

Warm-up

Solve:

$$|2y - 4| = 12$$

*Branch out into two
equations*

$$2y - 4 = 12$$

$$2y - 4 = -12$$

The extended system of numbers, called the *complex numbers*, consists of all real numbers and sums of real numbers and real number multiples of i . The following are all examples of complex numbers:

$$-6, \quad 5i, \quad \sqrt{5}, \quad -7i, \quad \frac{5}{2}i + \frac{2}{3}, \quad -2 + 3i, \quad 5 - 3i, \quad \frac{1}{3} + \frac{4}{5}i.$$

DEFINITION **Complex Number**

A **complex number** is any number that can be written in the form

$$a + bi,$$

where a and b are real numbers. The real number a is the **real part**, the real number b is the **imaginary part**, and $a + bi$ is the **standard form**.

Adding and Subtracting Complex Numbers

(a) $(7 - 3i) + (4 + 5i) =$

(b) $(2 - i) - (8 + 3i) =$

Multiplying Complex Numbers

$$(2 + 3i) \cdot (5 - i) =$$

Complex Conjugates and Division

DEFINITION Complex Conjugate

The **complex conjugate** of the complex number $z = a + bi$ is

$$\bar{z} = \overline{a + bi} = a - bi.$$

Dividing Complex Numbers

Write the complex number in standard form.

(a) $\frac{2}{3 - i}$

(b) $\frac{5 + i}{2 - 3i}$

Solving a Quadratic Equation

Solve $x^2 + x + 1 = 0$.