

Complex Numbers

Problems about complex numbers.

Problem 1 Which of the following are rational numbers? Select all that apply.

Select All Correct Answers:

- (a) 7 ✓
 - (b) e
 - (c) $\frac{\pi^2}{6}$
 - (d) $\frac{18}{11}$ ✓
 - (e) $8 - 3i$
 - (f) $\sqrt{-17}$
 - (g) $\sqrt[3]{-2}$
-

Problem 2 Which of the following are real numbers? Select all that apply.

Select All Correct Answers:

- (a) 7 ✓
 - (b) e ✓
 - (c) $\frac{\pi^2}{6}$ ✓
 - (d) $\frac{18}{11}$ ✓
 - (e) $8 - 3i$
 - (f) $\sqrt{-17}$
-

Learning outcomes:

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(g) $\sqrt[3]{-2}$ ✓

Problem 3 Which of the following are complex numbers? Select all that apply.

Select All Correct Answers:

(a) 7 ✓

(b) e ✓

(c) $\frac{\pi^2}{6}$ ✓

(d) $\frac{18}{11}$ ✓

(e) $8 - 3i$ ✓

(f) $\sqrt{-17}$ ✓

(g) $\sqrt[3]{-2}$ ✓

Problem 4 Assuming none of the numbers involved are zero, select all operations below which must produce an irrational number.

Select All Correct Answers:

(a) rational + rational

(b) rational + irrational ✓

(c) irrational + irrational

(d) rational \times rational

(e) irrational \times rational ✓

(f) irrational \times irrational

Problem 5 Find $(2 + i) + 4$. $\boxed{6}_{\text{given}} + \boxed{1}_{\text{given}} i$

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Problem 6 Find $(-3 + 4i) - (-8 - i)$. $\boxed{5}_{\text{given}} + \boxed{5}_{\text{given}} i$

Problem 7 Find $(2 - 6i) - (3 + 8i)$. $\boxed{-1}_{\text{given}} + \boxed{-14}_{\text{given}} i$

Problem 8 Find $(2 + i) \times 4$. $\boxed{8}_{\text{given}} + \boxed{4}_{\text{given}} i$

Problem 9 Find $(-3 + 4i) \times (-8 - i)$. $\boxed{28}_{\text{given}} + \boxed{-29}_{\text{given}} i$

Problem 10 Find $(2 - 6i) \times (3 + 8i)$. $\boxed{54}_{\text{given}} + \boxed{-2}_{\text{given}} i$

Problem 11 Write $\frac{1}{2+i}$ in the form $a + bi$. $\boxed{\frac{2}{5}}_{\text{given}} + \boxed{-\frac{1}{5}}_{\text{given}} i$

Hint: Try multiplying the numerator and denominator by something that will make the denominator into a whole number (in other words, the complex conjugate of $2 + i$).

Problem 12 Find $(1 - 3i) \div (-3 + 5i)$. $\boxed{-\frac{18}{34}}_{\text{given}} + \boxed{\frac{4}{34}}_{\text{given}} i$

Hint: First find $\frac{1}{-3 + 5i}$, and then multiply.

Problem 13 Find all solutions to the equation $x^3 - 3x^2 + 5x - 3 = 0$.

Hint: The Rational Root Theorem combined with some division of polynomials might help!

Enter your answers: first complex answers, and then real answers in order from smallest to largest.

$\boxed{1}_{\text{given}} + \boxed{\sqrt{2}}_{\text{given}} i, \boxed{1}_{\text{given}} - \boxed{\sqrt{2}}_{\text{given}} i, \boxed{1}_{\text{given}}$

Problem 14 Find all solutions to the equation $x^3 + 2x - 3 = 0$.

Hint: The Rational Root Theorem combined with some division of polynomials might help!

Enter your answers: first complex answers, and then real answers in order from smallest to largest.

$$\boxed{\frac{1}{2}}_{\text{given}} + \boxed{\frac{\sqrt{11}}{2}}_{\text{given}} i, \boxed{-\frac{1}{2}}_{\text{given}} - \boxed{\frac{\sqrt{11}}{2}}_{\text{given}} i, \boxed{1}_{\text{given}}$$

Problem 15 Find all solutions to the equation $x^4 + 6x^3 + 14x^2 + 30x + 45 = 0$.

Hint: The Rational Root Theorem combined with some division of polynomials might help!

Enter your answers: first complex answers, and then real answers in order from smallest to largest.

$$\boxed{0}_{\text{given}} + \boxed{\sqrt{5}}_{\text{given}} i, \boxed{0}_{\text{given}} - \boxed{\sqrt{5}}_{\text{given}} i, \boxed{-3}_{\text{given}}, \boxed{-3}_{\text{given}}$$