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) $\dfrac{\pi^2}{6}$

(d) $\dfrac{18}{11}$ ✓

(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) $\dfrac{\pi^2}{6}$ ✓

(d) $\dfrac{18}{11}$ ✓

(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) $\dfrac{\pi^2}{6}$ ✓

(d) $\dfrac{18}{11}$ ✓

(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* × *rational*

(e) *irrational* × *rational* ✓

(f) *irrational* × *irrational*

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

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

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

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

Problem 9 *Find* $(-3+4i)\times(-8-i)$. $\underset{\text{given}}{\boxed{28}} + \underset{\text{given}}{\boxed{35}} i$

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

Problem 11 *Write* $\dfrac{1}{2+i}$ *in the form* $a+bi$. $\underset{\text{given}}{\boxed{\frac{2}{3}}} + \underset{\text{given}}{\boxed{-\frac{1}{3}}} i$

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* $(1-3i)\div(-3+5i)$. $\underset{\text{given}}{\boxed{-\frac{18}{34}}} + \underset{\text{given}}{\boxed{\frac{4}{34}}} i$

Hint: *First find* $\dfrac{1}{-3+5i}$*, 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.

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

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.

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

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.

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