

Name:
Instructor:

Date:
Section:

7.7 Complex Numbers

Objectives

- 1** Recognize a complex number.
- 2** Add and subtract complex numbers.
- 3** Multiply complex numbers.
- 4** Divide complex numbers.
- 5** Find powers of i .

Key Vocabulary

imaginary numbers, imaginary unit, complex numbers, pure imaginary number, conjugate of a complex number, powers of i

1 Recognize a complex number.

Example 1 Write each complex number in the form $a + bi$.

a) $5 + \sqrt{-49}$

b) $3 - \sqrt{-18}$

c) -13

d) $\sqrt{-75}$

2 Add and subtract complex numbers.

Example 2 Add or subtract.

a) $(7 + 5i) + (-6 - 3i)$

b) $(5 - \sqrt{-72}) - (-6 + \sqrt{-98})$

3 Multiply complex numbers.

Example 3 Multiply.

a) $3i(7 - 4i)$

b) $\sqrt{-16}(\sqrt{-3} + 5)$

c) $(3 - \sqrt{-32})(\sqrt{-2} + 4)$

4 Divide complex numbers.

Example 4 Divide.

a) $\frac{5+i}{i}$

b) $\frac{3+4i}{3-i}$

5 Find powers of i .

Example 5 Evaluate.

a) i^5

b) i^{12}

c) i^{23}

d) i^{98}

Answers: 1a) $5 + 7i$ b) $3 - 3i\sqrt{2}$ c) $-13 + 0i$ d) $0 + 5i\sqrt{3}$ 2a) $1 + 2i$ b) $11 - 13i\sqrt{2}$ 3a) $12 + 21i$ b) $-4\sqrt{3} + 20i$ c) $20 - 13i\sqrt{2}$

4a) $1 - 5i$ b) $\frac{1+3i}{2}$ 5a) i b) 1 c) $-i$ d) -1

1. Find x and y : $6x - 3yi = 36 + 27i$

1. _____

For #2-3, solve the equations, finding all real and imaginary solutions.

2. $3x^2 + 4 = -5x$

3. $x^4 - x^2 - 6 = 0$

4. $2x^4 - 54x = 0$

For #5-6, find a polynomial with real coefficients that satisfy the given conditions. Leave your answer in factored form without any imaginary numbers.

5. degree 5: zeros include -2 (multiplicity 3) and $4i$

6. degree 2: zeros include $1 - 2i$; $f(2) = 4$

7. Find **all** the zeros of the polynomial
 $g(x) = x^4 - 5x^3 + 10x^2 - 20x + 24$,
given that $2i$ is a zero.

8. Find **all** the zeros of the polynomial
 $g(x) = x^4 - 4x^3 + 6x^2 - 4x + 5$,
given that $2 - i$ is a zero.