

# 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)  $\sqrt[3]{-2}$
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**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)  $\sqrt{-17}$

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Author(s): Bart Snapp and Brad Findell and Jenny Sheldon

(g)  $\sqrt[3]{-2}$  ✓

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

**Select All Correct Answers:**

(a) 7 ✓

(b)  $e \checkmark$

(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*  $\checkmark$

(f) *irrational*  $\times$  *irrational*

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

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

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

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

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

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

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

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

**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.

$\boxed{1}$   $+$   $\boxed{\sqrt{2}}$   $i$ ,  $\boxed{1}$   $-$   $\boxed{\sqrt{2}}$   $i$ ,  $\boxed{1}$   
given given given given 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  $x^3 + 2x - 3 = 0$ .

**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.

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