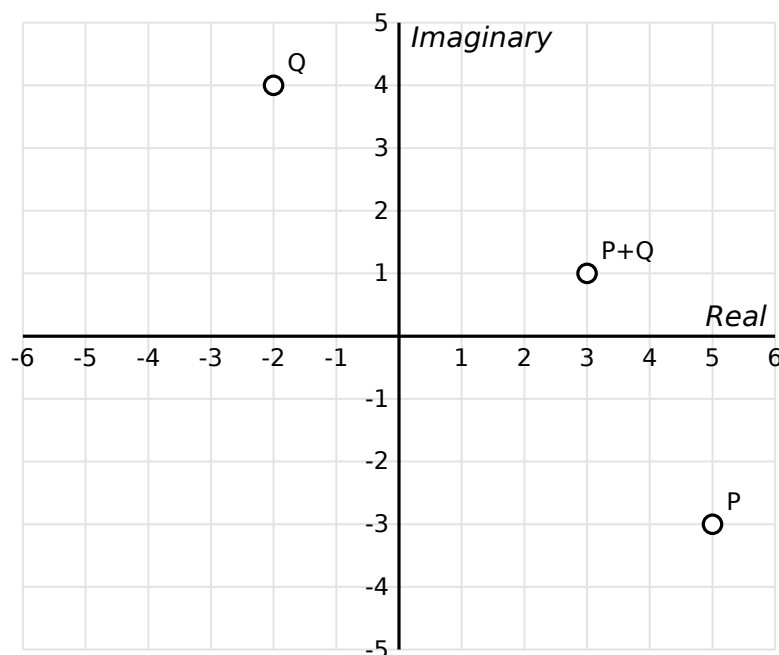
b) $82 = 4 \cdot 20 + 2$, so $i^{82} = -1$.

Scoring: 1 point each.

Question 6 Two points on the complex plane (2 points)

a) $P = 5 - 3i$, $Q = -2 + 4i$.

b) $(5 - 2) + (-3 + 4)i = 3 + i$.



The sum is plotted at $3 + i$.

Scoring: 1 point each part.

Question 7 Solve for a and b (3 points)

Match parts: $a + 2b = 11$ and $3a - b = 5$.

From the second, $b = 3a - 5$. Substitute: $a + 6a - 10 = 11$, so $a = 3$ and $b = 4$.

Check: $3 + 8 = 11$ and $9 - 4 = 5$.

$a = 3, b = 4$

Scoring: 1 point for the two equations, 1 for solving, 1 for correct values.

Question 8 Verify a solution (2 points)

$$(2 - 3i)^2 = 4 - 12i - 9 = -5 - 12i.$$

$$-4(2 - 3i) = -8 + 12i.$$

$$\text{Total: } -5 - 12i - 8 + 12i + 13 = \mathbf{0}.$$

Scoring: 1 point for the square, 1 point for the total of 0.

Question 9 Circuit calculations (2 points)

a) $(9 + 5) + (4 - 7)i = \mathbf{14 - 3i}$ ohms.

b) $(1 + 2i)(3 - 4i) = 3 - 4i + 6i - 8i^2 = \mathbf{11 + 2i}$ volts.

Scoring: 1 point each.